PLANAR TRIODE YU-176 & YU-176A

The Eimac YU-176 is a ceramic/metal planar triode designed for airborne, ground or space applications. It can be used as an rf amplifier or oscillator at frequencies as high as 1.5 GHz or as a series regulator or modulator. The extended grid to anode ceramic allows plate voltages up to 12 kV. The tube features high transconductance and mu, an oxide cathode and a rugged mesh grid. The YU-176A is identical except that it has a lower heater current. The YU-176A is recommended for all new equipment designs.

The tube is normally supplied without a radiator. Cooling may be accomplished by conduction, convection or liquid. Radiators for forced air cooling and adapters permitting anode dissipation up to 800 watts are available as separate items.

CHARACTERISTICS[1]

ELECTRICAL

Cathode (Oxide Coated, Unipotential)

- Heater Voltage ..... 6.3 Volts
- Heater Current at 6.3 Volts ..... 3.8 Amps
- Heater Current (YU-176A) ..... 2.8 - 3.6 Amps

Transconductance (Average):

- Ib = 75 ma ..... 55 mmhos
- Amplification Factory (Average) 200

Direct Interelectrode Capacitances [2] (grounded cathode):

- Cin ..... 28.0 pF
- Cout ..... 3.4 pF
- Cpk ..... 0.90 pF
- Cut-off Bias[3] ..... -90 Volts Max.

Frequency for Maximum Ratings:

- CW ..... 1200 MHz
- Plate or Grid-Pulsed ..... 1500 MHz

MECHANICAL:

Overall Dimensions:

- Length ..... 2.833 in;
- Diameter ..... 1.4 in;

Weight (approx.) ..... 5.2 oz; 146 g

Operating Position ..... Any

Maximum Operating Temperature:

- Ceramic/Metal Seals & Envelope ..... 250° C
- Cooling ..... Conduction, convection, liquid or forced air

[1] Characteristics and operating values are based upon performance tests and environmental conditions. These figures may change without notice as the result of additional data or product refinement. CPI MPP, Eimac Operation 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. When the cathode is heated to the proper temperature, the grid/cathode capacitance will increase from the cold value of approximately 2 pF due to thermal expansion of the cathode.

[3] Measured with 0.1 ma plate current and a plate voltage of 7 kVdc.

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Heater Current @ 6.3 Volts	**3.70**	**4.00**	**Amps**
Cathode Warm-up Time	**300**	**---**	**Seconds**

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

The values listed above represent specified limits for the product and are subject to change. The data should be used for basic information only. Formal, controlled specifications may be obtained from CPI for use in equipment design.

For information on this and other CPI products, visit our website at: **www.cpii.com**, or contact: CPI MPP, Eimac Operation, 607 Hansen Way, Palo Alto, CA 94303

TELEPHONE: 1(800) 414-8823. **FAX:** (650) 846-3795 | **EMAIL:** powergrid@cpii.com

7/15

PLANAR TRIODE YU-176 & YU-176A

ENVIRONMENTAL:

Shock, 11 ms, non-operating	60	G
Vibration, operating, all axes	10	G
Altitude max., in suitably designed circuit	60,000	Ft

INSTANTANEOUS GRID TO CATHODE VOLTAGE

Grid Negative to Cathode	-750	Volts
Grid Positive to Cathode	175	Volts
Pulse Plate Current	20	Amps
Pulse Grid Current	5	Amps
DC Grid Current	100	mA

ABSOLUTE MAXIMUM RATINGS:

Pulse Duration	100	µs
Duty Factor	0.025	
DC Plate Voltage (Grid Pulsed)	10,000	Volts
DC Plate Voltage (Plate Pulsed)	12,000	Volts
DC Grid Voltage	-350	Volts

DISSIPATION:

Average Plate Dissipation*	800	Watts
Average Grid Dissipation	2	Watts

* Measured with anode cooler, P/N 165306, 32 CFM and 10 CFM directed toward tube base.

TYPICAL OPERATION (rf Pulse Amplifier, Class AB_2 Grounded Grid Cathode Bias)

Frequency	425	MHz
Heater Voltage	6.3	Vac
DC Plate Voltage	7	kVdc
DC Grid Voltage	-120	Adc
Peak Video Plate Current	6	Amps
Peak Video Grid Current	1	Amp
Pulse Drive Power	1	kW
Useful Power Output	25	kW
Pulse Duration	100	µs
Duty Factor	0.02	

APPLICATION

MECHANICAL

The cathode and grid flanges should not be altered by machining or filing. Maximum torque applied to flanges during installation should not exceed 15 inch pounds.

Soldered connections may be made to the anode stud, grid or cathode flanges or heater contacts where adequate heat sinking and good soldering practices are followed to minimize the heat applied to the tube and seals. If forced air cooling is provided, auxiliary air flow apart from the air flowing through the radiator, should be provided to cool the tube envelope and other tube terminals. Some conduction cooling is always provided through the contact terminals. However, these terminals usually exhibit poor heat transfer, often having a temperature gradient across them as high as 50°C.

STORAGE – If a tube is to be stored as a spare it should be kept in its original shipping carton, with the original packing material, to minimize the possibility of handling damage. Before storage a new tube should be operated in the equipment for 100 to 200 hours to establish that it has not been damaged and operates properly. If the tube is still in storage 6 months later it should be operated in the equipment for 100 to 200 hours to make sure there has been no degradation. If operation is satisfactory the tube can again be stored with great assurance of being a known-good spare.

HEATER VOLTAGE - One of the most important factors affecting planar tube life and ultimate performance is the heater voltage. The heater voltage value indicated under "General Characteristics / Electrical" is the nominal value used when evaluating the tube during the manufacturing process. Optimum heater voltage for a specific use may, or may not be, the same value. Due to the many possible applications, no general definition of optimum heater voltage can be given. Many applications require lower heater voltage to assure the longest possibly tube life. When the heater of a planar triode is energized by a DC source, its useful life is always shorter than with equivalent AC operation. Heater life under DC conditions is extended by connecting the common heater/cathode terminal to the positive side of the heater supply. If the heater is electrically insulated from the cathode circuit, optimum heater life under DC conditions can be achieved by operating the heater at a negative potential with respect to the cathode.

PLANAR TRIODE YU-176 & YU-176A

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 serviceability of the tube may be impaired. In order not to exceed absolute 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, load variation, or manufacturing variation in the equipment itself. It does not necessarily follow that combinations of absolute maximum ratings can be attained simultaneously.

RF RADIATION - Avoid exposure to strong rf fields even at relatively low frequency. Absorption of rf energy by human tissue is dependent on frequency. Under 300 MHz most of the energy will pass completely through the human body with little attenuation or heating affect. Public health agencies are concerned with the hazard, and the published OSHA (Occupational Safety and Health Administration) or other local recommendations to limit prolonged exposure of rf radiation should be followed.

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 a socket, 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 normally 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" but since this tube does not use a socket no capacitance fixture is required. 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 equipment designer is cautioned to make allowance for the actual capacitance values which will exist in any normal application. Measurements should be taken with mounting which represents approximate final layout if capacitance values are highly significant in the design.

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. Use of a series current limiting resistor in the high voltage lead is highly recommended.

HIGH VOLTAGE - The YU-176 & YU-176A operate 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 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.

HOT SURFACES - Air-cooled surfaces and other parts of tubes can reach temperatures of several hundred degrees C and cause serious burns if touched within several minutes after all power is removed.

SPECIAL APPLICATIONS - If it is desired to operate this tube under conditions widely different from those given here, contact the Application Engineering Dept., CPI MPP Eimac Operation, Palo Alto, Calif. 94304 for information and recommendations.

OPERATING HAZARDS

Proper use and safe operating practices with respect to power tubes are the responsibility of equipment manufacturers and users of such tubes. All persons who work with and are exposed to power tubes, or equipment that utilizes such tubes, must take precautions to protect themselves against possible serious bodily injury. DO NOT BE CARELESS AROUND SUCH PRODUCTS.

The operation of this tube may involve the following hazards, any one of which, in the absence of safe operating practices and precautions, could result in serious harm to personnel.

HIGH VOLTAGE – Normal operating voltages can be deadly. Remember the HIGH VOLTAGE CAN KILL.

LOW-VOLTAGE HIGH-CURRENT CIRCUITS - Personal jewelry, such as rings, should not be worn when working with filament contacts or connectors as a short circuit can produce very high current and melting, resulting in severe burns.

RF RADIATION – Exposure to strong rf fields should be avoided, even at relatively low frequencies. CARDIAC PACEMAKERS MAY BE AFFECTED.

HOT WATER - Water used to cool tubes may reach scalding temperatures. Touching or rupture of the cooling system can cause serious burns.

HOT SURFACES – Surfaces of tubes can reach temperatures of several hundred°C and cause serious burns if touched for several minutes after all power is removed.

MATERIAL COMPLIANCE - This product and package conforms to the conditions and limitations specified in 49CFR 173.424 for radioactive material, excepted package-instruments or articles, UN2910. In addition, this product and package contains no beryllium oxide (BeO).

Please review the detailed Operating Hazards sheet enclosed with each tube, or request a copy from CPI MPP, Eimac Operation Application Engineering at (800) 414-8823, Opt. #1.

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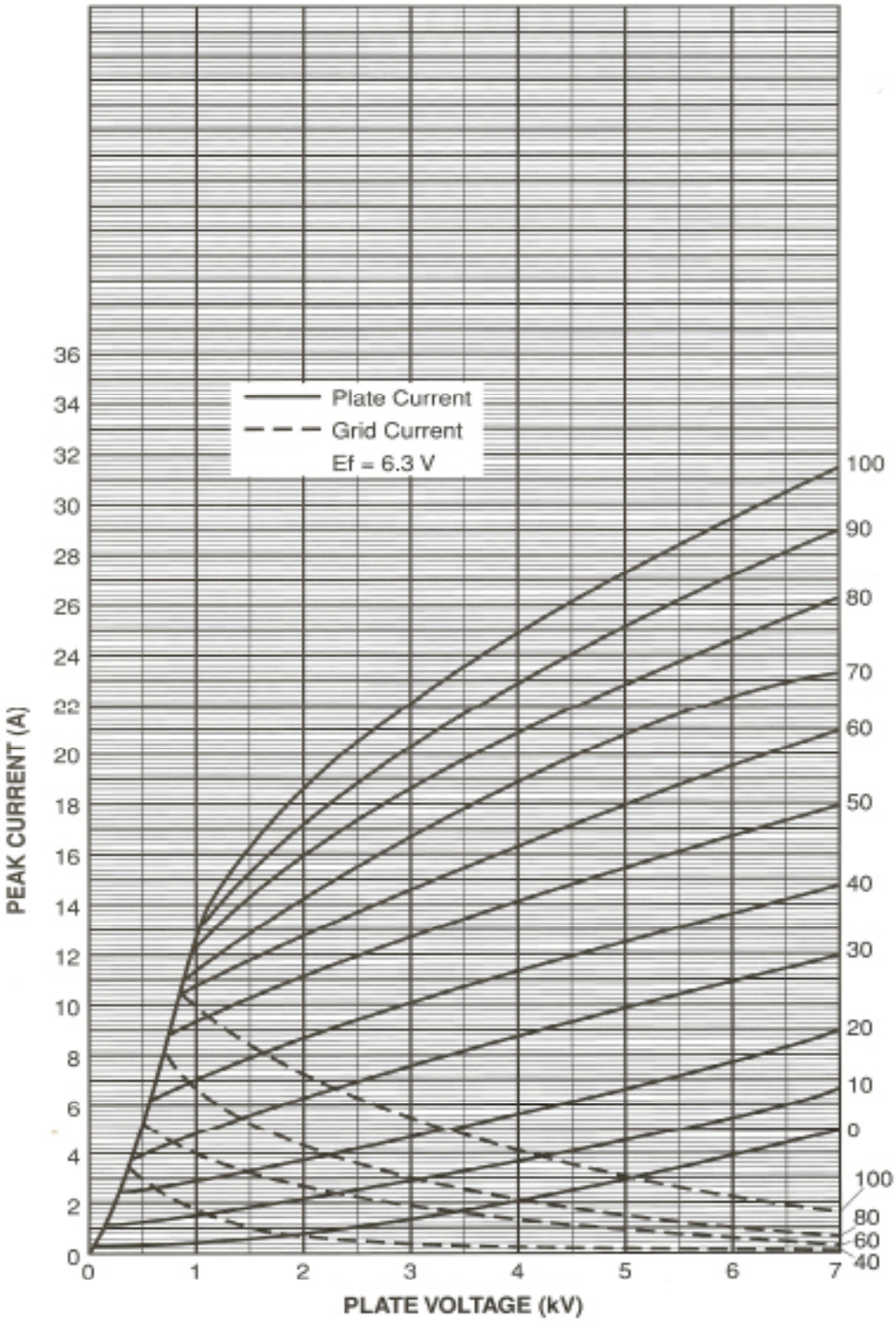
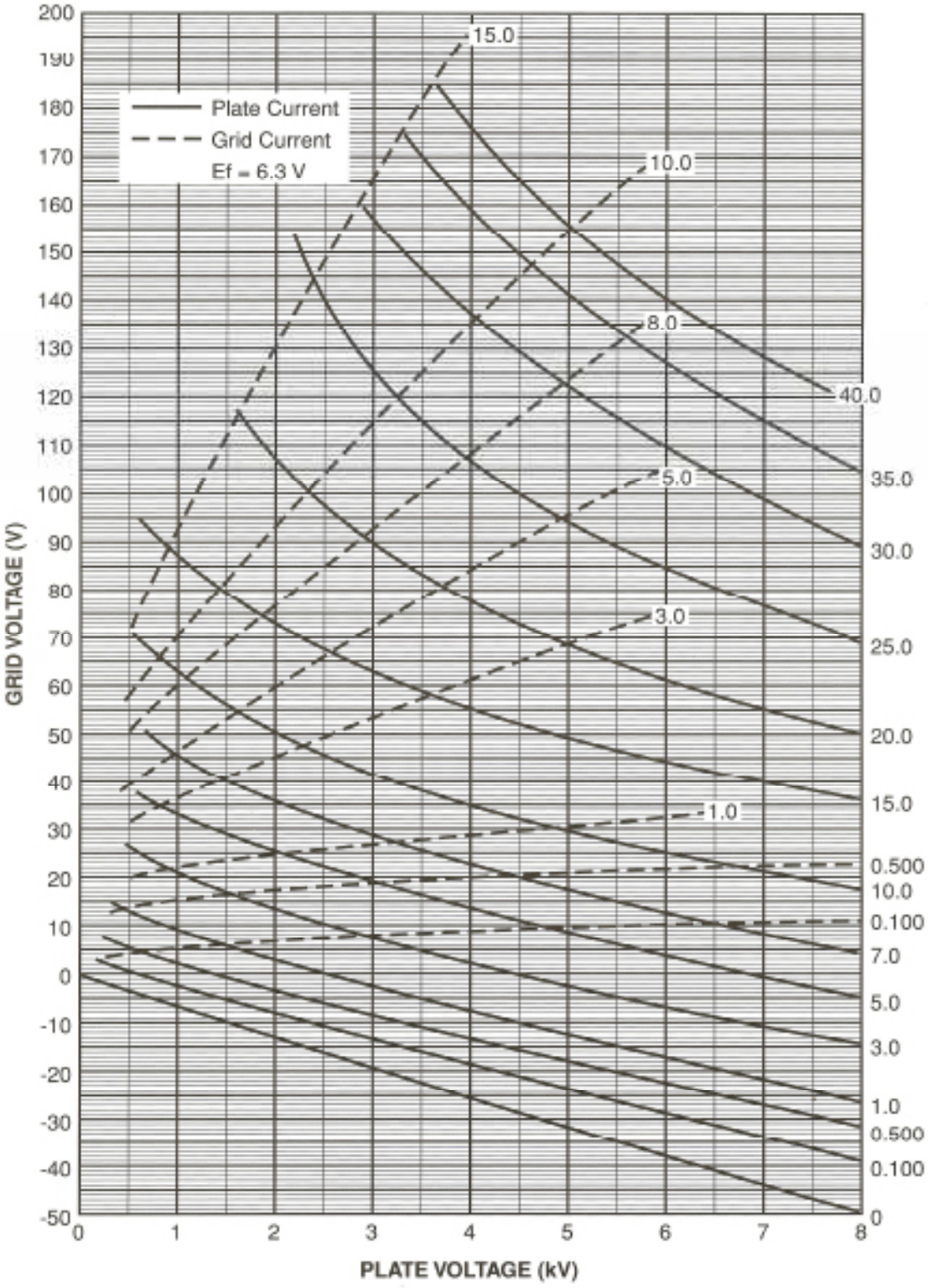
YU-176 & YU-176A

CONSTANT GRID VOLTAGE CHARACTERISTICS



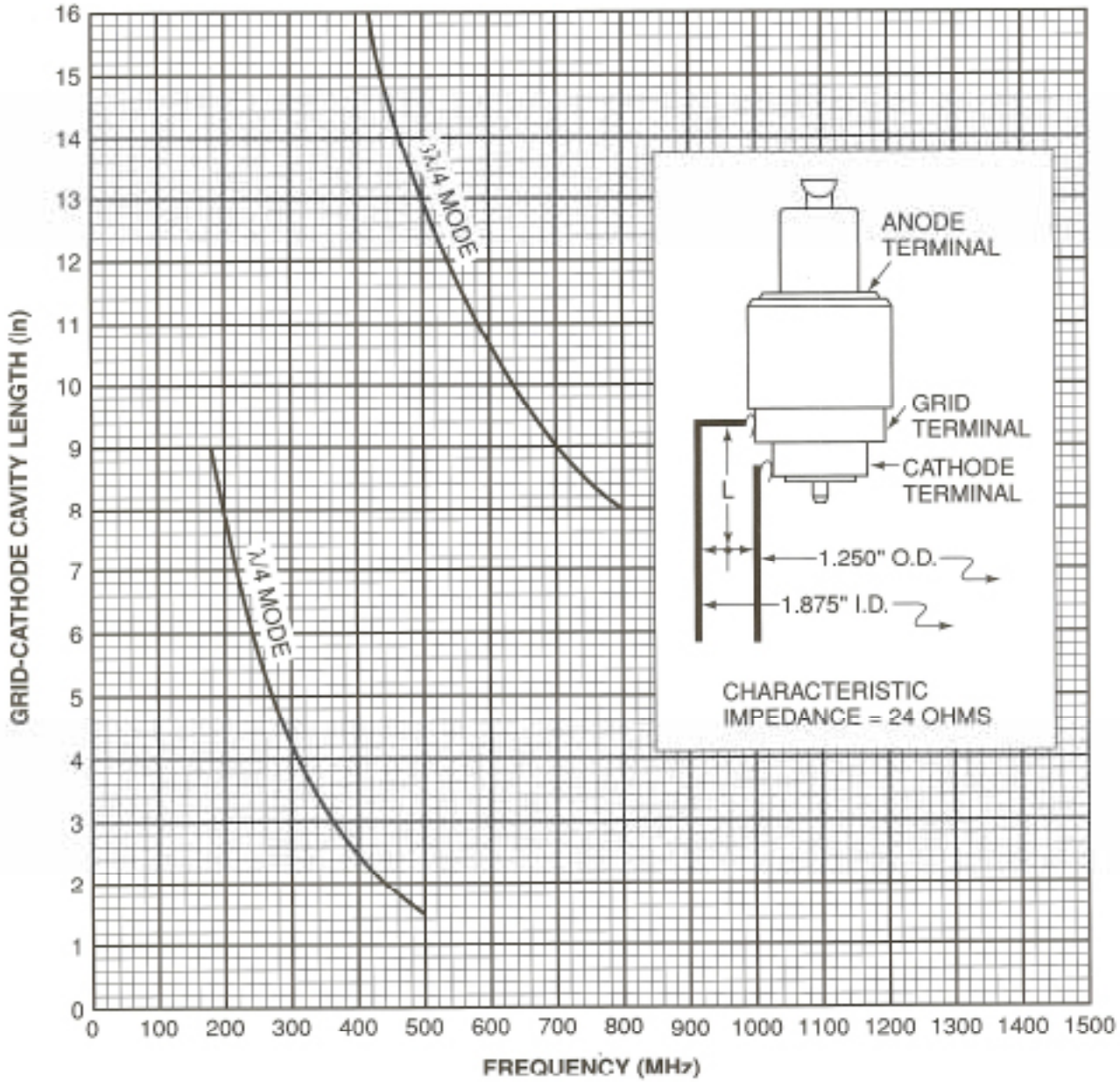
PLANAR TRIODE
YU-176 & YU-176A

CONSTANT PLATE CURRENT CHARACTERISTICS



PLANAR TRIODE
YU-176 & YU-176A

INPUT TUNING CURVES YU-176



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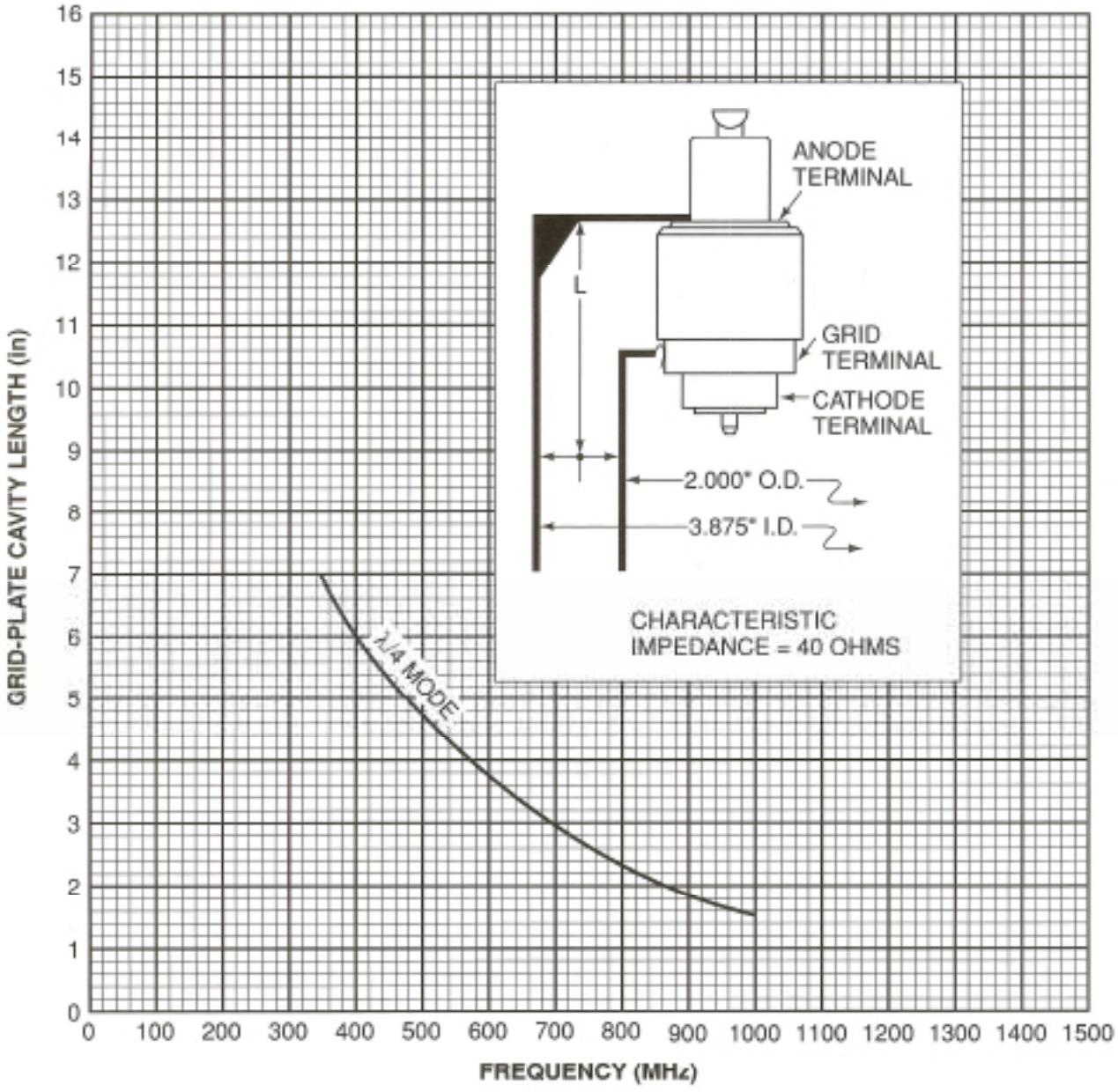
YU-176 & YU-176A



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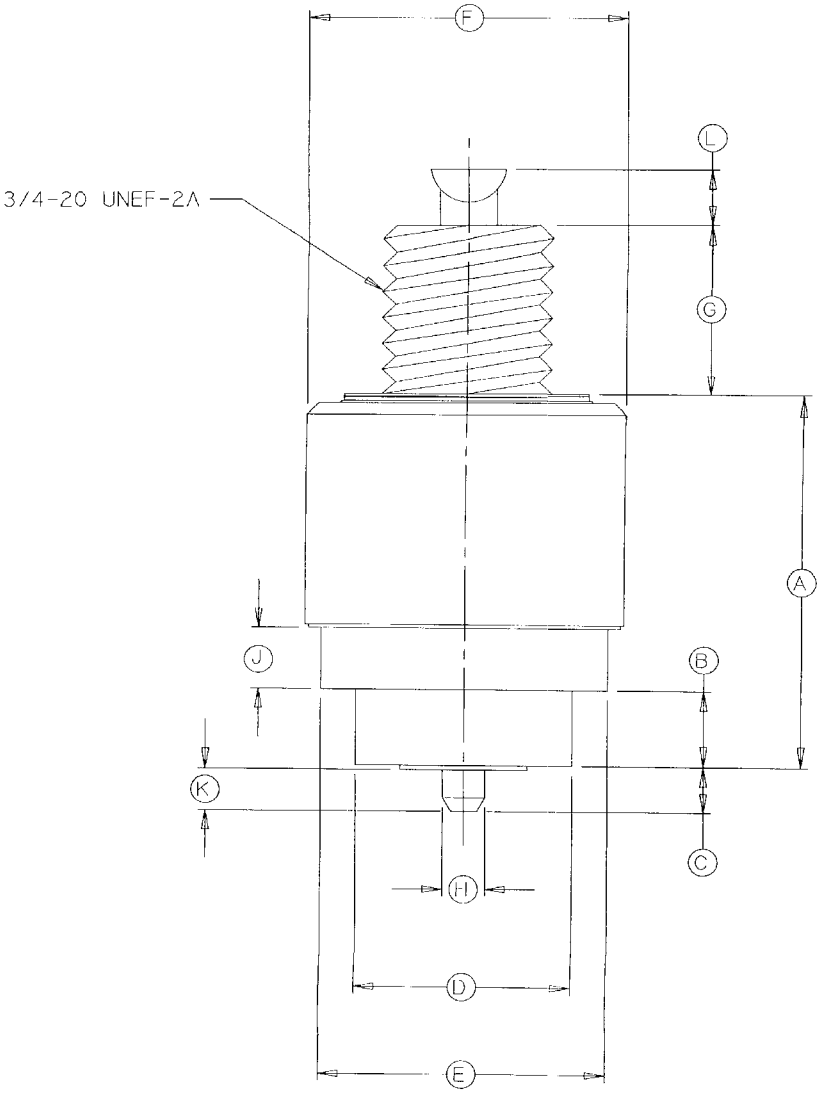

DIMENSIONAL DATA						
	INCHES			MILLIMETERS		
DIM.	MIN.	MAX.	REF.	MIN.	MAX.	REF.
QUALITY CONFORMANCE INSPECTION, PART 2						
A	1.650	1.720		41.91	43.69	
B	.290	.340		7.37	8.64	
C	.275	.325		6.98	8.25	
D	.942	.964		23.93	24.48	
E	1.255	1.265		31.88	32.13	
F	1.390	1.410		35.31	35.81	
G	.750	.810		19.30	20.57	
H	.182	.192		4.62	4.88	
J	.280	.290		7.11	7.37	
K	.240	.270		6.10	6.86	
L	-	.250		-	6.35	

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