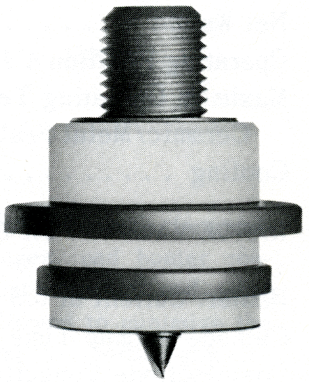
8940

PLANAR TRIODE



The 8940 is a planar triode of ceramic/metal construction and rugged design to be used in advanced airborne, ground, and space applications up to 2.5 GHz.

The 8940 may be used as an amplifier, oscillator, or frequency multiplier in the CW as well as the grid or plate-pulsed mode, or as a modulator or series regulator tube. In addition to the low interelectrode capacitance, high transconductance and amplification factor, the tube has an arc-resistant cathode and a vaporization shield to assure stable and reliable long life operation under adverse conditions.

The 8940 is normally supplied without a radiator and may be conduction, convection, heat-sink, or liquid cooled. Liquid cooling can be done by submersion of the tube in an insulating medium such as FC-75. Radiators for forced-air cooling as well as heat-sink adaptors permitting anode dissipation up to 750 watts are available as separate items.

GENERAL CHARACTERISTICS[1]

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	100 mmhos
Amplification Factor (Average):	65
Direct Interelectrode Capacitance (grounded cathode) [2]	
Cin	16.0 pF
Cout	0.11 pF
Cgp	3.8 pF
Cut-off Bias [3]	-50 V max
Frequency of Maximum Rating:	
Plate or Grid-Pulsed	2.5 GHz
CW	2.0 GHz

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. EIMAC Division of Varian should be consulted before using this information for final equipment design.

2. Capacitance values are 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.

(Effective 10-15-75) Printed in U.S.A.

MECHANICAL

Maximum Overall Dimensions:	
Length	1.985 in; 50.4 mm
Diameter	1.365 in; 34.6 mm
Net Weight	1.96 oz; 56 gm
Operating Position	Any
Maximum Operating Temperature:	
Ceramic/Metal Seals	250°C
Cooling	Conduction, convection, forced air, or liquid

RANGE VALUES FOR EQUIPMENT DESIGN

	Min.	Max.	
Heater: Current at 6.3 volts	2.05	2.50	A
Cathode Warmup Time	90	---	sec.
Interelectrode Capacitance[1] (grounded cathode connection)			
Cin	13.5	17.0	pF
Cout	---	0.11	pF
Cgp	3.3	4.2	pF

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

GRID PULSED OR PLATE PULSED AMPLIFIER OR OSCILLATOR

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE(grid pulsed)	4000	VOLTS
PEAK PULSE PLATE VOLTAGE (plate pulsed)	6500	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	500	VOLTS
Grid positive to cathode	200	VOLTS
PULSE PLATE CURRENT	12	AMPERES
PULSE GRID CURRENT	4	AMPERES
AVERAGE PLATE DISSIPATION		
Forced Air Cooling[1]	750	WATTS
GRID DISSIPATION (Average)	2	WATTS
FREQUENCY	2.5	GHz
PULSE DURATION[2]	6	μs
DUTY FACTOR[2]	.0033	

OPERATING CONDITIONS for 8940 in Respresentative Application

	Grid Pulsed Amplifier		Grid Pulsed OSC	Plate Pulsed OSC	
Frequency	1.3	1.2	1.03	1.65	GHz
Heater Voltage	6.3	6.3	6.3	6.3	V
DC Plate Voltage	4000	3500	3850	5000	Vdc
DC Grid Voltage	-50	-75	-80	--	Vdc
Peak Video Plate Current	3.0	3.0	6.0	6.0	a
Peak Video Grid Current	0.7	0.5	1.8	2.0	a
Pulse Drive Power(approx.)	600	600	--	--	w
Useful Power Output(")	6000	4000	11,500	10,000	w
Pulse Duration	500	3.5	5.0	5.0	μs
Duty Factor	0.01	0.04	.001	.001	
Bandwidth	75	10	--	--	MHz

1. Using EIMAC Radiator Part No. 158096.
2. For applications using longer pulse duration and/or higher duty cycle consult the nearest Varian Electron Tube & Devices Field Office, or the Product Manager, EIMAC Division of Varian, Salt Lake City, Utah.

PULSE MODULATOR AND PULSE AMPLIFIER SERVICE

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE	4000	VOLTS
PEAK PLATE VOLTAGE	6500	VOLTS
DC GRID VOLTAGE	-150	VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE		
Grid negative to cathode	500	VOLTS
Grid positive to cathode	100	VOLTS
PULSE CATHODE CURRENT	16	AMPERES
DC PLATE CURRENT	600	MILLIAMPERES
AVERAGE PLATE DISSIPATION		
Forced Air Cooling[1]	750	WATTS
GRID DISSIPATION (Average)	2.0	WATTS
PULSE DURATION[2]	6	μs
CUT-OFF MU	35	

1. Using EIMAC Radiator Part No. 158096.
2. For applications using longer pulse duration and/or higher duty cycle consult the nearest Varian Electron Tube & Devices Field Office, or the Product Manager, EIMAC Division of Varian, Salt Lake City, Utah.

CW RF POWER AMPLIFIER OR OSCILLATOR

ABSOLUTE MAXIMUM RATINGS:

DC PLATE VOLTAGE	4000 VOLTS
DC GRID VOLTAGE	-200 VOLTS
INSTANTANEOUS PEAK GRID-CATHODE VOLTAGE	
Grid negative to cathode	350 VOLTS
Grid positive to cathode	30 VOLTS
DC PLATE CURRENT	0.6 AMPERE
DC GRID CURRENT	0.07 AMPERE
AVERAGE PLATE DISSIPATION	
Forced-Air Cooling [1]	750 WATTS
GRID DISSIPATION (Average)	2.0 WATTS

1. Using EIMAC Radiator Part No. 158096.

APPLICATION

For general application information please refer to the Planar Triode Operating Instruction Sheet. The operating instructions should be consulted prior to the designing of new requirements around the above tube type. For unusual and special applications consult the nearest Varian Electron Tube Field Office, or the Product Manager, EIMAC Division of Varian, Salt Lake City, Utah.

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.

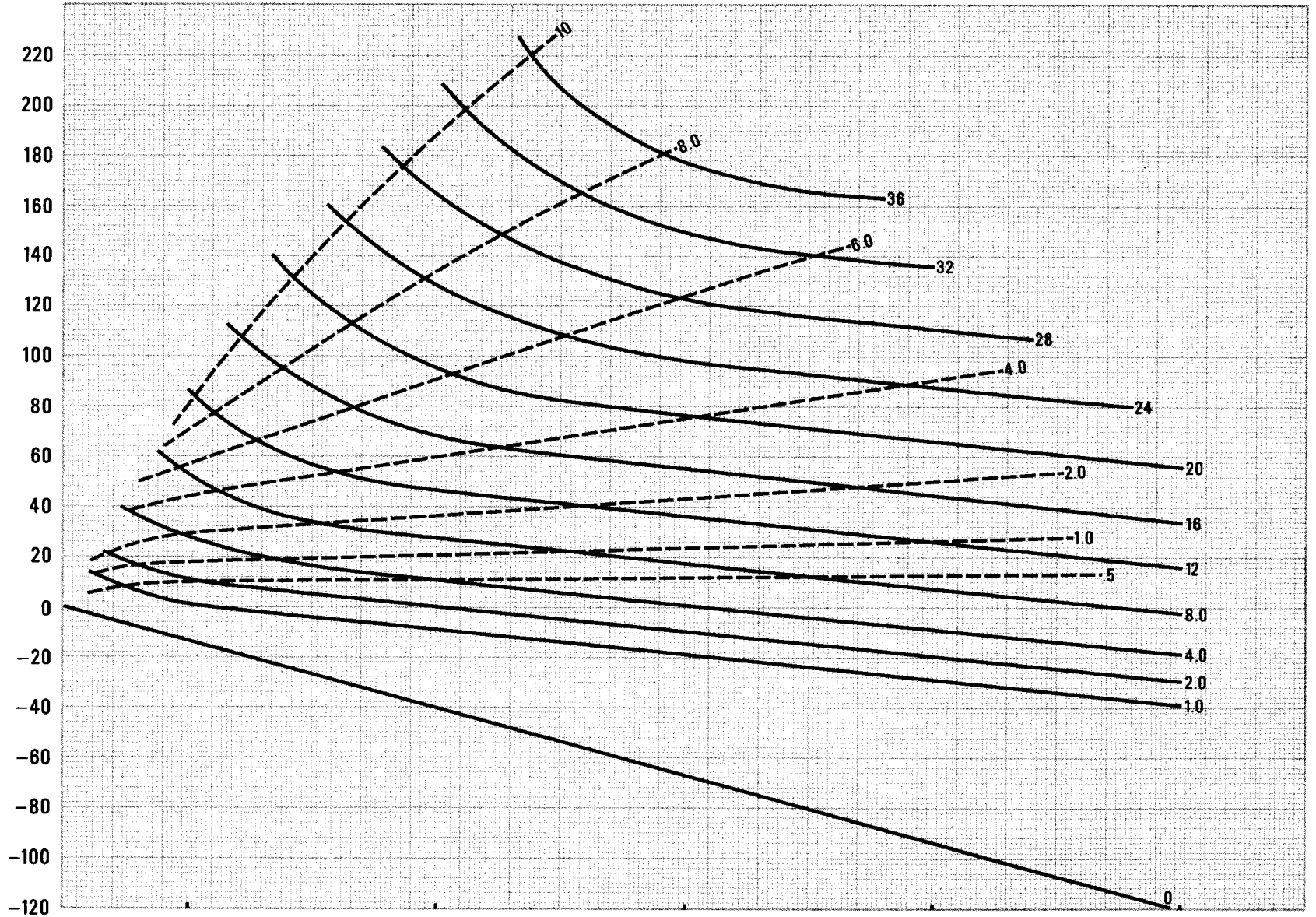
For optimum RF performance, the anode line should make good contact on the anode area indicated on the outline drawing.

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.

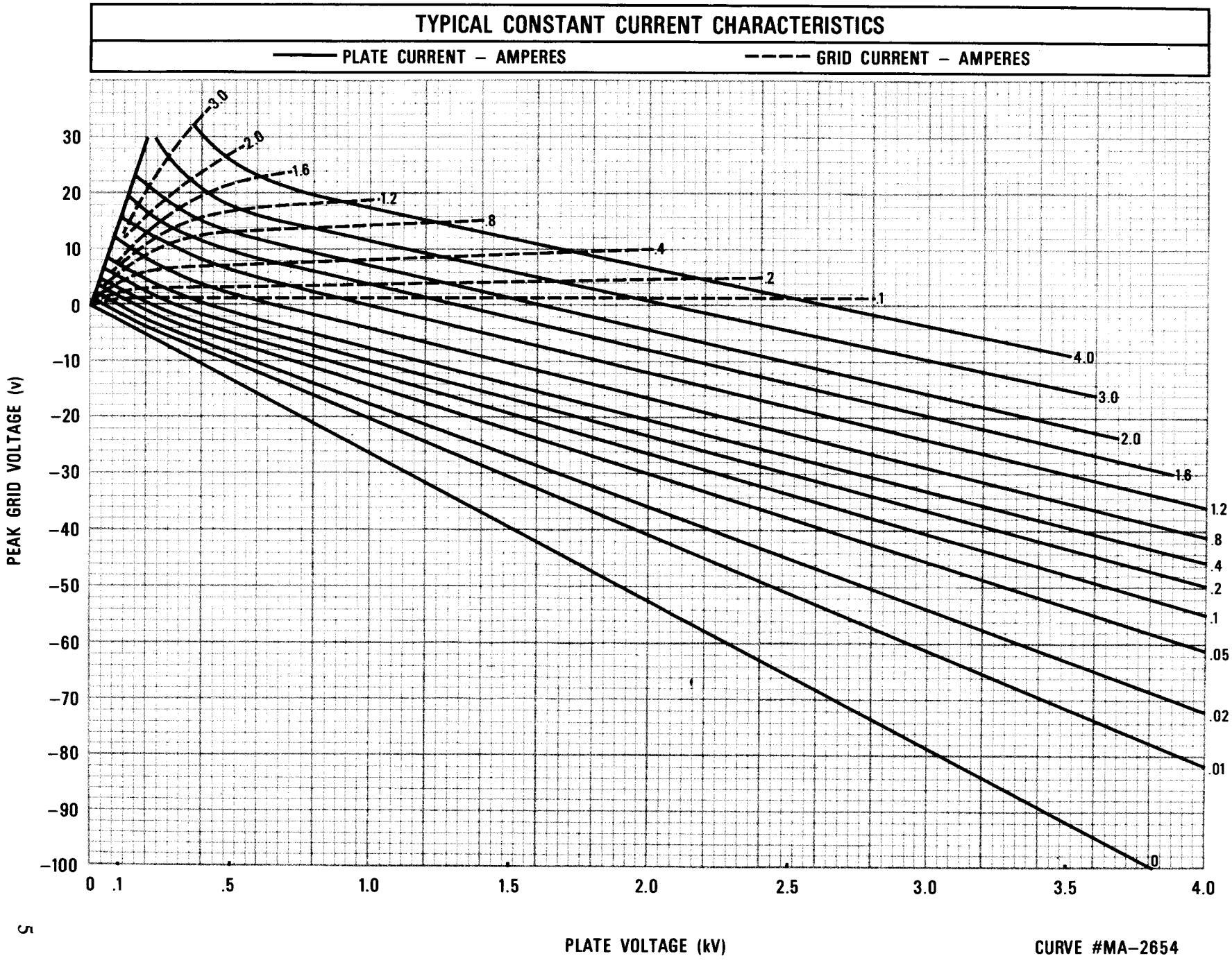
TYPICAL CONSTANT CURRENT CHARACTERISTICS

FOR PULSE OPERATION

PLATE CURRENT – AMPERES — GRID CURRENT – AMPERES



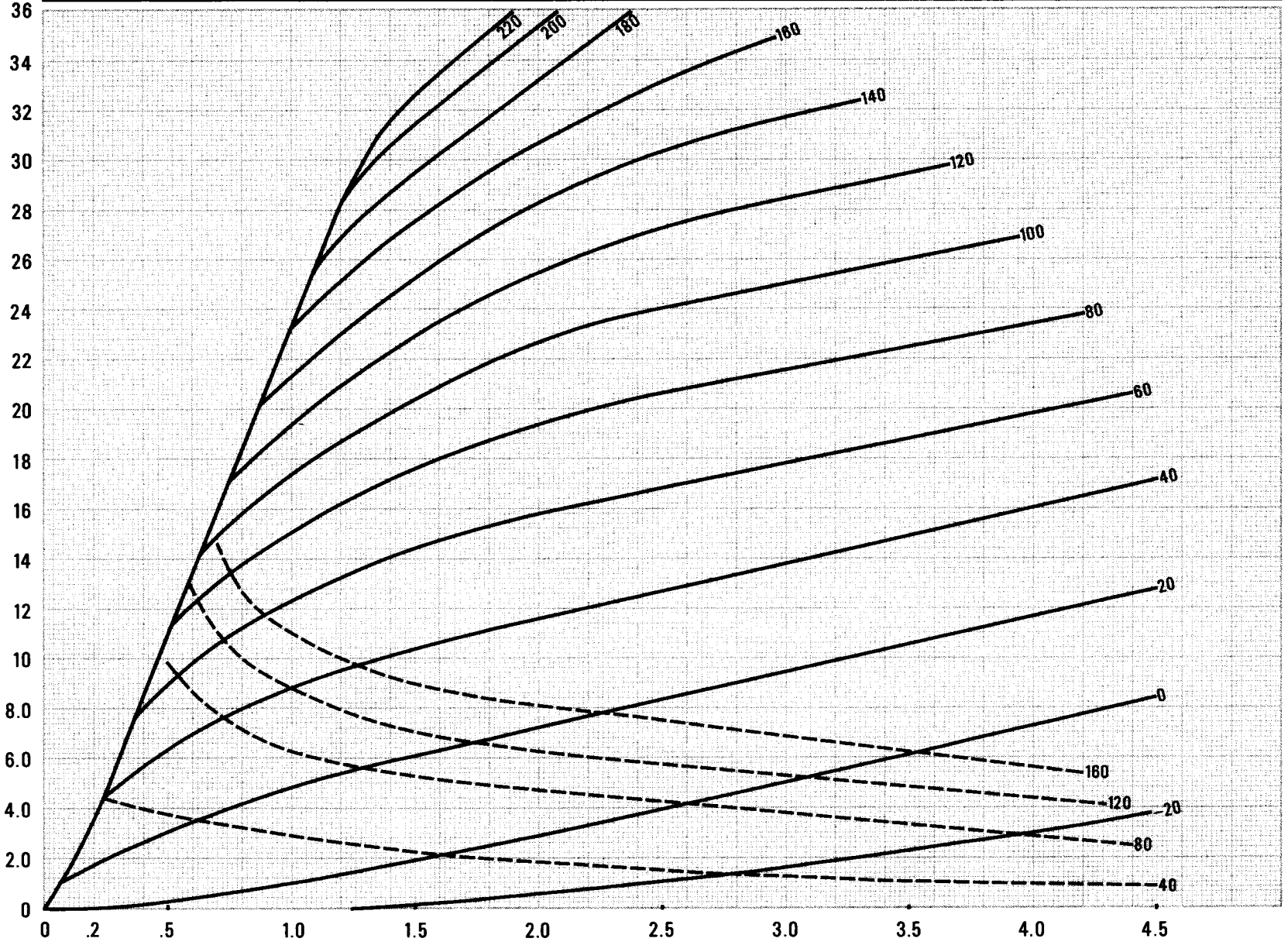
CURVE #MA–2594


TYPICAL CONSTANT CURRENT CHARACTERISTICS
PLATE CURRENT – AMPERES
GRID CURRENT – AMPERES
PEAK GRID VOLTAGE (v)
30
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
−90
−100
0
.1
.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
PLATE VOLTAGE (kV)
CURVE #MA–2654
3.0
2.0
1.6
1.2
.8
.4
.2
.1
4.0
3.0
2.0
1.6
1.2
.8
.4
.2
.1
.05
.02
.01
0

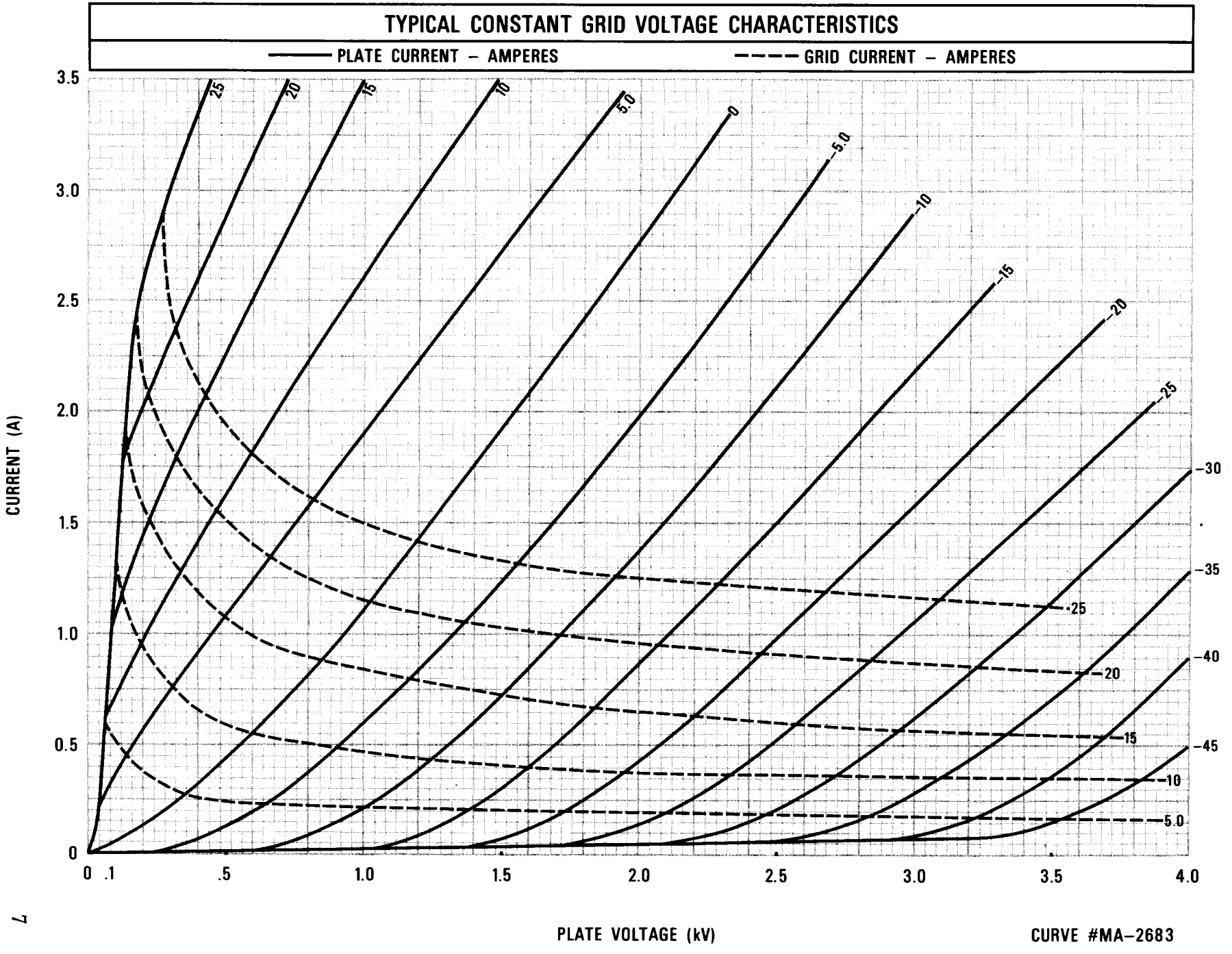
TYPICAL CONSTANT GRID VOLTAGE CHARACTERISTICS

FOR PULSE OPERATION

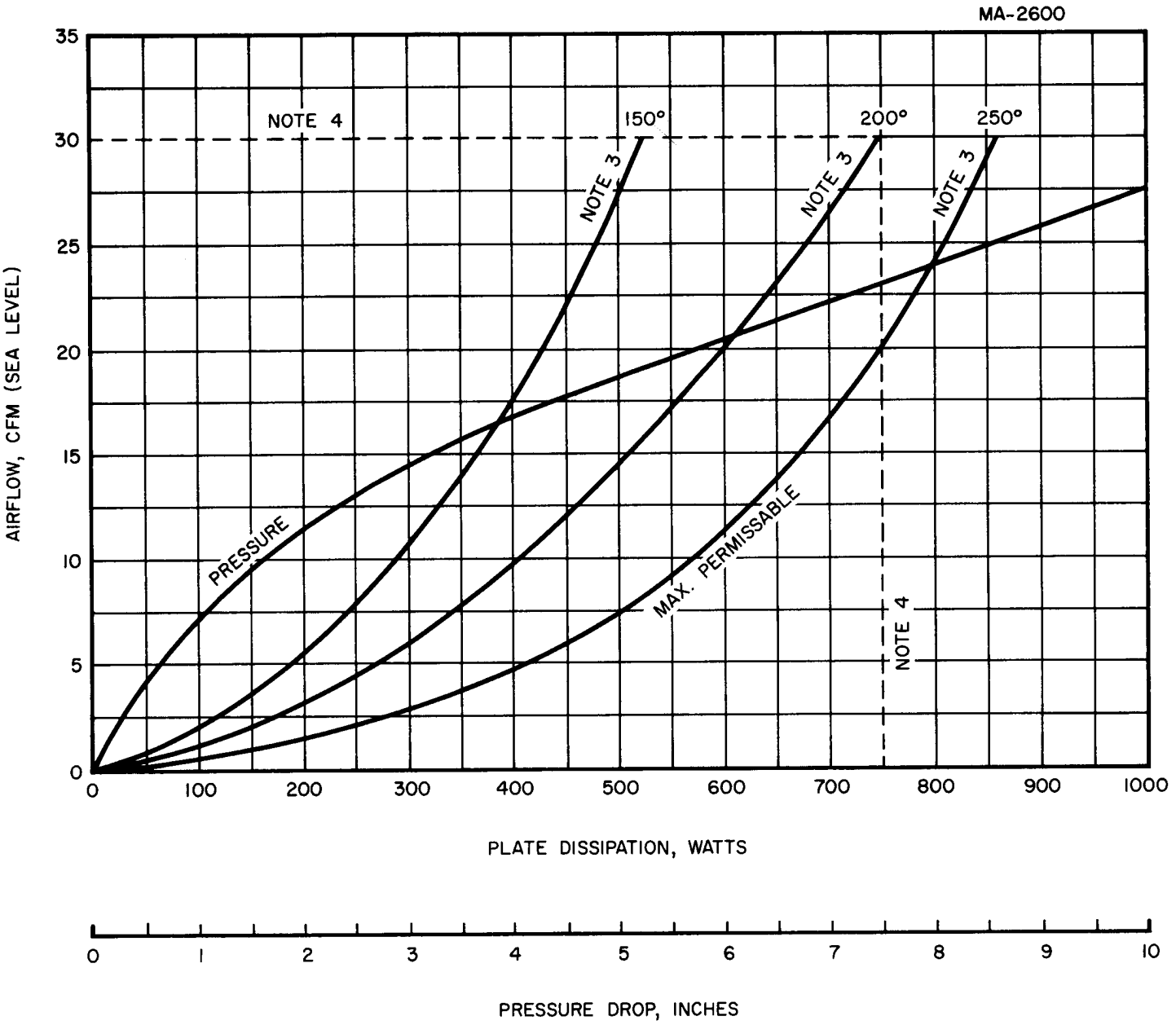
——— PLATE CURRENT – AMPERES - - - - GRID CURRENT – AMPERES

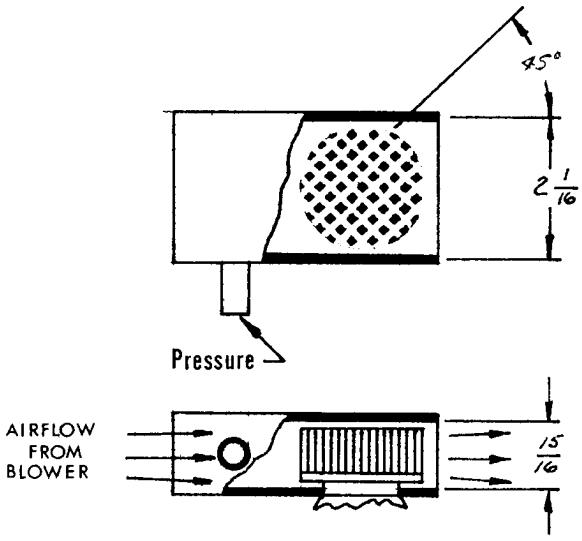


CURVE #MA–2682


TYPICAL CONSTANT GRID VOLTAGE CHARACTERISTICS
PLATE CURRENT – AMPERES
GRID CURRENT – AMPERES
CURRENT (A)
PLATE VOLTAGE (kV)
CURVE #MA–2683
0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
0
.1
.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
25
20
15
10
5.0
0
-5.0
-10
-15
-20
-25
-30
-35
-40
-45
-25
-20
-15
-10
-5.0

AIR COOLING DATA FOR 8940





– COWLING DETAIL –

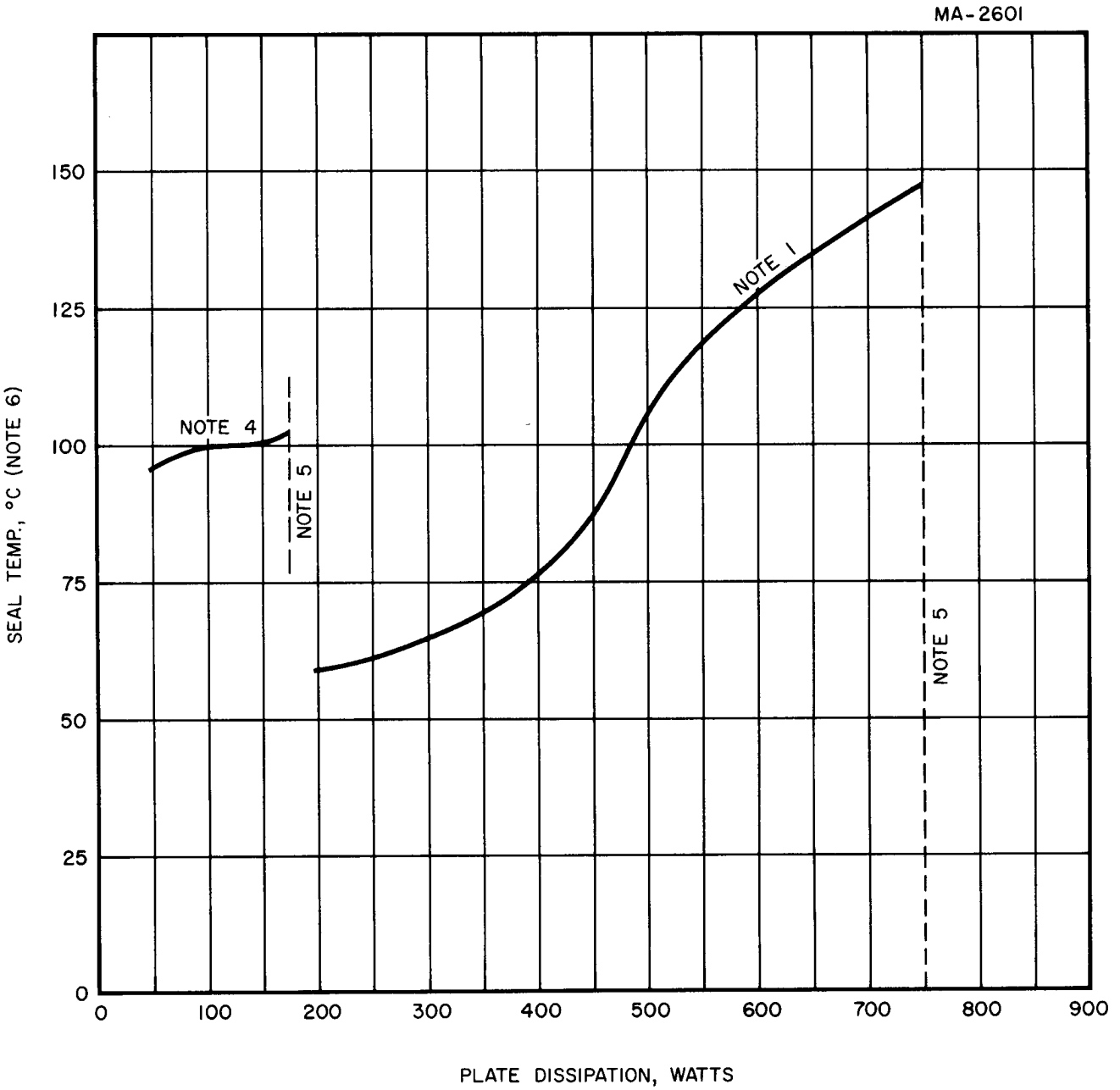
1. Inlet Air at 20°C

2. Use Radiator No. 158096 (Copper–Pin) in Cowling as shown.

3. Temp. measured at Anode Cup–Plate Insulator Seal.

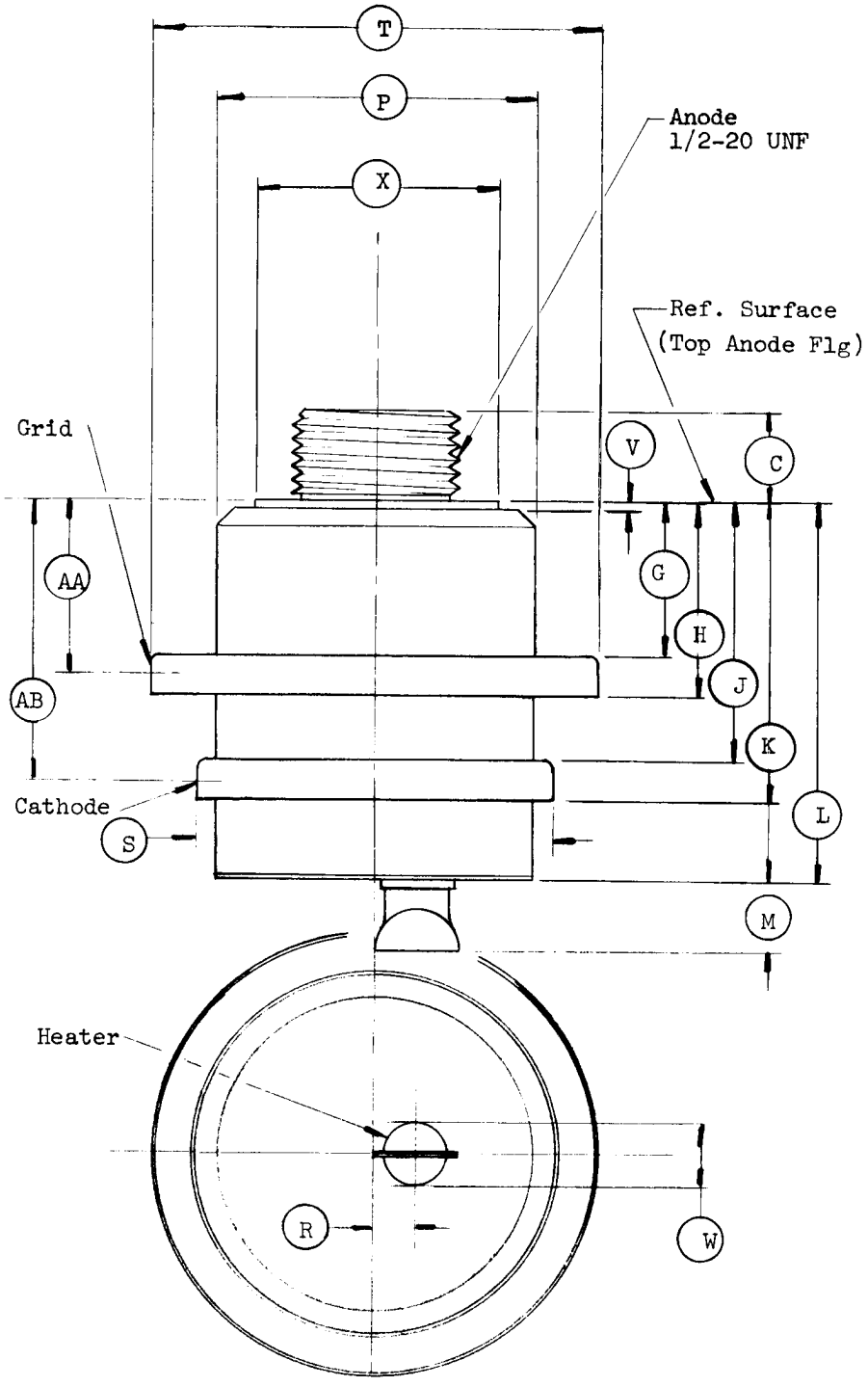
4. Describes Typical MAX. CW Operating Point.

COOLING DATA FOR 8940 IN FC 75 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.)



DIM	INCHES			MILLIMETERS		
	MIN.	MAX.	REF.	MIN.	MAX.	REF.
C	0.500	0.600	- -	12.70	15.24	- -
G	0.385	0.410	- -	9.78	10.41	- -
H	0.510	0.545	- -	12.95	13.84	- -
J	0.655	0.710	- -	16.64	18.03	- -
K	- -	0.845	- -	- -	21.46	- -
L	0.930	1.010	- -	23.62	25.65	- -
M	0.300	0.375	- -	7.62	9.52	- -
P	0.940	0.965	- -	23.88	24.51	- -
R	0.090	0.110	- -	2.29	2.79	- -
S	1.065	1.085	- -	27.05	27.56	- -
T	1.345	1.365	- -	34.19	34.67	- -
V	- -	0.035	- -	- -	0.89	- -
W	- -	- -	0.190	- -	- -	4.83
X	0.740	0.770	- -	18.80	19.56	- -
AA	(see note 2,3)		0.460	- -	- -	11.68
AB	(see note 2,3)		0.750	- -	- -	19.05

NOTES:

1. Ref. Dims. are for info. only & are not req'd 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 ± .030 around dim. indicated.
4. TIR of Contact Surfaces are specified in individual Tube Electrical Specs.