

4661 Power Tube

CERMOLOX[®] Beam Power Tube

- Ruggedized
- Reliable
- Forced-Air Cooled
- Matrix Cathode
- Full Input to 400 MHz
- Over 1000 Watts CW FM
- Over 250 Watts CW AM Linear

BURLE 4661 is designed to meet the low noise and stringent environmental conditions in unpressurized, airborne communication service. In FM telephony service the 4661 can deliver 1160 watts of useful CW power output at a bandwidth of 4.4 MHz and a gain of 12 dB. As an AM linear amplifier the 4661 can deliver 280 watts of useful CW power output at 4.5 MHz bandwidth and 12 dB gain.

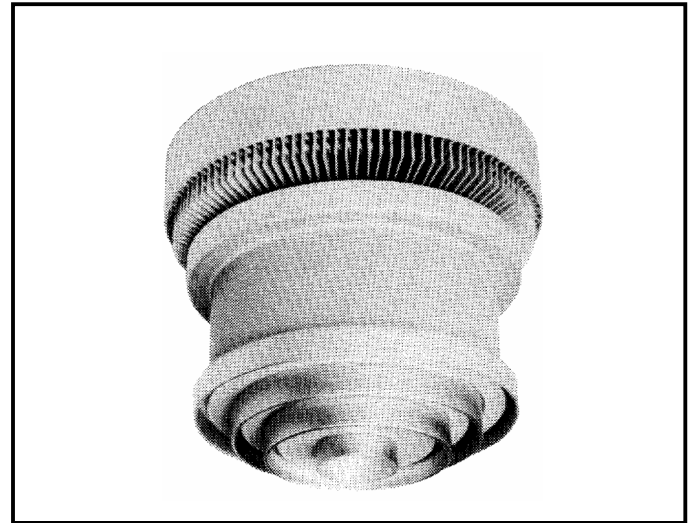
The sturdy, coaxial, Cermolox[®] tube construction minimizes tube inductances and feed-thru capacitances, enabling the use of straight-forward cavity circuit-design techniques for operation up to 500 MHz and minimizing induced noise problems in linear systems. Its efficient, forced-air cooled radiator reduces blower-noise and increases overall system efficiency. The rugged matrix cathode increases system reliability.

To assure compliance with environmental design objectives, sample tubes are subjected to 50 g, 11-millisecond shock, and up to 10g, 5 to 500 Hertz vibration testing.

This data sheet gives application information unique to the BURLE 4661. Information contained in the following publications will help to assure longer tube life and safer operation:

- TP-105 Application Guide for BURLE Power Tubes.
- TP-118 Application 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 17601-5688.

General Data

Electrical

Heater-Cathode:

| | | | |
|--------------------------|---|------|---|
| Type..... | Unipotential, Oxide Coated, Matrix Type | | |
| Voltage (AC or DC) | 5.5 | typ. | V |
| | 5.8 | max. | V |

| | | | |
|---------------------------|------|--|---|
| Current @ 5.5 V..... | 17.3 | | A |
| Minimum heating time..... | 180 | | s |

| | | | |
|--|------|------|----|
| Mu Factor ¹ , Grid No.1 to Grid No.2..... | 6.5 | | |
| Direct Interelectrode Capacitances: ² | | | |
| Grid No.1 to anode..... | 0.25 | max. | pF |
| Grid No.1 to cathode-heater..... | 38 | | pF |
| Anode to cathode-heater..... | 0.03 | | pF |
| Grid No.1 to grid No.2..... | 52 | | pF |
| Grid No.2 to anode..... | 12.7 | | pF |
| Grid No.2 to cathode-heater..... | 2.0 | max. | pF |

Mechanical

| | | | |
|--------------------------|-------------------------|--|--|
| Operating Position..... | Any | | |
| Maximum Length..... | 98.0 mm (3.86 in) | | |
| Greatest Diameter..... | 94.7 mm (3.73 in) | | |
| Terminal Connection..... | See Dimensional Outline | | |
| Socket..... | See Page 2 | | |
| Radiator..... | Integral Part of Tube | | |
| Weight (Approx.) | 0.9 kg (2 lbs) | | |

Thermal

| | | | |
|---|-----|------|----|
| Ceramic-Metal Interface Temperature ³ | | | |
| (Anode, grid No.1, grid No.2, cathode-heater, and heater) | 250 | max. | °C |
| Anode Core Temperature ³ | 250 | max. | °C |



Linear RF Power Amplifier

AM Telephony Service, Class AB

Carrier conditions for use with a maximum modulation factor of 1.0.

Maximum CCS Ratings, Absolute-Maximum Values

| | | |
|---------------------------|------|----|
| DC Anode Voltage..... | 3500 | V |
| DC Grid-No.2 Voltage..... | 1000 | V |
| DC Grid-No.1 Voltage..... | -300 | V |
| DC Anode Current..... | 700 | mA |
| Grid-No. 2 Input..... | 50 | W |
| Anode Dissipation..... | 1500 | W |

Calculated CCS Operation as a Class AB, Amplifier

In a cathode-drive circuit at 400 MHz with an output circuit bandwidth of 4.5 MHz⁵.

| | | |
|---|------|----|
| DC Anode Voltage..... | 2600 | V |
| DC Grid-No.2 Voltage..... | 550 | V |
| DC Grid-No.1 Voltage ⁶ | -75 | V |
| DC Anode Current..... | 490 | mA |
| DC Grid-No.2 Current..... | -15 | mA |
| DCCGrid-No.1 Current..... | 0 | mA |
| Drive Power (Approx.) | 18 | W |
| Output Circuit Efficiency (Approx.) | 90 | % |
| Useful Power Output..... | 280 | W |

RF Power Amplifier & Oscillator - Class C

Telegraphy and RF Power Amplifier - Class C FM Telephony

Maximum CCS Ratings, Absolute-Maximum Values

| | Up to 400 | MHz |
|---------------------------|-----------|-----|
| DC Anode Voltage..... | 3500 | V |
| DC Grid-No.2 Voltage..... | 1000 | V |
| DC Grid-No.1 Voltage..... | -300 | V |
| DC Anode Current..... | 1.25 | A |
| DCCGrid-No.1 Current..... | 0.2 | A |
| Grid-No.2 Input..... | 50 | W |
| Anode Dissipation..... | 1500 | W |

Maximum Circuit Values

| | |
|-----------------------------------|------------|
| Grid-No.1 Circuit Resistance..... | 5000 ohms |
| Grid-No.2 Circuit Impedance..... | See Note 4 |
| Anode Circuit Impedance..... | See Note 4 |

Calculated CCS Operation

In a cathode-drive circuit at 400 MHz with an output circuit bandwidth of 4.4 MHz⁵.

| | | |
|---|------|----|
| DC Anode Voltage..... | 2600 | V |
| DC Grid-No.2 Voltage..... | 550 | V |
| DC Grid-No.1 Voltage ⁷ | -85 | V |
| DC Anode Current..... | 900 | mA |
| DC Grid-No.2 Current..... | -10 | mA |
| DC Grid-No.1 Current..... | 5 | mA |
| Drive Power (Approx.) | 70 | W |
| Output Circuit Efficiency (Approx.) | 90 | % |
| Useful Power Output..... | 1160 | W |

1. For: Anode Voltage = 2500 V
Grid No.2 Voltage = 600 V
Anode Current = 600 mA
2. With special shield adapter.
3. See Dimensional Outline for temperature measurement points.
4. See TP-105.

5. Computed between half-power points using two times tube capacity.

6. Adjust for zero-signal DC anode current of 0.2 A.

7. Adjust for zero-signal DC anode current of 0.1 A.

Forced-Air Cooling

Air Flow:

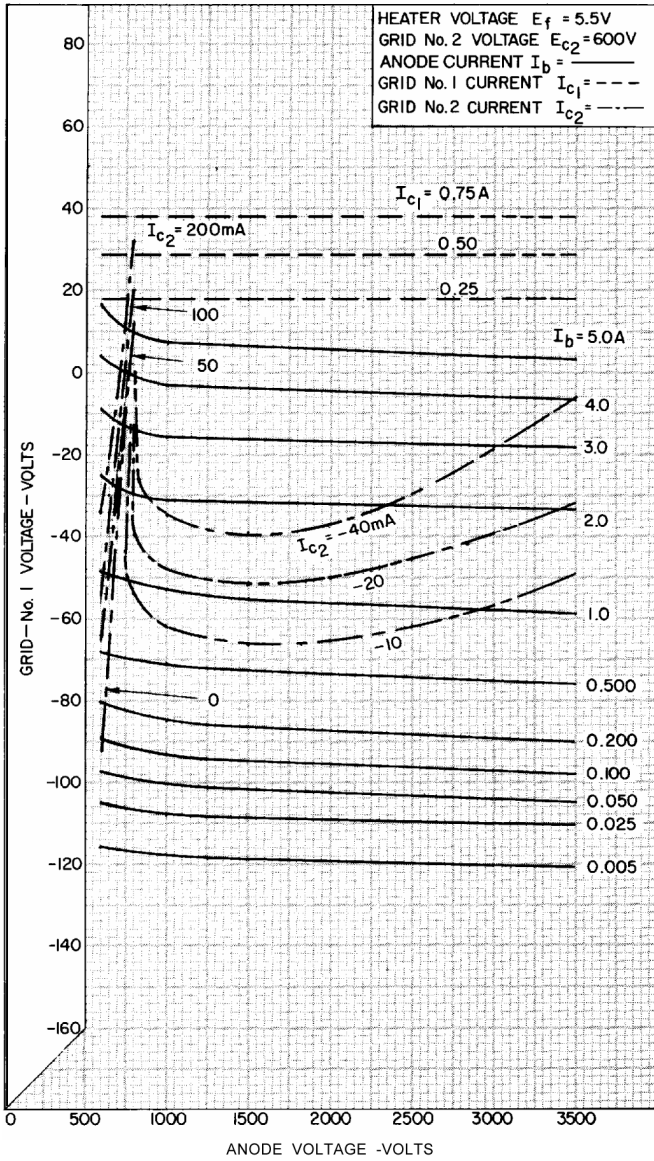
Cooling air flow is required to limit anode-core and terminal-seal temperatures to values that will assure long, reliable tube life. Sufficient air flow must be directed past each of these terminals to keep temperatures well below the absolute-maximum limit. A safety factor of 25° to 50 °C should be applied to compensate for all probable system and component variations throughout life. A blower of sufficient capacity must deliver cooling air to the anode radiator and to the terminal seals at all times that electrode voltage, even just heater voltage, is applied to the tube. For best tube life, cooling air flow should continue for at least three (3) minutes after all electrode voltages have been removed. See **Figure 6** Cooling Characteristics, For further information on forced-air cooling, refer to TP-118.

Mounting

Fixed mounting using commercial sockets or the design of **Figure 4** is recommended. Separate contact ring assemblies, each transversely adjustable, are not recommended for this tube type. Recommended socket: 89-095-01 or equivalent, available from Jettron Products Incorporated, 65 Route 10, P.O. Box 337, East Hanover, NJ 07938.

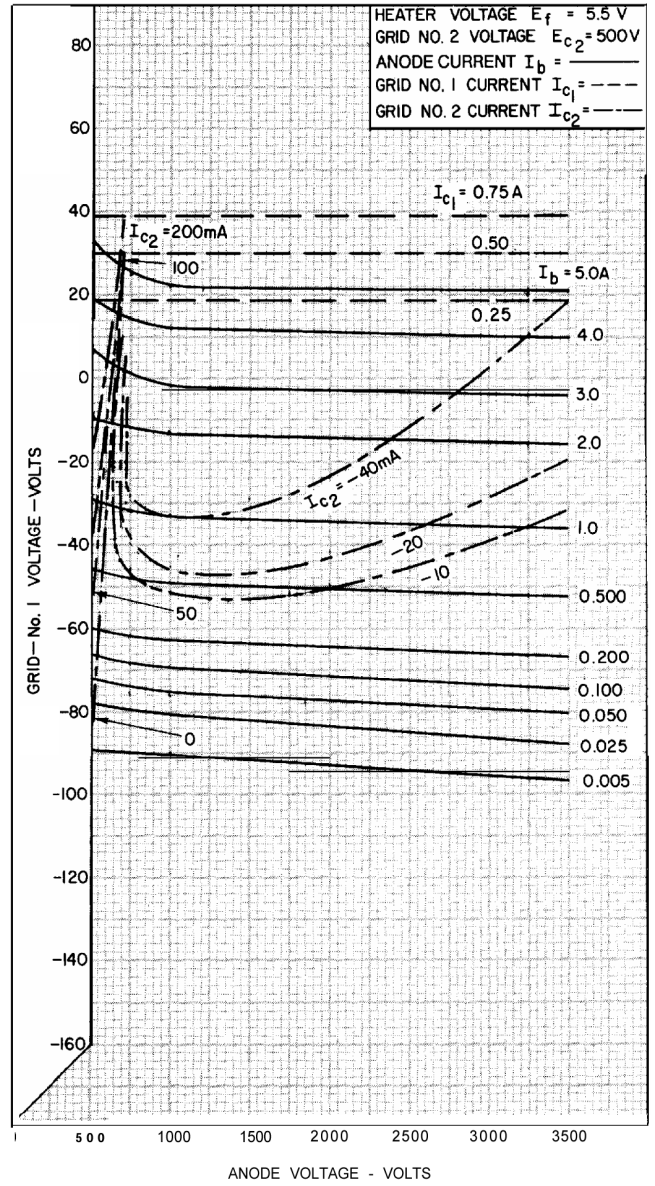
Warning – Personal Safety Hazard

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



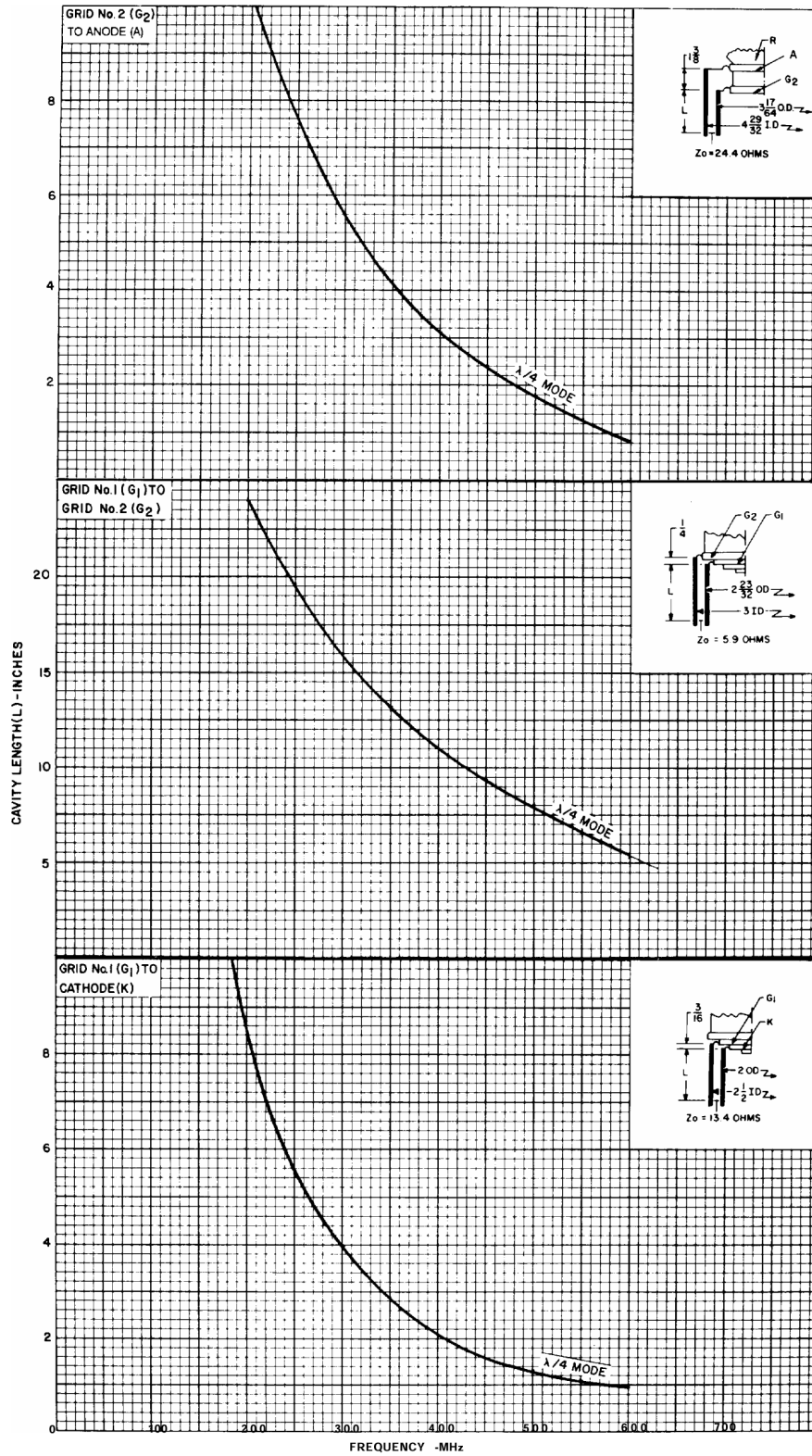
92LM- 2437

Figure 1 – Typical Constant Current Characteristics ($E_{c2} = 600 V$)



92LM- 2432

Figure 2 - Typical Constant Current Characteristics ($E_{c2} = 500 V$)



92LL-3559

Figure 3 - Electrode Cavity Tuning Characteristics

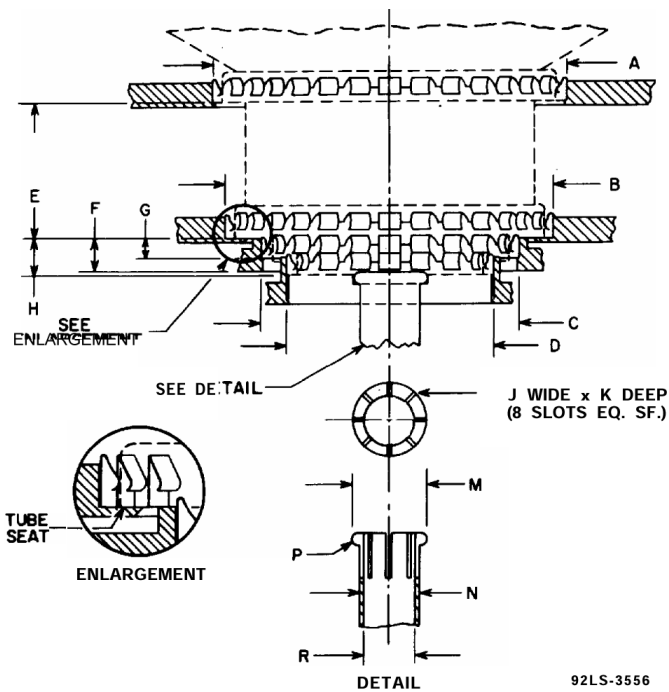


Figure 4 - Preferred Mounting Arrangement

Note: Finger stock is No.97-360A made by Instrument Specialities Co., P. O. Box A, Delaware Water Gap, PA 18327.

Tabulated Dimensions*

| Dimension | Value | |
|-----------|-------|---------|
| A Dia. | 87.00 | (3.425) |
| B Dia. | 81.53 | (3.210) |
| C Dia. | 63.63 | (2.505) |
| D Dia. | 48.56 | (1.912) |
| E | 36.07 | (1.320) |
| F | 8.38 | (0.330) |
| G | 5.08 | (0.200) |
| H | 9.40 | (0.370) |
| J | 0.64 | (0.025) |
| K | 12.70 | (0.500) |
| M Dia. | 18.42 | (0.725) |
| N Dia. | 15.09 | (0.594) |
| P Radius | 1.57 | (0.062) |
| R Dia. | 12.70 | (0.500) |

* Dimensions in millimeters, dimensions in parentheses are in inches.

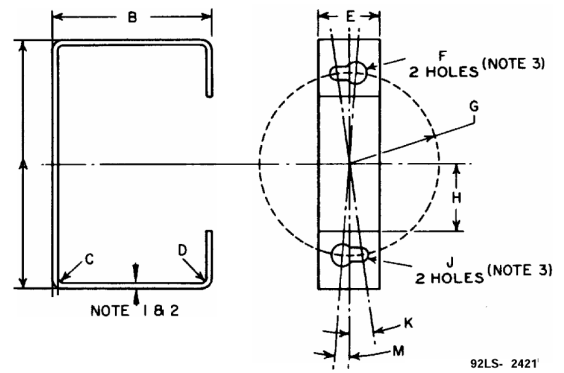


Figure 5 - Tube Extractor - Suggested Design

Tabulated Dimensions*

| Dimension | Value | |
|-----------|---------------|---------|
| A | 71 | (2.8) |
| B | 46 | (1.8) |
| C Radius | 1.5 | (0.06) |
| D Radius | 1.5 | (0.06) |
| E | 18 | (0.7) |
| F Dia. | 6.35 | (0.250) |
| G Radius | 25.78 | (1.015) |
| H | 19 | (0.75) |
| J Dia. | 3.56 | (0.140) |
| K | 0.145 radians | 8.3° |
| M | 0.078 radians | 4.5° |

Note 1: Material 1/16" thick cold rolled steel.

Note 2: Round all edges.

Note 3: Slot between holes.

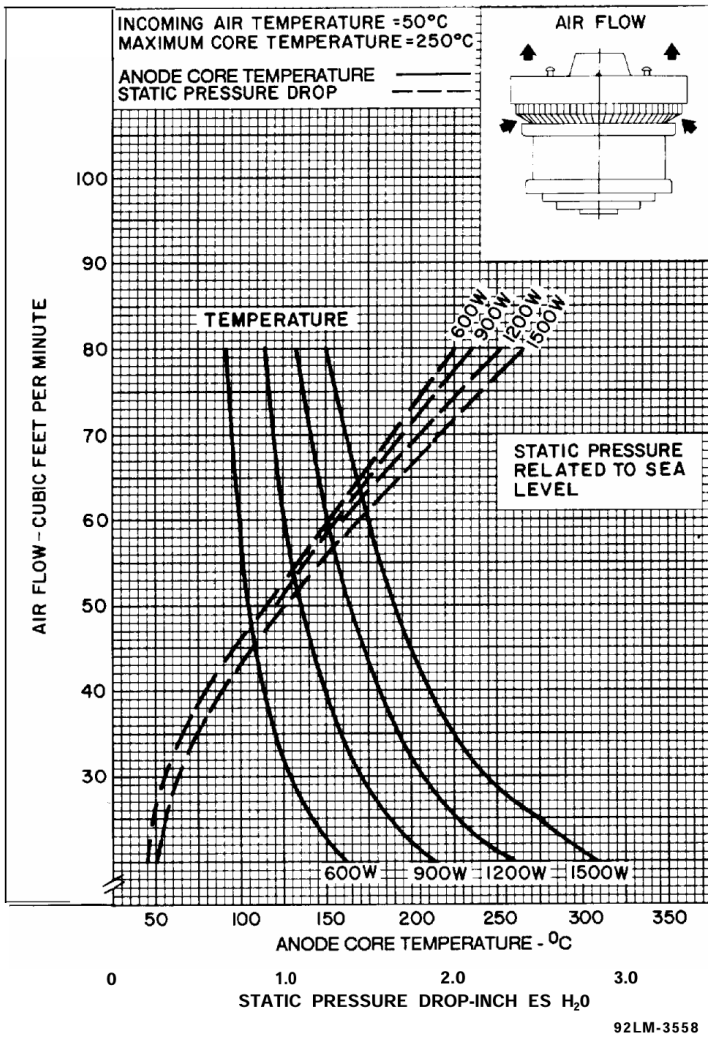


Figure 6 - Cooling Characteristics

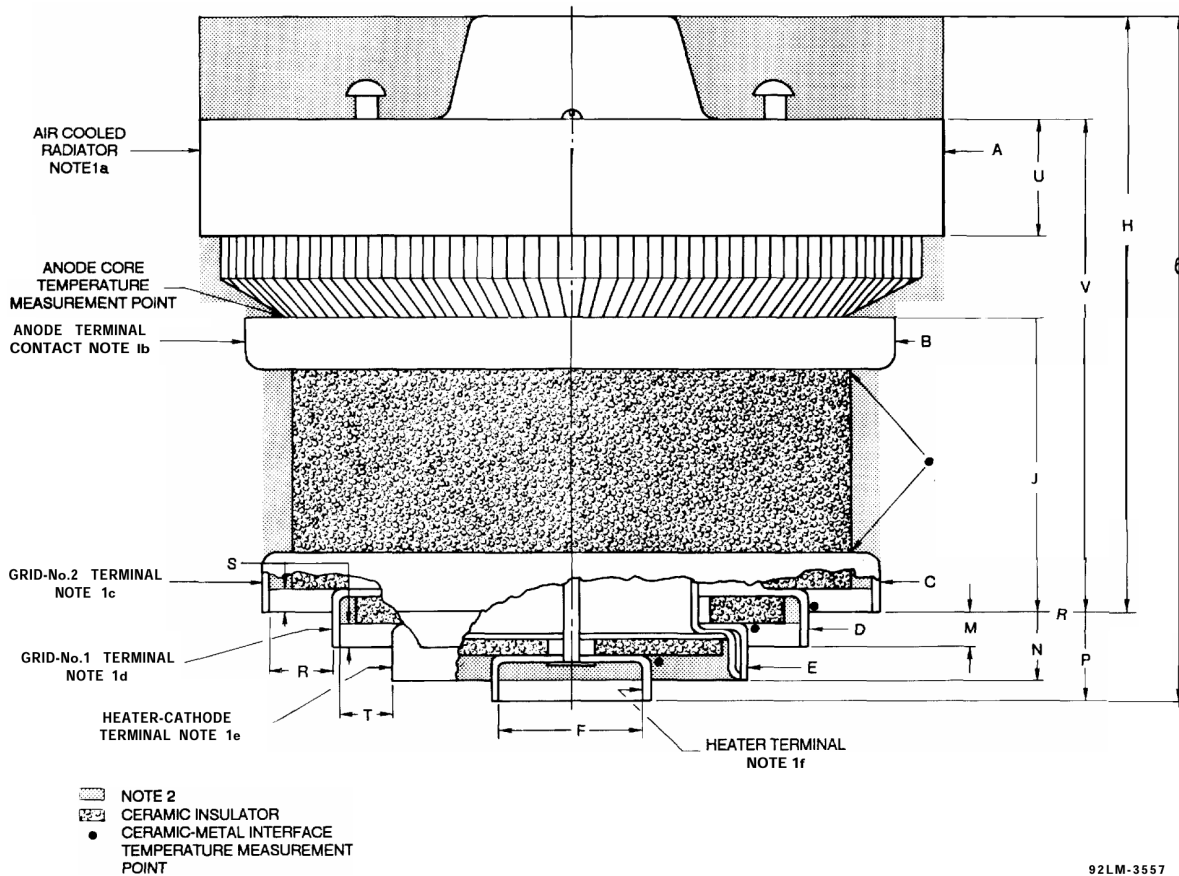


Figure 7 - Dimensional Outline

Tabulated Dimensions

| Dimension | Millimeters | Inches |
|-----------|-------------|--------------|
| A Dia. | 93.98 ± .76 | 3.70 ± .03 |
| B Dia. | 81.54 min. | 3.210 min. |
| C Dia. | 76.45 min. | 3.010 min. |
| D Dia. | 58.60 min. | 2.307 min. |
| E Dia. | 43.43 min. | 1.710 min. |
| F Dia. | 18.41max. | 0.725 max. |
| G | 95.5 ± 2.5 | 3.76 ± .10 |
| H | 83.8 ± 2.5 | 3.30 ± .10 |
| J | 41.91 ± .76 | 1.65 ± .03 |
| M | 5.08 ± .64 | 0.200 ± .025 |
| N | 9.40 ± .76 | 0.37 ± .03 |
| P | 11.68 ± .76 | 0.46 ± .03 |
| R | 6.35 min. | 0.250 min. |
| S | 2.67 min. | 0.105 min. |
| T | 5.08 min. | 0.200 min. |
| U | 15.75 min. | 0.620 min. |
| V | 68.8 ± 2.5 | 2.71 ± .10 |

Note 1: The contact distance* indicated is the minimum uniform length as measured from the edge of the terminal.

| | Contact | Distance |
|--------------------|---------|----------|
| 1.a Radiator | 15.75 | (0.620) |
| 1.b Anode | 5.59 | (0.220) |
| 1.c Grid No.2 | 5.59 | (0.220) |
| 1.d Grid No.1 | 4.45 | (0.175) |
| 1.e Heater-Cathode | 2.92 | (0.115) |
| 1.f Heater | 3.43 | (0.135) |

Note 2: Keep all stippled regions clear. In general do not allow contacts to protrude into these annular regions. If special connectors are required which may intrude on these regions, contact BURLE Power Tube Application Engineering for guidance.

*Dimensions in millimeters, dimensions in parentheses are in inches.