EIMAC
Division of Varian
SAN CARLOS
CALIFORNIA

5-500A

RADIAL-BEAM POWER PENTODE

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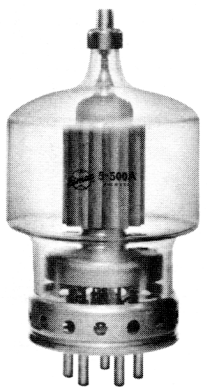
MODULATOR OSCILLATOR AMPLIFIER

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

ELECTRICAL

Filament: Thoriated Tungsten, balanced			
Voltage		10.0	volts
Current		10.2	amperes
Grid-Screen Amplification Factor (Average)		5.5	
Direct Interelectrode Capacitances, Grounded Cathode	*Min.*	*Max.*	
Grid-Plate	—	.10	pf
Input	15.0	19.0	pf
Output	9.5	12.0	pf

MECHANICAL

Base	see drawing
Basing	see drawing
Mounting Position	Vertical, base up or down
Cooling	Radiation and forced air
Recommended Heat Dissipating Connector	Eimac HR-6
Recommended Socket	Eimac SK-400 or SK-410 Air System Socket
Recommended Chimney	Eimac SK-426
Maximum Overall Dimensions	
Length	7.00 inches
Diameter	3.56 inches
Net Weight	11 ounces
Shipping Weight	2.5 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.

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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 VOLTAGE	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 Voltage	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	38 ma
Screen Dissipation	27.5	32.5	33 Watts
Grid Dissipation	2.8	3.8	5.0 Watts
Peak R-F Grid Input Voltage	310	330	365 Volts
MF Driving Power*	8.7	12	14 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.

RADIO-FREQUENCY LINEAR AMPLIFIER

Class AB_1, Grounded Cathode, one tube

MAXIMUM RATINGS

DC PLATE VOLTAGE	4000 Max. Volts
DC SCREEN VOLTAGE	1000 Max. Volts
DC SUPPRESSOR VOLTAGE	100 Max. Volts
DC PLATE CURRENT	450 Max. ma
PLATE DISSIPATION	500 Max. Watts
SCREEN DISSIPATION	35 Max. Watts

TYPICAL OPERATION (Frequencies below 30 Mc.)
Peak-Envelope or Modulation-Crest Conditions.
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	—41	—37 db

*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 Volts
DC SCREEN VOLTAGE	600 Volts
DC SUPPRESSOR VOLTAGE	100 Volts
DC GRID VOLTAGE	—500 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 Voltage	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 Voltage Approx. (100% Modulation)	350	330	350 Volts
Peak R-F Grid Voltage	355	385	375 Volts
MF Grid Driving Power	7	6	7 Watts
Plate Dissipation	160	220	280 Watts
Plate Power Output	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
SCREEN DISSIPATION	35 Max. Watts
GRID DISSIPATION	12 Max. Watts

TYPICAL OPERATION CLASS AB_1
(Sinusoidal wave, two tubes unless otherwise specified)

D-C Plate Voltage	3000	4000 Volts
D-C Screen Voltage	750	750 Volts
D-C Suppressor Voltage	0	0 Volts
D-C Grid Voltage (approx.)*	—112	—121 Volts
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 Ohms
Peak A-F Grid Input Voltage (per tube)	112	121 Volts
Driving Power	0	0 Watts
Max-Signal Plate Power Output	1224	1664 Watts

*Adjust to give stated zero-signal plate current. The D-C resistance in series with the control grid of each tube should not exceed 250,000 ohms.

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.

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,

$$Pg = \varepsilon cmp Ic$$

where Pg = Grid Dissipation

εcmp = Peak positive grid to cathode voltage, and

Ic = D-C grid current

εcmp 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.

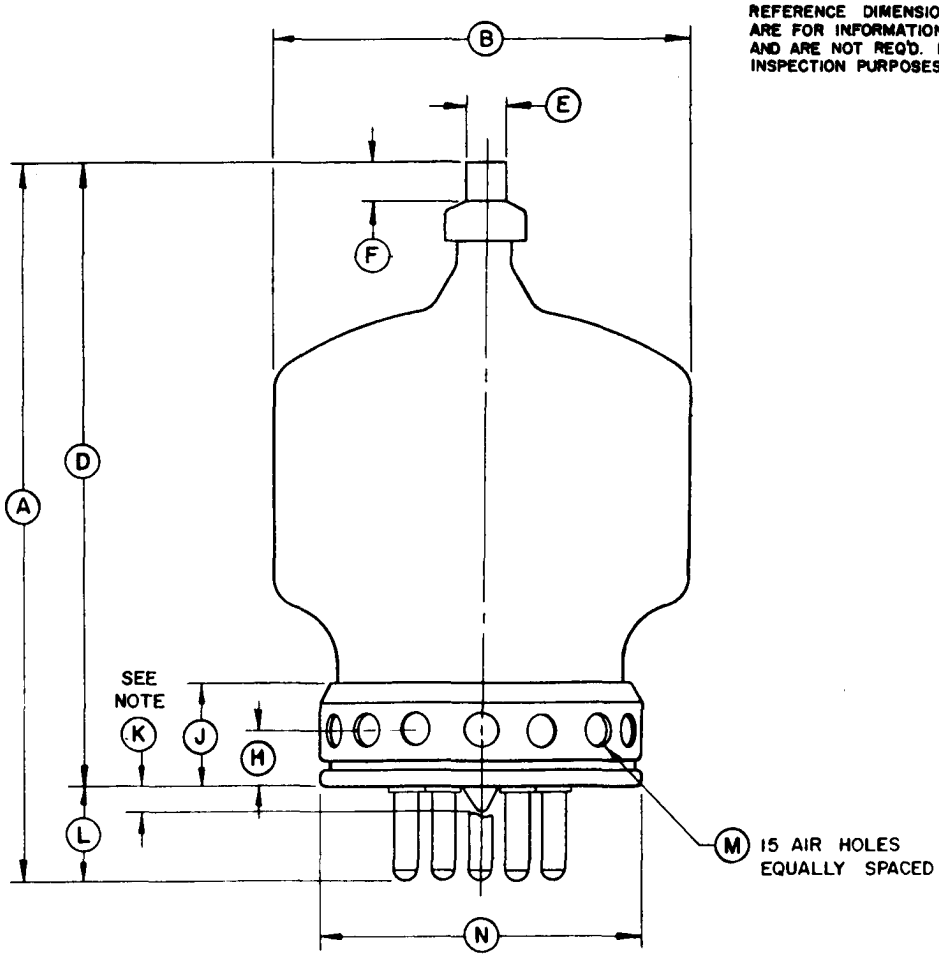
In plate modulated amplifier applications, the maximum allowable carrier-condition plate dissipation is 330 watts. The plate dissipation may rise to 500 watts under 100% sinusoidal modulation.

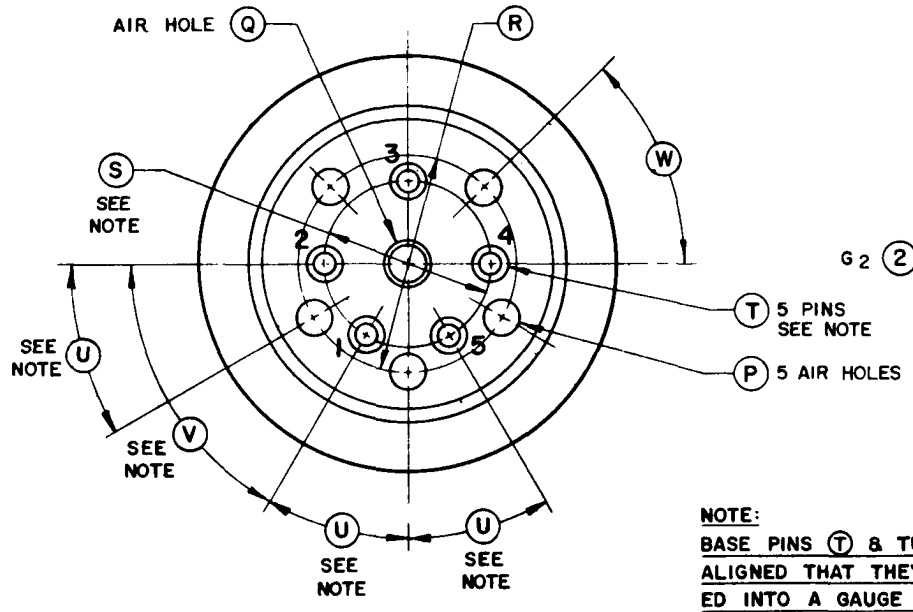
Plate dissipation in excess of the maximum rating is permissible for short periods of time, such as during tuning procedures.

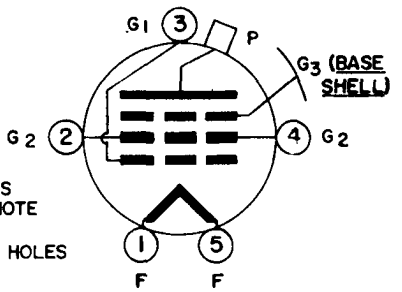
General information pertaining to the operation of the 5-500A may be found in Application Bulletin No. 8, "The Care and Feeding of Power Tetrodes." This Bulletin is available upon request.

REFERENCE DIMENSIONS ARE FOR INFORMATION ONLY AND ARE NOT REQ'D. FOR INSPECTION PURPOSES.

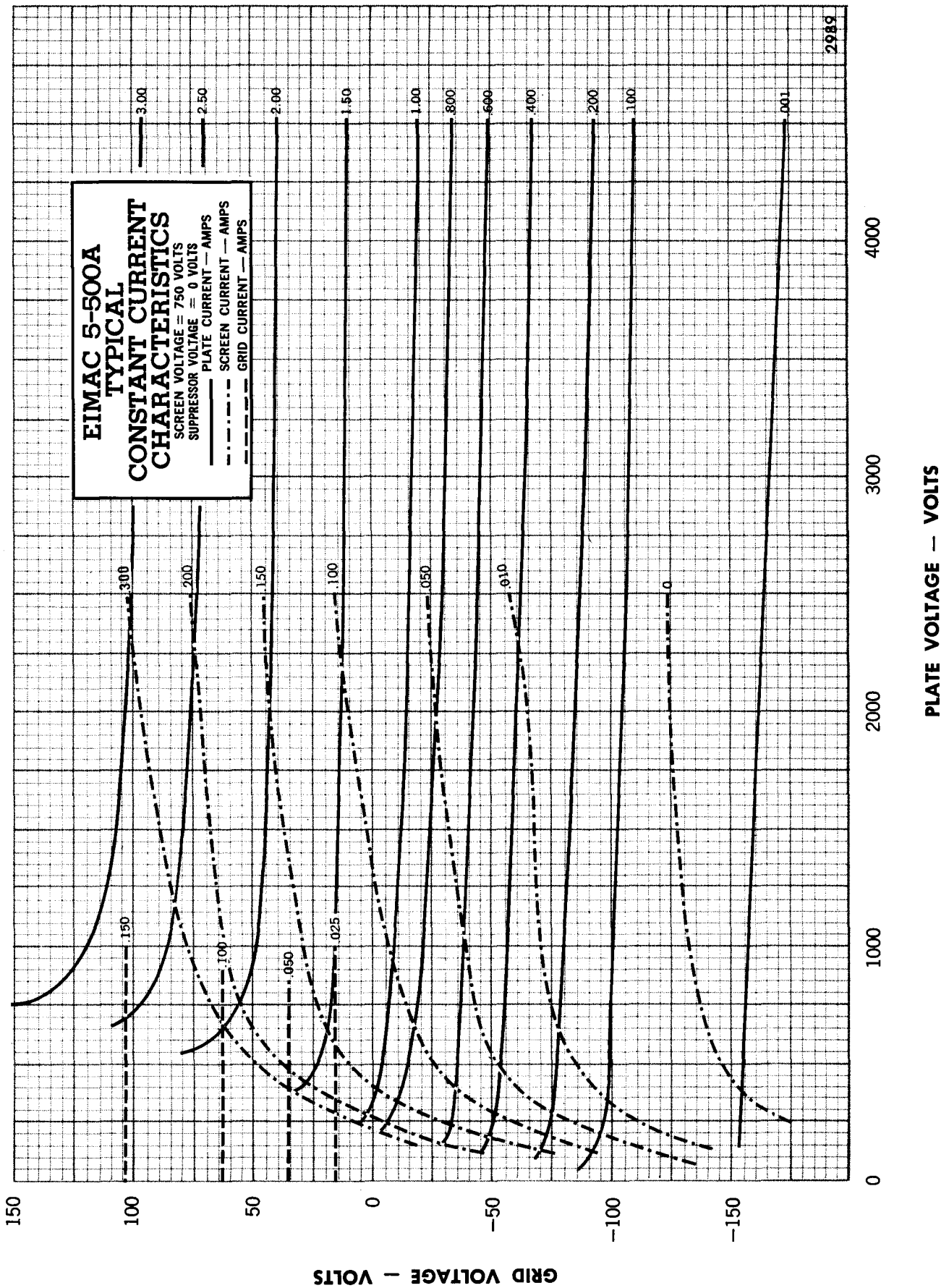
DIMENSIONS IN INCHES			
DIMENSIONAL DATA			
DIM.	MIN	MAX.	REF.
A	6.500	7.000	
B		3-9/16 D.	
D	5.750	6.250	
E	.350 D.	.365 D.	
F	21/64		
H			7/16
J			31/32
K		1.1/4	
L			3/4
M			1/4 D.
N		2-3/4 D.	
P			5/16 D.
Q			1/2 D.
R			1-5/8 D.
S			1-1/4 D.P.C.
T	.185 D.	.191 D.	
U			30°
V			60°
W			45°

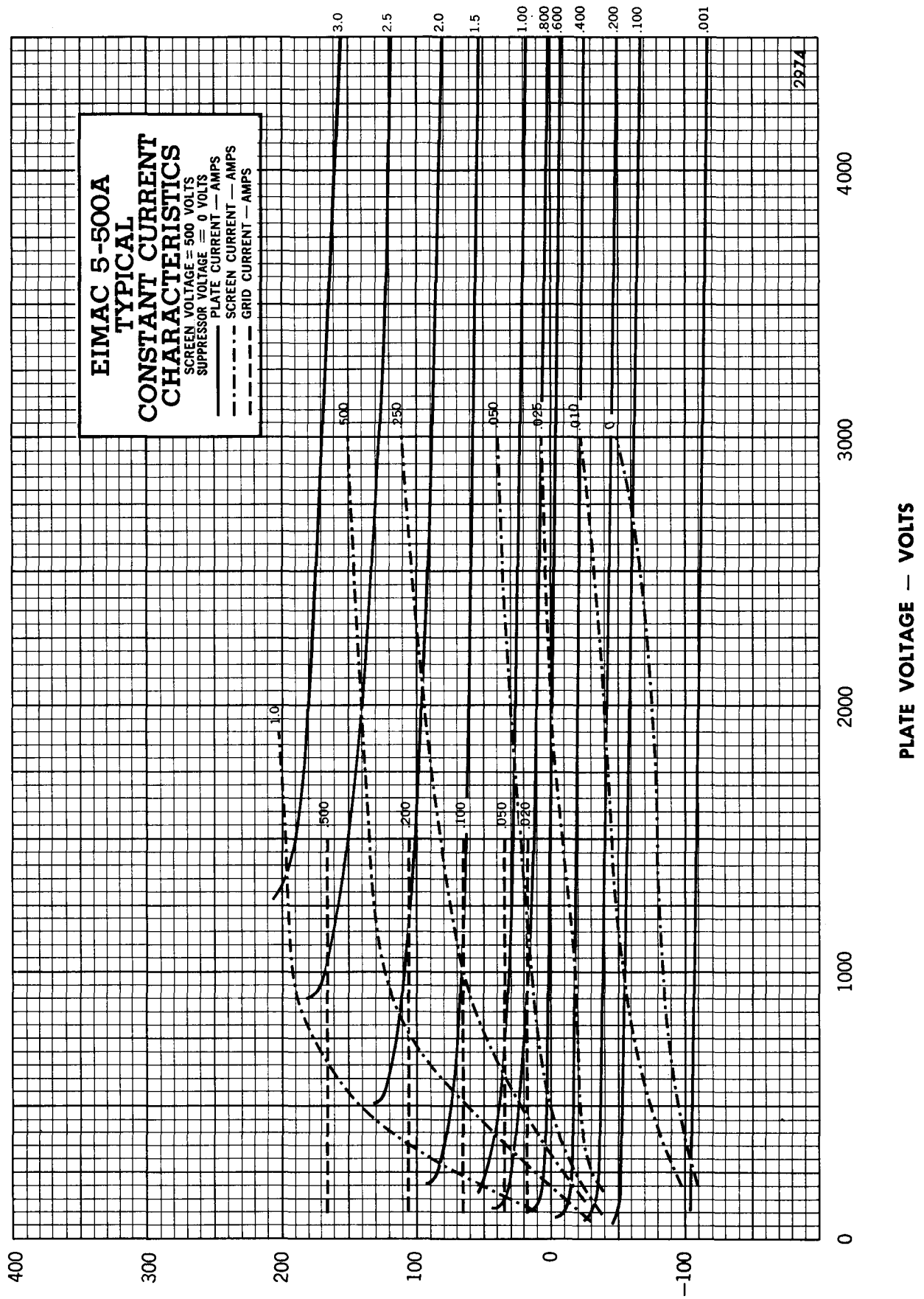






NOTE:
BASE PINS (T) & TUBULATION (K) ARE SO ALIGNED THAT THEY CAN BE FREELY INSERTED INTO A GAUGE 1/4" THICK WITH HOLE DIAMETERS OF .204 & .500 RESPECTIVELY LOCATED ON THE TRUE CENTERS BY THE GIVEN DIMENSIONS (V), (U), (S).


EIMAC 5-500A
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
SCREEN VOLTAGE = 750 VOLTS
SUPPRESSOR VOLTAGE = 0 VOLTS
PLATE CURRENT — AMPS
SCREEN CURRENT — AMPS
GRID CURRENT — AMPS
3.00
2.50
2.00
1.50
1.00
.800
.600
.400
.200
.100
.001
2989
.300
.200
.150
.100
.050
.150
.100
.050
.025
.010
0
150
100
50
0
−50
−100
−150
0
1000
2000
3000
4000
GRID VOLTAGE — VOLTS
PLATE VOLTAGE — VOLTS


EIMAC 5-500A
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
SCREEN VOLTAGE = 500 VOLTS
SUPPRESSOR VOLTAGE = 0 VOLTS
PLATE CURRENT — AMPS
SCREEN CURRENT — AMPS
GRID CURRENT — AMPS
2974
3.0
2.5
2.0
1.5
1.00
.800
.600
.400
.200
.100
.001
500
250
.050
.025
.010
0
1.0
.500
.200
.100
.050
.020
400
300
200
100
0
−100
0
1000
2000
3000
4000
GRID VOLTAGE — VOLTS
PLATE VOLTAGE — VOLTS