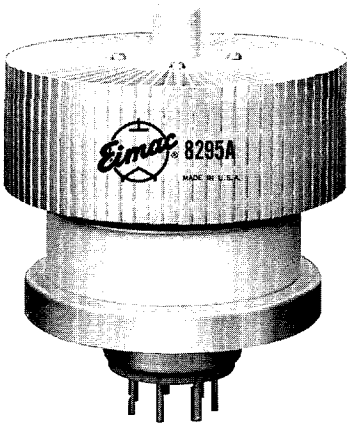
8295A

TECHNICAL DATA

RADIAL BEAM
POWER PENTODE

The EIMAC 8295A is a ceramic/metal, forced-air cooled, radial beam pentode with a rated maximum plate dissipation of 1000 watts. It is capable of high power gain and excellent efficiency at relatively low plate voltage. The 8295A is a direct replacement for the 8295.

This external-anode tube is especially suited for Class AB_1 linear rf amplifier service, but will also provide excellent performance in Class AB_2, Class B, and Class C service.



GENERAL CHARACTERISTICS [1]

ELECTRICAL

Cathode: Oxide Coated, Unipotential	
Heater: Voltage	6.0 ± 0.3 V
Current , at 6.0 volts	8.2 A
Amplification Factor (Average):	
Grid to Screen	3.4

Direct Interelectrode Capacitances (grounded cathode)[2]

Input	40 pF
Output	18.5 pF
Feedback	0.09 pF
Frequency of Maximum Rating:	
CW	30 MHz

1. Characteristics and operating values are based upon performance tests. These figures may change without notice as the result of additional data or product refinement. EIMAC Division of Varian should be consulted before using this information for final equipment design.

2. Capacitance values are for a cold tube as measured in a shielded fixture in accordance with Electronic Industries Association Standard RS-191.

MECHANICAL

Maximum Overall Dimensions:	
Length	5.05 in; 128 mm
Diameter	4.03 in; 102 mm
Net Weight	2.8 lb; 1.27 kg
Operating Position	Any

Printed in U.S.A.

Maximum Operating Temperature	
Ceramic/Metal Seals	250 °C
Anode Core	250 °C
Cooling	Forced Air
Base	7-Pin Special
Recommended Socket (includes integral chimney)	EIMAC SK-184 or EIMAC SK-184A

RADIO FREQUENCY LINEAR AMPLIFIER GRID DRIVEN, Class AB_1

MAXIMUM RATINGS:

DC PLATE VOLTAGE	3000	VOLTS
DC SUPPRESSOR VOLTAGE	100	VOLTS
DC SCREEN VOLTAGE	600	VOLTS
DC PLATE CURRENT	0.8	AMPERE
PLATE DISSIPATION	1000	WATTS
SCREEN DISSIPATION	30	WATTS

1. Adjust to specified zero-signal dc plate current.

2. The intermodulation distortion products are referenced against one tone of a two equal tone signal.

3. Approximate value

TYPICAL OPERATION (Frequencies to 30 MHz)
Class AB_1, Grid Driven, Peak Envelope or Modulation Crest Conditions

Plate Voltage	2000	2500	3000	Vdc
Suppressor Voltage	35	0	35	Vdc
Screen Voltage	500	500	500	Vdc
Grid Voltage [1]	-116	-119	-120	Vdc
Zero-Signal Plate Current	200	200	200	mAdc
Single Tone Plate Current [4]	800	800	800	mAdc
Zero-Signal Screen Current	5	5	4	mAdc
Single-Tone Screen Current [3/4]	75	43	54	mAdc
Peak rf Grid Voltage [3]	116	119	120	v
Single Tone Useful Output Power	1100	1250	1700	W
Resonant Load Impedance	1400	1500	2100	Ω
Intermodulation Distortion Products [2] - 3rd Order	-24	-22	-23	db
5th Order	-37	-50	-40	db

4. For peak conditions, or for single-tone modulation at full signal. Except for brief tuneup periods, operation under single-tone conditions may not be possible because of excessive screen dissipation.

RADIO FREQUENCY POWER AMPLIFIER OR OSCILLATOR

Class C Telegraphy or FM Telephony
(Key-Down Conditions)

MAXIMUM RATINGS:

DC PLATE VOLTAGE	3000	VOLTS
DC SUPPRESSOR VOLTAGE	75	VOLTS
DC SCREEN VOLTAGE	500	VOLTS
DC GRID VOLTAGE	-200	VOLTS
DC PLATE CURRENT	1.0	AMPERE
PLATE DISSIPATION	1000	WATTS
SCREEN DISSIPATION	30	WATTS

TYPICAL OPERATION (Frequencies to 30 MHz)

Plate Voltage	2000	2500	3000	Vdc
Suppressor Voltage	35	35	35	Vdc
Screen Voltage	500	500	500	Vdc
Grid Voltage	-175	-200	-200	Vdc
Plate Current	850	840	820	mAdc
Screen Current [1]	42	40	42	mAdc
Grid Current [1]	10	10	10	mAdc
Peak rf Grid Voltage [1]	188	210	210	v
Calculated Driving Power [1]	1.9	2.1	2.1	W
Plate Input Power	1700	2100	2460	W
Useful Output Power	1155	1440	1770	W

1. Approximate value.

NOTE: TYPICAL OPERATION data are obtained by calculation from published characteristic curves. Adjustment of the rf grid voltage to obtain the specified plate current at the specified bias, screen and plate voltages is assumed. If this procedure is followed, there will be little variation in output power when the tube is changed, even though there may be some variation in grid and screen current. 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 grid voltage is applied.

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Heater: Current at 6.0 volts	7.7	8.7	A
Cathode Warmup Time	3	---	minutes
Interelectrode Capacitances [1] (grounded cathode connection)			
Input	36.0	44.0	pF
Output	16.5	20.5	pF
Feedback	---	0.12	pF
Amplification Factor			
Grid to Screen	3.0	3.8	

1. Capacitance values are for a cold tube as measured in a shielded fixture in accordance with Electronic Industries Association Standard RS-191.

APPLICATION

MOUNTING - The 8295A may be operated in any position, and should normally be mounted in the EIMAC air-system socket SK-184 or SK-184A, or equivalent. The SK-184 socket has built-in bypass capacitors for the screen grid and suppressor grid. The SK-184A socket has a built-in bypass capacitor for the screen grid and has grounded suppressor grid contacts.

HEATER - The rated heater voltage for the 8295A is 6.0 volts, as measured at the socket or tube base pins. Variations should be restricted to plus or minus 0.3 volts for long tube life and consistent performance.

COOLING - Forced-air cooling is required in all applications, and the use of an air-system socket, such as the EIMAC SK-184 or EIMAC SK-184A, is recommended. Each of these sockets includes an integral chimney to direct air through the anode cooling fins. Cooling is simplified if air is directed in a base-to-anode direction. At full rated dissipation, with air at 50°C at sea level, an air flow of 25 cubic feet per minute, with a resulting pressure drop of approximately 0.15 inches of water, is sufficient to limit maximum tube temperature to 225°C. If air is not directed in the base-to-anode direction, additional cooling may be required for the base section of the tube. Cooling air should be applied before or simultaneously with the application of electrode voltages, including heater, and may be removed simultaneously with them.

CATHODE WARMUP TIME - Heater voltage should be applied for a minimum of three minutes before the application of other electrode voltages to allow proper conditioning of the cathode surface.

GRID OPERATION - In Class AB applications, grid bias voltage must be obtained from a fixed bias supply. The internal resistance of the bias source should not exceed 5000 ohms in Class AB_1 applications or 2000 ohms in Class AB_2 applications. Either fixed bias or cathode bias, or a combination of the two, is recommended for Class C applications. Partial grid leak bias, in combination with fixed or cathode bias, or both, may be used in Class C application provided the total resistance of the grid leak plus the bias source does not exceed 5000 ohms.

SCREEN OPERATION - If the screen voltage is obtained from a power supply separate from the plate voltage supply, the circuit should be arranged so that it is impossible to apply screen voltage without plate voltage. The use of a screen over-current relay is recommended, to remove screen voltage immediately in case of excessive screen current due to circuit problems, grid bias failure, or accidental removal of plate circuit loading. In linear amplifier service, the screen voltage must be obtained from a well regulated source, to prevent excessive screen voltage variation due to changes in screen current which occur between zero-signal and full-signal conditions.

SUPPRESSOR OPERATION - The 8295A performs well with the suppressor operated at cathode potential. For maximum efficiency at high power input and low plate voltages, a positive voltage of about 35 volts should be applied to the suppressor. However, the actual value is not critical, and voltages between 25 and 45 volts may be used with only minor differences in performance. The internal resistance of the suppressor grid voltage supply should not exceed 3000 ohms.

PLATE OPERATION - The maximum rated plate dissipation power for the 8295A is 1000 watts. Except for brief periods during circuit adjustment, this maximum value should not be exceeded. Contact to the plate may be made either at the top cap or by means of a circular clamp or spring-finger collet around the outer surface of the anode cooler itself. Points of electrical contact with the anode should be kept clean and free of oxide to minimize rf loss. The anode cooler should be inspected periodically and cleaned when necessary to remove any dirt which might interfere with effective cooling.

GENERAL OPERATION NOTES - A metal chassis or equivalent means should be provided to separate the input and output circuits of an amplifier employing the 8295A. Reasonable precautions should be observed in regard to bypassing and shielding of the supply leads to prevent coupling between input and output through external circuits. The use of the EIMAC SK-184 or SK-184A air-system sockets, with integral bypass capacitance built in, is helpful in these respects. When it is desired to apply voltage to the suppressor of the tube, it is recommended that any suppressor bypass capacitance be located on the anode side of a chassis Total suppressor bypass capacitance should be sufficient to result in a reactance of 3 ohms or less at the operating frequency. The dc supply lead to the suppressor should either be located entirely on the anode side of the shielding (chassis), or fed through an effective rf choke located well out of the field of the plate tank circuit and again bypassed before passing through the shielding into any compartment exposed to the control grid circuit.

NEUTRALIZATION FOR RF OPERATION - In most Class C applications, the 8295A may be operated without neutralization provided the suppressor grid and screen grid are effectively grounded for radio frequencies. The use of the EIMAC air-system sockets is helpful in this respect. For minimum-distortion Class AB1 linear amplifier service, where reaction on the driver circuit should be eliminated completely, it will usually be found advisable to neutralize the small feedback capacitance of the tube.

INTERELECTRODE CAPACITANCE - The actual internal interelectrode capacitance of a tube is influenced by many variables in most applications, such as stray capacitance to the chassis, capacitance added by the socket used, stray capacitance between tube terminals, and wiring effects. To control the actual capacitance values within the tube, as the key component involved, the industry and the Military Services use a standard test procedure as described in Electronic Industries Association Standard RS-191. This requires the use of specially constructed test fixtures which effectively shield all external tube leads from each other and eliminates any capacitance reading to "ground". The test is performed on a cold tube. Other factors being equal, controlling internal tube capacitance in this way normally assures good interchangeability of tubes over a period of time, even when the tube may be made by different manufacturers. The capacitance values shown in the manufacturer's technical data, or test specifications, normally are taken in accordance with Standard RS-191.

The equipment designer is therefore cautioned to make allowance for the actual capacitance values which will exist in any normal application. Measurements should be taken with the socket and mounting which represent approximate final layout if capacitance values are highly significant in the design.

HIGH VOLTAGE - The 8295A operates at voltages which can be deadly, and the equipment must be designed properly and operating precautions must be followed. Equipment must be designed so that no one can come in contact with high voltages. All equipment must include safety enclosures for high-voltage circuits and terminals, with interlock switches to open the primary circuits of the power supplies and to discharge high-voltage condensers whenever access doors are opened. Interlock switches must not be bypassed or "cheated" to allow operation with access doors open. Always remember that HIGH VOLTAGE CAN KILL.

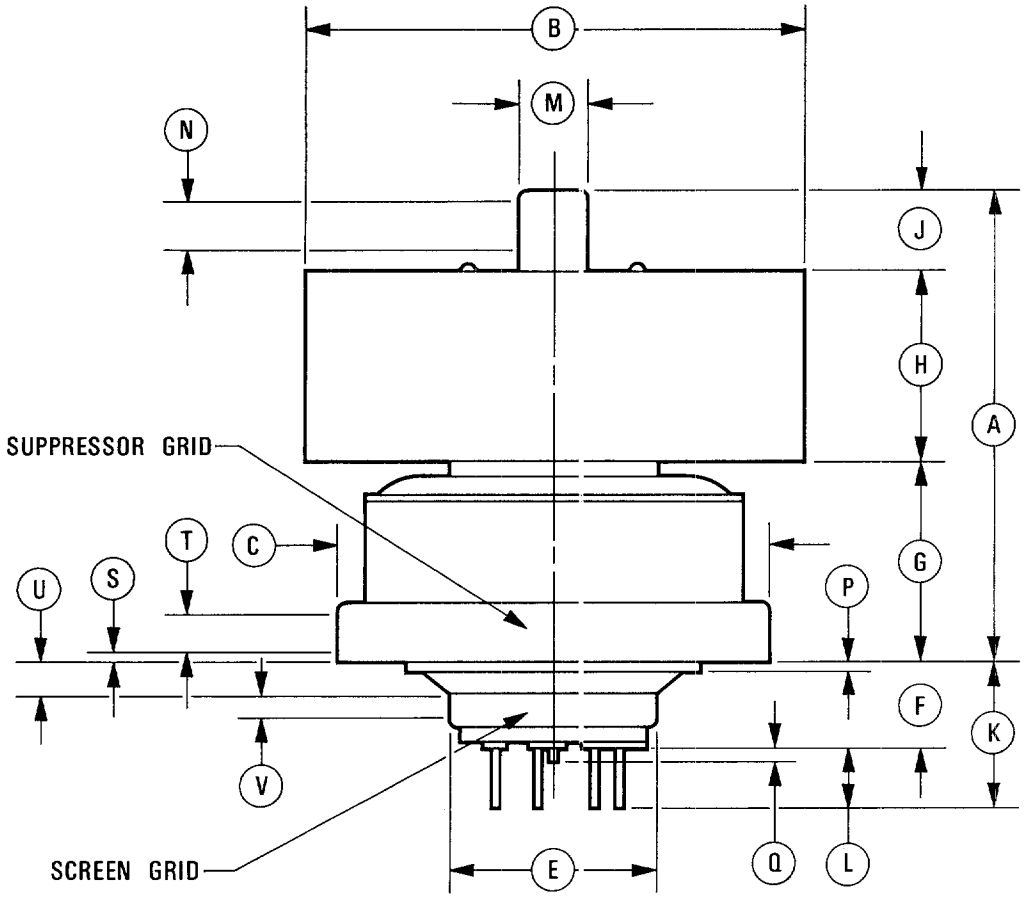
AIR-SYSTEM SOCKETS

Two air-system sockets are available for the 8295A, each of which makes all electrical contacts to the tube except to the anode. The characteristics of these sockets are as follows:

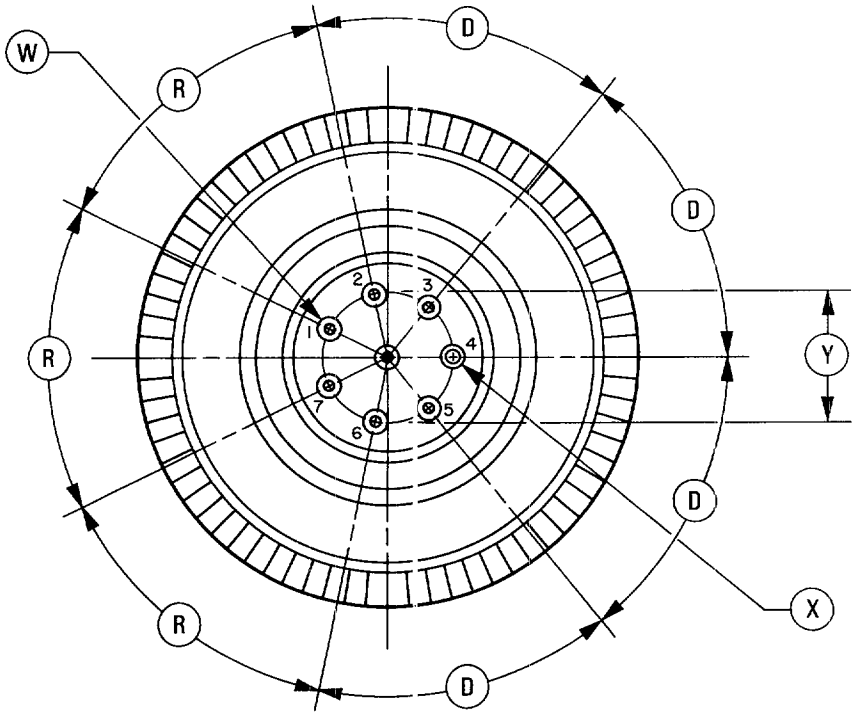
	EIMAC SK-184	EIMAC SK-184A
Screen Grid Bypass Capacitor	2000 pF,1000 Vdc	2000 pF, 1000 Vdc
Suppressor Grid Bypass Capacitor	2500 pF, 500 Vdc	none
Grounded Contacts (to socket frame)	none	Suppressor Grid
Anode Air Chimney	Integral	Integral

SPECIAL APPLICATION

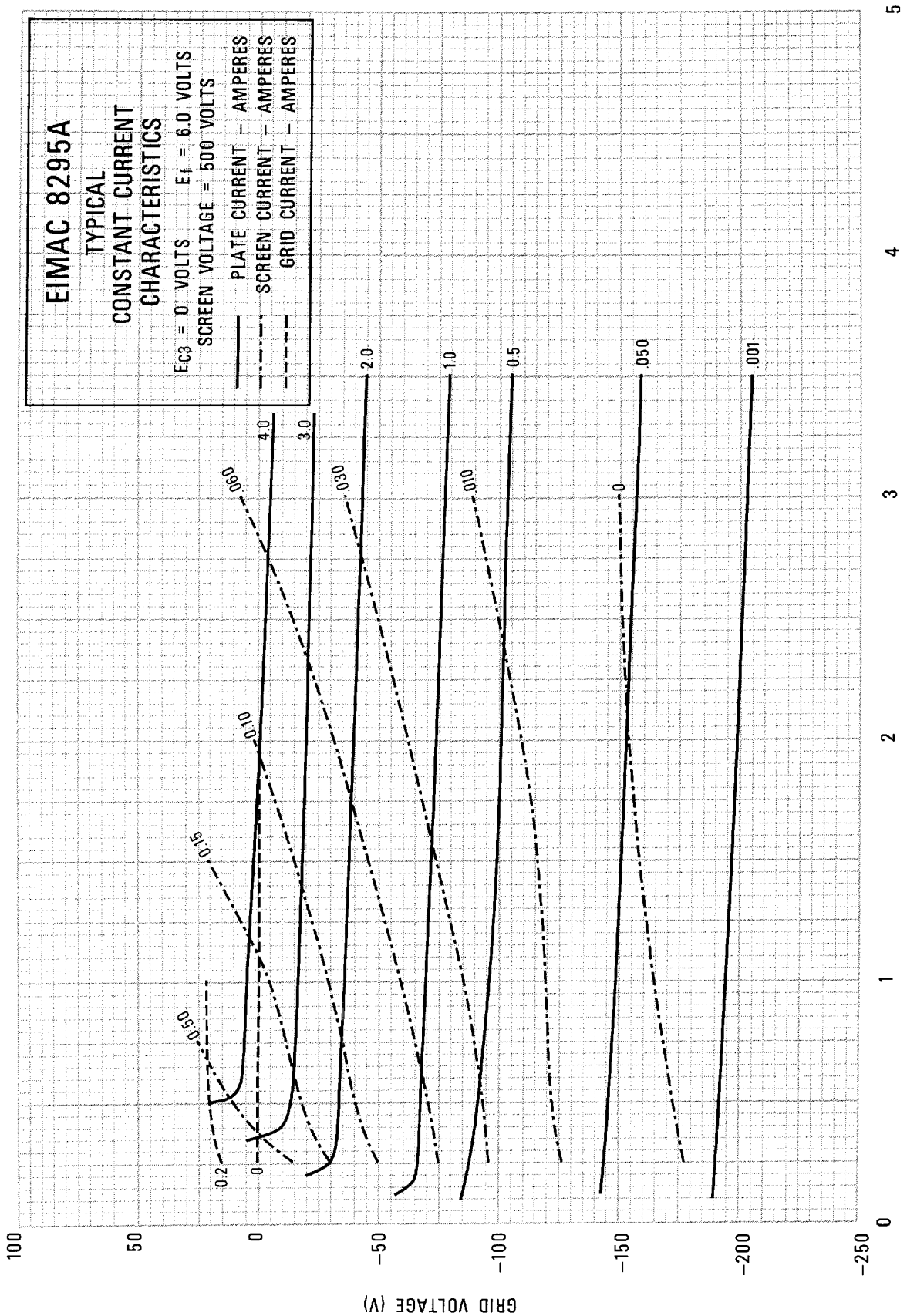
If it is desired to operate this tube under conditions widely different from those listed here, write to Power Grid Tube Division, EIMAC Division of Varian, 301 Industrial Way, San Carlos, California 94070, for information and recommendations.



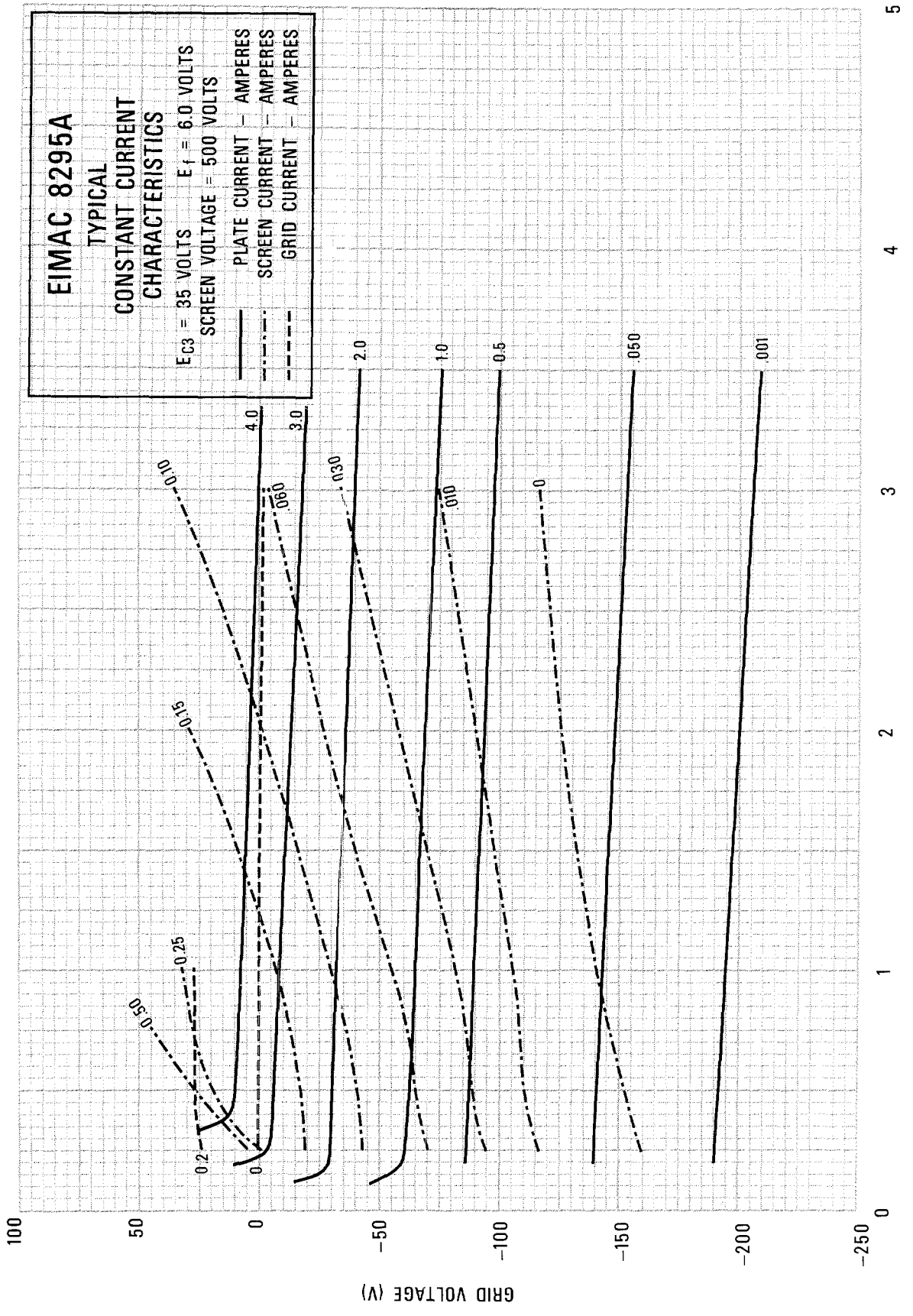
DIMENSIONAL DATA				
DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	3.458	3.832	87.83	97.33
B	3.968	4.032	100.79	102.41
C	3.485	3.515	88.52	89.28
E	1.615	1.630	41.02	41.40
F	.655	.719	16.64	18.26
G	1.395	1.645	35.43	41.78
H	1.468	1.532	37.29	38.91
J	.593	.657	15.06	16.69
K	1.056	1.219	26.82	30.96
L	.438	.562	11.13	14.27
M	.559	.573	14.20	14.55
N	.400	— —	10.16	— —
P	— —	.125	— —	3.18
T	.250	— —	6.35	— —
V	.220	— —	5.59	— —
W	.056	.062	1.42	1.57
X	.120	.127	3.05	3.23
REFERENCE DIMENSIONS				
D	51°			
Q	.125		3.18	
R	52°			
S	.125		3.18	
U	.250		6.35	
Y	1.000		25.40	



PIN CONNECTIONS	
PIN NO.	ELEMENT
1	k
2	g1
3	h
4	k
5	h
6	g1
7	k
CENTER PIN	INT. CON.
LOWER RING	g2
UPPER RING	g3
CAP	a


EIMAC 8295A
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
E_{c3} = 0 VOLTS E_f = 6.0 VOLTS
SCREEN VOLTAGE = 500 VOLTS
PLATE CURRENT – AMPERES
SCREEN CURRENT – AMPERES
GRID CURRENT – AMPERES
0.2
0.50
0.16
0
0.10
0.60
4.0
3.0
0.30
2.0
1.0
0.10
0.5
0
0.50
.001
100
50
0
−50
−100
−150
−200
−250
0
1
2
3
4
5
GRID VOLTAGE (V)
PLATE VOLTAGE – (KV)

CURVE #3767


EIMAC 8295A
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS
E_{C3} = 35 VOLTS E_f = 6.0 VOLTS
SCREEN VOLTAGE = 500 VOLTS
PLATE CURRENT – AMPERES
SCREEN CURRENT – AMPERES
GRID CURRENT – AMPERES
4.0
3.0
2.0
1.0
.5
.050
.001
0
.010
.030
.060
0.10
0.15
0.25
0.50
0.2
100
50
0
−50
−100
−150
−200
−250
0
1
2
3
4
5
GRID VOLTAGE (V)
PLATE VOLTAGE (KV)
CURVE #3770