TECHNICAL DATA

YU-157
POWER TRIODE

The **EIMAC YU-157** is a rugged coaxial-base ceramic and metal, power triode designed for use as a cathode driven Class AB_2 or Class C amplifier.

It is recommended for VHF or UHF service as a linear amplifier, power amplifier or pulse amplifier. Linearity and power gain are both excellent due to the low ratio of grid to plate current, and the relatively high amplification factor. Low grid interception of available emission current is due to the beam forming geometry of the special grid and cathode design.

The YU-157 is a practical size for use in ground based or mobile equipment in CW or PEP power levels of 1 to 2.5 kW. It is useful at frequencies higher than the upper frequency of maximum ratings, 500 MHz.

GENERAL CHARACTERISTICS[1]

ELECTRICAL

Cathode: Oxide Coated, Unipotential

Heater: Voltage	5.0 ± 0.25 Volts
Current @ 5.0 Volts	10.5 Amperes
Transconductance (Average):	
I_b = 1.0 Adc	55,000 μmhos
Amplification Factor (Average)	125
Direct Interelectrode Capacitance (Grounded Grid)[2]	
Cin	39 pF
Cout	13 pF
Cgp	0.14 pF
Ck-htr	12.8 pF
Frequency of Maximum Rating (CW)	500 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. **Varian EIMAC** 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.

varian
eimac salt lake division
1678 South Pioneer Road / Salt Lake City, Utah 84104 / (801) 972-5000

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RADIO FREQUENCY LINEAR AMPLIFIER CATHODE DRIVEN Class AB_2

TYPICAL OPERATION
(Frequencies to 30 MHz)
Class AB_2 Cathode Driven, Peak Envelope or
Modulation Crest Conditions

Plate Voltage	3500 Vdc
Grid Voltage[1]	-20 Vdc
Zero-Signal Plate Current	300 mAdc
Single-Tone Plate Current	900 mAdc
Two-Tone Plate Current	715 mAdc
Single-Tone Grid Current[3]	39 mAdc
Two-Tone Grid Current[3]	12 mAdc
Peak rf Cathode Voltage[3]	71 Volts
Driving Power[3]	50 Watts
Useful Output Power[4]	2030 Watts
Resonant Load Impedance	2200 Ohms
Intermodulation Distortion[2]	
3rd Order Products	-44 dB
5th Order Products	-44 dB

ABSOLUTE MAXIMUM RATINGS

DC Plate Voltage	4000 Volts
DC Plate Current	1.0 Ampere
Plate Dissipation	2500 Watts
Grid Dissipation	25 Watts

[1]Positive cathode bias provided by zener diode.
[2]The intermodulation distortion products are referenced against one tone of a two equal tone signal.
[3]Approximate value.
[4]Delivered to the load.

RADIO FREQUENCY POWER AMPLIFIER Class B or C

TYPICAL OPERATION
(Cathode Driven Amplifier)

Frequency of Operation	400 MHz
Heater Voltage	4.3 Volts
DC Plate Voltage	3000 Volts
DC Grid Voltage	-31 Volts
DC Plate Current	1.0 Ampere
DC Grid Current	5 mA
Measured Driving Power	83 Watts
Useful Output Power	1570 Watts
Power Gain	12.8 dB

PULSE OPERATION

Peak Pulse Plate Voltage	5500 Volts
DC Plate Current	1.0 Ampere
Plate Dissipation	2500 Watts
Grid Dissipation	25 Watts

MECHANICAL

Maximum Overall Dimensions:
- Length ..... 3.57 in; 91.00 mm
- Diameter ..... 3.38 in; 85.85 mm

Net Weight ..... 25 oz; 709 gm
Operating Position ..... Any

Maximum Operating Temperature:
- Ceramic/Metal Seals ..... 250°C
- Anode Core ..... 250°C

Cooling ..... Water
Base ..... Coaxial with Tabs

APPLICATION

MECHANICAL

MOUNTING - The YU-157 may be mounted in any position.

COOLING -

GPM	PSI	WATTS
0.1	.01	400
0.3	0.1	1200
0.5	0.26	2000
0.7	0.47	2800

The table above states minimum water flow requirements to maintain tube temperature below 175°C. The table is based upon a water temperature rise of 20°C and inlet temperature of 30°C. A separate air flow supply of approximately 5 CPM directed into the base is also required to maintain rated filament seal.

ELECTRICAL

FILAMENT OPERATION - Rated filament voltage for the YU-157 is 5.0 Volts. For CW operation at the higher end of the frequency range of the YU-157, it is advisable to reduce the heater voltage by a small percentage. For a CW or average power output of 1 kW or more at 400 MHz, it is recommended that heater voltage be reduced to 4.3 Volts. At frequencies between 400 and 200 MHz, nominal heater voltage, for the power level above, should be obtained from a straight line curve defined by 4.3 Volts at 400 MHz and 5.0 Volts at 200 MHz.

In equipment intended for a broad range of frequencies, a fixed compromise heater voltage is suggested. This may be the lowest heater voltage which provides adequate cathode emission current at the lower end of the frequency range, and should be between 4.3 and 5.0 Volts.

GRID OR CATHODE BIAS - It is convenient in linear amplifier service to use a zener diode or series of zener diodes in the cathode circuit if bias is required. The power loss is small because linear amplifier bias will generally be less than 25 Volts. Conventional grid bias sources may be used for CW or pulse applications.

UHF OPERATION - The YU-157 provides very high gain at UHF with simple cavity designs, as a result of beam focusing action of a series of strip electron guns in the cathode grid region, which produces very high mu with unusually low grid interception. Use of a high mu triode in the cathode driven configuration at UHF simplifies circuitry in many ways.

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 the tube terminals, and wiring effects. To control the actual capacitance values within the tube, as the key component involved, the industry and 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 terminals or 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.

ABSOLUTE MAXIMUM RATINGS - Values shown for each type of service are based on the "absolute system" and are not to be exceeded under any service conditions. These ratings are limiting values outside which the serviceability of the tube may be impaired. In order not to exceed aboslute ratings, the equipment designer has the responsibility of determining an average design value for each rating below the absolute value of that rating by a safety factor so that the absolute values will never be exceeded under any usual conditions of supply voltage variation in the equipment itself. It does not necessarily follow that combinations of absolute maximum ratings can be attained simultaneously.

FAULT PROTECTION - It is good practice to protect the tube from internal damage caused by an internal arc which may occur at high anode voltage.

RF RADIATION - Exposure to strong rf fields should be avoided, even at relatively low frequencies. The dangers of rf radiation are more severe at UHF and microwave frequencies and can cause serious bodily and eye injuries. CARDIAC PACEMAKERS MAY BE AFFECTED.

HOT SURFACES - When the tube is used in air and air cooled, external surfaces of the tube may reach temperatures up to 200 degrees C and higher. In addition to the anode, the cathode insulator and cathode/heater surfaces may remain hot for an extended time after the tube is shut off. To prevent serious burns, take care to avoid any bodily contact with these surfaces both during, and for a reasonable cool down period after, tube operation.

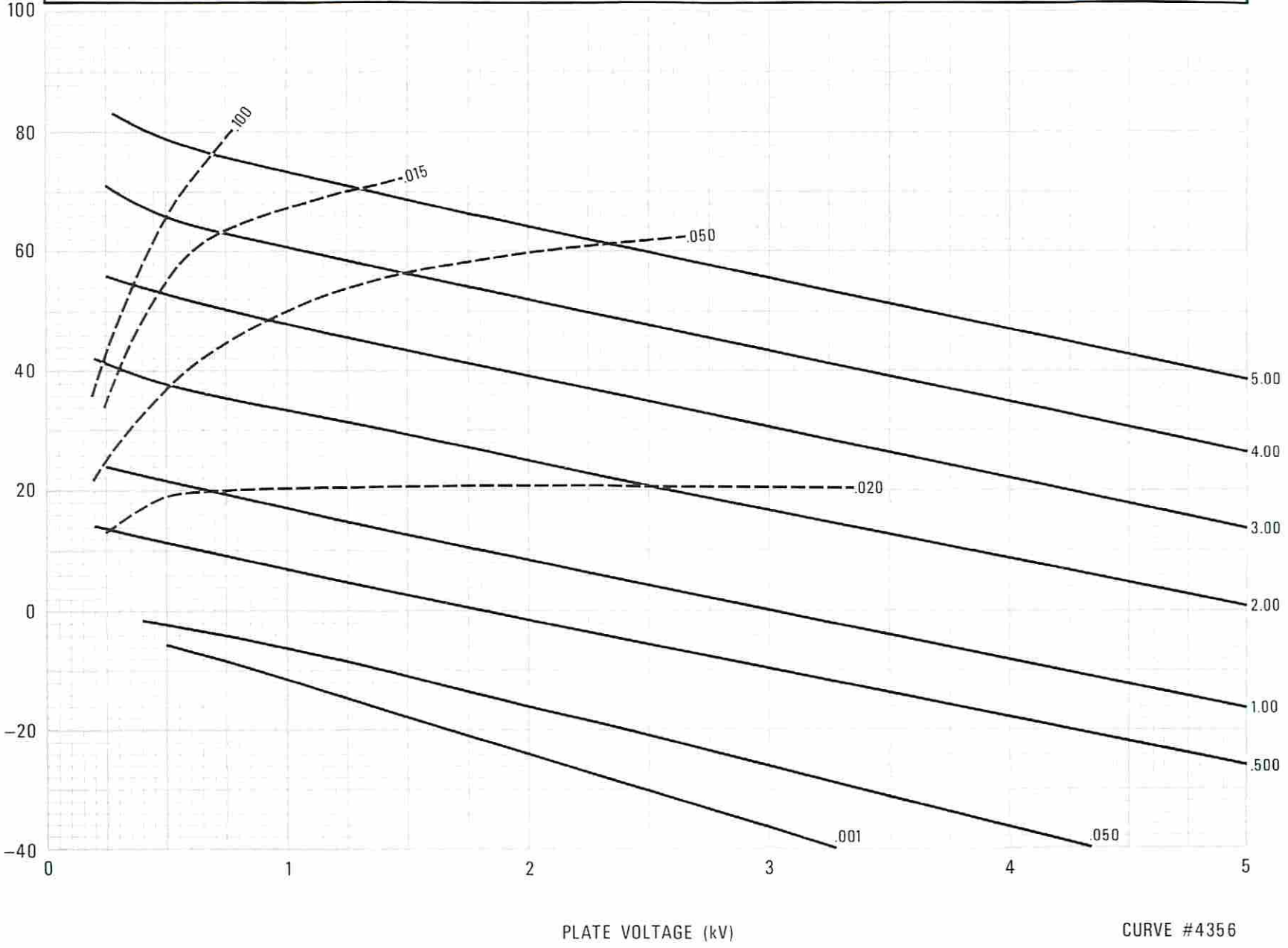
CAUTION - HIGH VOLTAGE - *Operating voltage for the YU-157 can be deadly, so the equipment must be designed properly and operating precautions must be followed. Design equipment so that no one can come in contact with high voltages. All equipment must include safety enclosures for high voltage circuits and terminals, with interlock switches to open the primary circuits of the power supply and to discharge high voltage capacitors 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 different from those given here, write to the Power Grid Tube Marketing Department, Varian EIMAC, 1678 South Pioneer Road, Salt Lake City. UT 84104, for information and recommendations.

YU-157 TYPICAL CONSTANT CURRENT CHARACTERISTICS

GROUNDED CATHODE E_f = 5.0

——— PLATE CURRENT – AMPERES – – – – GRID CURRENT – AMPERES

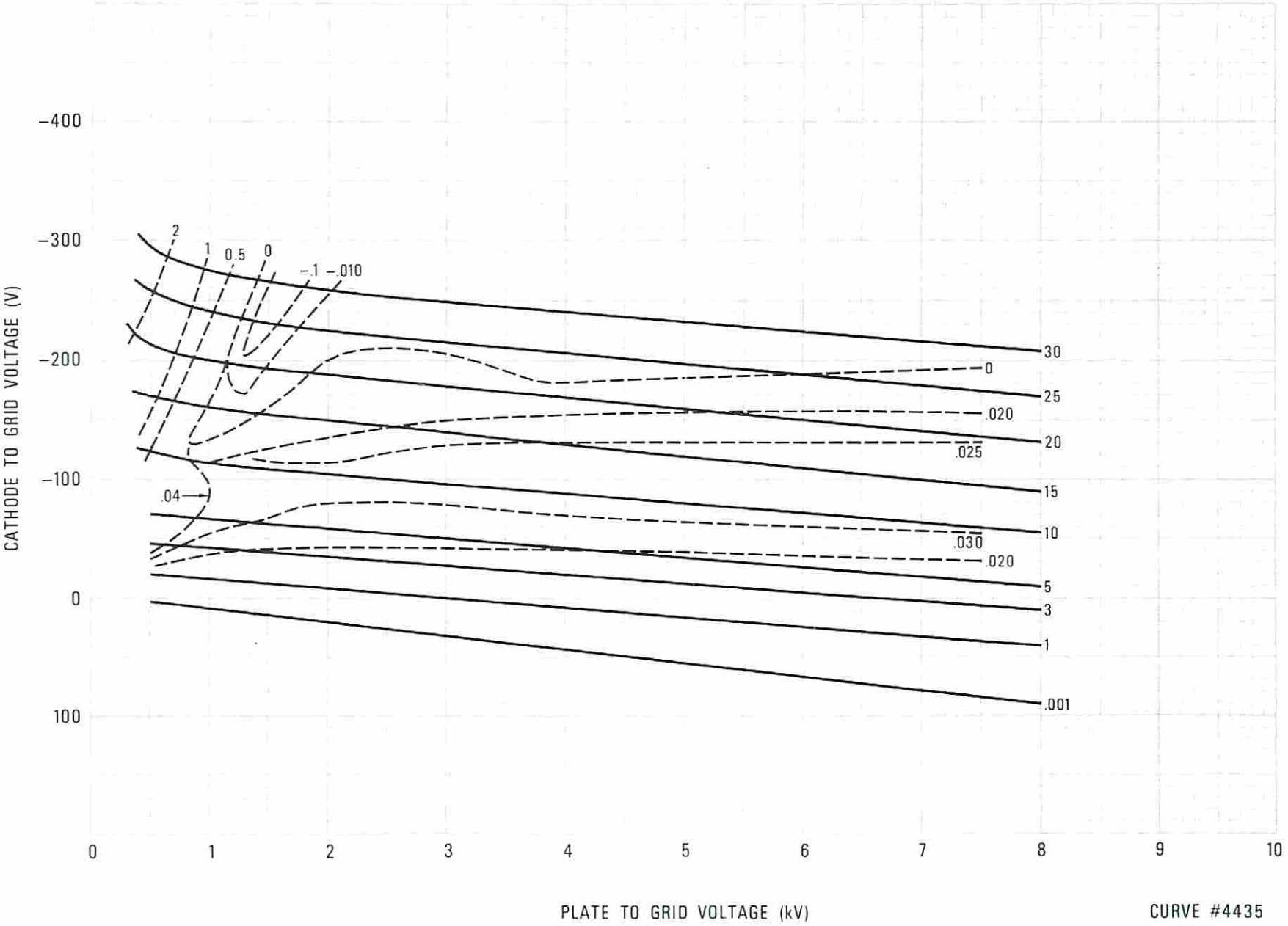


CURVE #4356

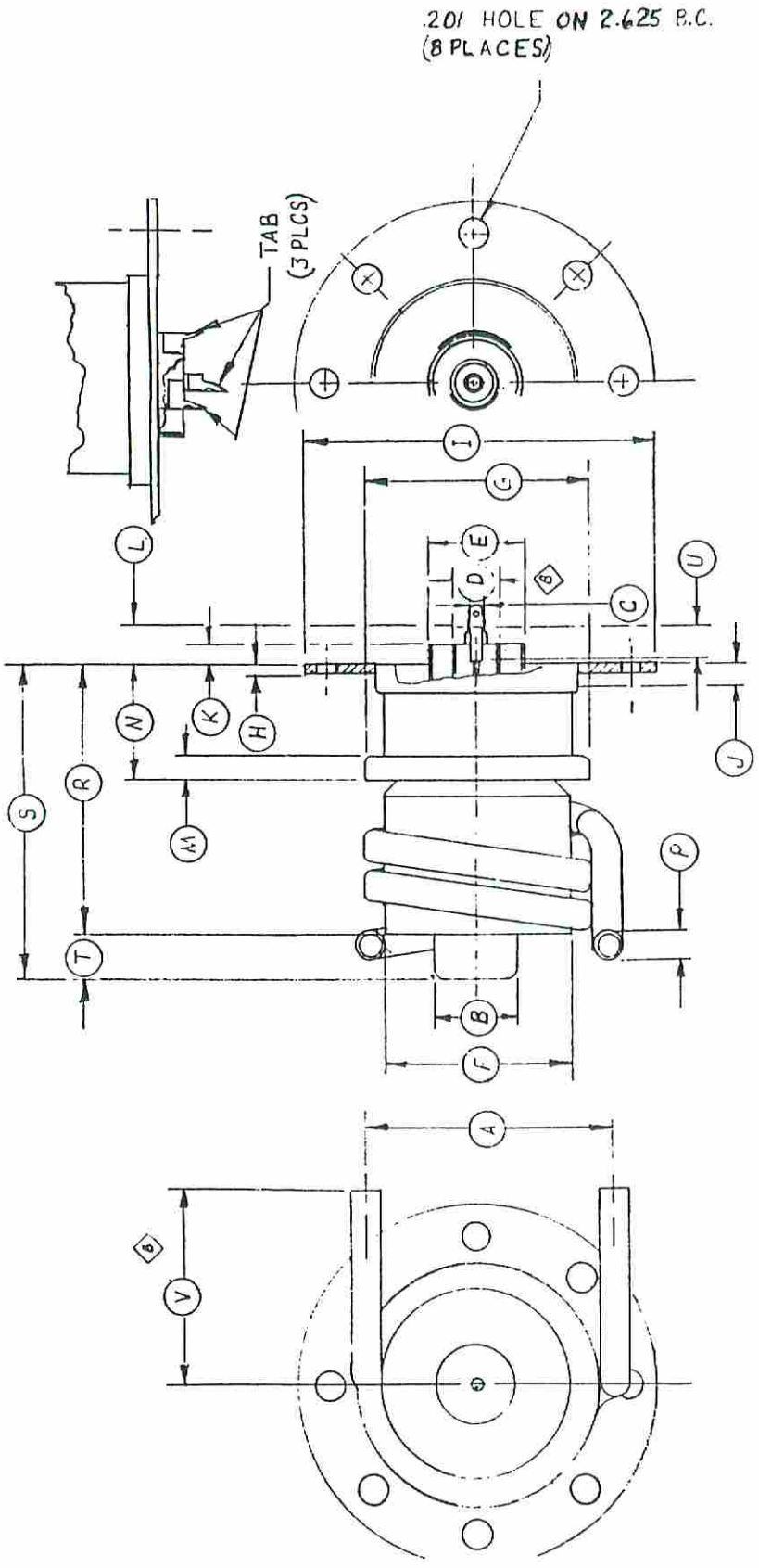
YU-157 TYPICAL CONSTANT CURRENT CHARACTERISTICS

GROUNDED GRID E_f = 5V

——— PLATE CURRENT – AMPERES – – – – GRID CURRENT – AMPERES



CURVE #4435



DIMENSIONAL DATA						
	INCHES			MILLIMETERS		
DIM.	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A			2.800			71.12
B	.810	.820		20.57	20.83	
C	.120	.127		3.05	3.23	
D	.477	.487		12.12	12.37	
E	.965	.975		24.51	24.76	
F			1.860			47.24
G	2.245	2.255		57.02	57.28	
H			.125			3.17
I			2.969			75.41
J	.235			5.97		
K	.170	.200		4.32	5.08	
L	.370	.400		9.40	10.16	
M	.235			5.97		
N	1.110	1.170		28.19	29.72	
P			.375			9.52
R			2.625			66.67
S	3.180	3.280		80.77	83.31	
T	.515	.615		13.08	15.62	
U	.350			8.89		
V	1.570	1.970		39.88	50.04	
W						
X						
Y						
Z						

NOTES:

1. REF DIMENSIONS ARE FOR INFO ONLY & ARE NOT REQUIRED FOR INSPECTION PURPOSES.

2. METRIC EQUIVALENTS TO THE NEAREST .01mm, ARE GIVEN FOR GENERAL INFO ONLY & ARE BASED ON 1 INCH=25.4mm.