



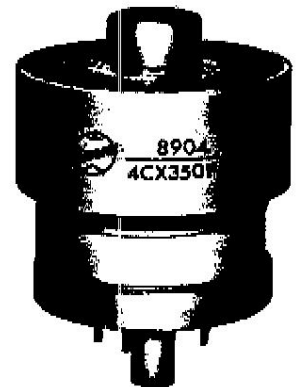
**8904**  
**4CX350FJ**

**TECHNICAL DATA**

**RADIAL BEAM  
POWER TETRODE**

The EIMAC 8904/4CX350FJ is a compact radial-beam tetrode with a maximum plate dissipation of 350 watts, intended for Class AB linear rf amplifier service. The tube has rugged internal construction features.

The 8904/4CX350FJ may be used as an exact replacement for the 8322/4CX350F in most applications, requiring only minor circuit adjustment and retuning. The tube has improved intermodulation distortion characteristics. It contains a 26.5 volt heater, and is recommended for new equipment designs.



**GENERAL CHARACTERISTICS<sup>1</sup>**

**ELECTRICAL**

Cathode: Oxide-coated, Unipotential

Voltage . . . . . 26.5 ± 1.3 V

Current, at 26.5 volts . . . . . 0.65 A

Transconductance (Average):

$I_b = 150 \text{ mAdc}$  . . . . . 22,000  $\mu\text{mhos}$

Amplification Factor (Average):

Grid to Screen . . . . . 17

Direct Interelectrode Capacitances (grounded cathode)<sup>2</sup>

$C_{in}$  . . . . . 22.0 pF

$C_{out}$  . . . . . 5.9 pF

$C_{gp}$  . . . . . 0.033 pF

1. Characteristics and operating values are based on 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 special shielded fixture in accordance with Electronic Industries Association Standard RS-191.

**MECHANICAL**

Base . . . . . Special 9-pin, JEDEC B8-236

Recommended Air-System Socket . . . . . EIMAC SK-600 Series

Recommended Air Chimney . . . . . EIMAC SK-600 Series

Maximum Overall Dimensions:

Length . . . . . 2.46 in; 62.59 mm

Diameter . . . . . 1.64 in; 41.65 mm

Operating Position . . . . . Any

Cooling . . . . . Forced Air

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## 8904/4CX350FJ

Net Weight (Approximate) . . . . .	4 oz; 113 gm
Shipping Weight (Approximate) . . . . .	1.6 lb; 3.5 kg
Maximum Operating Temperature:	
Anode Core and metal/ceramic seals . . . . .	250°C

### RADIO FREQUENCY LINEAR AMPLIFIER GRID DRIVEN Class AB 1

#### ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE . . . . .	2500 VOLTS
DC SCREEN VOLTAGE . . . . .	400 VOLTS
DC PLATE CURRENT . . . . .	300 MA
PLATE DISSIPATION . . . . .	350 WATTS
SCREEN DISSIPATION . . . . .	8 WATTS
GRID CURRENT . . . . .	2 MA

1. Adjust to specified Zero-Signal Plate Current.
2. Approximate value.

### TYPICAL OPERATION (Frequencies to 30 MHz) Class AB1, Grid Driven, Peak Envelope or Modulation Crest Conditions

Plate Voltage . . . . .	1400	2200	Vdc
Screen Voltage . . . . .	300	400	Vdc
Grid Voltage <sup>1</sup> . . . . .	-14	-19	Vdc
Zero-Signal Plate Current . . . . .	80	100	mAdc
Single-Tone Plate Current . . . . .	165	227	mAdc
Single-Tone Screen Current <sup>2</sup> . . . . .	6	8	mAdc
Useful Output Power <sup>3</sup> . . . . .	100	250	W
Resonant Load Impedance . . . . .	3600	5000	Ω
Intermodulation Distortion <sup>4</sup>			
3rd Order Products . . . . .	-45	-40	dB
5th Order Products . . . . .	-50	-45	dB

3. Power delivered to the load.
4. The IMD products are referenced against one tone of a two-equal-tone signal.

NOTE: TYPICAL OPERATION data is obtained from direct measurement. Adjustment of the rf grid voltage to obtain 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 screen current, which is incidental and which will vary from tube to tube. These current variations cause no difficulty so long as the circuit maintains the correct screen grid voltage in the presence of the variations in current.

### RANGE VALUES FOR EQUIPMENT DESIGN

	<u>Min.</u>	<u>Max.</u>
Heater: Current at 26.5 volts . . . . .	0.50	0.81 A
Interelectrode Capacitances <sup>1</sup> (grounded cathode):		
C <sub>in</sub> . . . . .	20.0	24.0 pF
C <sub>out</sub> . . . . .	5.6	6.2 pF
C <sub>gp</sub> . . . . .	---	0.038 pF

## APPLICATION

### MECHANICAL

**MOUNTING** - The 4CX350FJ may be operated in any position. An EIMAC Air-System Socket, SK-600 series, or a socket having equivalent characteristics, is required. Sockets are available with or without built-in screen bypass capacitors and may be obtained with either grounded or ungrounded cathode terminals. Air chimneys are also available for these sockets, including a unit which securely clamps the tube into place in the

socket for applications where environmental stress is anticipated.

**COOLING** - Sufficient cooling must be provided for the anode, base seals, and body seals to maintain operating temperatures below the rated maximum value. Air requirements to maintain seal temperatures at 225°C in 50°C ambient air are shown. These values apply when the EIMAC

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.

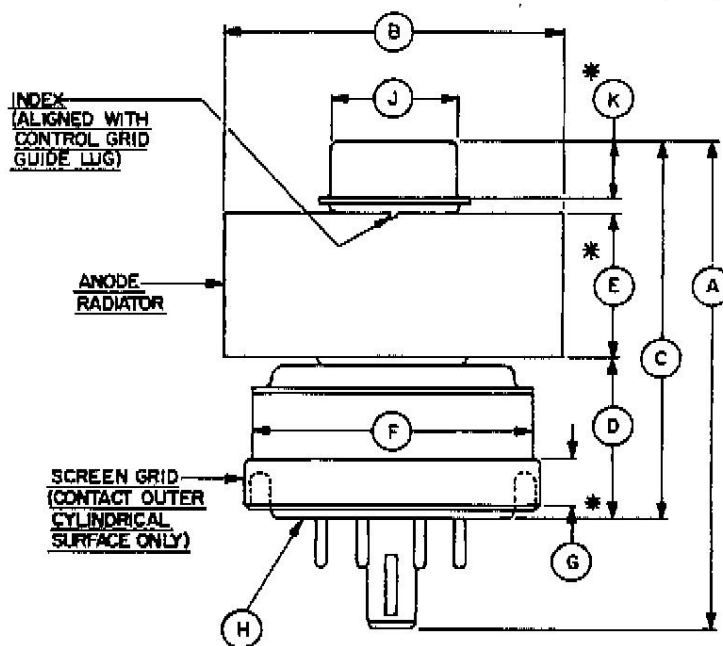
**SPECIAL APPLICATIONS** - If it is desired to operate this tube under conditions widely different from those given here, write to Power Grid Tube Division, EIMAC Division of Varian, 301 Industrial Way, San Carlos, CA 94070, for information and recommendations.

- PIN No. 1: SCREEN GRID
- PIN No. 2: CATHODE
- PIN No. 3: HEATER
- PIN No. 4: CATHODE
- PIN No. 5: I.C. DO NOT USE FOR EXTERNAL CONNECTION
- PIN No. 6: CATHODE
- PIN No. 7: HEATER
- PIN No. 8: CATHODE
- CENTER PIN: CONTROL GRID

DIM.	DIMENSIONAL DATA			
	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	2.324	2.464	59.03	62.59
B	1.610	1.640	40.89	41.68
C	1.810	1.910	45.97	48.51
D	0.780	0.810	19.05	20.57
E	0.710	0.790	18.03	20.07
F	--	1.406	--	35.71
G	D.187	--	4.75	--
H	BASE BB-236 (JEDEC DESIGNATION)			
J	0.559	0.573	14.20	14.55
K	0.240	--	6.10	--

**NOTES:**

1. REF DIMS. ARE FOR INFO ONLY AND ARE NOT REQD. FOR INSPECTION PURPOSES.
2. (\*) CONTACT SURFACE



## 8904/4CX350FJ

4CX350FJ is 8.0 watts, and the screen input power should be kept below that level. The product of the peak screen voltage and the indicated dc screen current approximates the screen input power except when the screen current indication is near zero or negative. In the usual tetrode amplifier, where no signal voltage appears between cathode and screen, the peak screen voltage is equal to the dc screen voltage.

If tuning of a linear amplifier circuit is to be done under single-tone conditions, extra care should be exercised to be sure the screen dissipation rating is not exceeded, as this is often the limiting factor during this type of operation.

Protection for the screen can be provided by an over-current relay and by interlocking the screen supply so the plate voltage must be applied before screen voltage can be applied.

The screen current may reverse under certain conditions and produce negative current indications on the screen milliammeter. This is a normal characteristic of most tetrodes. The screen power supply should be designed with this characteristic in mind, so that the correct operating voltage will be maintained on the screen under all conditions. A current path from the screen to cathode must be provided by a bleeder resistor or shunt regulator connected between screen and cathode and arranged to pass approximately 15 milliamperes per connected screen. A series regulator circuit can be used only when an adequate bleeder resistor is provided.

**PLATE OPERATION** - The maximum rated plate-dissipation power for the 4CX350FJ is 350 watts. The maximum dissipation rating may be exceeded for brief periods during circuit adjustment without damage to the tube.

At frequencies up to approximately 30 Megahertz the top cap on the anode cooler may be used for a plate terminal. At higher frequencies a circular clamp or spring-finger collet encircling the outer surface of the anode cooler should be used.

**MULTIPLE OPERATION** - Tubes operating in parallel or push-pull must share the load equally. It is good engineering practice to provide for individual metering and individual adjustment of the bias or screen voltage to equalize inputs.

Where overload protection is provided, it should be capable of protecting the surviving tube(s) in the event one tube should fail.

**UHF OPERATION** - The 4CX350FJ is useful in the UHF region. Operation at these frequencies should be conducted with heavy plate loading and the lowest driving power consistent with satisfactory performance. It is often preferable to operate at a sacrifice in efficiency to obtain increased tube life.

**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 4CX350FJ 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-

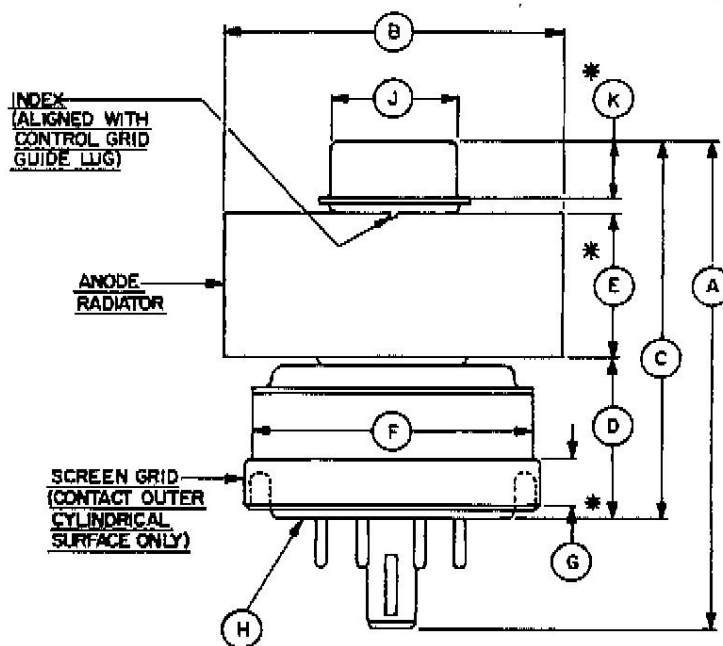
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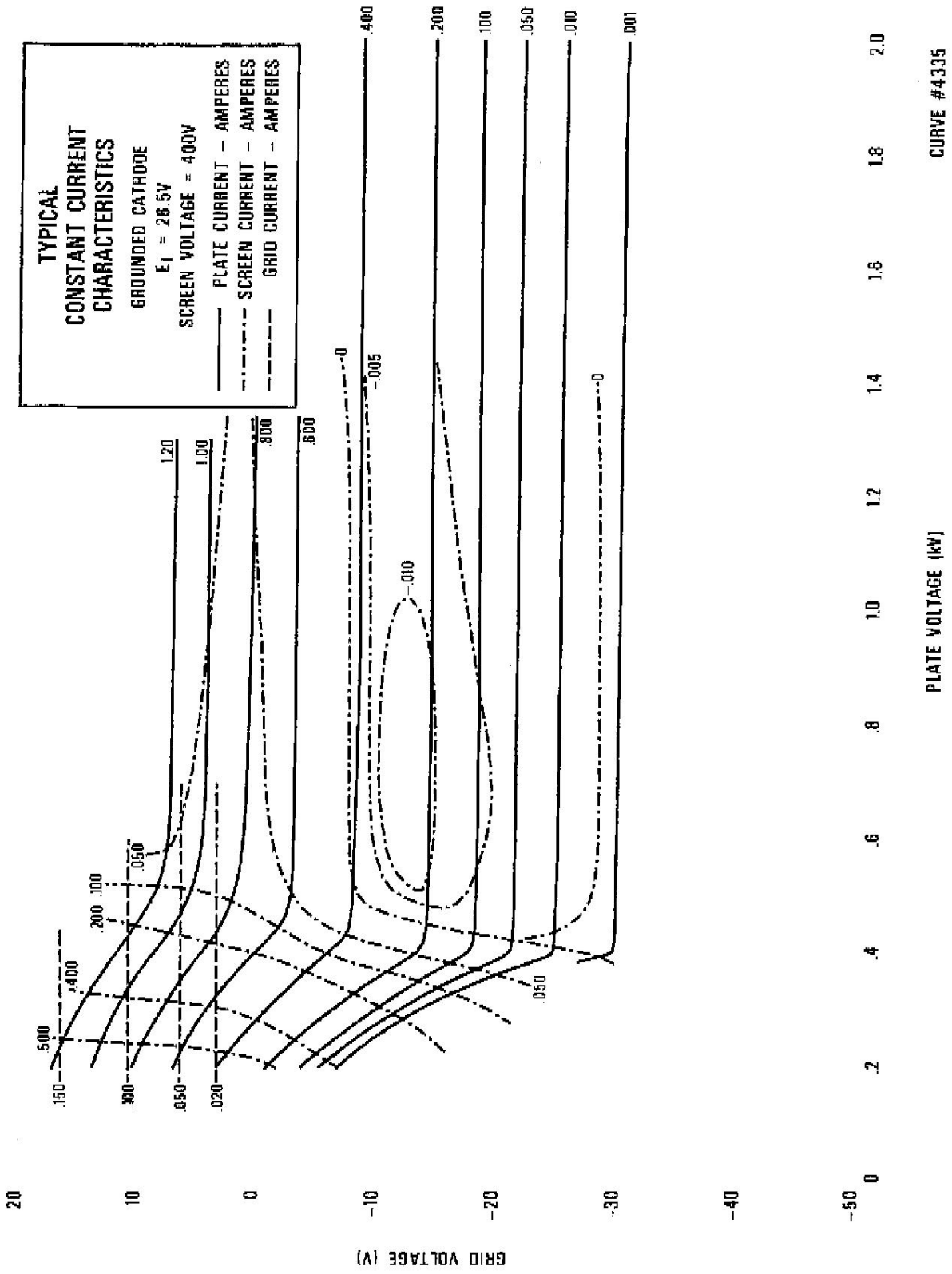
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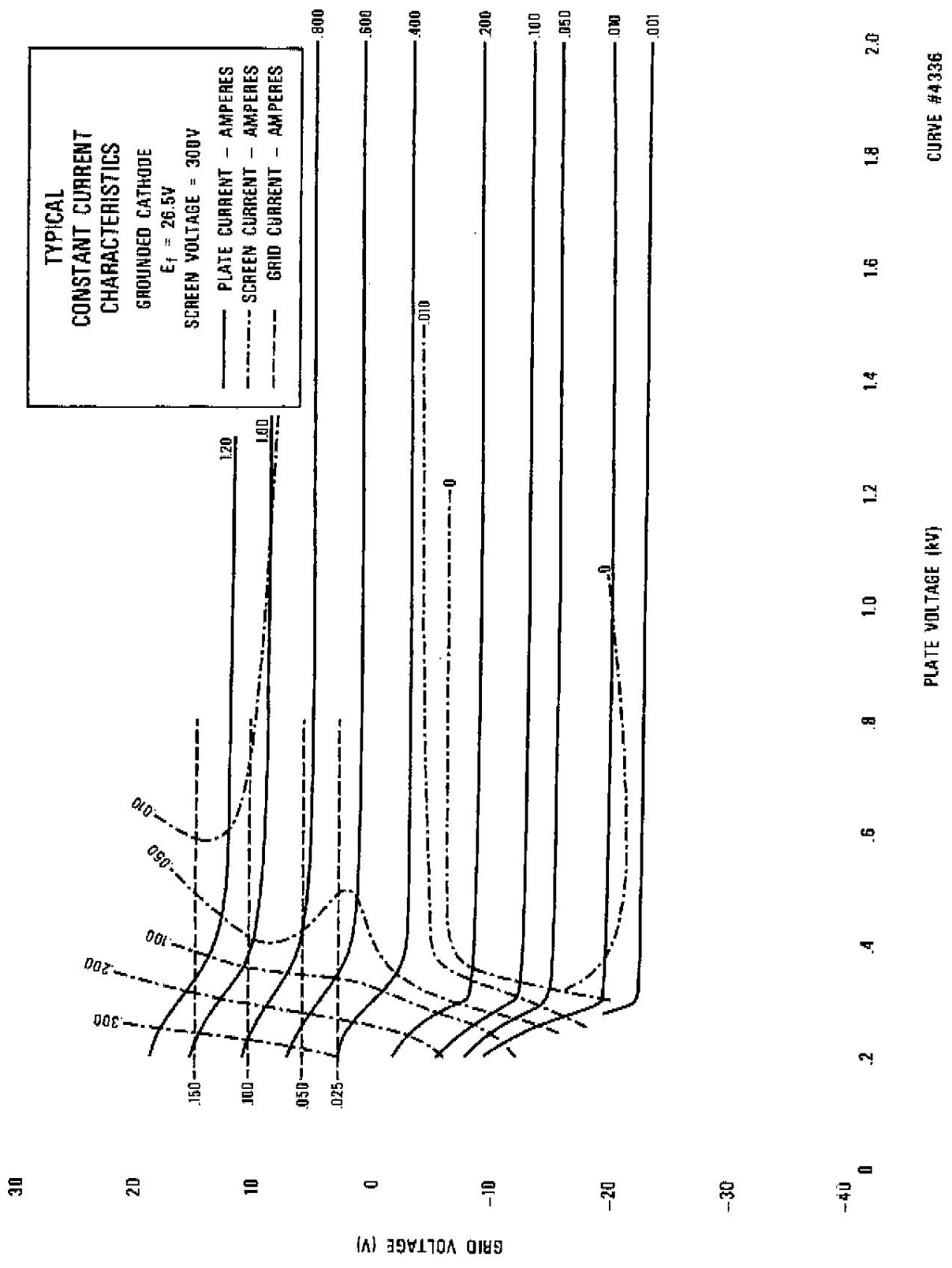
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CURVE #4335



CURVE #4336