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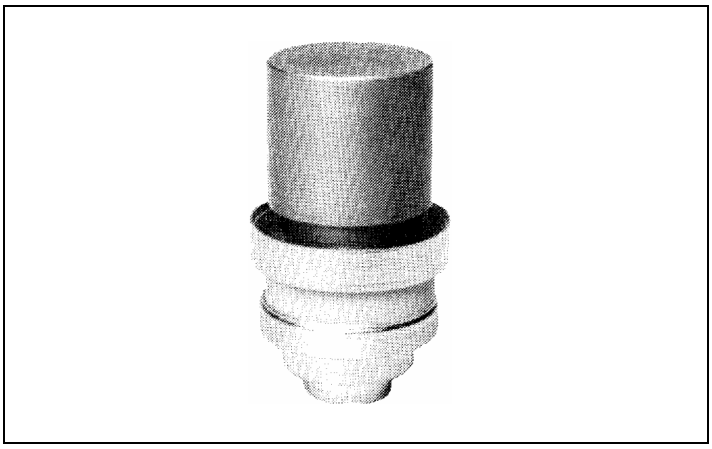
7843
Power Tube
Conduction-Cooled UHF Beam Power Tube

- **Cermolox® Construction**
- **Oxide-Coated Cathode**
- **Conduction Cooled**
- **Peak Power Output:**
  400 MHz - 80 W
  1215 MHz-40W



BURLE 7843 is a compact, conduction-cooled UHF beam power tube designed for applications where air cooling may not be practical. The tube features Cermolox construction, a unipotential, oxide-coated cathode, and an integral aluminum alloy conduction cylinder for high thermal conductivity.

The tube is rated as an AF power amplifier and modulator, and up to 1215 MHz as a linear RE power amplifier, an anode-modulated RE power amplifier in Class C telephony service, an RE power amplifier and oscillator in Class C telegraphy service, and an RE power amplifier in Class C EM telephony service. The 7843 may also be useful in a variety of other applications such as frequency multipliers, linear RE power amplifiers (AM or television), pulse modulators, pulsed RE amplifiers, regulators, or other special services.

This data sheet gives application information unique to the BURLE 7843. Information contained in the following publications will help to assure longer tube life and safer operation:

TP-105 Applications Guide for BURLE Power Tubes

TP-118 Applications Guide for Forced-Air Cooling of BURLE Power Tubes

TP-122 Screen-Grid Current Loading and Bleeder Considerations

For copies of these publications, contact your BURLE representative or write BURLE INDUSTRIES, INC., Tube Products Division, 1000 New Holland Avenue, Lancaster, PA 17601-5888.

* Erie Specialty Products, Inc., 645 West 11th Street, Erie, Pennsylvania 16512

General Data
Electrical

Heater for Oxide-Coated Unipotential Cathode:			
Voltage (AC or DC)			26.5 ± 10%
Current at 26.5 volts			0.5 A
Minimum heating time			2 minutes
Mu-Factor, Grid No.2 to Grid No.1			18
Direct Interelectrode Capacitances[1]:			
Grid No.1 to anode	0.065	max	pF
Grid No.1 to cathode & heater	13		pF
Anode to cathode & heater	013	max	pF
Grid No.1 to grid No.2	17.5		pF
Grid No.2 to anode	4.7		pF
Grid No.2 to cathode & heater	0.45	max	pF

Mechanical

Operating Position	Any
Overall Length	1.880" ± .050"
Greatest Diameter	1.120" max.
Terminal Connections	See Dimensional Outline
For operation up to 400 MHz	
Socket, including Grid-No.2	
Bypass Capacitor	Erie* 9819-000, or equivalent
Grid-No.2 Bypass Capacitor	Erie* 2929-001, or equivalent
For operation at high frequencies	
See Preferred Mounting Arrangement	Page 4
Weight (Approx.)	2 oz.

Thermal

Terminal Temperature (Anode, grid No.2, grid No.1, cathode, and heater)	250	max.	°C
Anode-Core Temperature	250	max.	°C

See **Dimensional Outline** for temperature-measurement points

AF Power Amplifier & Modulator-Class AB1
Maximum CCS Ratings, Absolute-Maximum Values

DC Anode Voltage	1000	volts
DC Grid No.2 Voltage	300	volts
Max. Signal DC Anode Current	180	mA
Max. Signal Anode Input	180	watts
Max. Signal Grid No.2 Input	7	watts
Anode Dissipation	115	watts

Maximum Circuit Values

Grid No.1 Circuit Resistance Under Any Condition:		
With fixed bias	30,000	ohms
With cathode bias	Not Recommended	

Typical CCS Operation

Values are for 2 tubes.			
DC Anode Voltage	650	850	volts
DC Grid No.2 Voltage	300	300	volts
DC Grid No.1 Voltage:			
From fixed-bias source	-15	-15	volts
Peak AF Grid No.1 to Grid No.1 Voltage	30	30	volts
Zero-Signal DC Anode Current	80	80	mA
Max-Signal DC Anode Current	200	200	mA
Zero-Signal DC Grid No.2 Current	0	0	mA
Max-Signal DC Grid No.2 Current	20	20	mA
Effective Load Resistance (Anode to Anode)	4330	7000	ohms
Max-Signal Driving Power (Approx.)	0	0	watts
Max-Signal Power Output (Approx.)	50	50	watts

AF Power Amplifier & Modulator - Class AB2
Maximum CCS Ratings, Absolute-Maximum Values

DCAnode Voltage	1000	volts
DC Grid No.2 Voltage	300	volts
Max-Signal DC Anode Current	180	mA
Max-Signal DC Grid No.1 Current	30	mA
Max-Signal Anode Input	180	watts
Max-Signal Grid No.2 Input	7	watts
Anode Dissipation	115	watts

Typical CCS Operation

Values are for 2 tubes.			
DC Anode Voltage	650	850	volts
DC Grid No.2 Voltage	300	300	volts
DC Grid No.1 Voltage:			
From fixed-bias source	-15	-15	volts
Peak AF Grid No. 1 -to-Grid No.1 Voltage	46	46	volts
Zero-Signal DC Anode Current	80	80	mA
Max-Signal DC Anode Current	355	355	mA
Zero-Signal DC Grid No.2 Current	0	0	mA
Max-Signal DC Grid No.2 Current	25	25	mA
Max-Signal DC Grid No.1 Current	15	15	mA
Effective Load Resistance (Anode to anode)	2450	3960	ohms
Max-Signal Driving Power (Approx.)	0.3	0.3	watts
Max-Signal Power Output (Approx.)	85	140	watts

Anode-Modulated RF Power Amplifier - Class C Telephony
Carrier conditions per tube for use with a max. modulation factor of 1.0

Maximum CCS Ratings, Absolute-Maximum Values

	Up to 1215 MHz	
DC Anode Voltage	800	volts
DC Grid No.2 Voltage	300	volts
DC Grid No.1 Voltage	-1 00	volts
DC Anode Current	150	mA
DC Grid No.1 Current	30	mA
Anode Input	120	watts
Grid No.2 Input	4.6	watts
Anode Dissipation	75	watts

Typical CCS Operation

	At 400 MHz		
DC Anode Voltage	400	700	volts
DC Grid No.2 Voltage	200	250	volts
DC Grid No.1 Voltage	-20	-50	volts
DC Anode Current	100	130	mA
DC Grid No.2 Current	5	10	mA
DC Grid No.1 Current	5	10	mA
Driver Power Output (Approx.)	2	3	watts
Useful Power Output (Approx.)	16	45	watts

Maximum Circuit Values

Grid No.1 Circuit Resistance under Any Condition	30,000 ohms

RF Power Amplifier & Oscillator - Class C Telegraphy and RE Power Amplifier - Class C FM Telephony
Maximum CCS Ratings, Absolute-Maximum Values

	Up to 1215 MHz	
DC Anode Voltage	1000	volts
DC Grid No.2 Voltage	300	volts
DC Grid No.1 Voltage	-100	volts
DC Anode Current	180	mA
DC Grid No. 1 Current[2]	30	mA
Anode Input	180 max.	watts
Grid No.2 Input	7	watts
Anode Dissipation	115	watts

Typical CCS Operation

	At 400 MHz		At 1215 MHz	
DC Anode Voltage	400	900	900	volts
DC Grid No.2 Voltage	200	300	300	volts
DC Grid No.1 Voltage	-35	-30	-22	volts
DC Anode Current	150	170	170	mA
DC Grid No.2 Current	5	1	1	mA
DC Grid No. 1 Current	3	10	4	mA
Driver Power Output (Approx.)	3	3	5	watts
Useful Power Output (Approx.)	23	80	40	watts

Maximum Circuit Values

Grid No.1 Circuit Resistance under Any Condition	30,000 ohms

Linear RF Power Amplifier, Class AB
Single-Sideband Suppressed-Carrier Service
Peak envelope conditions for a signal having a minimum peak-to-average power ratio of 2.

Maximum CCS Ratings, Absolute-Maximum Values

	Up to 1215 MHz	
DC Anode Voltage	1000	volts
DC Grid No.2 Voltage	300	volts
DC Anode Current at Peak of Envelope[3]	250	mA
DC Grid No.1 Current	30	mA
Anode Input	180	watts
Grid No.2 Input	7	watts
Anode Dissipation	115	watts

Maximum Circuit Values

Grid No. 1 -Circuit Resistance Under Any Condition:	
With fixed bias	25,000 ohms
With fixed bias (In Class AB_1 operation)	100,000 ohms
With cathode bias	Not Recommended

Typical AB_1 CCS Operation with "Two-Tone" Modulation:

		At 30 MHz	
DC Anode Voltage	660	850	volts
DC Grid No.2 Voltage	300	300	volts
DC Grid No.1 Voltage	-18.5	-18.5	volts
Zero-Signal DC Anode Current	40	40	mA
Effective RF Load Resistance	2200	3500	ohms
DC Anode Current at Peak of Envelope	100	100	mA
Average DC Anode Current	75	75	mA
DC Grid No.2 Current at Peak of Envelope	8.2	4.2	mA
Average DC Grid No.2 Current	3.6	1.7	mA
Peak-Envelope Driver Power Output (Approx.)	0.5	0.5	watt
Output-Circuit Efficiency (Approx.)	90	90	%
Distortion Products Level:			
Third Order	35	30	dB
Fifth Order	36	36	dB
Useful Power Output (Approx.):			
Average	12.5	20	watts
Peak envelope	25	40	watts

Characteristics Range Values

	Min.	Max.	
Heater Current[4]	0.48	0.60	A
Direct Interelectrode Capacitances:			
Grid No.1 to anode[1]	-	0.065	pF
Grid No.1 to cathode & heater[1]	11 .0	15.0	pF
Anode to cathode & heater'	-	0.013	pF
Grid No.1 to grid No.2[1]	15.0	20.0	pF
Grid No.2 to anode[1]	4.2	5.2	pF
Grid No.2 to cathode & heater[1]	-	0.45	pF
Grid No.1 Voltage[4,5]	-9	-18	volts
Grid No.1 Cutoff Voltage[4,6]	.	-48	volts
Grid No.1 Current[4,7]	6		mA
Reverse Grid No. 1 Current[4,5]	-	8	uA
Grid No. 2 Current[4,5]	-4.7	+ 2.0	mA
Peak Emission[4,7]	-	300	peak volts
Interelectrode Leakage Resistance[8]	1.0	-	megohm
Useful Power Output[9]	85	-	watts

Notes

Note 1: Measured with special shield adapter.

Note 2: In applications where the frequency is less than 80 MHz and the bias is less than -50 volts, the maximum value is 40 mA.

Note 3: The maximum DC anode current at peak of envelope is 250mA DC for a signal having a minimum peak-to-average power ratio of 2. During short periods of circuit adjustment under "Single-Tone" conditions, the average anode current may be as high as 250 mA. The maximum rating for a signal having a minimum peak-to-average power ratio less than 2, such as is obtained in Single-Tone operation, is 180 mA.

Note 4: with 26.5 volts AC or DC on heater.

Note 5: With DC anode voltage of 1000 volts, DC grid No.2 voltage of 300 volts, and DC grid No.1 voltage adjusted to give a DC anode current of 115 mA.

Note 6: With DC anode voltage of 1000 volts, DC grid No.2 voltage of 300 volts, and DC grid No.1 voltage adjusted to give a DC anode current of 1 mA.

Note 7: With grid No.1, grid No.2, and anode tied together; and pulse voltage source connected between anode and cathode. Pulse duration is 2 microseconds, pulse repetition frequency is 60 pps, and duty factor is 0.0001 2. The voltage-pulse amplitude is adjusted until a peak cathode current of 10 amperes is obtained. After 1 minute at this value, the voltage-pulse amplitude will not exceed the value specified.

Note 8: With tube at 20° to 30 °C for at least 30 minutes without any voltages applied to the tube. The minimum resistance between any two adjacent electrodes as measured witha 200-volt Megger-type ohmmeter having an internal impedance of 1.0 megohm, will exceed the value specified.

Note 9: In a single-tube, grid-driven coaxial-tuned amplifier circuit at 400 MHz and for conditions with 24.0 volts AC or DC on heater, DC anode voltage of 1000 volts, DC grid No.2 voltage of 300 volts, grid No. 1 voltage adjusted for DC anode current of 180 mA maximum, DCgrid No.1 current 30 mA maximum and driver power output of 3.3 watts maximum.

Warning Personal Safety Hazards

Electrical Shock — Operating voltages applied to this device present a shock hazard.

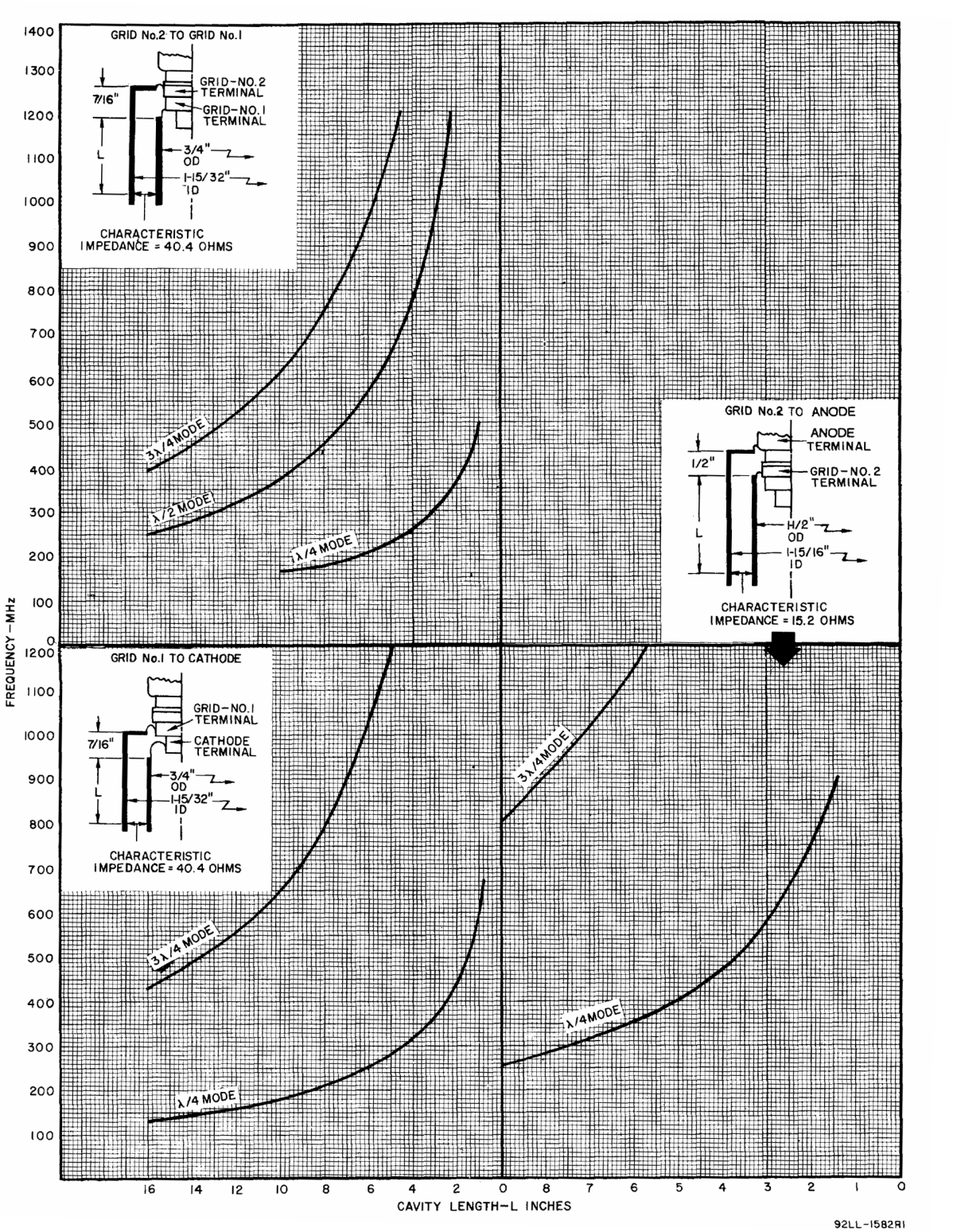


Figure 1- Tuning Characteristics

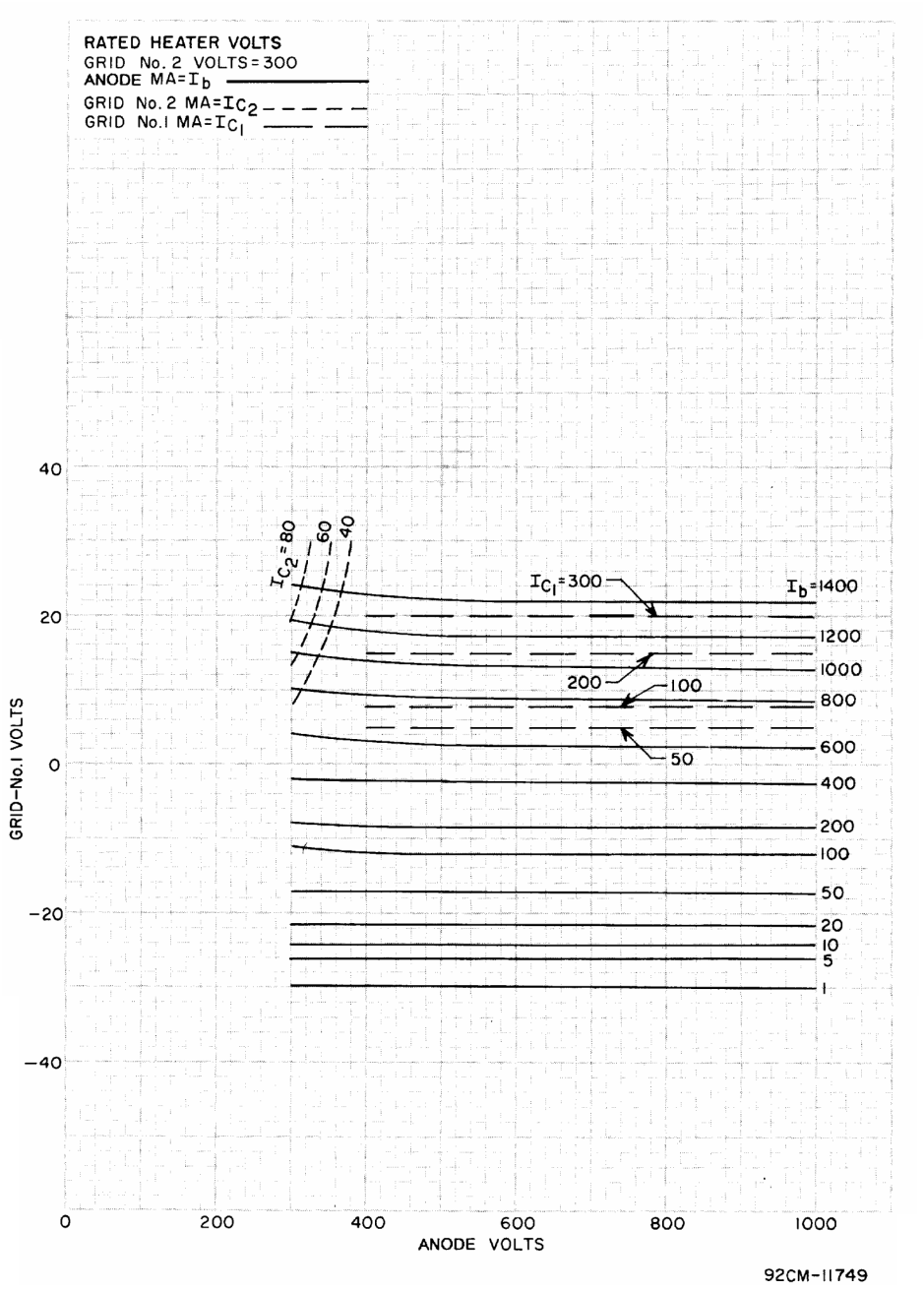


Figure 2 - Typical Constant-Current Characteristics With Grid No.2 Volts = 300

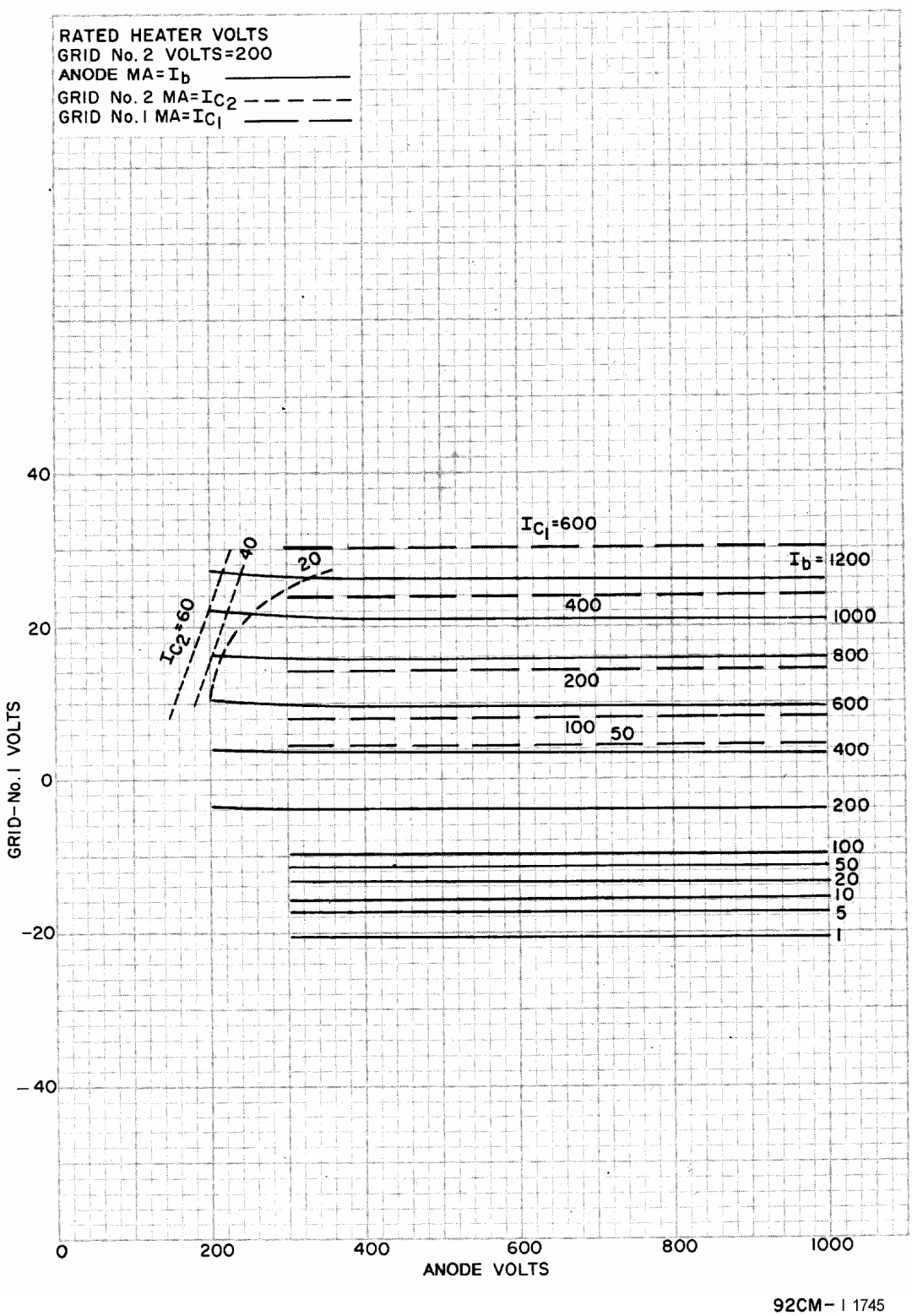


Figure 3 - Typical Constant-Current Characteristics With Grid No.2 Volts = 200

Conduction Properties of the Tube

The conduction cylinder is an aluminum alloy with high thermal conductivity to conduct the heat of anode dissipation to the surface of the cylinder. The cooling system for a given application should be designed to dissipate the heat from the tube. The permissible anode dissipation for this type may be calculated from the equation:

$$W = KA \frac{(T_2 - T_1)}{L}$$

using 2.2 square inches for the maximum area of conduction-cylinder walls. An additional 0.6 square inch is available on top on the conduction cylinder. The matching coupler to the tube should have a surface to provide intimate thermal contact with the cylinder. See reference 7.

It may also be necessary to couple grid No.2, grid No. 1, cathode and heater terminals to the heat sink. In all cases it is necessary to maintain the conduction cylinder and all seals at a temperature under the maximum temperature of 250 °C. Tube life can be substantially increased by maintaining the conduction cylinder and seal temperatures at lower temperatures.

References

1. J. E. Brosz and R. H. Decker, “Beryllia Aids Equipment Cooling”, Electronic Equipment Engineering, January 1960.
2. D. W. White, Jr. and J. E. Burke, “The Metal Beryllium” (book) published by the American Society for Metals, Cleveland, Ohio.
3. Donald P. O’Neil, “Toxic Materials Machined Safely”, American Machinist, June 4, 1955.
4. Sidney Laskin, Robert A. N. Turner, and Herbert E. Stokinger, “Analysis of Dust and Fume Hazards in a Beryllium Plant”, U.S. Atomic Energy Commission, MDDC-1355.
5. James J. Gangler, “Some Physical Properties of Eight Refractory Oxides and Carbides”, American Ceramic Society Journal, Vol.33, December 1950.
6. W. D. Kingery, J. Francl, R. L. Coble, and 1. Vasilos, “Thermal Conductivity X- Data for Several Pure Oxide Materials Corrected to Zero Porosity”, American Ceramic Society Journal, Vol.37, February 1954.
7. Graff, “Thermal Conductance Across Metal Joints”, Machine Design, September 15, 1960.

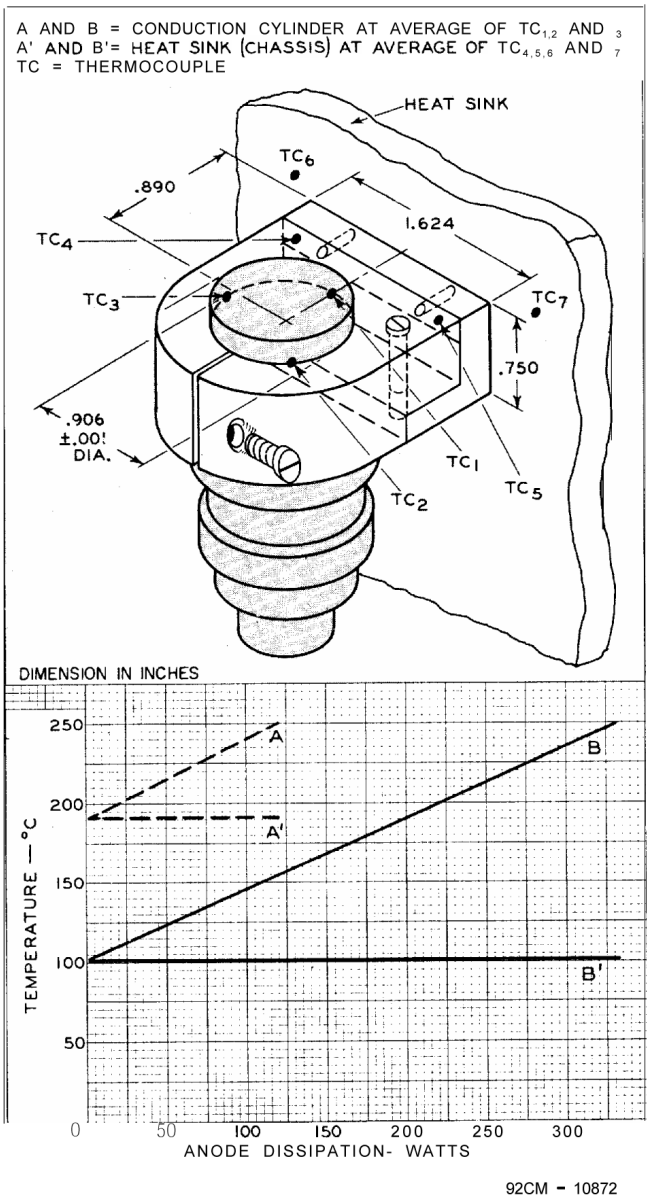
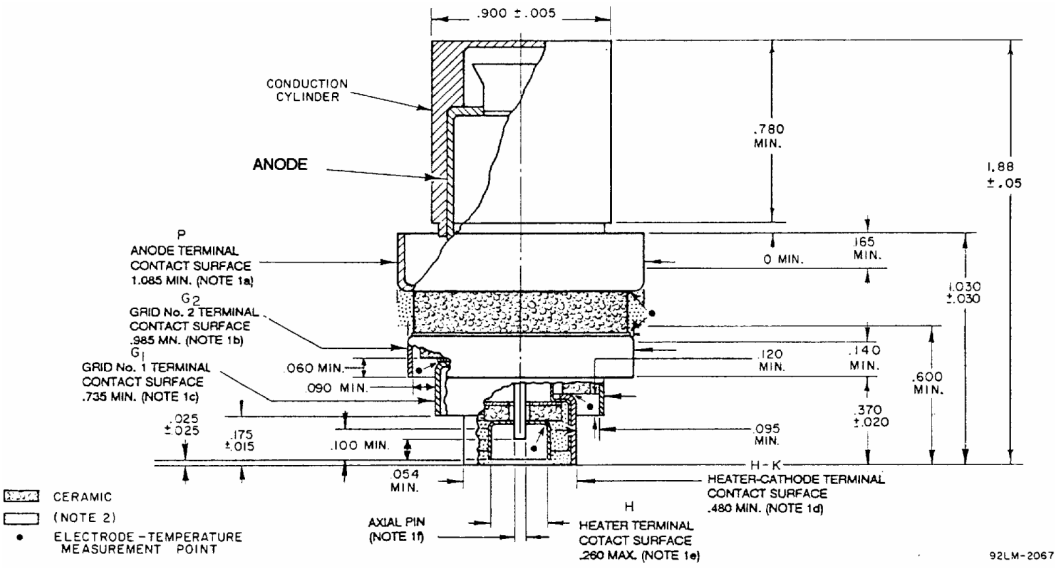


Figure 4 – Cooling Characteristics Of Typical Clamp Conduction Cooling System



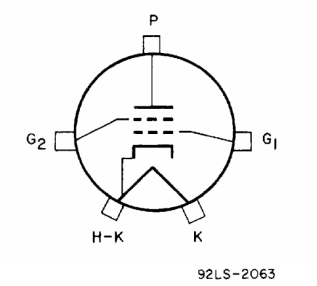
Dimensions in inches.

Note 1: The following diametrical space requirements accommodate the concentricity of the cylindrical surfaces of the axial pin and each electrode terminal:

a. Anode Terminal - 1.120”
b. Grid Terminal - 1.020”
c. Grid No. 1 Terminal - 0.765”
d. Heater-Cathode Terminal - 0.520”
e. Heater Terminal - 0.238’
f. Axial Pin - 0.072”

Note 2: Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular volumes.

Figure 6 - **Dimensional Outline**



See Dimensional Outline for Terminal Connections

Note 1: If a clamp is used, it must be adjustable in a plane normal to the major tube axis to compensate for variations in concentricity between the conduction cylinder and the contact terminals.

Note 2: Contact ring No.97-252 or finger stock No.97-380.

Note 3: Contact ring No.97-253 or finger stock No.97-380.

Note 4: Contact ring No.97-254 or finger stock No.97-380.

Note 5: Contact ring No.97-255 or finger stock No.97-380.

Note 6: Either specified contact ring of preformed stock or finger stock No.97380 provide adequate electrical contact, but the finger stock No.97380 is less susceptible to breakage than the specified contact ring. Both types are made by Instruments Specialties Co., P.O.Box A, Delaware Water Gap, PA 18327

Figure 6 - **Terminal Diagram**

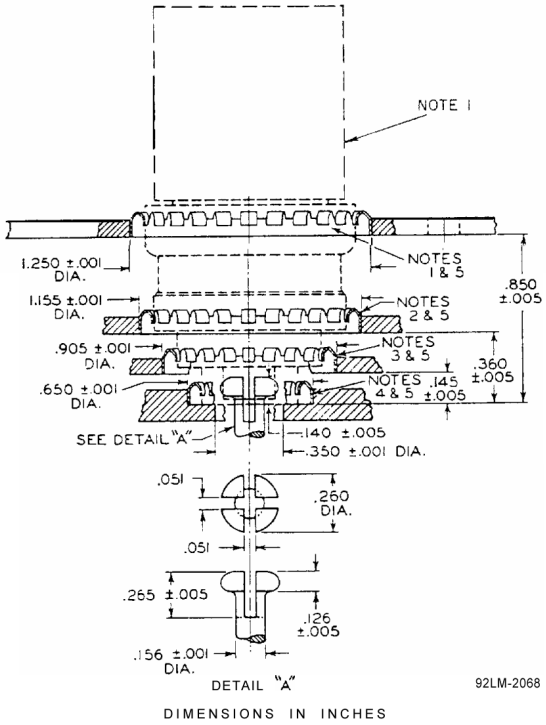


Figure 7: Preferred Mounting Arrangement