

ELECTRICAL

# E I M A C Division of Varian S A N C A R L O S C A L I F O R N I A

5-500A
RADIAL-BEAM
POWER PENTODE

MODULATOR OSCILLATOR AMPLIFIER

The Eimac 5-500A is a compact, ruggedly constructed radial-beam power pentode having a maximum plate dissipation rating of 500 watts. It is intended for use as an amplifier, oscillator or modulator. The high plate current rating, low grid-plate capacitance and low driving power requirements permit maximum power capability to be combined with circuit simplicity and economic driver requirements.

The Eimac 5-500A is cooled by radiation from the plate and by circulation of forced-air through the base, around the envelope and over the plate seal. Cooling may be greatly simplified by the use of the Eimac SK-400 or SK-410 Air System Socket and the accompanying Eimac SK-426 glass chimney. These sockets are designed to maintain the correct balance of cooling air between the component parts of the tube.

The suppressor element of the 5-500A terminates at the tube base shell, and is designed to be operated at ground (zero) potential. The base shell must be grounded by means of suitable spring clips.



# GENERAL CHARACTERISTICS

-	LECINICAL																		
	Filament: Tho	riat	ed 7	Γung	ster	ı, ba	lanc	ed											
	Voltage -		-	- `	<b>-</b>	<b>-</b>	-	_	-	-	-	_	-	-	-	_	1	10.0 v	olts
	Current -		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	10.2 a	mperes
	Grid-Screen An	npli	fica	tion	Fac	tor (	Ave	rage	) -	-	-	-	-	-	-	-		5.5	
	Direct Interele	ctro	de	Cap	acita	ance	s, G	roun	ded	Cath	ode				Min.			Max.	
	Grid-Plate		-		-	-	-	-	-	-	-	-	-					.10	$\mathbf{pf}$
	Input -		-	-	-	-	-	-	-	-	-	-	-		15.0			19.0	pf
	Output -		-	-	-	-	-	-	-	-	-	-	-		9.5			12.0	$\mathbf{p}\mathbf{f}$
M	ECHANICAL																		
	Base		-	-	-	-	-	-	-	-	-	-	-	-	_	_	-	see	drawing
	Basing		-	-	-	-	-	-	-	-	-	-	-	-	-	_	-	see	drawing
	Mounting Posi	tior	1	-	-	-	-	-	-	-	-	_	-	-	Vert	ical,	ba	se up	or down
	Cooling		-	-	-	-	-	-	_	-	-	-	-	-	Rac	liati	on	and fo	orced air
	Recommended	He	at I	Dissi	patii	ng C	onne	ector	-	-	-	-	-	-	-	-	-	Eim	ac HR-6
	Recommended	So	cket	t -	-	-	-	-	-	-	Eim	ac S	SK-400	) o	r SK-4	10 /	Air	Syster	n Socket
	Recommended	Ch	imr	ney	-	-	-	-	-	-	-	-	-	-	-	-	- 1	Eimac	SK-426
	Maximum Ove	rall	Di	men	sion	S													
	Length -		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		) inches
	Diameter		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.56	inches
	Net Weight -		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1:	lounces
	Shipping Weig	ht	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.5	5 pounds

NOTE: Typical operation data are based on conditions of adjusting the r-f grid drive to a specified plate current, maintaining fixed conditions of grid bias and screen voltage. It will be found that if this procedure is followed there will be little variation in power output between tubes even though there may be some variation in grid and screen currents. Where grid bias is obtained principally by means of a grid resistor, to control plate current it is necessary to make the resistor adjustable.



# RADIO FREQUENCY POWER **AMPLIFIER AND OSCILLATOR**

Class-C Telegraphy or FM Telephony

### MAXIMUM RATINGS

D-C PLATE VOLTAGE -	-	-	4000	Max.	Volts
D-C SCREEN VOLTAGE	-	-	600	Max.	Volts
D-C SUPPRESSOR VOLTA	AGE	-	100	Max.	Volts
D-C PLATE CURRENT -	-	-	450	Max.	ma
PLATE DISSIPATION -	-	-	500	Max.	Watts
SCREEN DISSIPATION	-	-	35	Max.	Watts
GRID DISSIPATION -	-	-	12	Max.	Watts

### TYPICAL OPERATION

D-C Plate Voltage	-	-	-	-	2500	3000	4000	Volts			
D-C Screen Voltage	-	-	-	-	500	500	500	Volts			
D-C Grid Voltage	-	-	-	-	210	220	240	Volts			
D-C Suppressor Volta	age	-		-	0	0	0	Volts			
D-C Plate Current	-	-	-	-	405	432	450	ma			
D-C Screen Current	-	-	-	-	55	65	65	ma			
D-C Grid Current	-	-	-	-	28	35		ma			
Screen Dissipation	-	-	-	-	27.5	32.5	33	Watts			
Grid Dissipation	-	-	-	-	2.8	3.8		Watts			
Peak R-F Grid Input		tage	-	-	310	330		Volts			
MF Driving Power*	-	-	-	•	8.7	12		Watts			
Plate Power Input	-	-	-	-	1015	1300	1800	Watts			
Plate Dissipation	-	-	-	-	265	495	500	Watts			
Plate Power Output	-	-	-	-	750	805	1300	Watts			
*Driving Power increases as frequency is increased.											

TYPICAL OPERATION (Frequencies below 30 Mc.) Peak-Envelope or Modulation-Crest Conditions.

## RADIO-FREQUENCY LINEAR AMPLIFIER

Class AB<sub>1</sub>, Grounded Cathode, one tube

### MAXIMUM RATINGS

DC PL	ATE V	OLTA	GE	-	-	-	4000	Max.	Volts
DC SC	REEN	<b>VOLT</b>	AGE	•	-	-	1000	Max.	Volts
DC SU	JPPRES	SOR	VOL	TAG	ξE	-	100	Max.	Volts
DC PL	ATE C	URRE	NT	-	-	-	450	Max.	ma
PLATE	DISS	IPATI	ON	-	-	-	500	Max.	Watts
SCREE	N DIS	SIPA	rion	l	-	-	35	Max.	Watts

Adjusted for minimum distortion.

DC Plate Voltage	-	2000	3000	4000 Volts
DC Screen Voltage	-	750	750	750 Volts
DC Suppressor Voltage	-	0	0	0 Volts
DC Control Grid Voltage* -	-	—100	112	—121 Volts
Zero-Signal DC Plate Current -	-	150	100	80 mA
Single-Tone DC Plate Current	-	338	320	322 mA
Two-Tone DC Plate Current -	-	252	221	212 mA
Single-Tone DC Screen Current	-	31	26	24 mA
Two-Tone DC Screen Current	-	15	12	10 mA
Peak RF Grid Voltage	-	100	112	121 Volts
Useful Output Power	-	395	612	832 Watts
Resonant Load Impedance -	-	3600	5800	7700 Ohms
Third Order Intermodulation				
Products**	-	52	33	—28 db
Fifth Order Intermodulation				
Products**	-	49	<u>—41</u>	—37 db
4.9 4.11				

\*1. Adjust to the specified zero-signal plate current.

\*\*2. Equal or better than stated for all signal levels up to indicated useful output power. Reference to one tone of a two-tone test signal.

# PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions unless otherwise specified.) MAXIMUM RATINGS

DC PLATE VOLTAGE		-	-	-	4000	VOITS
DC SCREEN VOLTAGE		-	-	-	600	Volts
DC SUPPRESSOR VOL	TAGI	E	-	-	100	Volts
DC GRID VOLTAGE	-	-	-		<b>-500</b>	Volts
DC PLATE CURRENT	-	-	-	-	340	ma
PLATE DISSIPATION		-	-	-	330	Watts
SCREEN DISSIPATION		-	-	-	35	Watts
GRID DISSIPATION	-	-	-	_	12	Watts

### TYPICAL OPERATION

DC Plate Voltage	-	-	-	-	2700	3100	3500 Volts
DC Screen Voltage	-	-	-	-	450	470	500 Volts
DC Grid Voltage	-	-	-	-	270	310	—300 Volts
DC Suppressor Vol	tage	-	-	-	0	0	0 Volts
DC Plate Current	-	_	-	-	285	260	305 ma
DC Screen Current	-	-	-	-	68	50	55 ma
DC Grid Current	-	-	-	_	20	15	18 ma
Screen Dissipation	-	-	-	-	31	23	27 Watts
Peak A-F Screen V		e A	Approx	x.			
(100% Modulati	ion) ັ	_	· -	_	350	330	350 Volts
Peak R-F Grid Volta	ae	_	-	-	355	385	375 Volts
MF Grid Driving Po		_	-	_	フ	6	7 Watts
Plate Dissipation		_	-	-	160	220	280 Watts
Plate Power Outpu	t		_	-	580	580	780 Watts

# **AUDIO FREQUENCY POWER** AMPLIFIER AND MODULATOR

Class AB

# MAXIMUM RATINGS (Per Tube)

D-C PLATE VOLTAGE - - 4000 Max. Volts D-C SCREEN VOLTAGE - - 1000 Max. Volts D-C SUPPRESSOR VOLTAGE - 100 Max. Volts MAX-SIGNAL D-C PLATE CURRENT -450 ma PLATE DISSIPATION -500 Max. Watts 35 Max. Watts SCREEN DISSIPATION GRID DISSIPATION -12 Max. Watts

### TYPICAL OPERATION CLASS ABI

(Sinusoidal wave, two tubes unless otherwise specified)

(Sillosoldal Wave, IWO lobes office	,5 011	101 11		opociou,	,	
D-C Plate Voltage	-	-	-	3000	4000 Vol	ts
D-C Screen Voltage	-	-	-	750	750 Vol	
D-C Suppressor Voltage	-	-	-	0	0 Vol	
D-C Grid Voltage (approx.)* -	-	-	-	112	—121 Vol	ts
Zero-Signal D-C Plate Current	-	-	-	200	160 ma	
Max-Signal D-C Plate Current	-	-	-	640	645 ma	
Zero-Signal D-C Screen Current	-	-		0	0 ma	
Max-Signal D-C Screen Current	-	-	-	52	48 ma	
Effective Load, Plate-to-plate -	-	-	-	11,600	15,400 Ohi	
Peak A-F Grid Input Voltage (per	tub	e)	-	112	121 Vol	
Driving Power	-	-	-	0	0 Wa	
Max-Signal Plate Power Output	-	-	-	1224	1664 Wa	tts
*Adjust to give stated zero-signation series with the control grid	al pl	ate c each	urr 1 tu	ent. The ube shoul	D-C resistar d not exce	ice ed

If it is desired to operate this tube under conditions widely different from those given under "Typical Operation," possibly exceeding the maximum ratings given for CW service, write Eimac, A Division of Varian Associates, for information and recommendations.

250,000 ohms.

# APPLICATION

### **MECHANICAL**

MOUNTING—The 5-500A must be mounted vertically, base up or base down. The socket must be constructed so as to allow an unimpeded flow of air through the holes in the base of the tube and must also provide clearance for the glass tip-off which extends from the center of the base. The metal tube-base shell should be grounded by means of suitable spring fingers. The above requirements are met by the Eimac SK-400 and SK-410 Air-System Sockets. A flexible connecting strap should be provided between the Eimac HR-6 cooler on the plate terminal and the external plate circuit. The tube must be protected from severe vibration and shock.

COOLING—Adequate forced-air cooling must be provided to maintain the base seals at a temperature below 200°C., and the plate seal at a temperature below 225°C.

When the Eimac SK-400 or SK-410 Air-System Sockets and SK-426 chimney are used, a minimum air flow of 14 cubic feet per minute at a static pressure of 0.25 inches of water, as measured in the socket at sea level, is required to provide adequate cooling under all conditions of operation. Seal temperature limitations require that cooling air be supplied to the tube even when the filament alone is on during standby periods.

In the event an Air-System socket is not used, provision must be made to supply equivalent cooling of the base, the envelope, and the plate lead.

Tube temperatures may be measured with the aid of "Tempilaq," a temperature-sensitive laquer manufactured by the Tempil Corporation, 132 West 22nd Street, New York 11, N.Y.

### **ELECTRICAL**

FILAMENT VOLTAGE—For maximum tube life the filament voltage, as measured directly at the filament pins, should be the rated voltage of 10.0 volts. Variations in filament voltage must be kept within the range of 9.5 to 10.5 volts.

The 5-500A features a balanced filament structure to help the designer meet FCC hum and noise specifications in AM service.

BIAS VOLTAGE — The d-c bias voltage for the 5-500A should not exceed 500 volts. If grid leak bias is used, suitable means must be provided to prevent excessive plate or screen dissipation in the event of loss of excitation, and the grid-leak resistor should be made adjustable to

facilitate maintaining the bias voltage and plate current at the desired values from tube to tube. In operation above 50 Mc., it is advisable to keep the bias voltage as low as is practicable.

SCREEN VOLTAGE—The d-c screen voltage for the 5-500A should not exceed 800 volts in r-f applications. In audio applications a maximum d-c screen voltage of 1,000 volts may be used. The screen voltages shown under "Typical Operation" are representative voltages for the type of operation involved.

PLATE VOLTAGE—The plate-supply voltage for the 5-500A should not exceed 4000 volts in CW and audio applications. In plate-modulated telephony service the d-c plate-supply voltage should not exceed 3200 volts, except below 30 Mc., intermittent service, where 4000 volts may be used.

GRID DISSIPATION — Grid dissipation for the 5-500A should not be allowed to exceed 12 watts. Grid dissipation may be calculated from the following expression,

 $Pg = \varepsilon cmpIc$ where Pg = Grid Dissipation

εcmp ⋅= Peak positive grid to cathode

voltage, and Ic = D-C grid current

Ecmp may be measured by means of a suitable peak voltmeter connected between filament and grid.

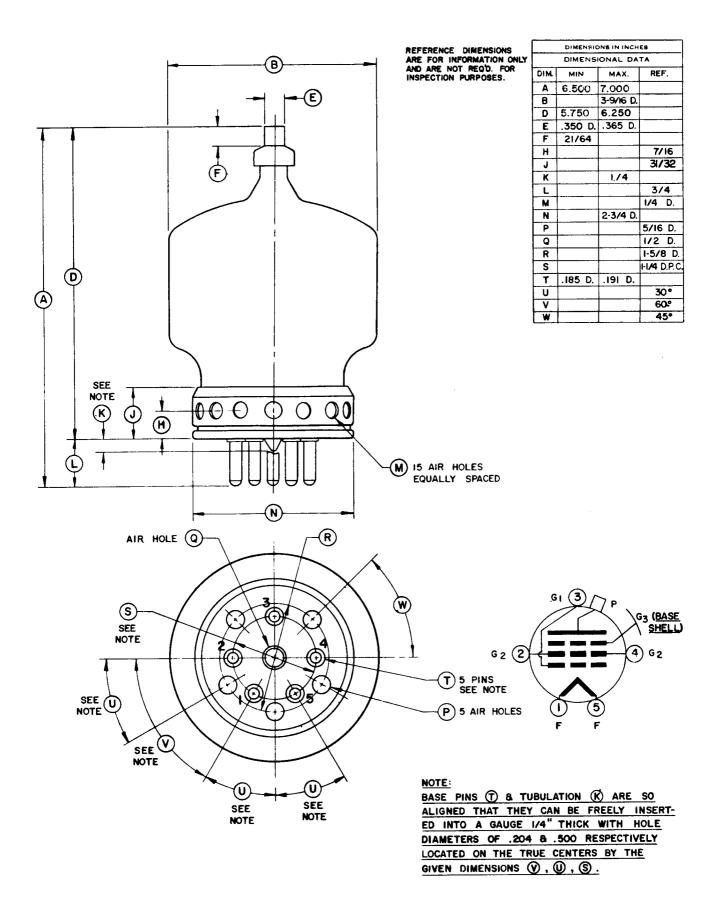
SCREEN DISSIPATION — The power dissipated by the screen of the 5-500A must not exceed 35 watts. Screen dissipation is likely to rise to excessive values when the plate voltage, bias voltage or plate load are removed with filament and screen voltages applied. Suitable protective means must be provided to limit screen dissipation to 35 watts in event of circuit failure.

PLATE DISSIPATION—Under normal operating conditions, the plate dissipation of the 5-500A should not be allowed to exceed 500 watts.

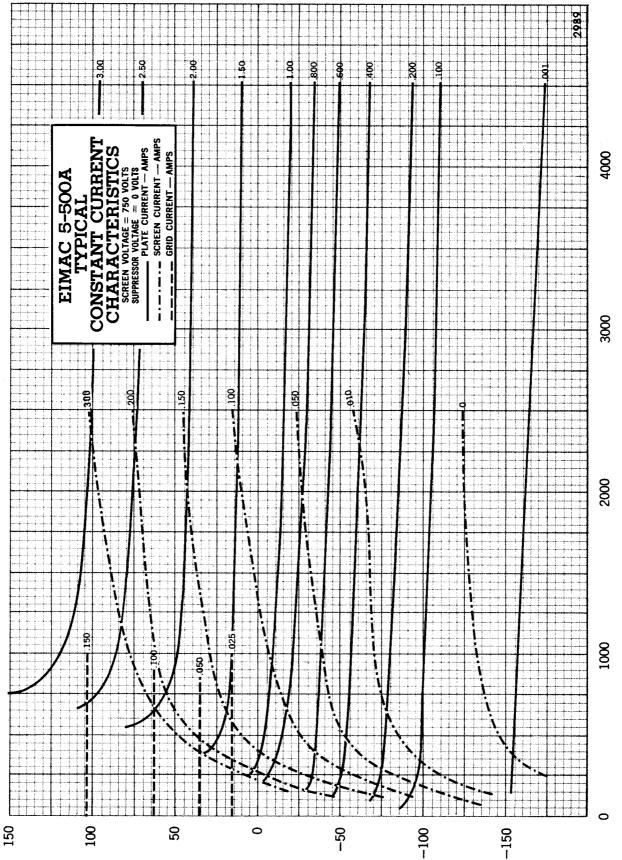
In plate modulated amplifier applications, the maximum allowable carrier-condition plate dissipation is 330 watts. The plate dissipation may rise to 500 watts under 100% sinusoidal modulation.

Plate dissipation in excess of the maximum rating is permissible for short periods of time, such as during tuning procedures.

General information pertaining to the operation of the 5-500A may be found in Application Bulletin No. 8, "The Care and Feeding of Power Tetrodes." This Bulletin is available upon request.

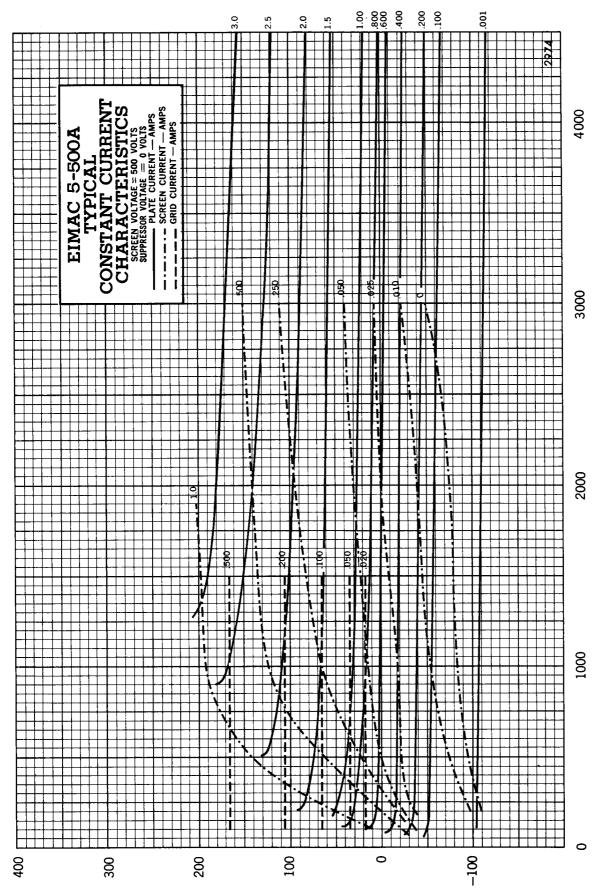






GRID VOLTAGE - VOLTS

PLATE VOLTAGE - VOLTS



GRID VOLTAGE - VOLTS

PLATE VOLTAGE — VOLTS