EIMAC
Division of Varian
SAN CARLOS
CALIFORNIA

4CV20,000A

VAPOR-COOLED
RADIAL-BEAM
POWER-TETRODE

The Eimac 4CV20,000A is a vapor-cooled, ceramic-metal, power tetrode designed for use as an oscillator, modulator, or amplifier in audio and radio-frequency applications. The vapor-cooled anode is conservatively rated at 20 kilowatts of plate dissipation when mounted in an Eimac BR-200 boiler.

A pair of these tubes in class AB_1 audio frequency or radio frequency linear amplifier service will deliver 35 kilowatts output. The frequency for maximum ratings is 30 megacycles; operation to 110 megacycles is possible at reduced input.

GENERAL CHARACTERISTICS

ELECTRICAL

		Min.	Nom.	Max.	
Filament:	Thoriated Tungsten				
	Voltage		7.5		V
	Current	73		78	A
Amplification Factor (Grid-Screen)			4.5		
Direct Interelectrode Capacitances, Grounded Cathode:					
	Input	108		122	pF
	Output	18		23	pF
	Feedback			1.0	pF
Direct Interelectrode Capacitances, Grounded Grid:					
	Input	48		58	pF
	Output	18		23	pF
	Feedback			1.0	pF
Frequency for Maximum Ratings				30	MHz

MECHANICAL

Base	Special, Concentric
Recommended Socket	Eimac, SK-300A
Recommended Boiler	Eimac, BR-200
Operating Position	Axis vertical, base up
Cooling	Vapor & Forced air
Maximum Seal Temperature	250° C
Maximum Anode Core Temperature	250° C
Maximum Over-all Dimensions:	
Height	9.13 in
Diameter	7.75 in
Net Weight	21 lbs

RADIO FREQUENCY POWER AMPLIFIER OR OSCILLATOR

Class-C Telegraphy or FM Telephony

MAXIMUM RATINGS

DC PLATE VOLTAGE (to 30 Mc)	7500 VOLTS
(30-60 Mc)	7000 VOLTS
(60-110 Mc)	6500 VOLTS
DC SCREEN VOLTAGE	1500 VOLTS
DC PLATE CURRENT (to 30 Mc)	3.0 AMPS
(30-60 Mc)	2.8 AMPS
(60-110 Mc)	2.6 AMPS
PLATE DISSIPATION	20,000 WATTS
SCREEN DISSIPATION	250 WATTS
GRID DISSIPATION	75 WATTS

TYPICAL OPERATION (Below 30 Mc)

DC Plate Voltage	6000	7500 volts
DC Screen Voltage	500	500 volts
DC Grid Voltage	-290	-300 volts
DC Plate Current	3.0	3.0 amps
DC Screen Current*	500	500 mA
DC Grid Current	290	290 mA
Peak RF Grid Voltage*	520	530 volts
Driving Power	150	155 watts
Plate Output Power	12,900	17,000 watts

*Approximate Values

Printed in U.S.A.

PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER

Class-C Telephony (Carrier conditions except where noted)

MAXIMUM RATINGS

DC PLATE VOLTAGE	5000 VOLTS
DC SCREEN VOLTAGE	1000 VOLTS
DC PLATE CURRENT	2.5 AMPS
PLATE DISSIPATION*	13,500 WATTS
SCREEN DISSIPATION	250 WATTS
GRID DISSIPATION	75 WATTS

* Corresponds to 20,000 watts at 100-percent sine-wave modulation.

** Approximate values.

TYPICAL OPERATION
(Frequencies below 30 megacycles)

DC Plate Voltage	4000	5000	volts
DC Screen Voltage	500	500	volts
Peak AF Screen Voltage (For 100%) modulation)	470	490	volts
DC Grid Voltage	-320	-340	volts
DC Plate Current	2.2	2.2	amps
DC Screen Current**	335	330	mA
DC Grid Current**	160	150	mA
Peak RF Grid Voltage**	490	510	volts
Grid Driving Power	78.5	76.5	watts
Plate Dissipation	3050	3250	watts
Plate Output Power	5750	7750	watts

RADIO-FREQUENCY LINEAR AMPLIFIER

Class AB_1

MAXIMUM RATINGS (per tube)

DC PLATE VOLTAGE	7500 VOLTS
DC SCREEN VOLTAGE	1500 VOLTS
DC PLATE CURRENT	4.0 AMPS
PLATE DISSIPATION	20,000 WATTS
SCREEN DISSIPATION	250 WATTS
GRID DISSIPATION	75 WATTS

* Per Tube

**Approximate values.

TYPICAL OPERATION (Peak-Envelope or Modulation-Crest Conditions.

DC Plate Voltage	5000	7500	volts
DC Screen Voltage	1500	1500	volts
DC Grid Voltage	-250	-260	volts
Max-Signal Plate Current	4.0	4.0	amps
Zero-Signal Plate Current	2.0	2.0	amps
Max-Signal Screen Current*	165	150	mA
Peak RF Grid Voltage*	240	250	volts
Driving Power	0	0	watts
Plate Dissipation	9700	12,500	watts
Plate Output Power	10,300	17,500	watts
Resonant Load Impedance	590	1030	ohms

AUDIO-FREQUENCY AMPLIFIER OR MODULATOR

Class-AB_1

MAXIMUM RATINGS

DC PLATE VOLTAGE	7500 VOLTS
DC SCREEN VOLTAGE	1500 VOLTS
DC PLATE CURRENT	4.0 AMPS
PLATE DISSIPATION	20,000 WATTS
SCREEN DISSIPATION	250 WATTS
GRID DISSIPATION	75 WATTS

* Approximate values

TYPICAL OPERATION (Two Tubes)

DC Plate Voltage	5000	7500	volts
DC Screen Voltage	1500	1500	volts
DC Grid Voltage	-250	-260	volts
Max-Signal Plate Current	8.0	8.0	amps
Zero-Signal Plate Current	4.0	4.0	amps
Max-Signal Screen Current**	330	300	mA
Peak RF Driving Voltage**	240	250	volts
Driving Power	0	0	watts
Load Resistance, Plate-to-Plate	1180	2060	ohms
Max-Signal Plate Dissipation*	9700	12,500	watts
Max-Signal Plate Output Power	20,600	35,000	watts

NOTE: "TYPICAL OPERATION" data are obtained by calculation from published characteristic curves. No allowance is made for circuit losses of any kind. 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 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 4CV20,000A must be operated with its axis vertical, base up in an Eimac BR-200 boiler. Care must be exercised when installing to insure that the boiler is level, the water is at the proper level and that the flange of the tube makes a vapor tight seal against the rubber "O" ring and boiler. A typical vapor cooling system is shown below.

SOCKET — The Eimac SK-300A socket is available for use with the 4CV20,000A. Filament, control grid and screen grid connections are made to this socket.

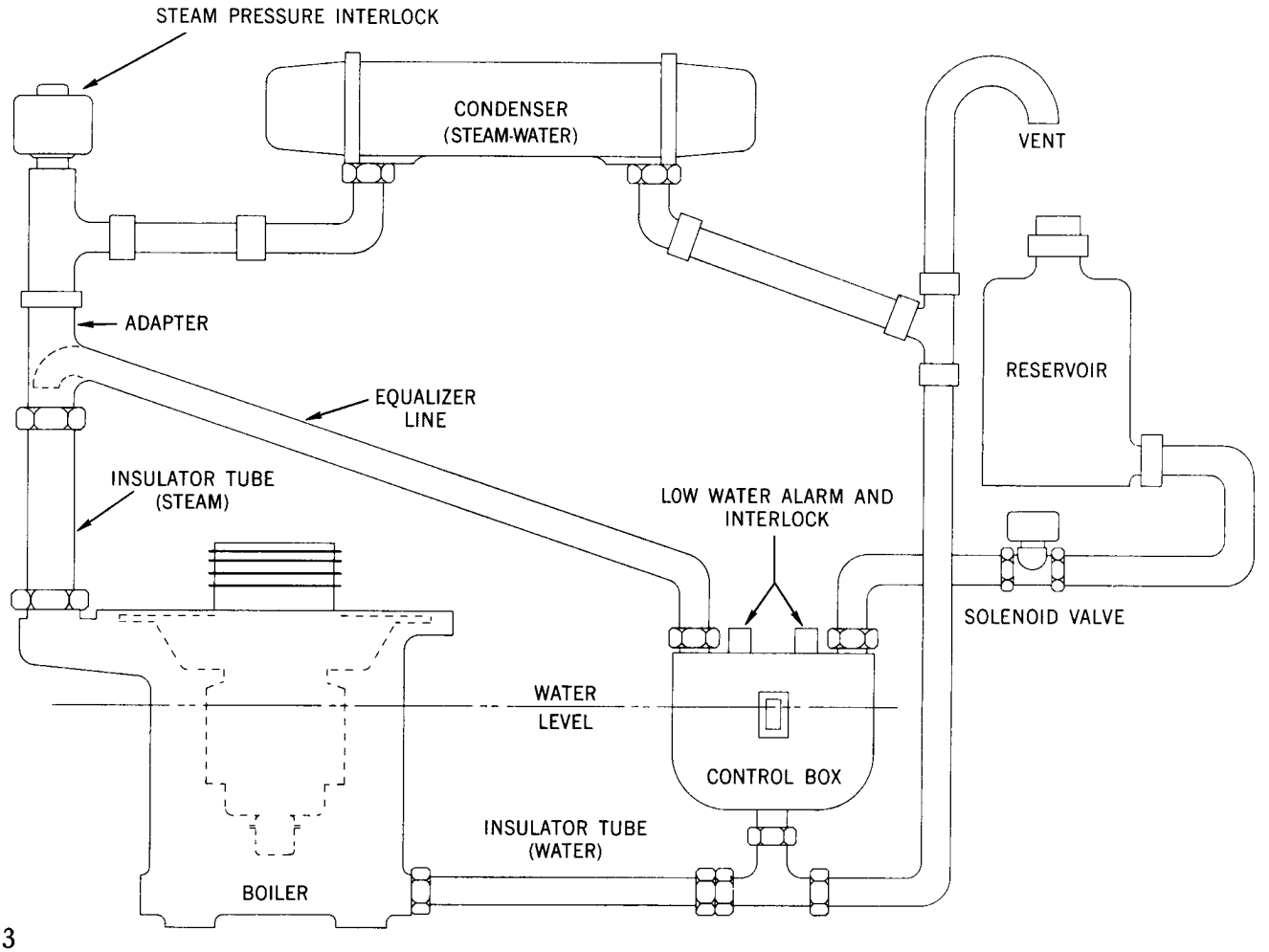
COOLING — Cooling is accomplished by immersing the anode in the distilled water filled BR-200 boiler. The energy dissipated at the anode causes the water to boil at the surfaces of the anode, be converted into steam and be carried away to the condenser. The boiling action keeps the anode surfaces at approximately 100°C. In a properly designed boiler-tube system (such as the 4CV20,000A and BR-200), it is extremely unlikely that the anode surfaces will ever exceed 110°C - well below the 250°C maximum rating - at full dissipation ratings.

The water in the boiler must be maintained at a constant level as indicated by the mark on the boiler, just below the top of the fins on the anode cooler. This is accomplished automatically in the vapor cooling system shown. Condensate from the condenser is returned to the boiler to maintain this constant fluid level. Any losses or drops in liquid level are sensed by the control box, CB-202. A low water level in the control box activates the solenoid water valve, allowing make-up water from the reservoir to enter the boiler. When the proper level is reached, the control box de-energizes the solenoid, stopping the flow from the reservoir. A second switch in the control box is energized if the water level drops to a lower level because of an empty reservoir or a constriction in the line. This switch may be used to shut down the equipment or activate an alarm.

For reliable operation, it is important that the control box and boiler be mounted so that the level sensed by the control box is exactly the same as the level in the boiler.

Cooling of the tube base is accomplished by blowing 25-50 CFM of air into the socket in the area of the filament seals.

VAPOR COOLING SYSTEM



ELECTRICAL

FILAMENT OPERATION — The rated filament voltage for the 4CV20,000A is 7.5 volts. Filament voltage, as measured at the socket, must be maintained at 7.5 volts plus or minus five percent to obtain maximum tube life. The use of a constant voltage filament transformer is recommended.

CONTROL-GRID OPERATION — The 4CV20,000A control grid has a maximum dissipation rating of 75 watts. Precautions should be observed to avoid exceeding this rating. Grid dissipation is the product of the dc grid current and the peak positive grid voltage swing.

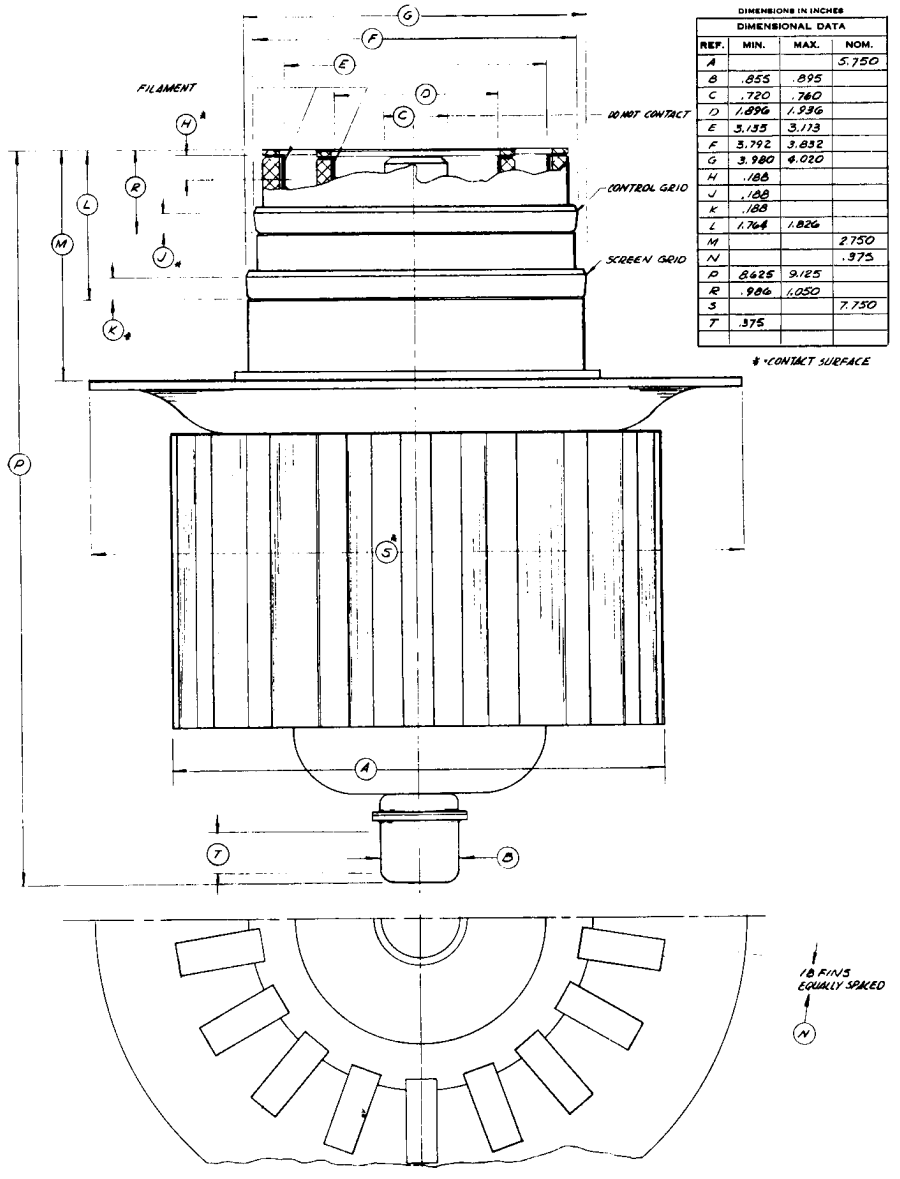
SCREEN-GRID OPERATION — The power dissipated by the screen must not exceed 250 watts. Screen dissipation, in cases where no ac is applied to the screen is the product of screen voltage and screen current. If the screen voltage is modulated, the screen dissipation will depend upon loading, driving power and 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 in the event of these failures.

PLATE DISSIPATION — The plate dissipation rating of 20,000 watts attainable through vapor cooling provides a large margin of safety. It is unlikely that this rating will be exceeded, even during tuning periods.

When the 4CV20,000A is used as a plate-modulated rf amplifier, this rating is reduced to 13,500 watts with a reduced plate input rating of 5000 volts and 2.5 amps.

SPECIAL APPLICATIONS — If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Marketing Department, EIMAC Division of Varian, 301 Industrial Way, San Carlos, California for information and recommendations.

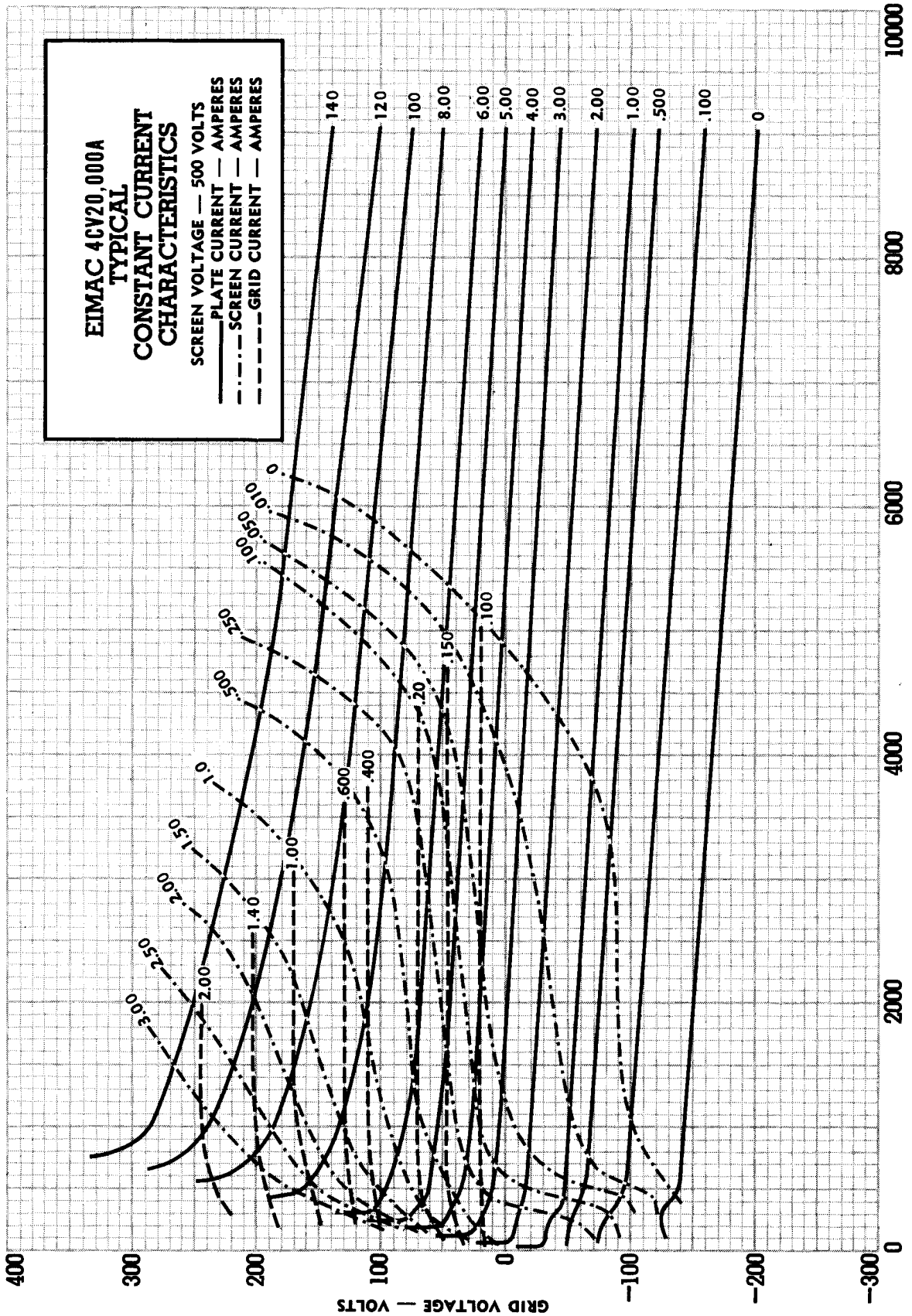


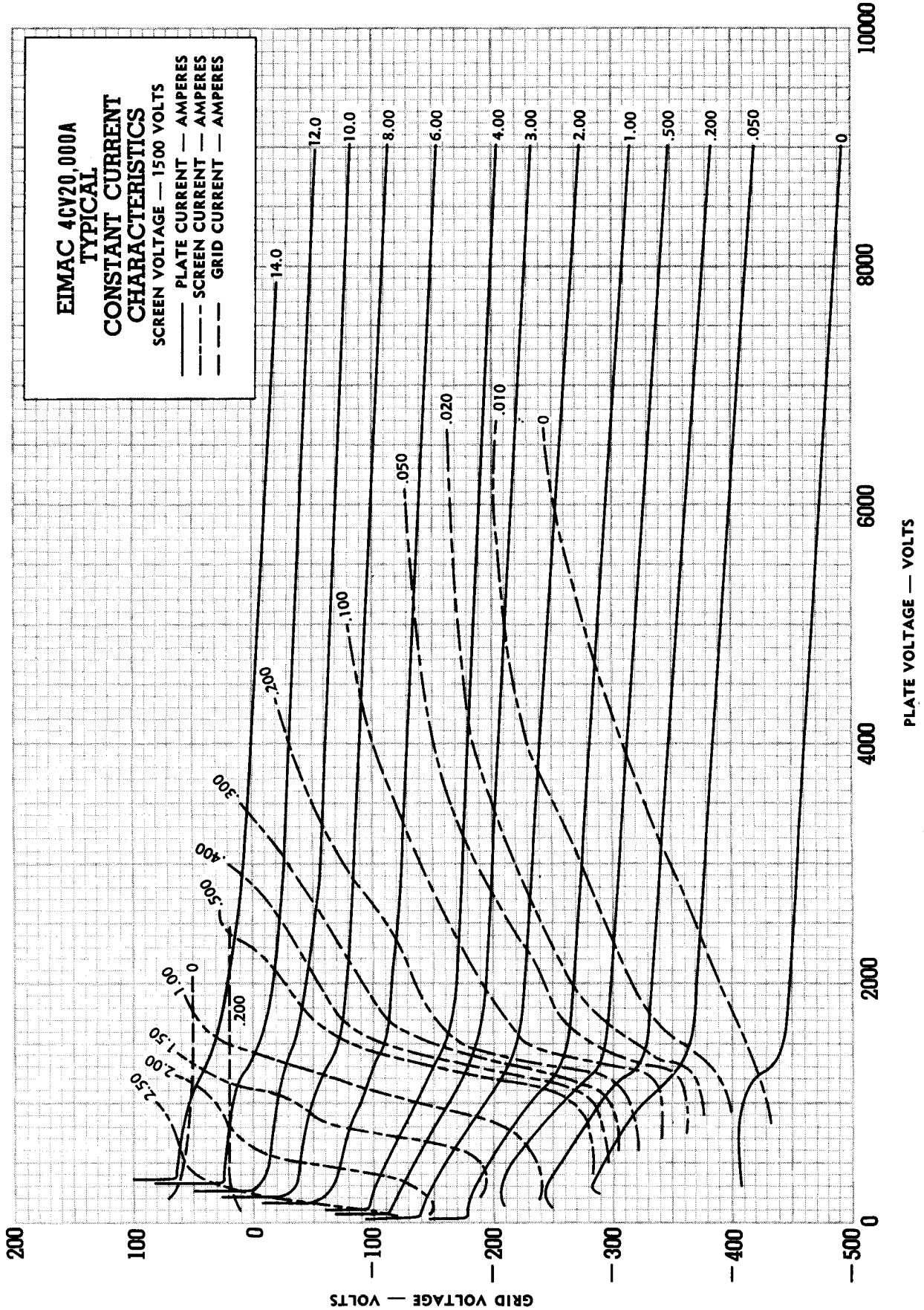
DIMENSIONS IN INCHES

DIMENSIONAL DATA

REF.	MIN.	MAX.	NOM.
A			5.750
B	.855	.895	
C	.720	.760	
D	1.896	1.936	
E	3.135	3.173	
F	3.792	3.832	
G	3.980	4.020	
H	.188		
J	.188		
K	.188		
L	1.764	1.826	
M			2.750
N			.375
P	8.625	9.125	
R	.986	1.050	
S			7.750
T	.375		

CONTACT SURFACE


EIMAC 4CV20,000A
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
SCREEN VOLTAGE — 500 VOLTS
PLATE CURRENT — AMPERES
SCREEN CURRENT — AMPERES
GRID CURRENT — AMPERES
140
120
100
8.00
6.00
5.00
4.00
3.00
2.00
1.00
.500
.100
0
.010
.050
.100
.250
.500
1.0
1.50
2.00
2.50
3.00
1.40
.600
.400
.20
.150
.100
400
300
200
100
0
−100
−200
−300
0
2000
4000
6000
8000
10000
GRID VOLTAGE — VOLTS
PLATE VOLTAGE — VOLTS


EIMAC 4CV20,000A
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
SCREEN VOLTAGE — 1500 VOLTS
PLATE CURRENT — AMPERES
SCREEN CURRENT — AMPERES
GRID CURRENT — AMPERES
14.0
12.0
10.0
8.00
6.00
4.00
3.00
2.00
1.00
.500
.200
.050
0
.020
.010
.100
.200
.300
.400
.500
1.00
1.50
2.00
2.50
200
100
0
—100
—200
—300
—400
—500
0
2000
4000
6000
8000
10000
GRID VOLTAGE — VOLTS
PLATE VOLTAGE — VOLTS