



E I M A C
Division of Varian
SAN CARLOS
CALIFORNIA

8169
4CX3000A
RADIAL-BEAM
POWER TETRODE

The EIMAC 8169/4CX3000A is a ceramic and metal power tetrode designed to be used as a Class-AB₁ linear amplifier in audio or radio-frequency applications. Its characteristics of low intermodulation distortion make it especially suitable for single sideband service.

This tube is unique in that a production test is included to insure minimum distortion products. The 8169/4CX3000A must produce a *minimum* of 5300 watts in Class AB₁ service with IM distortion at least 32 db down, 3rd order.

The tube is also recommended for use as a Class-C radio-frequency power amplifier and plate-modulated radio-frequency power amplifier.



GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten	<u>Min.</u>	<u>Nom.</u>	<u>Max.</u>	
Voltage - - - -		9.0		volts
Current - - - -	39.5		43.5	amps

Amplification Factor (Grid Screen) 5.5

Frequency For Maximum Ratings 150 MHz

Direct Interelectrode Capacitances, Grounded Cathode:

Input - - - -	120	140	pF
Output - - - -	10.5	14.5	pF
Feedback - - - -		1.4	pF

Direct Interelectrode Capacitances, Grounded Grid and Screen:

	<u>Min.</u>	<u>Max.</u>	
Input - - - - -	55	67	pF
Output - - - - -	10.5	14.5	pF
Feedback - - - - -		0.2	pF

MECHANICAL

Base - - - - -	Special ring and breechblock terminal surfaces
Maximum Seal Temperature - - - - -	250°C
Maximum Anode Core Temperature - - - - -	250°C
Recommended Socket - - - - -	EIMAC SK-1400 series
Recommended Air Chimney - - - - -	EIMAC SK-1406
Operating Position - - - - -	Axis vertical, base up or down
Maximum Dimensions:	
Height - - - - -	7.9 inches
Diameter - - - - -	4.6 inches
Cooling - - - - -	Forced air
Net Weight - - - - -	5.5 pounds
Shipping Weight (Approximate) - - - - -	10 pounds

RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR

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

MAXIMUM RATINGS

DC PLATE VOLTAGE	-	-	-	-	7000 VOLTS
DC SCREEN VOLTAGE	-	-	-	-	1000 VOLTS
DC PLATE CURRENT	-	-	-	-	2.0 AMPS
PLATE DISSIPATION	-	-	-	-	3000 WATTS
SCREEN DISSIPATION	-	-	-	-	175 WATTS
GRID DISSIPATION	-	-	-	-	50 WATTS

TYPICAL OPERATION

DC Plate Voltage	-	-	-	-	5000	7000 volts
DC Screen Voltage	-	-	-	-	500	500 volts
DC Grid Voltage	-	-	-	-	-280	-300 volts
DC Plate Current	-	-	-	-	1.9	1.9 amps
DC Screen Current	-	-	-	-	250	230 mA
DC Grid Current	-	-	-	-	100	100 mA
Peak RF Grid Voltage	-	-	-	-	385	405 volts
Driving Power	-	-	-	-	39	41 watts
Plate Dissipation	-	-	-	-	1900	2300 watts
Plate Output Power	-	-	-	-	7600	11,000 watts

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER

Class-C Telephony (Carrier Conditions unless noted)

MAXIMUM RATINGS

DC PLATE VOLTAGE	-	-	-	-	5000 VOLTS
DC SCREEN VOLTAGE	-	-	-	-	600 VOLTS
DC PLATE CURRENT	-	-	-	-	1.4 AMPS
PLATE DISSIPATION*	-	-	-	-	2000 WATTS
SCREEN DISSIPATION	-	-	-	-	175 WATTS
GRID DISSIPATION	-	-	-	-	50 WATTS

*Corresponds to 3000 watts at 100 percent sine-wave modulation.

TYPICAL OPERATION

DC Plate Voltage	-	-	-	-	-	5000 volts
DC Screen Voltage	-	-	-	-	-	500 volts
Peak AF Screen Voltage	-	-	-	-	-	
(For 100% Modulation)	-	-	-	-	-	415 volts
DC Grid Voltage	-	-	-	-	-	-375 volts
DC Plate Current	-	-	-	-	-	1.4 amps
DC Screen Current	-	-	-	-	-	170 mA
DC Grid Current	-	-	-	-	-	68 mA
Peak RF Grid Voltage	-	-	-	-	-	455 volts
Grid Driving Power	-	-	-	-	-	31 watts
Plate Dissipation	-	-	-	-	-	1250 watts
Plate Output Power	-	-	-	-	-	5750 watts

AUDIO-FREQUENCY AMPLIFIER OR MODULATOR

Class-AB

MAXIMUM RATINGS (Per Tube)

DC PLATE VOLTAGE	-	-	-	-	6000 VOLTS
DC SCREEN VOLTAGE	-	-	-	-	1000 VOLTS
DC PLATE CURRENT	-	-	-	-	2.0 AMPS
PLATE DISSIPATION	-	-	-	-	3500 WATTS
SCREEN DISSIPATION	-	-	-	-	175 WATTS
GRID DISSIPATION	-	-	-	-	50 WATTS

*Per tube

**Approximate values

TYPICAL OPERATION (Two Tubes), Class AB₁

DC Plate Voltage	-	-	-	-	5000	6000 volts
DC Screen Voltage	-	-	-	-	850	850 volts
DC Grid Voltage*	-	-	-	-	-180	-200 volts
Max-Signal Plate Current	-	-	-	-	3.6	3.1 amps
Zero-Signal Plate Current	-	-	-	-	1.0	0.7 amp
Max-Signal Screen Current**	-	-	-	-	170	120 mA
Zero-Signal Screen Current	-	-	-	-	0	0 mA
Peak AF Driving Voltage*	-	-	-	-	155	175 volts
Driving Power	-	-	-	-	0	0 watts
Load Resistance, Plate-to-Plate	-	-	-	-	3000	4160 ohms
Max-Signal Plate Dissipation*	-	-	-	-	3300	3100 watts
Max-Signal Plate Output Power	-	-	-	-	11,400	12,400 watts

NOTE: In Class AB operation, maximum plate voltage and plate current must not be applied simultaneously, as plate dissipation will be exceeded.

RADIO-FREQUENCY LINEAR AMPLIFIER

Class-AB

MAXIMUM RATINGS

DC PLATE VOLTAGE	-	-	-	-	6000 VOLTS
DC SCREEN VOLTAGE	-	-	-	-	1000 VOLTS
DC PLATE CURRENT	-	-	-	-	2.0 AMPS
PLATE DISSIPATION	-	-	-	-	3500 WATTS
SCREEN DISSIPATION	-	-	-	-	175 WATTS
GRID DISSIPATION	-	-	-	-	50 WATTS

*Approximate values

These values are obtained in existing equipment. A design test is performed on a sampling basis, insuring that the 4CX3000A will perform as indicated with respect to IM distortion products and power output.

TYPICAL OPERATION Class AB₁, Grid Driven

DC Plate Voltage	-	-	-	-	-	5000 volts
DC Screen Voltage	-	-	-	-	-	850 volts
DC Grid Voltage*	-	-	-	-	-	180 volts
Zero-Signal DC Plate Current	-	-	-	-	-	0.5 amp
Single-Tone DC Plate Current	-	-	-	-	-	1.65 amps
Single-Tone DC Screen Current	-	-	-	-	-	25 mA
Two-Tone DC Plate Current	-	-	-	-	-	1.10 amps
Two-Tone DC Screen Current	-	-	-	-	-	20 mA
Peak RF Grid Voltage	-	-	-	-	-	155 volts
Driving Power	-	-	-	-	-	0 watts
Peak Envelope Useful Output Power	-	-	-	-	-	5300 watts
Resonant Load Impedance	-	-	-	-	-	1700 ohms
Intermodulation Distortion Products (without negative feedback)	-	-	-	-	-	-32 db

NOTE: "TYPICAL OPERATION" data are obtained by calculation from published characteristic curves and confirmed by direct tests. No allowance is made for circuit losses. Adjustment of the rf grid drive to obtain the specified plate current at the specified grid bias, screen voltage, and plate voltage is assumed.



APPLICATION

MECHANICAL

Mounting — The 4CX3000A 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-1400A and SK-1470A sockets have been designed especially for the 4CX3000A. 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 an Air Chimney, the SK-1406, and through the anode cooling fins.

Cooling — The maximum temperature rating for the external surfaces of the 4CX3000A 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 200°C in 40°C ambient air are tabulated below (for operation below 30 megahertz).

Plate Dissipation* (Watts)	SEA LEVEL		10,000 FEET	
	Air Flow (CFM)	Pressure Drop (Inches of water)	Air Flow (CFM)	Pressure Drop (inches of water)
1500	36.5	0.3	53	0.4
2500	60	0.8	88	1.2
3500	86	1.6	125	2.3

*Since the power dissipated by the filament represents about 450 watts and since grid-plus-screen dissipation can, under some conditions, represent another 225 watts, allowance has been made in preparing this tabulation for an additional 675 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 4CX3000A is 9.0 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.

Intermodulation Distortion — The operating conditions including distortion data are the results of actual operation in a neutralized, grid-driven amplifier. This test is performed on sample tubes from regular production runs. A plot of IM distortion versus power output under two-tone condition for a typical tube is shown on the next page.

Control Grid Operation — The rated dissipation of the grid is 50 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.

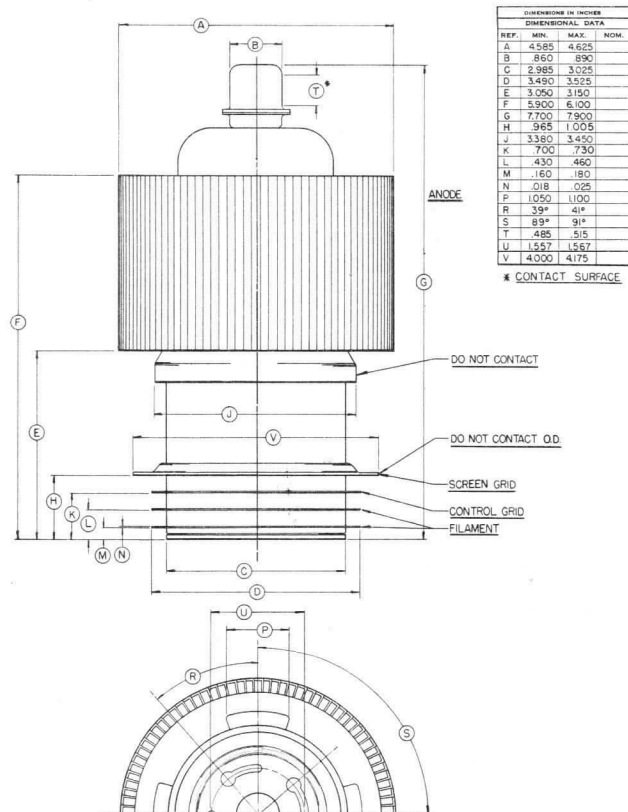
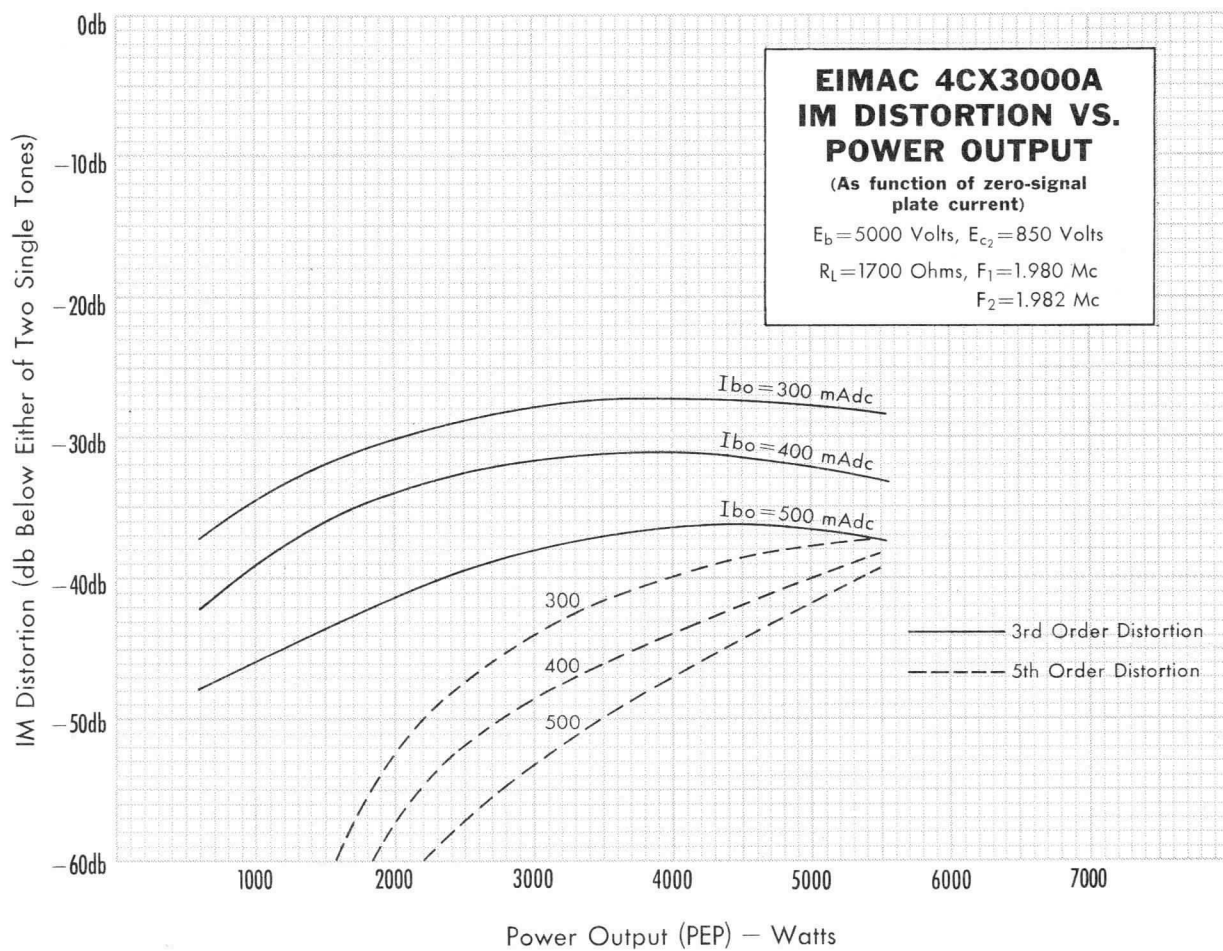
Screen-Grid Operation — The power dissipated by the screen of the 4CX3000A must not exceed 175 watts.

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 175 watts in the event of circuit failure.

Plate Dissipation—The plate-dissipation ratings for the 4CX3000A are 2000 watts for Class-C plate-modulated service and 3000 watts for Class-C telegraphy. In Class-AB operation this rating has been increased to 3500 watts to allow more input. In any Class-AB application maximum plate current and maximum plate voltage should not be applied simultaneously as the plate-dissipation rating would be exceeded.

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 or Product Manager, EIMAC Division of Varian, 301 Industrial Way, San Carlos, California, for information and recommendations.



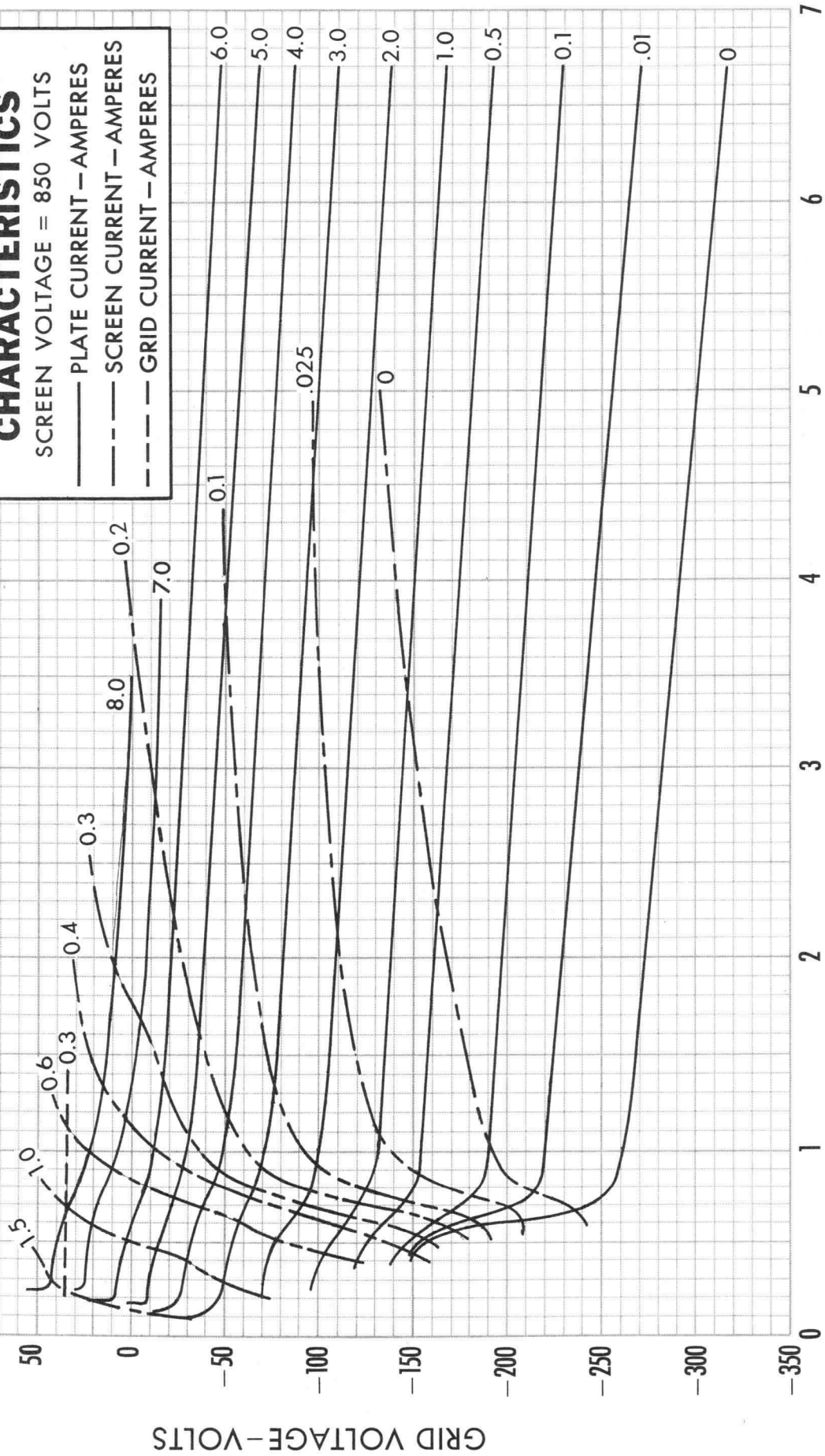


4CX3000A

EIMAC 4CX3000A TYPICAL CONSTANT CURRENT CHARACTERISTICS

SCREEN VOLTAGE = 850 VOLTS

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





4CX3000A

EIMAC 4CX3000A TYPICAL CONSTANT CURRENT CHARACTERISTICS

SCREEN VOLTAGE = 500 VOLTS

— PLATE CURRENT — AMPERES

- - - SCREEN CURRENT — AMPERES

- - - - GRID CURRENT — AMPERES

