EITEL-McCULLOUGH, INC. SAN BRUNO, CALIFORNIA

RADIAL-BEAM **POWER TETRODE**

MODULATOR **OSCILLATOR AMPLIFIER**

The Eimac 4-400A is a compact, ruggedly constructed power tetrode having a maximum plate dissipation rating of 400 watts. It is intended for use as an amplifier, oscillator or modulator. The low grid-plate capacitance of this tetrode coupled with its low driving-power requirement allows considerable simplification of the associated circuit and driver stage.

The 4-400A 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 can be greatly simplified by using an Eimac 4-400A/4000 Air-System Socket and its accompanying glass chimney. This socket is designed to maintain the correct balance of cooling air between the component parts of the tube.

ELECTRICAL Filament: Thoriated tungsten Voltage 5.0 volts Current 5.1 Direct Interelectrode Capacitances (Average) Grid-Plate 0.12 μμfd Input 12.5 μμfd Output 4.7 μμfd Transconductance (I _b =100ma., E _b =2500V., E _{cz} =500V.) Frequency for Maximum Ratings See drawing Basing See drawing Mounting Position Recommended Heat Dissipating Plate Connector Recommended Socket Eimac 4- Maximum Over-all Dimensions Length	1																					200		300	9				
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Maximum Over-all Dimensions Length -	1.400 A /																				400	. . /	4000	. A:					-
Diameter	r-400A/	nac 1 -	Eimac	EIN													_	ima	ac	7	r- 4 00	, ~,	7000		r-3)	/51 C (11		,ckt	,,
Diameter	_	_	_	_		_						_		_	_		_		_	_	_		_	-		6.38	t in	chi	
Net Weight	_		_	_		_		-		_		-		_	_		_		_		_		_	_		3.56			_
												_														- 9			_
																										2.5			-
If an Air-System Socket is used, mounted on a 1/4 inch deck, the over-all dimensions of the HR-6 Heat Dissipating Plate Connector are:																													
Length	_		_	_		_		_			_	_			_		_		_	-	_		-	-		8.0	in	ch4	
Diameter	_	_	_	_		_		_						_	_		_		_	_	_	_	_	_			in		-

representations of adjusting the register of 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 (Key-down conditions, per tube to 110 Mc.)

D-C PLATE VOLTAGE	-	-	-	-	-	-		-				_	-	4000 MAX. VOLTS
D-C SCREEN VOLTAGE	-	-	-	-	-	-	-	-	-		-	-	-	600 MAX, VOLTS
D-C PLATE CURRENT	-	-	-	-	-	-	-	-	-	-	-	-		350 MAX. MA
PLATE DISSIPATION	-	-	-	-	-	-	-	-	-	-	-	-	-	400 MAX. WATTS
SCREEN DISSIPATION	-	-	-	-	-	-	-	-	-	-	-		-	35 MAX. WATTS
GRID DISSIPATION	_	-	-	-	-	-	-	-	-	_	-	_	-	IO MAX. WATTS

TYPICAL OPERATION (Frequencies below 75 Mc., one tube)

D-C Plate Voltage		-	-	-		2500	3000	4000	voits
D-C Screen Voltage		-	-	-	-	500	500	500	volts
D-C Grid Voltage		-	-	-		200	220	-220	volts
D-C Plate Current	-	~	-	-	-	350	350	350	ma
D-C Screen Current	-	-	-	-	-	46	46	40	ma
D-C Grid Current	-	-	-	-	-	18	19	18	ma
Screen Dissipation	-	-	-	-	-	23	23	20	watts
Grid Dissipation -	-	-	-	-		1.8	1.9	1.8	watts
Peak R-F Grid Input	Volta	age	-	-	-	300	320	320	volts
Driving Power* -	-	-	-		-	5.4	6.1	5.8	watts
Plate Power Input	-	-	-	-	-	875	1050	1400	watts
Plate Dissipation -	-	-	-	-	-	235	250	300	watts
Plate Power Output	-	•	-	-	-	640	800	1100	watts
*Driving Power inci	reases	as	frec	uenr	v is	increas	ed At	75 M	r the

driving power required is approximately 12 watts. †Guarantee applies only when the 4-400A is used as specified with

adequate air in the 4-400A / 4000 Air-System Socket or equivalent.

TYPICAL OPERATION (110 Mc., two tubes)

D-C Plate Voltage		-	-	-	-		-	3500	4000	volts
D-C Screen Voltage	-		-	-	-	-	-	500	500	volts
D-C Grid Voltage	-	-	-	•	-	-	-	170	—170	volts
D-C Plate Current	-	-	-	-	-	-	-	500	540	ma
D-C Screen Current	-	-	-	-	-	-	-	34	31	ma
D-C Grid Current	-	-	-		-	-	-	20	20	ma
Driving Power (app	гох.)		-	-	-	-	-	20	20	watts
Plate Power Output	(ap	prox	.)	-	-	-	-	1300	1600	watts
Useful Power Output	ŀ		-	-	-		-	1160	1440	watts

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PLATE MODULATED RADIO FREQUENCY AMPLIFIER

Class-C Telephony (Carrier conditions unless otherwise specified. One tube)

MAXIMUM RATINGS Service)	; (Frequ	uencies	belo	w 75 N	Ис. С	ontinuous	i	Servi	ice)		TION	(Fr	eque	ncies be	low 75	Mc. Con	inuou
D-C PLATE VOLTAG	Е -	-	-	3200	MAX	VOLTS		D-C	Screen	Voltage Voltage		-	:	: :	500	500 500	volts volts
D-C SCREEN VOLTA	GE -	_		600	MAX	VOLTS				Voltage Current		:	:	: : .	—220 — 275	-220220 275 275	volts ma
D-C GRID VOLTAGE	-	_	_			VOLTS		D-C S	Screen Grid	Current Current	•	-	-		30 12	28 26 12 12	ma
		•						Scree	n Diss	ipation ation -	-	•	•		15 1.1	14 13 1.1 1.1	watt
D-C PLATE CURREN		-	-		MAX.			Peak	A-F S	reen Vo modulat	tage				350		
PLATE DISSIPATION		•	-	270	MAX.	WATTS		Peak	R-F G	rid Inpu		ige		: :	290	290 290	
SCREEN DISSIPATIO	N -	-	-	35	MAX.	WATTS		Plate		r Input	-	:	-	: :	3.5 550	3.5 3.5 688 825	watt watt
GRID DISSIPATION		-	-	10	MAX.	WATTS				oation - Outpu		:	:	: :	170 380	178 195 510 630	watt:
MAXIMUM RATINGS Service)	(Frequ	encies	below	, 30 Ma	c., Int	ermittent		TYPI Servi		OPERA	TION	(Fre	quei	ncies bel	ow 30 I	Mc., Intern	nitten
D-C Plate Voltage		-	-	4000	MAX	. VOLTS		D-C	Plate	Voltage	-	-	•	2000			volt
D-C Screen Voltage				600	MAX	. VOLTS		D-C (Grid '	Voltage Voltage	:	-	-			–220 ––22 5	volt
•										Current Current	:	:	:	275 30	275 28		ma ma
D-C Grid Voltage		-	-	500	MAX	. VOLTS				Current ipation	-	-	-	12 15	12 14		ma wat
D-C Plate Current		-	-	275	MAX	. MA		Grid	Dissi	pation creen Vo		-	•	1.1	1.1		wat
Plate Dissipation		-	-	270	MAX	. WATTS		(100)% mo	dulation rid Inp)		-	350 290	350 290		volt volt
Screen Dissipation		_	_	35	MAX	. WATTS		Drivin	ig Po	wer	-		-	3.5	3.5	3.5 4.0	watt
Grid Dissipation		_	_			. WATTS		Plate	Dissi	r Input pation r Outpu	-	-	:	550 170 380	688 178 510	195 235	watt
						. **********		riale	rowe	Curpu				300	310	030 /03	watt
AUDIO FREQUENC	R—CLAS GS (PEI	SS AB R TUBE	≣)	EŘ													
MAXIMUM RATIN		TACE	_	-			-	-	-			-				VOLTS	
D-C PLA							-	-	-		_			- 800	J MAX.	VOLTS	
D-C PLA D-C SCR	EEN VC	LTAGI	Е -	CURRE	-		_		_		_			_ 3E/	YAM	MA	
D-C PLA	EEN VO	LTAGI	Е -	-	-		-	-	-						MAX.		
D-C PLA D-C SCR MAX-SIG	EEN VO	LTAGI I-C PL	E - .ATE -	-	-		-	-	-					- 400	MAX.	MA. WATTS WATTS	

(3) nuscidal wave, Iwo lubes unit	33 U	11161 4126	specille	:4)		
D-C Plate Voltage	•	2500	3000	3500	4000	volts
D-C Screen Voltage	-	750	750	750	750	volts
D-C Grid Voltage (approx.)*	-	—130	—I37	—145	-150	volts
Zero-Signal D-C Plate Current	-	190	160	140	120	ma
Max-Signal D-C Plate Current	-	635	635	610	585	ma
Zero-Signal D-C Screen Curren	† -	0	0	0	0	ma
Max-Signal D-C Screen Curren	t -	28	26	32	40	ma
Effective Load, Plate-to-Plate	-	6800	8900	11,500	14,500	ohms
Peak A-F Grid Input Voltage						
(per tube)	-	130	137	145	150	volts
Driving Power	-	0	0	0	0	watts
Max-Signal Plate Dissipation						
(per tube)	-	370	400	400	400	watts
Max-Signal Plate Power Output	-	850	1110	1330	1540	watts
*Adjust to give stated zero-sig	nal	plate cu	irrent. T	he D-C	resista	nce in
series with the control arid of						

(Sinusoidal wave, two tubes unless oth	erwise	specifie	d)		
D-C Plate Voltage	2500	3000	3500	4000	volts
D-C Screen Voltage	500	500	500	500	volts
D-C Grid Voltage (approx.)* -	75	—80	—8 5	9 0	volts
Zero-Signal D-C Plate Current -	190	160	140	120	ma
Max-Signal D-C Plate Current -	700	700	700	638	ma
Zero-Signal D-C Screen Current -	0	0	0	0	ma
Max-Signal D-C Screen Current -	50	40	38	32	ma
Effective Load, Plate-to-Plate -	7200	9100	10,800	14,000	ohms
Peak A-F Grid Input Voltage					
(per tube)	133	140	145	140	volts
Max-Signal Peak Driving Power	8.6	9.0	10.2	7.0	watts
Max-Signal Nominal Driving Power	4.3	4.5	5. l	3.5	watts
Max-Signal Plate Dissipation					
(per tube)	320	363	400	400	watts
Max-Signal Plate Power Output -	1110	1375	1650	1750	watts
*Adjust for stated zero-signal plate cur	rent.				

Pulse Service—For information on Pulse Service Ratings, "Application Bulletin No. 3, Pulse Service Notes", will be furnished free on request.

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 EITEL-McCULLOUGH, INC., FOR INFORMATION AND RECOMMENDATIONS.

MECHANICAL

Mounting—The 4-400A 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 4-400A/4000 Air-System Socket. 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.

APPLICATION

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 4-400A/4000 Air-System Socket is 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 may 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, pro-



vision 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 lacquer manufactured by the Tempil Corporation, 11 West 25th Street, New York 10, 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 5.0 volts. Variations in filament voltage must be kept within the range from 4.75 to 5.25 volts.

Bias Voltage—The d-c bias voltage for the 4-400A 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 4-400A should not exceed 600 volts in r-f applications. In audio applications a maximum d-c screen voltage of 800 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 4-400A 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 4-400A should not be allowed to exceed 10 watts. Grid dissipation may be calculated from the following expression,

 $P_g = e_{emp}I_e$

where Pg = Grid Dissipation

eemp = Peak positive grid to cathode voltage, and

I_e = D-c grid current

eemp may be measured by means of a suitable peak voltmeter connected between filament and grid. (For suitable peak v.t.v.m. circuits see Eimac Application Bulletin Number 6, "Vacuum Tube Ratings." This bulletin is available on request.)

Screen Dissipation—The power dissipated by the screen of the 4-400A 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 4-400A should not be allowed to exceed 400 watts.

In plate modulated amplifier applications, the maximum allowable carrier-condition plate dissipation is 270 watts. The plate dissipation will rise to 400 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 4-400A MAY BE FOUND IN APPLICATION BULLETIN NO. 8, "THE CARE AND FEEDING OF POWER TETRODES." THIS BULLETIN IS AVAILABLE UPON REQUEST.







