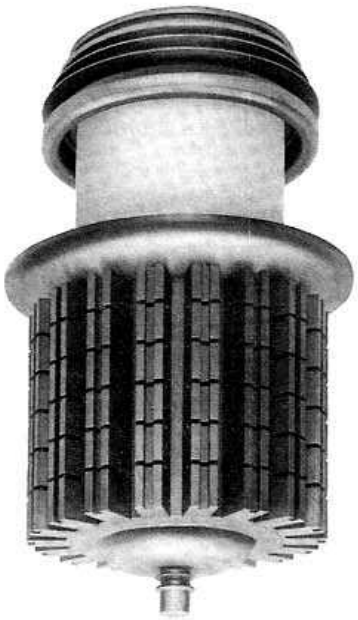
EIMAC
Division of Varian
SAN CARLOS
CALIFORNIA

8351
4CV100,000C
VAPOR COOLED POWER TETRODE

The EIMAC 8351/4CV100,000C is a ceramic-metal, vapor-cooled power tetrode intended for use at the 100 to 200 kilowatt output power level. It is recommended for use as a Class-C rf amplifier or oscillator, a Class-AB, rf linear amplifier or a Class-AB, push-pull af amplifier or modulator. The 8351/4CV100,000C is also useful as a plate and screen modulated Class-C rf amplifier.

The vapor-cooled anode is rated at 100 kilowatts of plate dissipation when mounted in the EIMAC BR-300 series boiler.



GENERAL CHARACTERISTICS

ELECTRICAL

Filament: Thoriated Tungsten			
Voltage		10	V
Current		300	A
Amplification Factor (Grid-Screen) (average)		4.5	
Interelectrode Capacitances, Grounded Cathode	*Min.*	*Max.*	
Input	420	500	pF
Output	46	56	pF
Feedback	1.5	3.2	pF
Interelectrode Capacitances, Grounded Grid			
Input	170	210	pF
Output	48	58	pF
Feedback	---	0.6	pF
Frequency for Maximum Ratings		30	MHz

MECHANICAL

Base	Special, graduated rings
Maximum Seal Temperature	250°C
Maximum Anode Flange Temperature	130°C
Recommended Socket	EIMAC SK-1500 Series
Recommended Boiler	EIMAC BR-300 Series
Operating Position	Vertical, base up
Maximum Dimensions:	
Height	17.0 in
Diameter	10.0 in
Cooling	Liquid to vapor and forced air
Net Weight	95 lbs
Shipping Weight (approximate)	150 lbs

RADIO-FREQUENCY POWER AMPLIFIER OR OSCILLATOR

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

MAXIMUM RATINGS

DC PLATE VOLTAGE	20,000	VOLTS
DC SCREEN VOLTAGE	2500	VOLTS
DC PLATE CURRENT	15.0	AMPS
PLATE DISSIPATION	100,000	WATTS
SCREEN DISSIPATION	1750	WATTS
GRID DISSIPATION	500	WATTS

TYPICAL OPERATION (Frequencies below 30 megacycles)

DC Plate Voltage	15	17.5	kV
DC Screen Voltage	1.5	1.5	kV
DC Grid Voltage	-1020	-1050	V
DC Plate Current	11.8	11.8	A
DC Screen Current	1.0	1.0	A
DC Grid Current	100	100	mA
Peak RF Grid Voltage	1220	1250	V
Driving Power*	120	125	W
Plate Dissipation	38	38.5	kW
Plate Output Power	139	168	kW
Resonant Load Impedance	600	710	Ω

Printed in U.S.A.

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER-CATHODE DRIVEN

Class-C Telephony (Carrier conditions except where noted)

MAXIMUM RATINGS

DC PLATE VOLTAGE	17,500	VOLTS
DC SCREEN VOLTAGE	2000	VOLTS
DC PLATE CURRENT	15.0	AMPS
PLATE DISSIPATION*	66,500	WATTS
SCREEN DISSIPATION‡	1750	WATTS
GRID DISSIPATION‡	500	WATTS

* Corresponds to 100,000 watts at 100 per cent sine wave modulation
** Approximate value
† Calculated low frequency drive power
‡ Average, with or without modulation

TYPICAL OPERATION (Frequencies below 30 megacycles)

DC Plate Voltage	14	16	kV
DC Screen Voltage	750	750	V
Peak AF Screen Voltage (for 100% modulation**)	750	750	V
DC Grid Voltage	-700	-700	V
DC Plate Current	9.1	12.0	A
DC Screen Current	2.0	1.75	A
DC Grid Current	1.0	1.20	A
Peak RF Grid Voltage	1000	1050	V
Grid Driving Power†	1000	1260	W
Plate Dissipation	20.4	54.0	kW
Plate Output Power	107	138.5	kW
Resonant Load Impedance	790	620	Ω

AUDIO-FREQUENCY AMPLIFIER OR MODULATOR

Class-AB_1

MAXIMUM RATINGS

DC PLATE VOLTAGE	20,000	VOLTS
DC SCREEN VOLTAGE	2500	VOLTS
DC PLATE CURRENT	15.0	AMPS
PLATE DISSIPATION	100,000	WATTS
SCREEN DISSIPATION	1750	WATTS
GRID DISSIPATION	500	WATTS

*Per Tube
**Approximate value

TYPICAL OPERATION (Two Tubes)

DC Plate Voltage	15	18	kV
DC Screen Voltage	1.5	1.5	kV
DC Grid Voltage	-360	-380	V
Max-Signal Plate Current	18.8	20.0	A
Zero-Signal Plate Current	6.0	6.0	A
Max-Signal Screen Current**	0.690	0.700	A
Peak AF Driving Voltage*	350	380	V
Driving Power	0	0	W
Load Resistance, Plate-to-Plate	1800	2080	Ω
Max-Signal Plate Dissipation*	47.3	56.8	kW
Max. Signal Plate Output Power	187.4	246.4	kW

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER-GRID DRIVEN

Class-C Telephony (Carrier conditions except where noted)

MAXIMUM RATINGS

DC PLATE VOLTAGE	17,500	VOLTS
DC SCREEN VOLTAGE	2000	VOLTS
DC PLATE CURRENT	15.0	AMPS
PLATE DISSIPATION	66,500	WATTS
SCREEN DISSIPATION‡	1750	WATTS
GRID DISSIPATION‡	500	WATTS

*Voltages given are referenced to ground
‡Average, with or without modulation

TYPICAL OPERATION (Frequencies below 30 megacycles)

DC Plate Voltage*	12	15	kV
DC Screen Voltage*	560	900	V
DC Grid Voltage*	-440	-600	V
DC Plate Current	12.4	11.6	A
DC Screen Current	1.32	0.72	A
DC Grid Current	0.20	0.10	A
Peak RF Cathode Voltage	655	720	V
Cathode Driving Power	8.1	8.1	kW
Cathode Driving Impedance	27	32	Ω
Plate Dissipation	49.2	47.0	kW
Plate Output Power	112.7	141.0	kW
Resonant Load Impedance	480	650	Ω

RADIO-FREQUENCY LINEAR AMPLIFIER

Class-AB_1

MAXIMUM RATINGS

DC PLATE VOLTAGE	20,000	VOLTS
DC SCREEN VOLTAGE	2500	VOLTS
DC PLATE CURRENT	15.0	AMPS
PLATE DISSIPATION	100,000	WATTS
SCREEN DISSIPATION	1750	WATTS
GRID DISSIPATION	500	WATTS

*Approximate value

TYPICAL OPERATION, Peak-Envelope or Modulation-Crest Conditions, (Frequencies below 30 megacycles)

DC Plate Voltage	15	18	kV
DC Screen Voltage	1.5	1.5	kV
DC Grid Voltage	-360	-380	V
Max-Signal Plate Current	9.4	10.0	A
Zero-Signal Plate Current	3.0	3.0	A
Max-Signal Screen Current*	0.345	0.350	A
Peak RF Grid Voltage	350	380	V
Driving Power	0	0	W
Plate Dissipation	47.3	56.8	kW
Plate Output Power	93.7	123.2	kW
Resonant Load Impedance	900	1040	Ω

NOTE: "TYPICAL OPERATION" data are obtained by calculation from published characteristic curves. Adjustment of the rf grid drive to obtain the specified plate current at the specified grid bias, screen voltage, and plate voltage is assumed. If this procedure is followed, there will be little variation in output power when the tubes are changed, even though there may be some variations in grid and screen currents. The grid and screen currents which result when the desired plate current is obtained are incidental and vary from tube to tube. These current variations cause no difficulty so long as the circuit maintains the correct voltage in the presence of the variations in current. If grid bias is obtained principally by means of a grid resistor, the resistor must be adjustable to obtain the required bias voltage when the correct rf driving voltage is applied.

APPLICATION

MECHANICAL

Mounting: The 4CV100,000C must be mounted vertically, anode down, in an EIMAC BR-300 series boiler. Care must be exercised to insure that the axis of the tube/boiler combination is vertical and that water in the boiler is at the level indicated. The anode flange on the tube must seat securely against the rubber "O" ring, forming a vapor-tight seal between tube and boiler.

Socket: The EIMAC SK-1500 series socket is available for use with the 4CV100,000C. Filament, control grid and screen grid connections are made to this socket. Spring finger contacts on the socket are used to make connections to the concentric rings on the tube base.

Cooling: Cooling is accomplished by immersing the anode of the 4CV100,000C in a "Boiler" filled with distilled water. Energy dissipated by the anode causes the water to boil at the anode surfaces, be converted into steam and be carried away to an external condenser. The condensate is then returned to the boiler, completing the cycle.

This boiling action maintains the anode surfaces at a fairly constant temperature near 100°C. The vapor-cooled tube has good overload capabilities; excess dissipation for moderate periods only causes more water to boil.

The system schematic drawing shown below outlines a vapor-cooling installation. A control box (EIMAC CB-202) is used to sense water level, to signal for make-up water and to shut down the system in case of low water level. In order to perform its function, the control box must be mounted so that its water level mark is at the same elevation as the water level mark on the boiler.

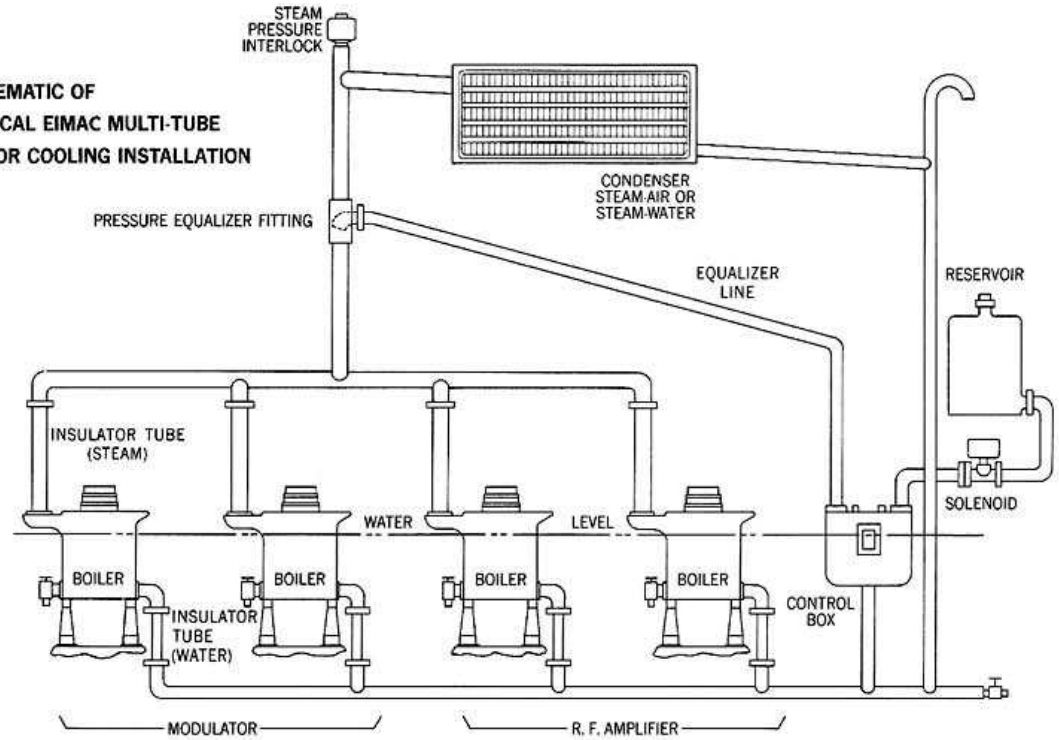
Since the tube anode and boiler are usually at high potential to ground, water and steam connections to the boiler are made through insulating tubing.

A pressure equalizing line is shown between the steam side of the system and the top of the control box. Its function is to provide the same pressure in the control box as in the boiler.

Separate cooling of the tube base is required and is accomplished by directing approximately 120 cfm of air horizontally through the socket from the side. It is preferable to direct this air through three equally spaced ducts.

The well in the center of the baseplate of the tube is a critical area which requires cooling to maintain envelope temperatures less than 250°C. For most applications, 1 to 2 C.F.M. of air directed through the center of the socket is sufficient for this purpose.

SCHEMATIC OF TYPICAL EIMAC MULTI-TUBE VAPOR COOLING INSTALLATION



ELECTRICAL

Filament The rated filament voltage for the 4CV100,000C is 10.0 volts. Filament voltage, as measured at the socket, should be maintained at 10 volts plus or minus five percent to obtain maximum life and consistent performance.

Filament starting current must be limited to a maximum of 900 amperes.

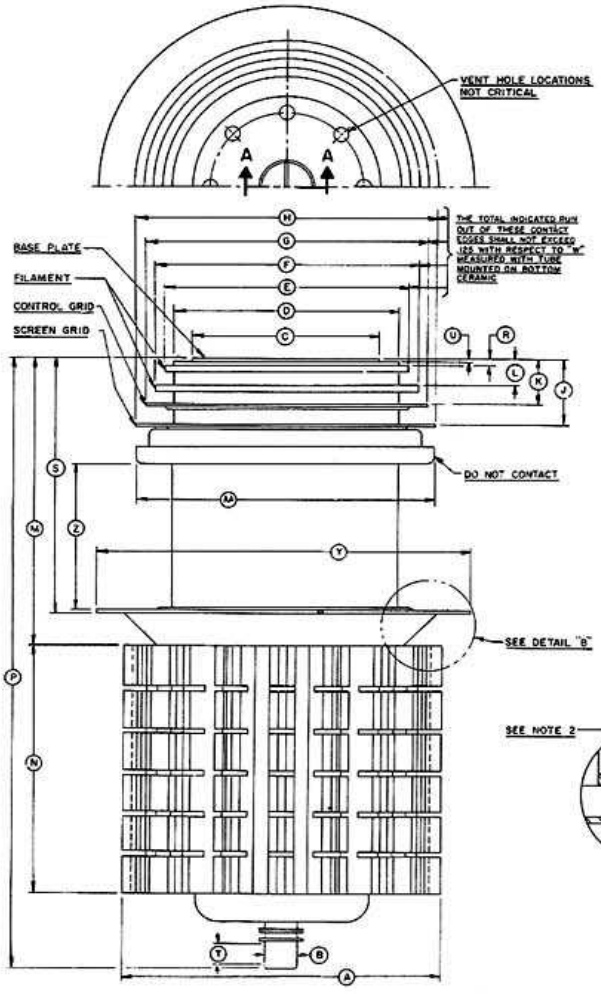
Voltage between filament and the base plates of either tube, or SK-1500 socket, must not exceed 100 volts.

Control-Grid Operation The 4CV100,000C control grid is rated at 500 watts of dissipation. Grid dissipation is the approximate product of grid current and peak positive grid voltage.

Screen Dissipation The power dissipated by the screen grid must not exceed 1750 watts. Where no ac is applied to the screen, dissipation is the product of dc screen voltage and dc screen current. With screen modulation the dissipation is dependent on RMS screen voltage, and RMS screen current. Plate voltage, plate load or bias voltage must never be removed while filament and screen voltages are present since the screen dissipation rating will be exceeded. Suitable protective means must be provided to prevent any of these conditions.

Plate Dissipation The plate dissipation of 100 kilowatts attainable through vapor cooling provides a large margin of safety in most applications. The rating may be exceeded for brief periods during tuning. When the 4CV100,000C is used as a plate-modulated rf amplifier, plate dissipation under carrier conditions is limited to 66,500 watts.

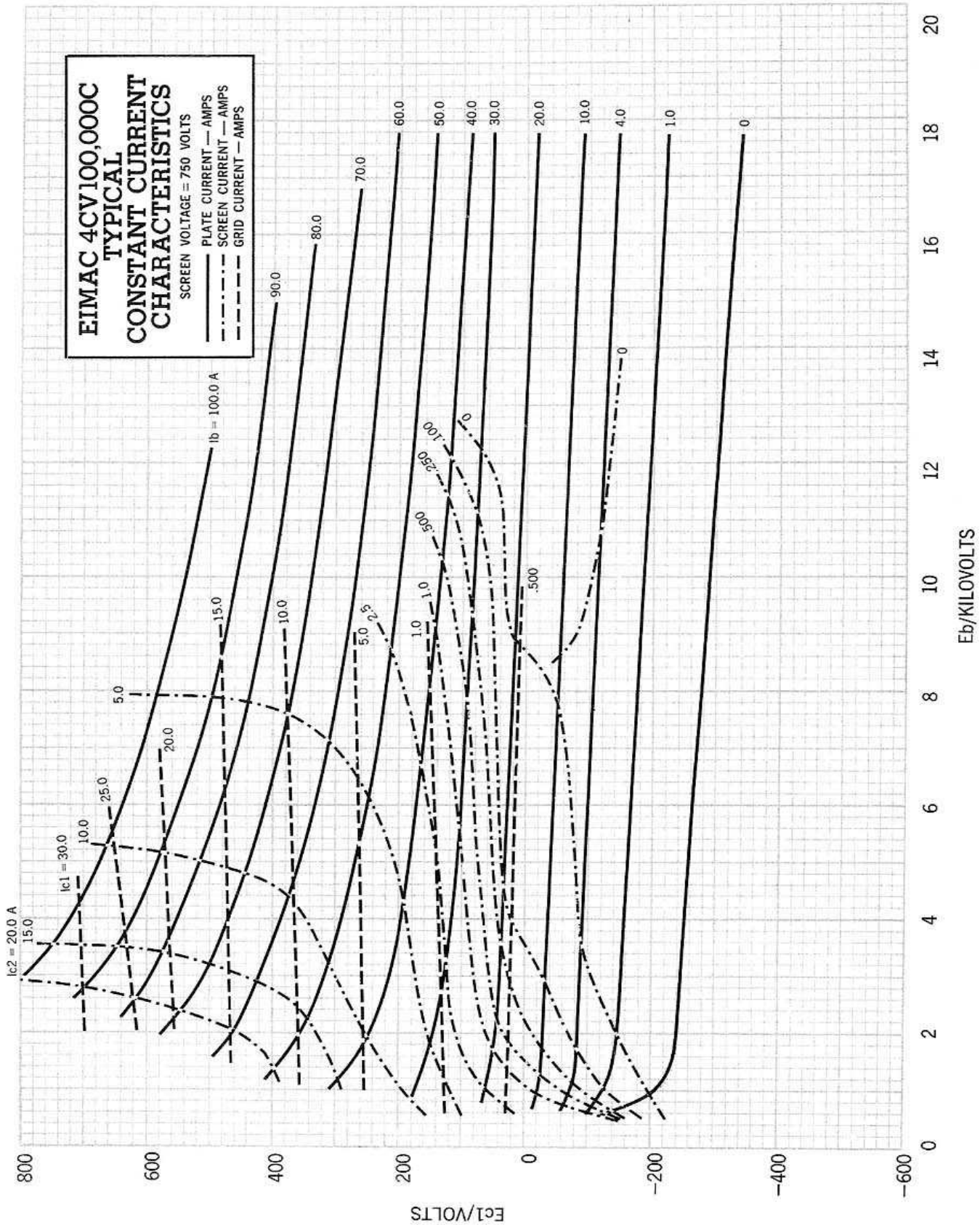
Special Application Where it is desired to operate this tube under conditions widely different from those listed here, write to Power Grid Tube Division, EIMAC Division of Varian, 301 Industrial Way, San Carlos, California, for information and recommendations.

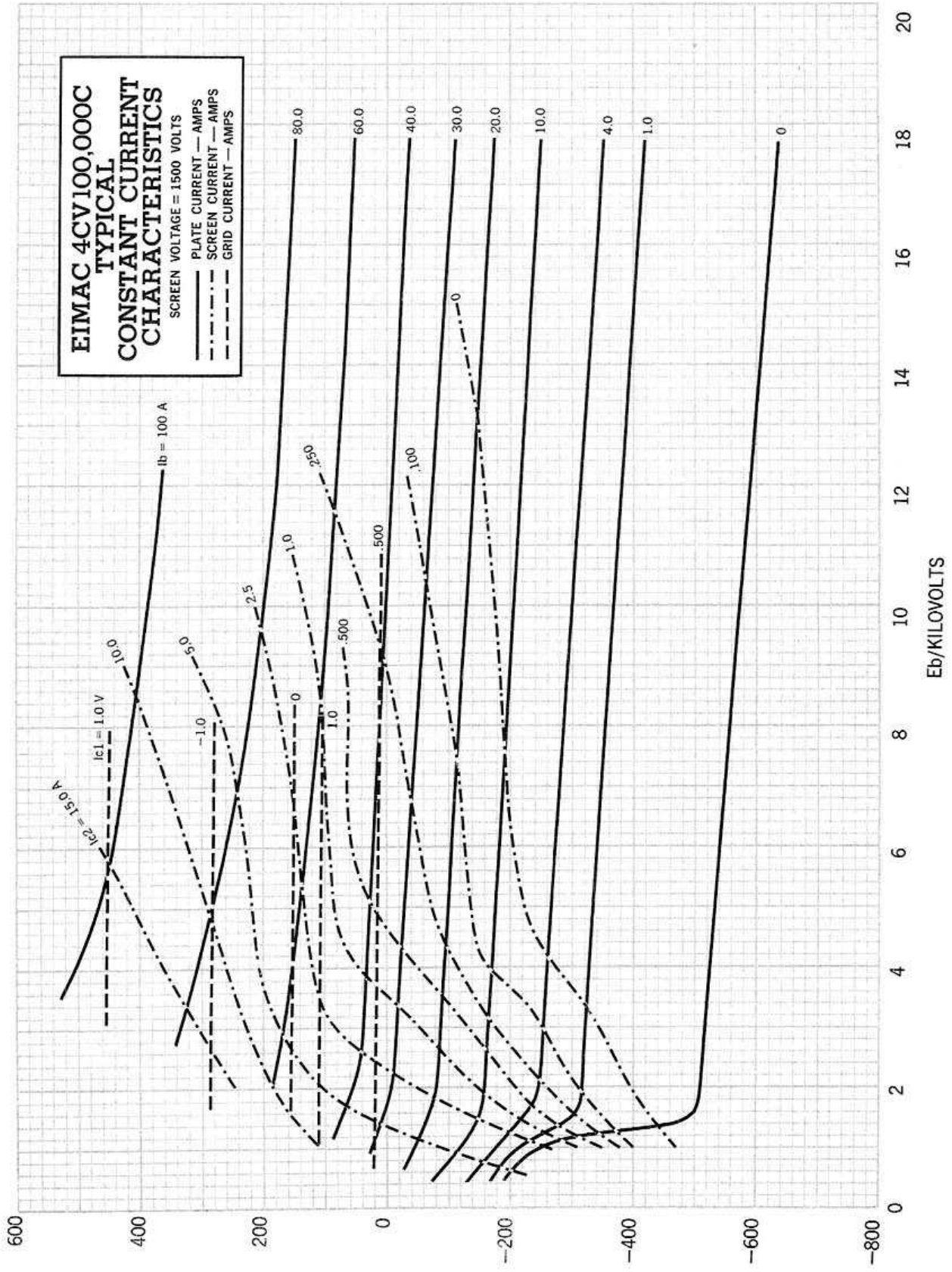


DIMENSIONS IN INCHES

DIMENSIONAL DATA			
DIM	MIN.	MAX.	REF.
A	8.400	8.650	
B	.880	.890	
C	4.980	5.020	
D	5.980	6.020	
E	6.510	6.560	
F	6.980	7.020	
G	7.480	7.520	
H	7.975	8.015	
J	1.750	1.800	
K	1.220	1.270	
L	.690	.740	
M	7.890	8.140	
N	6.690	6.940	
P	16.840	17.240	
R	.173	.213	
S	7.010	7.265	
T	.485	.515	
U	.045	.075	
V		.135	
W	1.250	1.270	
X	.490	.530	
Y	9.900	10.100	
Z	3.830	--	
AA	7.075	8.120	

NOTES:
1. AREA FOR MEASURING ANODE FLANGE TEMPERATURE.
2. SILICONE RUBBER INSULATION.
3. 1/4" CROSS SECTION X 9-1/2" O.D. "O" RING IS SUPPLIED WITH TUBE.
4. REFERENCE DIMENSIONS ARE FOR INFORMATION ONLY & ARE NOT REQUIRED FOR INSPECTION PURPOSES.


EIMAC 4CV100,000C
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
SCREEN VOLTAGE = 750 VOLTS
PLATE CURRENT — AMPS
SCREEN CURRENT — AMPS
GRID CURRENT — AMPS
Ib = 100.0 A
Ic1 = 30.0
Ic2 = 20.0 A
Ec1/VOLTS
Eb/KILOVOLTS


EIMAC 4CV100,000C
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
SCREEN VOLTAGE = 1500 VOLTS
PLATE CURRENT — AMPS
SCREEN CURRENT — AMPS
GRID CURRENT — AMPS
Ib = 100 A
Ic1 = 1.0 V
Ic2 = 150 A
10.0
5.0
2.5
1.0
0
-1.0
80.0
60.0
40.0
30.0
20.0
10.0
4.0
1.0
0
250
100
50
10
5
1
.500
.500
600
400
200
0
-200
-400
-600
-800
0
2
4
6
8
10
12
14
16
18
20
Ec1/VOLTS
Eb/KILOVOLTS