

## EITEL-McCULLOUGH, INC. SAN CARLOS, CALIFORNIA

# 8169 4CX3000A

RADIAL-BEAM POWER TETRODE

4CX3000A

Indicates change from sheet dated 5-1-62

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 makes 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 AB<sub>1</sub> service with IM distortion at least 32 db below PEP output.

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

(Effective 3-1-63) @ Copyright, 1961-1962-1963 by Eitel-McCullough, Inc:

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PLATE-MODULATED RA POWER AMPLIFIER	DIO-FR	EQUE	NCY	TYPICAL OPERATION	1				
Class-C Telephony (Ca	rrier C	onditi	ons	DC Plate Voltage	-	<del></del> 0	-	5000	volts
unless noted)				DC Screen Voltage	-	2011	_	500	volts
				Peak AF Screen Volt	age	<del>-</del> 55	-		
MAXIMUM RATINGS				(For 100% Modulation	on)			415	volts
DC PLATE VOLTAGE	5000	MAX.	VOLTS	DC Grid Voltage	: <del>-</del>	<del>#</del> 6	=0	-375	volts
DC SCREEN VOLTAGE	600	MAX.	VOLTS	DC Plate Current	_	12	-	1.4	amps
DC PLATE CURRENT	1.4	MAX.	AMPS	DC Screen Current	-	_	<del>-</del>	170	m.A
PLATE DISSIPATION*	2000	MAX.	WATTS	DC Grid Current	_	12	-	68	m.A
SCREEN DISSIPATION	175	MAX.	WATTS	Peak RF Grid Voltag	e	=	<b>H</b>	455	volts
GRID DISSIPATION	50	MAX.	WATTS	Grid Driving Power		<u>_</u>	20	31	watts
1.0.000	3100 _ 3	. 100	200 % 1.00	Plate Dissipation	-	<u></u>	¥6	1250	watts
*Corresponds to 3000 v	vatts a	£ 100	percent	Plate Output Power		_		5750	watts
sine-wave modulation.									
sine-wave modulation.  AUDIO-FREQUENCY AM		2		TYPICAL OPERATION	I (Two I	ubes)	, Class	s AB <sub>1</sub>	
sine-wave modulation. AUDIO-FREQUENCY AM OR MODULATOR		1		TYPICAL OPERATION	I (Two I			IN/	
sine-wave modulation.  AUDIO-FREQUENCY AM			<u> </u>	TYPICAL OPERATION  DC Plate Voltage	<u> </u>	m <b>a</b>	5000	6000	
sine-wave modulation. AUDIO-FREQUENCY AM OR MODULATOR Class-AB	IPLIFIE			TYPICAL OPERATION  DC Plate Voltage  DC Screen Voltage	= =		5000 850	6000 850	volts
sine-wave modulation.  AUDIO-FREQUENCY AM OR MODULATOR Class-AB  MAXIMUM RATINGS (Pe	IPLIFIE	)		TYPICAL OPERATION  DC Plate Voltage  DC Screen Voltage  DC Grid Voltage*	- -	0722 100 20	5000 850 -180	6000 850 -200	volts volts
sine-wave modulation.  AUDIO-FREQUENCY AM OR MODULATOR Class-AB  MAXIMUM RATINGS (Pe	PLIFIER er Tube 6000	) MAX.	VOLTS	TYPICAL OPERATION  DC Plate Voltage  DC Screen Voltage  DC Grid Voltage*  Max-Signal Plate C	- - urrent	102 2	5000 850 -180 3.6	6000 850 -200 3.1	volts volts amps
sine-wave modulation.  AUDIO-FREQUENCY AM OR MODULATOR Class-AB  MAXIMUM RATINGS (Pe DC PLATE VOLTAGE DC SCREEN VOLTAGE	er Tube 6000 1000	) MAX. MAX.	VOLTS	TYPICAL OPERATION  DC Plate Voltage  DC Screen Voltage  DC Grid Voltage*  Max-Signal Plate C  Zero-Signal Plate C	- - - urrent urrent		5000 850 -180 3.6 1.0	6000 850 -200 3.1 0.7	volts volts amps amp
sine-wave modulation.  AUDIO-FREQUENCY AM OR MODULATOR Class-AB  MAXIMUM RATINGS (Pe DC PLATE VOLTAGE DC SCREEN VOLTAGE DC PLATE CURRENT	PLIFIER 6000 1000 2.0	) MAX. MAX.	VOLTS AMPS	TYPICAL OPERATION  DC Plate Voltage  DC Screen Voltage  DC Grid Voltage*  Max-Signal Plate C  Zero-Signal Plate C  Max-Signal Screen	- - urrent urrent Current	- - - - **	5000 850 -180 3.6 1.0	6000 850 -200 3.1 0.7 120	volts volts amps amp mA
Sine-wave modulation.  AUDIO-FREQUENCY AMON OR MODULATOR  Class-AB  MAXIMUM RATINGS (PEDC PLATE VOLTAGE DC SCREEN VOLTAGE DC PLATE CURRENT PLATE DISSIPATION	PLIFIER 6000 1000 2.0 3500	MAX. MAX. MAX. MAX.	VOLTS AMPS WATTS	TYPICAL OPERATION  DC Plate Voltage  DC Screen Voltage  DC Grid Voltage*  Max-Signal Plate C  Zero-Signal Plate C  Max-Signal Screen  Zero-Signal Screen	- - urrent urrent Current Current	**	5000 850 -180 3.6 1.0 170	6000 850 -200 3.1 0.7 120	volts volts amps amp mA mA
sine-wave modulation.  AUDIO-FREQUENCY AM OR MODULATOR Class-AB  MAXIMUM RATINGS (Pe DC PLATE VOLTAGE DC SCREEN VOLTAGE DC PLATE CURRENT PLATE DISSIPATION SCREEN DISSIPATION	er Tube 6000 1000 2.0 3500 175	MAX. MAX. MAX. MAX. MAX.	VOLTS AMPS WATTS WATTS	TYPICAL OPERATION  DC Plate Voltage  DC Screen Voltage  DC Grid Voltage*  Max-Signal Plate C  Zero-Signal Plate C  Max-Signal Screen  Zero-Signal Screen  Peak AF Driving Vol	- - urrent urrent Current Current	- - - - **	5000 850 -180 3.6 1.0 170 0	6000 850 -200 3.1 0.7 120 0	volts volts amps amp mA volts
Sine-wave modulation.  AUDIO-FREQUENCY AMON OR MODULATOR  Class-AB  MAXIMUM RATINGS (PEDC PLATE VOLTAGE DC SCREEN VOLTAGE DC PLATE CURRENT PLATE DISSIPATION	er Tube 6000 1000 2.0 3500 175	MAX. MAX. MAX. MAX. MAX.	VOLTS AMPS WATTS	TYPICAL OPERATION  DC Plate Voltage  DC Screen Voltage  DC Grid Voltage*  Max-Signal Plate C  Zero-Signal Plate C  Max-Signal Screen  Zero-Signal Screen  Peak AF Driving Vol  Driving Power	- urrent urrent Current Current tage*	- - - - **	5000 850 -180 3.6 1.0 170 0 155	6000 850 -200 3.1 0.7 120 0 175	volts volts amps amp mA volts watts
SINE-WAVE MODULATION.  AUDIO-FREQUENCY AM OR MODULATOR  Class-AB  MAXIMUM RATINGS (PEDC PLATE VOLTAGE DC SCREEN VOLTAGE DC PLATE CURRENT PLATE DISSIPATION SCREEN DISSIPATION GRID DISSIPATION	er Tube 6000 1000 2.0 3500 175	MAX. MAX. MAX. MAX. MAX.	VOLTS AMPS WATTS WATTS	TYPICAL OPERATION  DC Plate Voltage  DC Screen Voltage  DC Grid Voltage*  Max-Signal Plate C  Zero-Signal Plate C  Max-Signal Screen  Zero-Signal Screen  Peak AF Driving Vol  Driving Power  Load Resistance, Pl	- urrent urrent Current Current tage* - ate-to-	- - - ** -	5000 850 -180 3.6 1.0 170 0 155 0	6000 850 -200 3.1 0.7 120 0 175 0	volts volts amps amp mA wolts watts ohms
sine-wave modulation.  AUDIO-FREQUENCY AM OR MODULATOR Class-AB  MAXIMUM RATINGS (Pe DC PLATE VOLTAGE DC SCREEN VOLTAGE DC PLATE CURRENT PLATE DISSIPATION SCREEN DISSIPATION	er Tube 6000 1000 2.0 3500 175	MAX. MAX. MAX. MAX. MAX.	VOLTS AMPS WATTS WATTS	TYPICAL OPERATION  DC Plate Voltage  DC Screen Voltage  DC Grid Voltage*  Max-Signal Plate C  Zero-Signal Plate C  Max-Signal Screen  Zero-Signal Screen  Peak AF Driving Vol  Driving Power	- urrent urrent Current Current tage* - ate-to-	- - - ** - - Plate on*	5000 850 -180 3.6 1.0 170 0 155 0 3000 3300	6000 850 -200 3.1 0.7 120 0 175 0 4160 3100	volts volts volts amps amp mA volts watts ohms 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		TYPICAL OPERATION			
LINEAR AMPLIFIER		Class AB, Grid Driven			
Class-AB		And Annual Control of the Control of			
		DC Plate Voltage	-	5000	volts
MAXIMUM RATINGS		DC Screen Voltage	-	850	volts
DC PLATE VOLTAGE	6000 MAX. VOLTS	DC Grid Voltage*	-	180	volts
DC SCREEN VOLTAGE	1000 MAX. VOLTS	Zero-Signal DC Plate Current	<del>11</del> 00	0.5	amp
DC PLATE CURRENT	2.0 MAX. AMPS	Single-Tone DC Plate Current	<b>2</b> 2	1.65	amps
PLATE DISSIPATION	3500 MAX. WATTS	Single-Tone DC Screen Current	<del></del>	25	mA
SCREEN DISSIPATION	175 MAX. WATTS	Two-Tone DC Plate Current -	223	1.10	amps
GRID DISSIPATION	50 MAX. WATTS	Two-Tone DC Screen Current	<del>55</del> 22	20	mA
*Approximate values		Peak RF Grid Voltage -	400	155	volts
[BLD] 1.44 MIN (BLD) 1.44 MIN (BLD)	e obtained in exist-	Driving Power -		0	watts
ing equipment. A design	gn test is performed	Peak Envelope Useful Output Power	-	5300	watts
on a sampling basis,	insuring that the	Resonant Load Impedance -	<del>-</del>	1700	ohms
4CX3000A will perform		Intermodulation Distortion Products			
respect to IM distortion		(without negative feedback) -	<del></del> 0	32	db
er output.	8 7.00	or m	ore be	elow PI	EP level

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 4CX-3000A. The use of recommended air-flow rates through these sockets provides effective forcedair 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 megacycles).

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

\*Since the power dissipated by the filament represents about 450 watts and since grid-plusscreen 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 10 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.

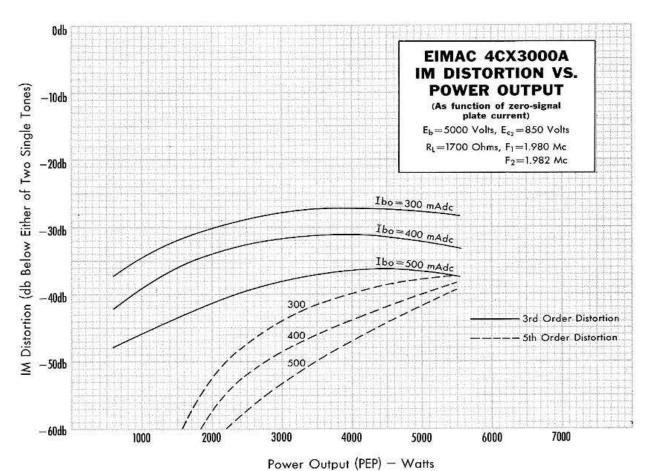
Screen dissipation, in cases where there is no a capplied to the screen, is the simple product of the screen voltage and the screen current. If the screen voltage is modulated, the screen dissipation will depend upon loading, driving power, and carrier screen voltage.

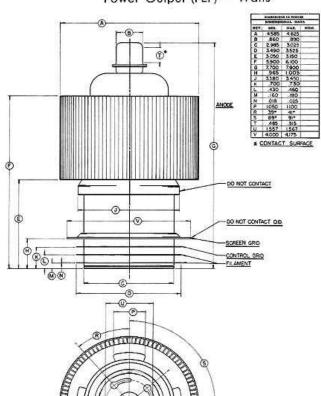
Screen dissipation is likely to rise to excessive values when the plate voltage, bias voltage, or plate load are removed with filament and screen voltages applied. Suitable protective means must be provided to limit the screen dissipation to 175 watts in the event of circuit failure.

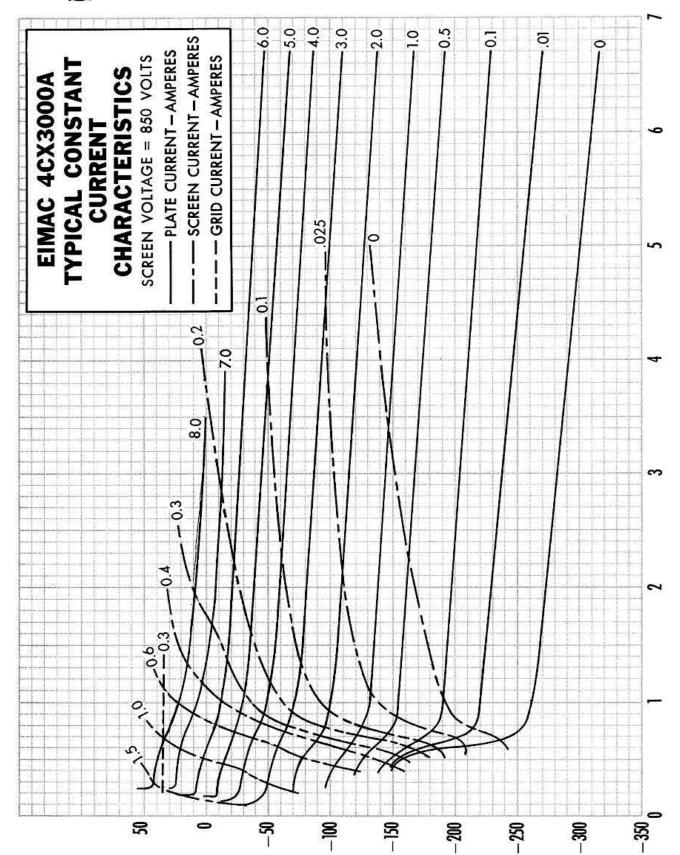
▶ Plate Dissipation The plate-dissipation ratings for the 4CX3000A are 2000 watts for Class-C plate-modulated service and 3000 watts for Class-C telegraphy. In Class-AB operation this rating has been increased to 3500 watts to allow more input. In any Class-AB application maximum plate current and maximum 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 Marketing Department, Eitel-McCullough, Inc. 301 Industrial Way, San Carlos, California, for information and recommendations.



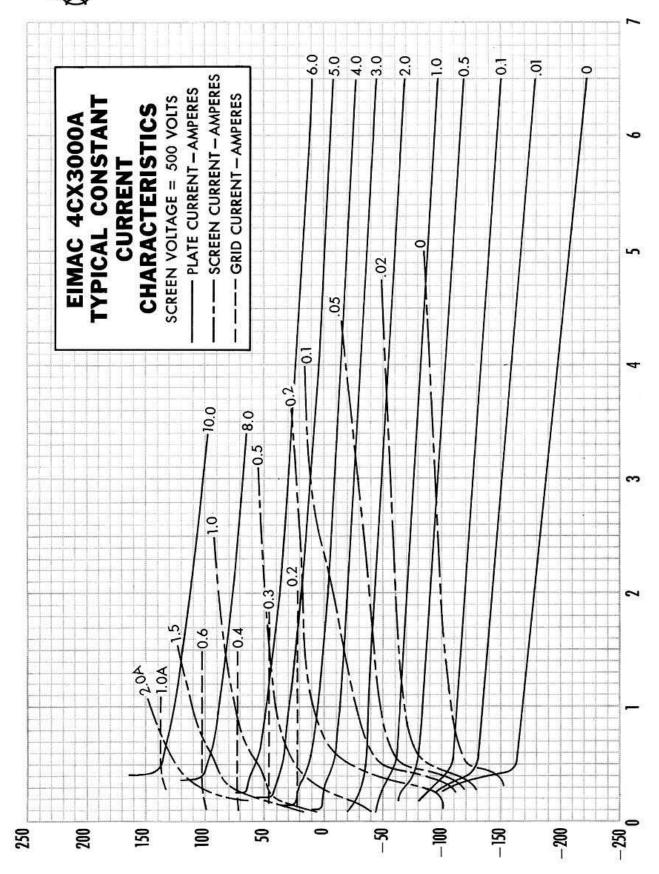






GRID VOLTAGE-VOLTS

PLATE VOLTAGE—KILOVOLTS



4CX3000A

PLATE VOLTAGE—KILOVOLTS