



TECHNICAL DATA

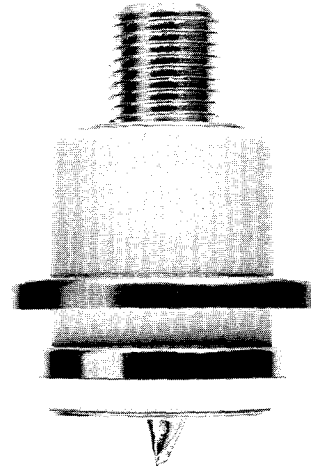
8941/Y690

PLANAR TRIODE

The 8941 is a planar triode of ceramic/metal construction designed for use in airborne, ground and space applications as a grid/plate pulsed oscillator or amplifier at frequencies up to 2.0 GHz, series regulator or modulator. The elongated grid-to-anode insulator assures reliable operation; in some applications to 12 kV¹. The other special features of this tube include high transconductance, high mu and high current capability from an arc-resistant, extended interface matrix cathode.

The tube is normally supplied without radiator and may be conduction, convection, heat sink or liquid cooled such as immersion in an insulating medium (e.g. FC-77). Radiators for forced-air cooling as well as heat sink adapters permitting anode dissipation up to 750 watts are available as separate items.

The Y690 is an 8941 which has been specially processed for series/shunt regulator and switch tube (modulator) service and will operate in some applications up to 15 kV¹. Solder tabs are available on the Y690A permitting attachment of flying leads for grid, cathode and heater connections.



GENERAL CHARACTERISTICS¹

ELECTRICAL

Cathode: Oxide Coated, Unipotential

Heater: Voltage.....	6.3 ± 0.3 V
Current, at 6.3 Volts.....	2.25 A
Transconductance (average):	
I _b = 160 mA.....	75 mmhos
Amplification Factor (average):.....	200
(Cut-off) ³	400
Direct Interelectrode Capacitance (grounded cathode) ²	
C _{in}	14 pF
C _{out}	0.11 pF
C _{gp}	2.8 pF
Cut-off Bias ³	-20 V max
Frequency of Maximum Rating:	
CW.....	2000 MHz
Plate or Grid-Pulsed.....	2000 MHz

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. 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. When the cathode is heated to the proper temperature, the grid/cathode capacitance will increase from the cold value by approximately 2 pF due to thermal expansion of the cathode.

³ Measured with one milliampere plate current and a plate voltage of 1 kVdc.



MECHANICAL

Maximum Overall Dimensions:

Length	2.235 in;	56.77 mm
Diameter	1.365 in;	34.67 mm
Net Weight	1.96 oz;	56 gm
Operating Position		Any

Maximum Operating Temperature:

Ceramic/Metal Seals	250°C
Cooling	Conduction, convection, liquid or forced air

ENVIRONMENTAL

Shock: 11 ms, non-operating	60 G
Vibration: Operating, All Axes	10 G
Altitude: max., in suitably designed circuit	60,000 ft.

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Heater: Current at 6.3 volts	2.05	2.50	A
Cathode Warm-up Time	90	—	sec.
Interelectrode Capacitance* (grounded cathode connection)			
C _{in}	12.5	16.5	pF
C _{out}	—	0.11	pF
C _{gp}	2.4	3.3	pF

* Capacitance values are for a cold tube as measured in a special shielded fixture. When the cathode is heated to the proper temperature, the grid/cathode capacitance will increase from the cold value by approximately 2 pF due to thermal expansion of the cathode.

GRID PULSED OR PLATE PULSED AMPLIFIER OR OSCILLATOR

ABSOLUTE MAXIMUM RATINGS

DC PLATE VOLTAGE (grid pulsed)	10,000 V
PEAK PULSE PLATE VOLTAGE (plate pulsed)	12,000 V
DC GRID VOLTAGE	-350 V
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE	
Grid negative to cathode	-750 V
Grid positive to cathode	175 V
PULSE PLATE CURRENT	12 A
PULSE GRID CURRENT	3.0 A
DC GRID CURRENT	45 mA
AVERAGE PLATE DISSIPATION	
Forced Air Cooling ¹	750 W
GRID DISSIPATION (average)	2.0 W
FREQUENCY	2.0 GHz
PULSE DURATION ²	6.0 μ s
DUTY FACTOR ²	0.0033

Operating Conditions for 8941/Y690 in representative applications:

	Cathode Biased, rf Pulsed Amplifier ³	Grid Pulsed Amplifier
Frequency	1850	1090 MHz
Heater Voltage	6.3	6.3 V
DC Plate Voltage	4500	5000 Vdc
DC Grid Voltage	-40	-60 Vdc
Peak Video Plate Current	3.1	4.0 a
Peak Video Grid Current6	.75 a
Useful Power Output	4.2	10.0 kw (peak)
Pulse Duration	3.0	3.0 μ s
Duty Cycle	0.04	0.001
Gain	11.5	12.0 dB
Bandwidth	20	— MHz

² For applications using longer pulse duration and/or higher duty cycle consult the nearest Varian Electron Device Sales Office, or the Product Manager, Varian EIMAC, Salt Lake City, Utah.

³ No gate pulse used.

¹ Using EIMAC radiator PN 158096, or equivalent

PULSE MODULATOR AND PULSE AMPLIFIER SERVICE

(Type Y690 or Y690A)

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE	15,000 V*
PEAK PLATE VOLTAGE	18,000 V
DC GRID VOLTAGE	-350 V
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE	
Grid negative to cathode	-750 V
Grid positive to cathode	100 V
PULSE CATHODE CURRENT	16 A
DC PLATE CURRENT	600 mA

* In suitably designed circuit

AVERAGE PLATE DISSIPATION

Forced Air Cooling ¹	750 W
GRID DISSIPATION (average)	2 W
PULSE DURATION ²	6.0 μ s
DUTY FACTOR ²	0.0033
CUT-OFF MU	90

¹ Using EIMAC radiator PN 158096, or equivalent.

² For applications using longer pulse duration and/or higher duty cycle consult the nearest Varian Electron Device Sales Office, or the Product Manager, Varian EIMAC, Salt Lake City, Utah.

APPLICATION

MECHANICAL

The cathode and grid flanges should not be altered in any way such as by machining or filing, since the final seal could be damaged. Maximum torque applied to flanges during installation should not exceed 15 inch pounds.

For optimum rf performance, the anode line should make good contact with the anode area indicated on the outline drawing.

Soldered connections may be made to the anode stud, grid or cathode flanges, and heater contacts where adequate heat sinking and good soldering practices are followed to minimize the heat applied to the tube and the thermal gradient across the metal-to-ceramic brazed areas. 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.

X-RAY RADIATION

High voltage tubes operating at voltages higher than 15kV produce progressively more dangerous x-ray

radiation as the voltages increase. The 8941/Y690 operating at its rated voltages and currents is a potential x-ray hazard. Only limited shielding is afforded by the tube envelope. Moreover, the x-ray radiation level can increase significantly with aging and gradual deterioration due to leakage path or emission characteristics as they are affected by the high voltage.

X-ray shielding must be provided on all sides of the tubes operating at these voltages to provide adequate protection throughout the life of the tubes. Periodic checks on the x-ray level should be made and the tube should never be operated without adequate shielding in place at voltages above 15kV. When voltages above 15kV are in use, lead glass (which attenuates x-rays) is available for viewing windows.

If there is any doubt as to the requirement for, or the adequacy of shielding, an expert in this field should be contacted to perform an x-ray survey of the equipment. Operation of high voltage equipment with interlock switches cheated and cabinet doors open in order to better locate an equipment malfunction, can result in serious x-ray exposure.



8941/Y690

HEATER VOLTAGE

One of the most important factors affecting planar tube life and ultimate performance is 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 possible tube life. When the heater of a planar triode is energized by a d-c source, its useful life is always shorter than with equivalent a-c operation. Heater life under d-c 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 d-c conditions can be achieved by operating the heater at a negative potential with respect to the cathode.

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. To not 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 in the equipment itself. It does not necessarily follow that combinations of absolute maximum ratings can be attained simultaneously.

HIGH VOLTAGE

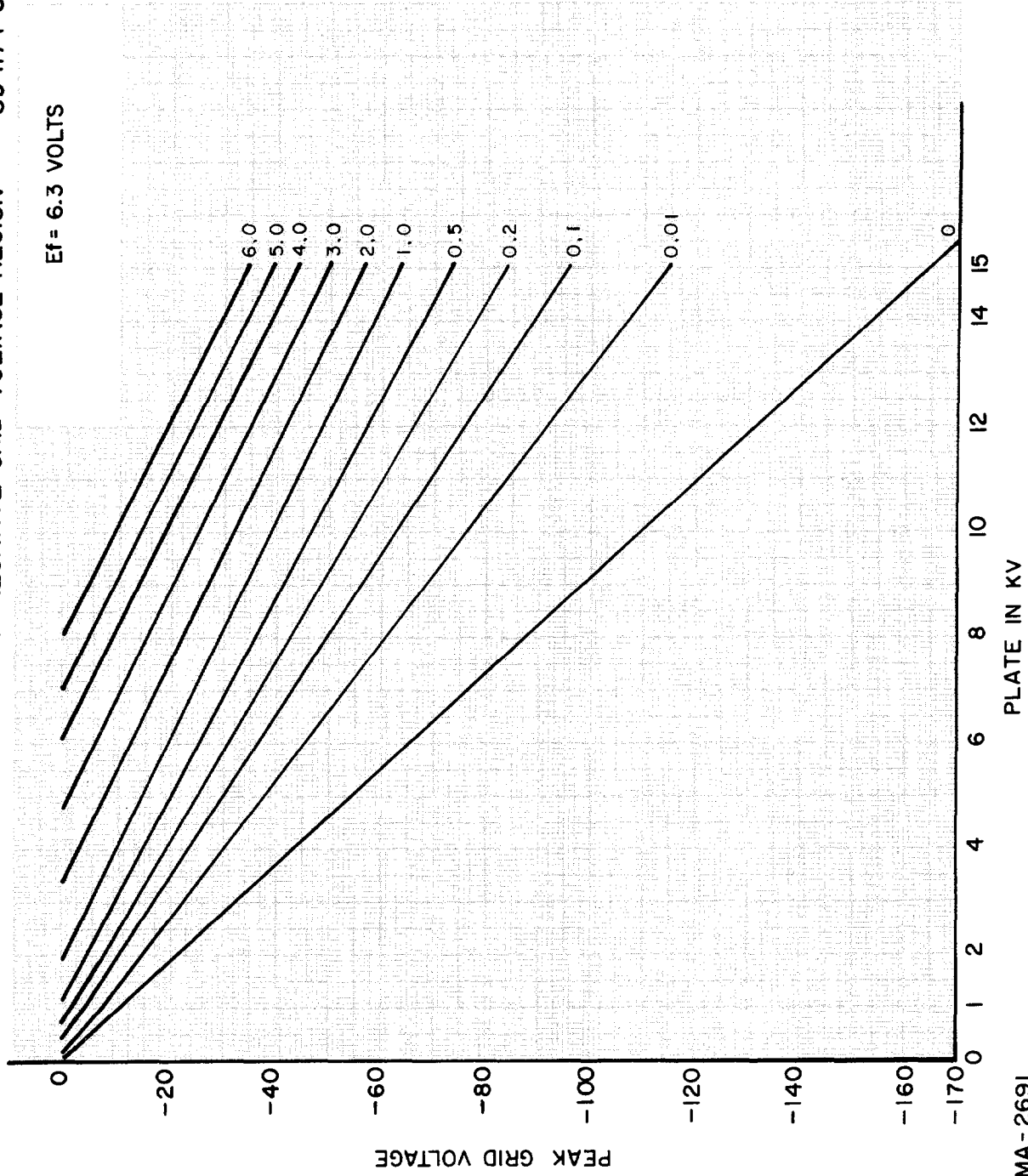
Normal operating voltages used with this tube are deadly. Equipment must be designed properly and operating precautions must be followed. Design all equipment so no one can come in contact with high voltages. All equipment must include safety enclosures for high-voltage circuits and terminals, with interlock switches to open 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.

GENERAL

For general application information please refer to the Planar Triode Operating Instruction Booklet. The operating instructions should be consulted prior to the designing of new requirements around the 8941/Y690 tube type. For unusual and special applications consult the nearest Varian Electron Device Group Sales Office, or the Product Manager, Varian EIMAC, Salt Lake City, Utah.

CONSTANT PLATE CURRENT OPERATION - NEGATIVE GRID VOLTAGE REGION 8941/Y-690

$E_f = 6.3$ VOLTS

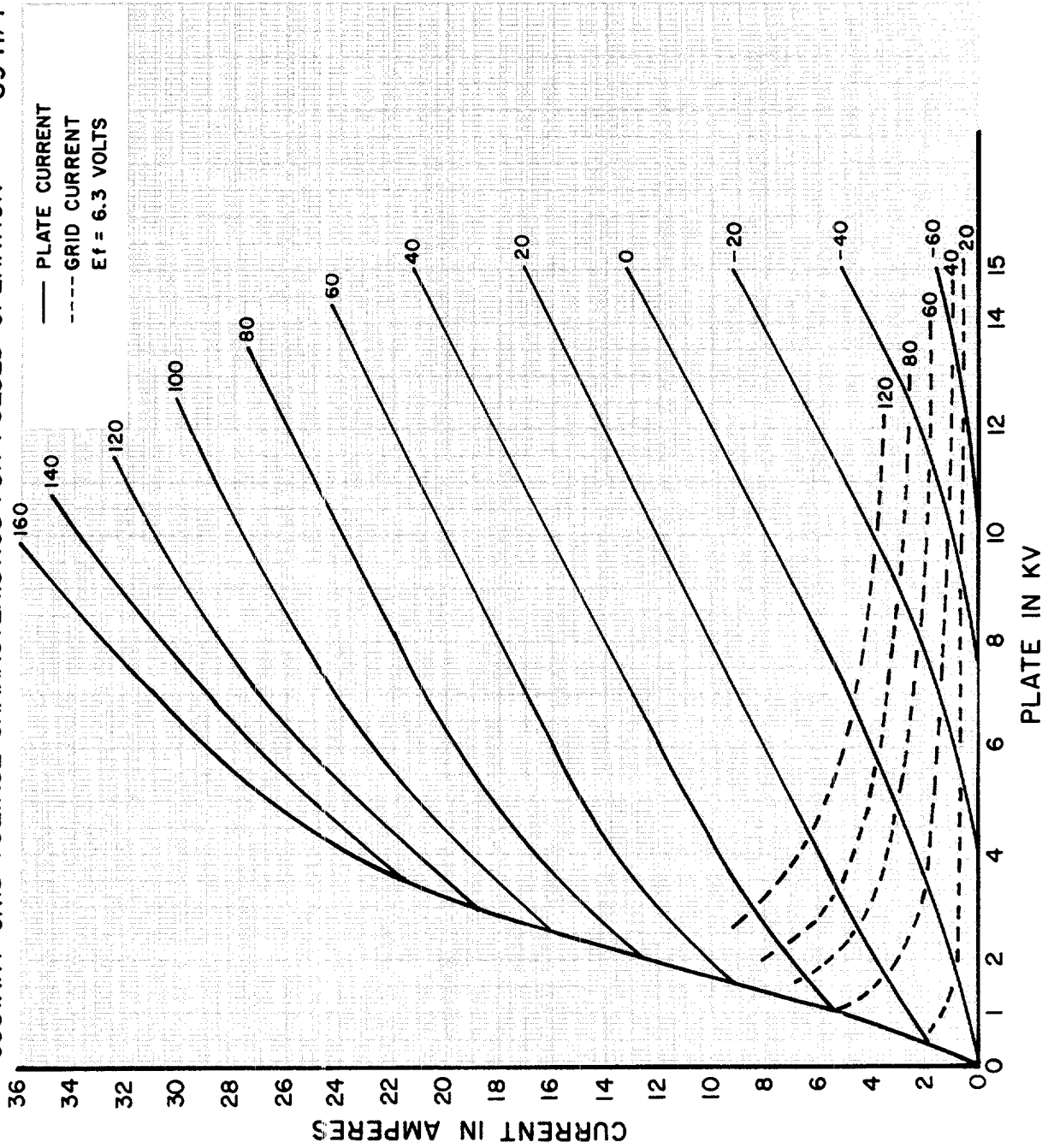


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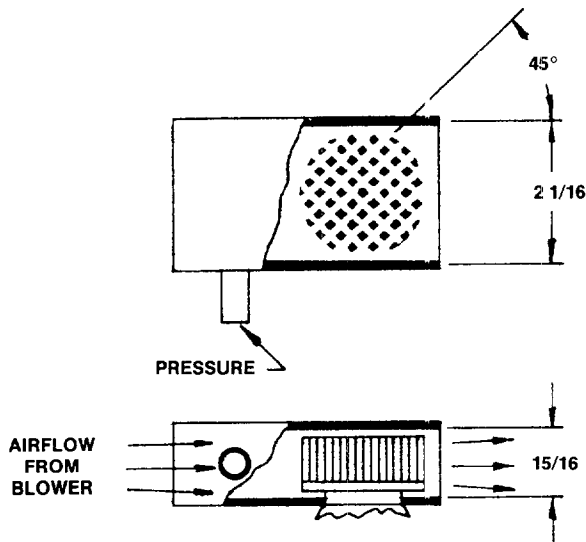
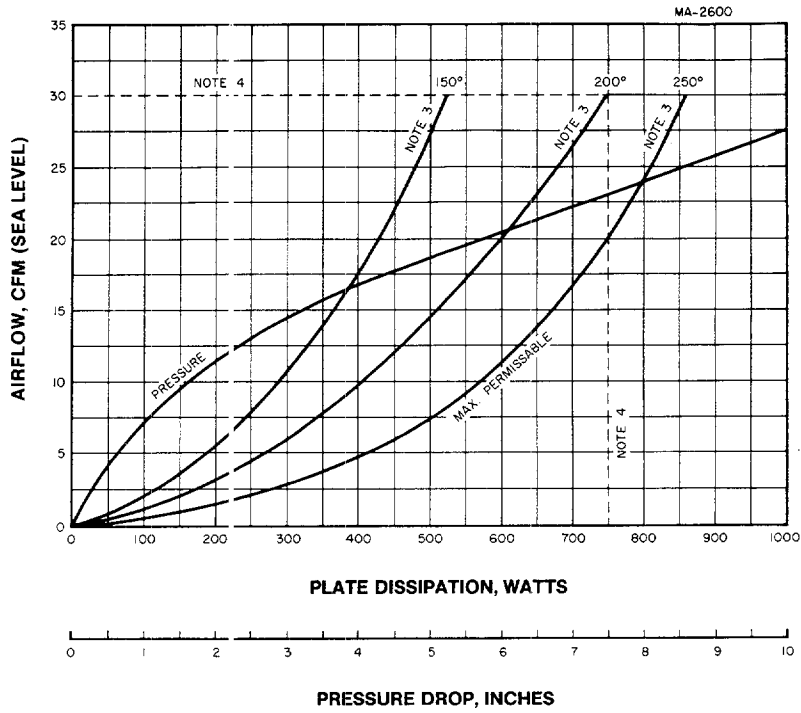


8941/Y690

COSTANT GRID VOLTAGE CHARACTERISTICS FOR PULSED OPERATION 8941/Y-690



AIR COOLING DATA FOR 8941/Y690

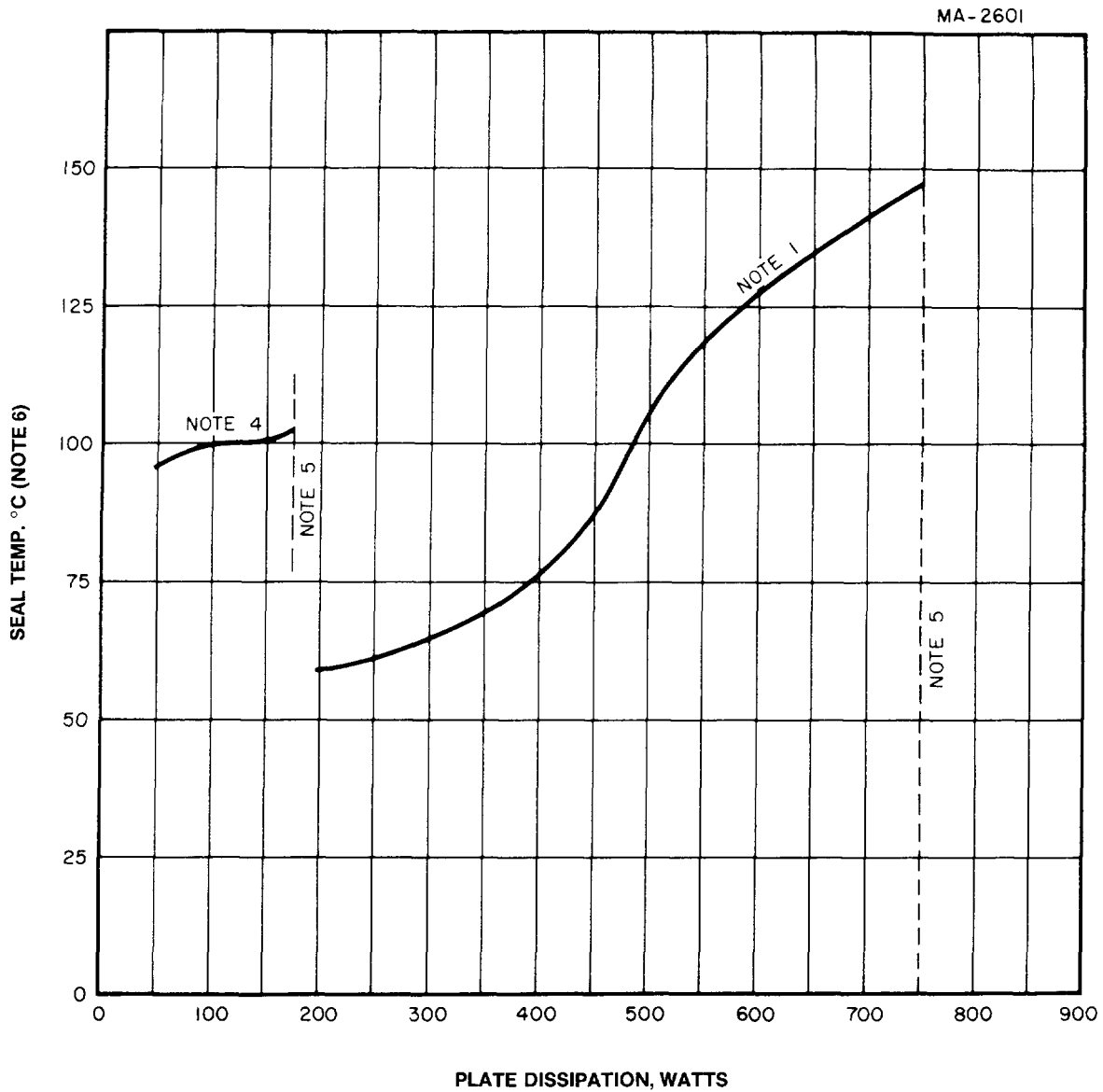


COWLING DETAIL

1. INLET AIR AT 20°C.
2. USE RADIATOR NO. 158096 (COPPER-PIN) IN COWLING AS SHOWN.
3. TEMP. MEASURED AT ANODE CUP-PLATE INSULATOR SEAL.
4. DESCRIBES TYPICAL MAX. CW OPERATING POINT.

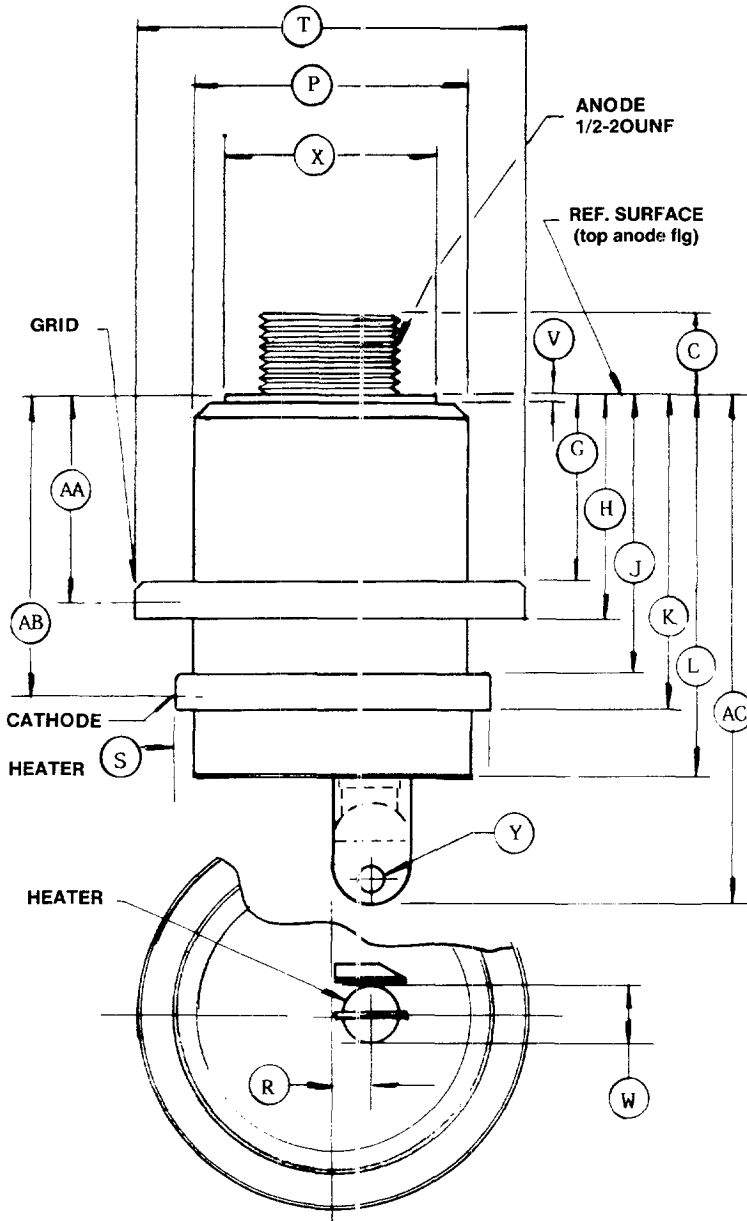


COOLING DATA FOR 8941/Y690 IN FC 77 DIELECTRIC COOLANT



NOTES:

1. USE RADIATOR 158096 (COPPER-PIN)
2. TUBE AXIS VERTICAL IN LIQUID.
3. LIQUID AMBIENT TEMPERATURE 40°C.
4. TUBE W/O COOLER STUD COOLING ONLY.
5. MAX. CW RATING—CONTACT PLANAR MGR. EIMAC, SLC ON INTERMEDIATE OR HIGHER POWERS THAN SHOWN.
6. SEAL TEMPERATURE IS MEASURED AT PLATE TO ANODE INSULATOR FLANGE (SEE 'V' ON OUTLINE DWG.)



DIMENSIONS IN INCHES

DIMENSIONAL DATA			
REF.	MIN.	MAX.	NOM.
C	.500	.600	
G	.635	.660	
H	.760	.795	
J	.905	.960	
K		1.095	
L	1.180	1.260	
P	.940	.965	
R	.090	.110	
S	1.065	1.085	
T	1.345	1.365	
V		.050	
W			190
X	.760	.815	
Y	.060	.090	
AA	SEE NOTES 2 & 3		710
AB	SEE NOTES 2 & 3		1 000
AC	1.625		

NOTES:

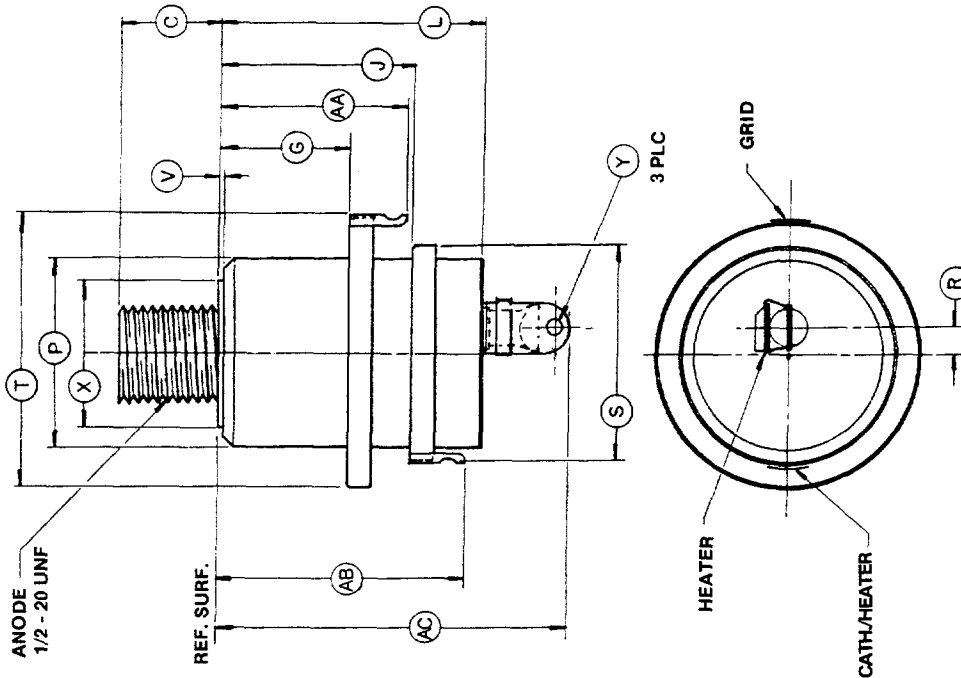
1. REF. DIMS. ARE FOR INFO ONLY & ARE NOT REQUIRED FOR INSPECTION PURPOSES.
2. CONTACT SURFACE DIMS. AA & AB ARE FOR CAVITY DESIGN PURPOSES ONLY & ARE NOT INTENDED AS INSPECTION CRITERIA.
3. CONTACT SURFACES ARE $\pm .030$ AROUND DIM. INDICATED.
4. T.I.R. OF CONTACT SURFACES ARE SPECIFIED IN INDIVIDUAL TUBE ELECTRICAL SPECS.



DIM.	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
C	.500	.600		12.7	15.24	
G	.635	.660		16.13	16.76	
J	.905	.960		24.13	24.38	
L	1.180	1.260		29.97	32.0	
P	.940	.965		23.87	24.51	
R	.090	.110		2.28	2.79	
S	1.065	1.100		27.05	27.94	
T	1.345	1.380		34.16	35.05	
V	.035				.89	
W	.740	.815	.190	18.78	20.70	4.82
Y	.060	.080		1.52	2.28	
AA		.965			24.51	
AB		1.265			32.13	
AC		1.625			41.27	

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.
3. NO. T.I.R. SPECIFIED FOR CONTACT SURFACES BECAUSE OF THE TABS.



Y690A