



TECHNICAL DATA

YU-106 HIGH-MU WATER COOLED POWER TRIODE

The **EIMAC YU-106** is a ceramic/metal, water cooled, high mu triode for use as an amplifier, oscillator, or modulator, or in voltage regulator applications. Its maximum rated anode dissipation is 5000 Watts.

The YU-106 is a water cooled version of the air cooled 3CX3000F7, and is identical except for the addition of flexible leads on the base for grid and filament connections, which can simplify socketing in low frequency operations.

Operation with zero grid bias in many applications offers circuit simplicity by eliminating the bias supply. Grounded grid operation is attractive since a power gain of over 20 times can be obtained.



GENERAL CHARACTERISTICS¹

ELECTRICAL

Filament: Thoriated Tungsten

Voltage 7.5 ± 0.37 Volts

Current @ 7 Volts 51.5 Amperes

Amplification Factor (Average) 160

Direct Interelectrode Capacitance (Grounded Filament)²

Cin 38.0 pF

Cout 0.6 pF

Cgp 24.0 pF

Direct Interelectrode Capacitance (Grounded Grid)²

Cin 38.0 pF

Cout 24.0 pF

Cgp 0.6 pF

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

²Capacitance values are for a cold tube as measured in a special shielded fixture.



Frequency of Maximum Rating 75 MHz

RADIO FREQUENCY LINEAR AMPLIFIER CATHODE DRIVEN Class AB₂

TYPICAL OPERATION

(Frequencies to 30 MHz) Class AB₂

Peak Envelope or Modulation Crest Conditions

Plate Voltage	4800	4800	4900	Vdc
Zero-Signal Plate Current ¹	0.35	0.35	0.36	Adc
Single-Tone Plate Current	1.68	2.00	2.25	Adc
Single-Tone Grid Current ²	0.46	0.60	0.65	Adc
Driving Power ²	293	410	535	Watts
Plate Dissipation	2275	2275	2275	Watts
Single-Tone Plate Output Power	6000	7266	8250	Watts
Resonant Load Impedance	1720	1425	1308	Ohms
Driving Impedance	50.0	46.3	49.2	Ohms

¹Bias Voltage may be required.

²Approximate value.

ABSOLUTE MAXIMUM RATINGS

DC Plate Voltage	5000 Volts
DC Plate Current	2.5 Amperes
Plate Dissipation	5000 Watts
Grid Dissipation	225 Watts

RADIO FREQUENCY LINEAR AMPLIFIER GRID DRIVEN Class AB₂

TYPICAL OPERATION

(Frequencies to 30 MHz) Class AB₂

Grid Driven, Carrier Conditions

Plate Voltage	4000	4900	Vdc
Zero-Signal Plate Current ¹	0.25	0.36	Adc
DC Plate Current	0.74	1.23	Adc
DC Grid Current ¹	0.13	0.17	Adc
Peak rf Grid Voltage ²	85.0	125	Volts
Driving Power ²	11.5	21.2	Watts
Plate Dissipation	1830	3840	Watts
Carrier Plate Output Power	1130	2200	Watts
Resonant Load Impedance	1750	1100	Ohms

¹Bias Voltage may be required.

²Approximate value.

ABSOLUTE MAXIMUM RATINGS

DC Plate Voltage	5000 Volts
DC Plate Current	2.5 Amperes
Plate Dissipation	5000 Watts
Grid Dissipation	225 Watts

RADIO FREQUENCY POWER AMPLIFIER
Class C Telegraphy or FM, Cathode Driven (Key-down Conditions)

TYPICAL OPERATION
(Frequencies to 110 MHz)

Plate Voltage	4900 Vdc
Grid Voltage	-50 Vdc
Plate Current	2.16 Adc
Grid Current ¹	0.61 Adc
Peak rf Cathode Voltage ¹	300 Volts
Calculated Driving Power ¹	691 Watts
Plate Dissipation	2315 Watts
Useful Output Power ²	7500 Watts

¹Approximate value.
²Output circuit and filter loss of 10% assumed.

ABSOLUTE MAXIMUM RATINGS

DC Plate Voltage	5000 Volts
DC Plate Current	2.5 Amperes
Plate Dissipation	5000 Watts
Grid Dissipation	225 Watts

AUDIO FREQUENCY POWER AMPLIFIER OR MODULATOR
Class AB₂, Grid Driven (Sinusoidal Wave)

TYPICAL OPERATION
(Two Tubes)

Plate Voltage	4000	4900	Vdc
Zero-Signal Plate Current ³	0.50	0.72	Adc
Max. Signal Plate Current	3.58	4.72	Adc
Max. Signal Grid Current ¹	0.58	1.10	Adc
Peak af Grid Voltage ²	190	250	Volts
Driving Power ¹	115	276	Watts
Max. Signal Plate Dissipation	3820	6618	Watts
Plate Output Power	10.5	16.4	kW
Load Resistance (plate to plate)	2720	2352	Ohms

¹Approximate value.
²Per tube.
³Bias Voltage may be required.

ABSOLUTE MAXIMUM RATINGS (Per Tube)

DC Plate Voltage	5000 Volts
DC Plate Current	2.5 Amperes
Plate Dissipation	5000 Watts
Grid Dissipation	225 Watts



VOLTAGE REGULATOR SERVICE

ABSOLUTE MAXIMUM RATINGS

DC Plate Voltage	10,000 Vdc
DC Plate Current	4.0 Adc
Pulsed Plate Current	10.0 Amperes
Plate Dissipation (see note)	5,000 Watts
Grid Dissipation (see note)	225 Watts

NOTE: The equipment designer or user must assure that rated dissipation values are not exceeded. In continuous operation (Class A) element dissipation is simply the product of voltage and current at the operating conditions. In pulsed operation the element dissipation is basically the product of voltage, current, and duty factor, though pulse shape and circuit conditions may effect actual dissipation values.

NOTE: TYPICAL OPERATION data are obtained by measurement or calculation from published characteristic curves. Adjustment of the rf grid voltage to obtain the specified plate current at the specified bias, 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 current. The grid current which results when the desired plate current is obtained is incidental and varies 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.

RANGE VALUES FOR EQUIPMENT DESIGN

	<u>Min.</u>	<u>Max.</u>	
Filament Current @ 7.5 Volts	48.0	54.0	Amperes
Interelectrode Capacitance ¹ (Grounded Filament Connection)			
Cin	30.0	45.0	pF
Cout	—	1.0	pF
Cgp	20.0	28.0	pF
Interelectrode Capacitance ¹ (Grounded Grid Connection)			
Cin	30.0	45.0	pF
Cout	20.0	28.0	pF
Cpk	—	1.0	pF
Zero Bias Plate Current (E b = 5000 Volts)	0.36	0.52	Ampere
Cut-off Bias			
(E b = 5000 Volts, I b = 1.0 mA dc)	—	-45.0	Volts

¹Capacitance values are for a cold tube as mounted in a shielded fixture.



MECHANICAL

Maximum Overall Dimensions:

Length (including filament leads)	22.062 in; 56.04 cm
Diameter	3.625 in; 9.22 cm
Operating Position	Vertical, base up or down
Net Weight (Approximate)	5.5 lb. 2.5 kg
Cooling	Water
Base	Special with Flying Leads
Maximum Operating Temperature:	
Envelope and Ceramic/Metal Seals	250°C
Filament Lead/Tube Base Junctions	150°C

APPLICATION

MECHANICAL

MOUNTING - The YU-106 must be mounted vertically, base down or up at the convenience of the circuit designer.

COOLING - (Cooling information is shown on attached graph) The filament stem structure also requires forced air cooling. A minimum of 6 cfm should be directed into the space between the inner and outer filament contacting surfaces.

A major factor effecting long life of water cooled tubes is the condition of the cooling water. High purity water must be used to minimize power loss, corrosion of metal fittings, and loss of anode dissipation capability. Water resistivity must be maintained at 1 megohm/cm (at 25°C) or better for long term operation. EIMAC Application Bulletin #16 should be consulted for details on maintenance of water quality standards and use of a water purification loop in the installation. Since the anode is normally at high potential to ground, water connections to the anode are made through insulating tubing, with long enough sections that column resistance is above 4 megohms per 1000 plate supply Volts, or 10 megohms total, whichever is less.

Both air and water flow must be supplied before or simultaneously with the application of electrode voltages, including the filament, and may be removed simultaneously with them. Where long life and consistent performance are factors, cooling in excess of minimum requirements is normally beneficial.

ELECTRICAL

FILAMENT OPERATION - The filament voltage, as measured at the filament terminals, should be 7.5 Volts, with maximum allowable variations due to the line fluctuations of from 7.12 to 7.87 Volts.

INTERLOCKS - An interlock device should be provided to ensure that cooling water and air flow is established before application of electrical power, including the heater. The circuit should be so arranged that rf drive cannot be applied in the absence of normal plate voltage.

INPUT CIRCUIT - When operated as a grounded grid rf amplifier, the use of a matching network in the cathode circuit is recommended. For best results with a single ended amplifier, and depending on the application, it is suggested the cathode tuned circuit operate with a "Q" of 5 or more.

RADIO FREQUENCY RADIATION - Avoid exposure to strong rf fields even at relatively low frequency. Absorption of rf energy by human tissue is dependent on frequency. Under 30 MHz, most of the energy will pass completely through the human body with little attenuation or heating effect. Public health agencies are concerned with the hazard, however, even at these frequencies, and it is worth noting that some commercial dielectric heating units actually operate at frequencies as low as the 13 and 27 MHz bands.

Many EIMAC power tubes, such as these, are specifically



designed to generate or amplify radio frequency power. There may be a relatively strong rf field in the general proximity of the power tube and its associated circuitry -the more power involved the stronger the rf field. Proper enclosure design and efficient coupling of rf energy to the load will minimize the rf field in the vicinity of the power amplifier unit itself.

FAULT PROTECTION - In addition to normal cooling flow interlock and plate over-current interlock, it is good practice to protect the tube from internal damage which could result from occasional plate arcing at high plate voltage.

In all cases some protective resistance, at least 10 ohms, should be used in series with the tube anode to absorb power supply stored energy in case a plate arc should occur.

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 leads from each other and eliminate 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 if the tube is 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.

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.

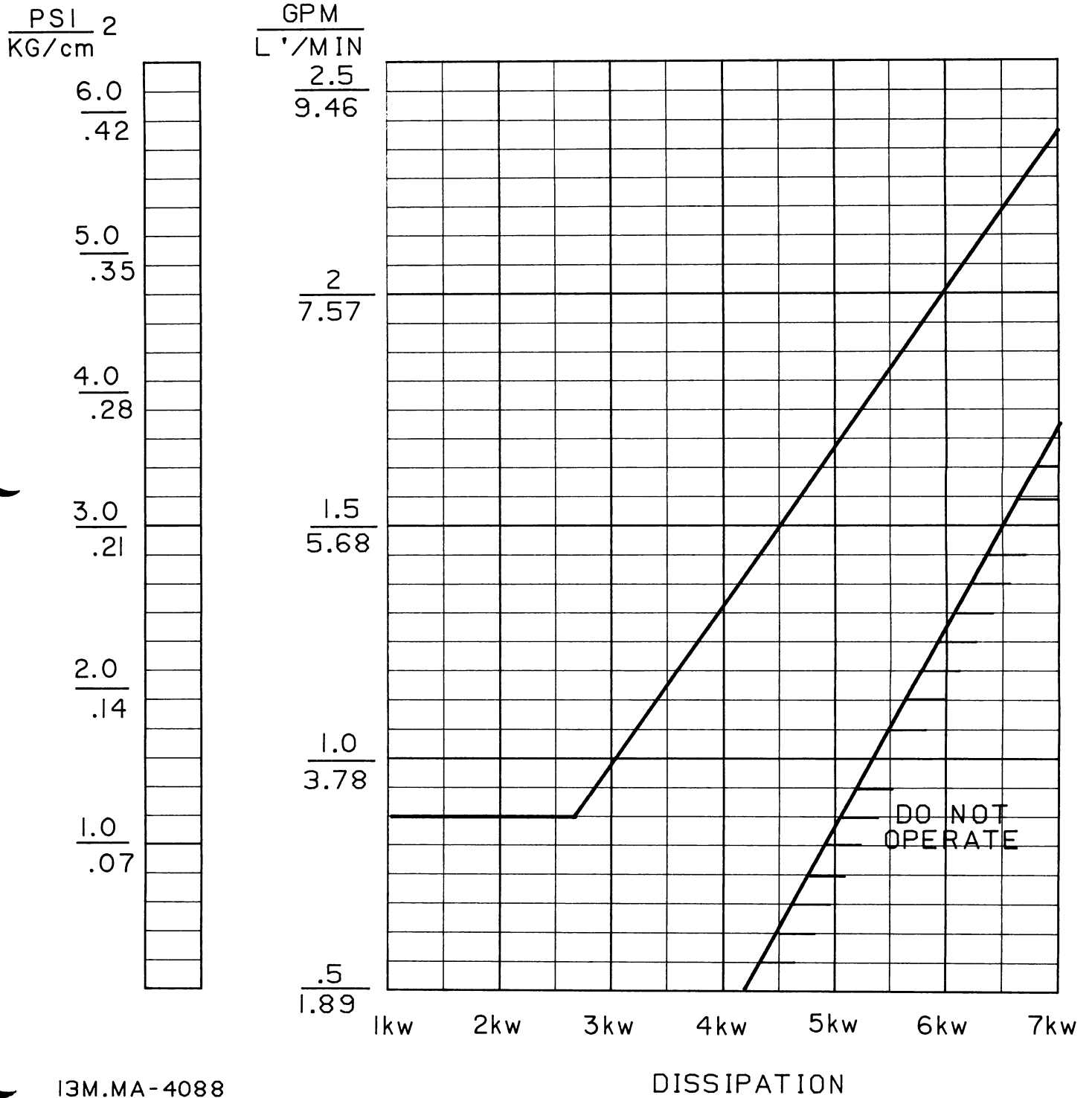
CAUTION - HIGH VOLTAGE - *Operating voltage for the YU-106 can be deadly, so the equipment must be designed properly and operating precautions must be followed. Design equipment so that no one can come in contact with high voltages. All equipment must include safety enclosures for high voltage circuits 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.



COOLING DATA

YU-106



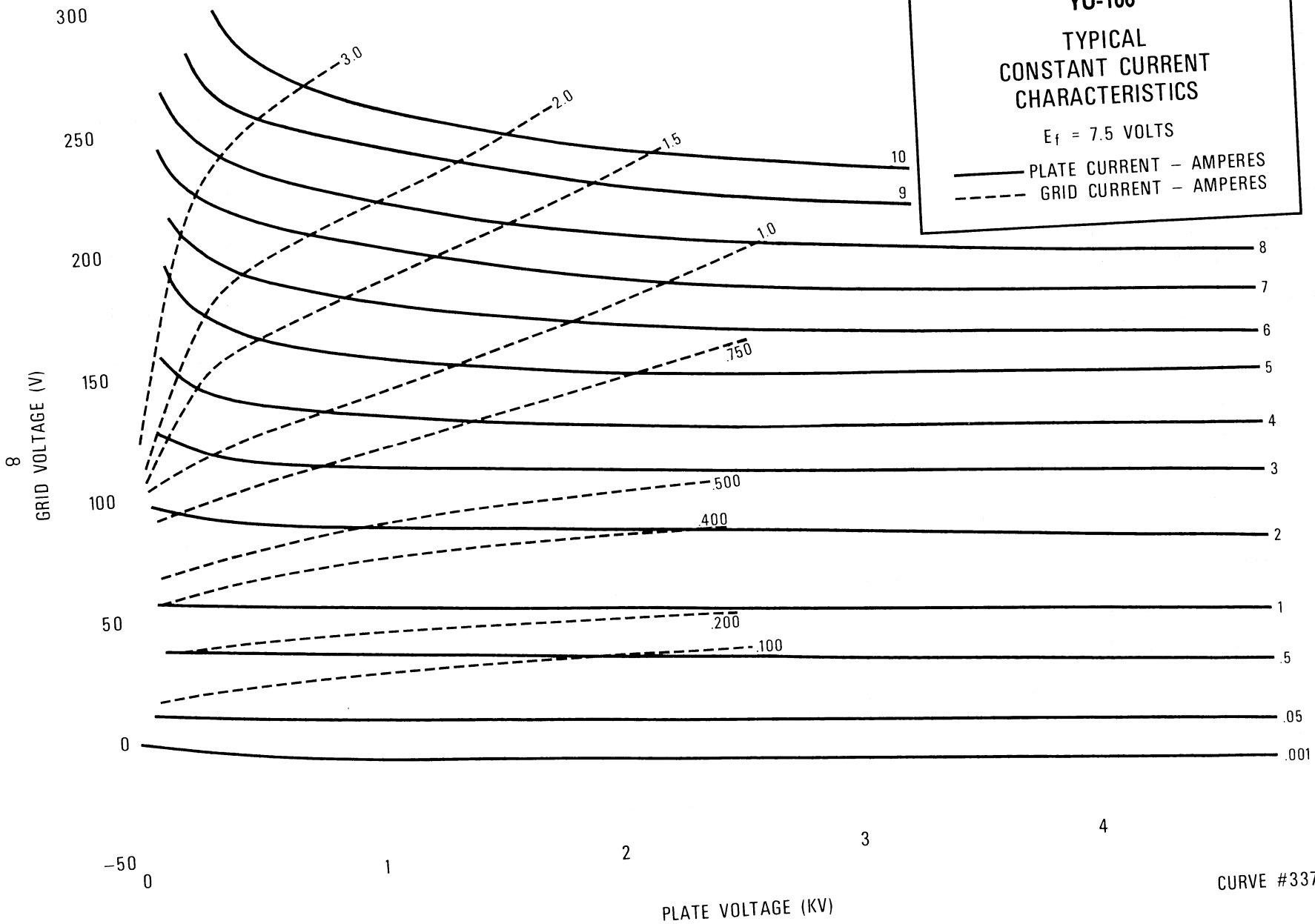


YU-106

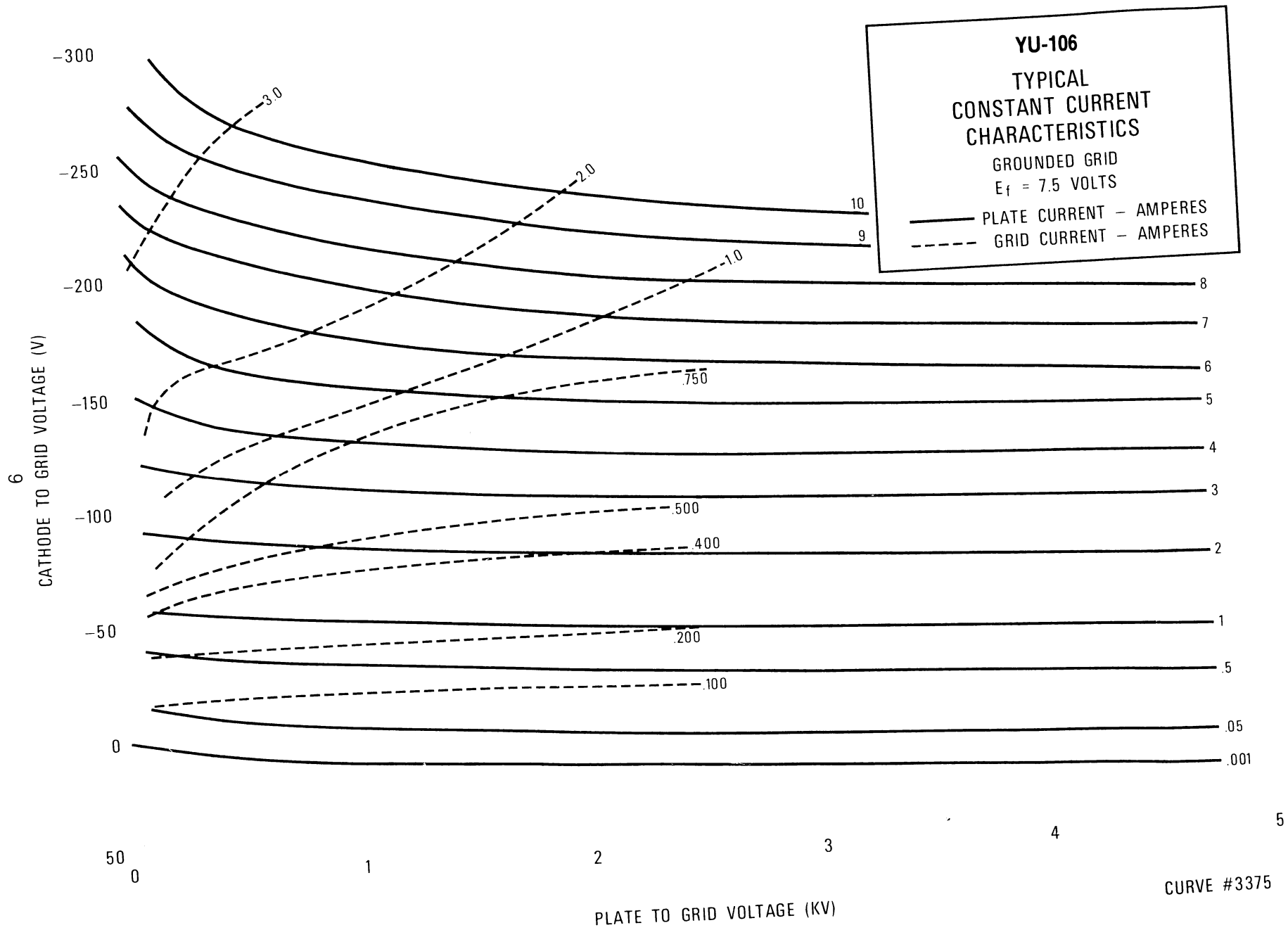
YU-106
TYPICAL
CONSTANT CURRENT
CHARACTERISTICS

$E_f = 7.5$ VOLTS

— PLATE CURRENT — AMPERES
- - - GRID CURRENT — AMPERES



CURVE #3373



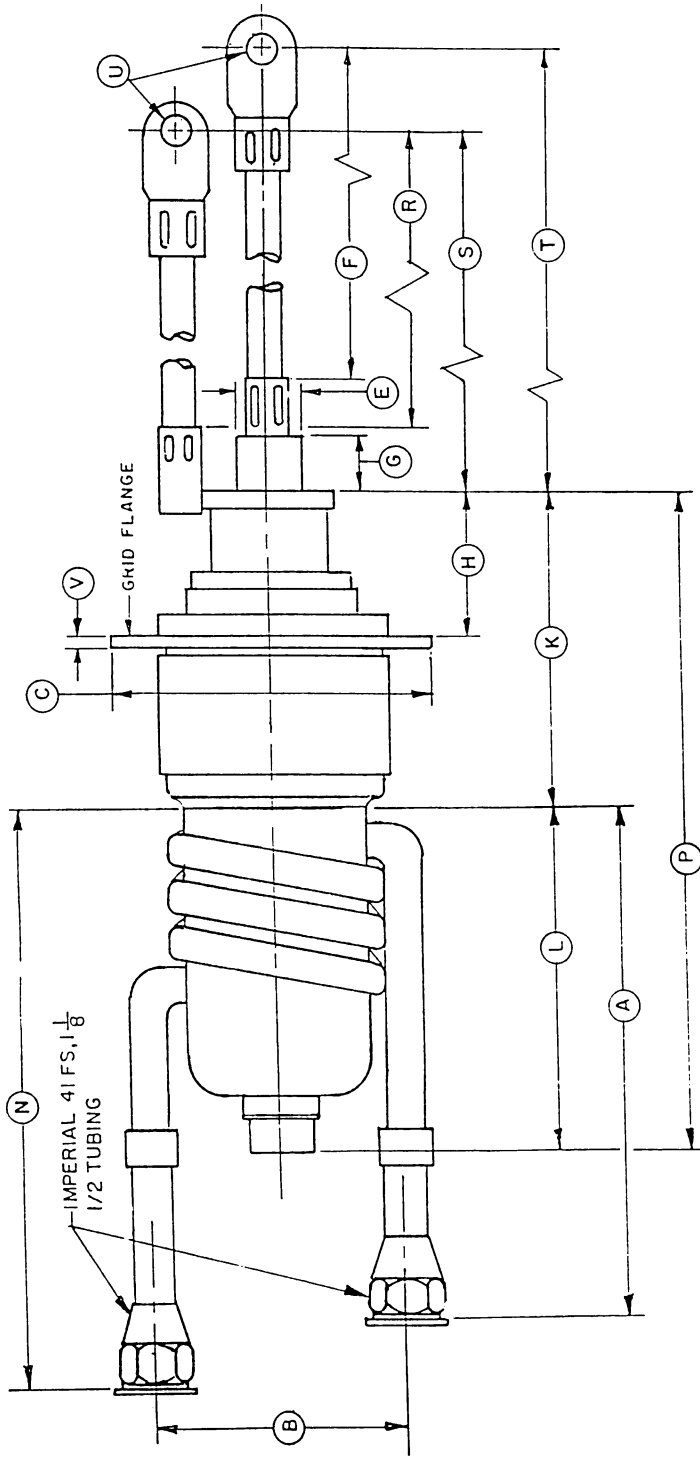
YU-106

CURVE #3375



NOTES:

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



DIM	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
A			5.250			133.4
B			2.625			66.68
C	4.230	4.250		107.4	107.9	
D	3.855	3.885		97.9	98.7	
E	.859	.890		21.8	22.6	
F	7.000	7.500		177.8	190.5	
G	.812	.938		20.62	23.82	
H	1.703	1.953		43.26	49.6	
I						
J	29°	31°				
K			3.650			92.71
L			4.040			102.6
M						
N			6.000			152.4
P	7.710	8.460		195.8	214.88	
R	7.000	7.500		177.8	190.5	
S	7.937	8.437		201.60	214.30	
T	8.937	9.437		226.99	239.69	
U	.385	.395		9.78	10.03	
V			.125			3.175
W						
X						
Y						
Z						

