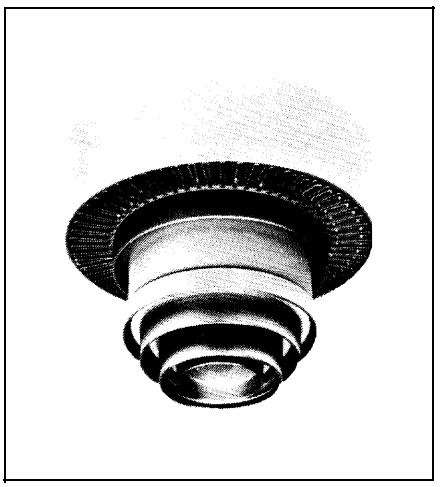
8791
Power Tube



Linear Beam Power Amplifier Tube

- **Ruggedized, Reliable**
- **80 Watt Average-Noise-Power Output with White Noise Loading**
- **250 Watt Power Output in VHF-Linear Translator Service**
- **500 Watt PEP Output in SSB Suppressed-Carrier Service**
- **CERMOLOX® Power Tube**
- **Full Input to 400 MHz**

The BURLE 8791 is designed specifically to meet the high linearity and low noise requirements of modern data transmission and communication systems. Its ruggedized construction makes it ideal for use in portable or mobile equipments.

The design linearity has been evaluated using Method 2206 of MIL-STD-1311. This method employs white noise with a Gaussian amplitude distribution to check the inherent distortion in power amplifiers over a broad operating spectrum. The 8791 tested better than the -40 dB specified for Government high-performance equipments for data transmission. This test checks the linearity for all methods of modulation both continuous (amplitude, frequency and phase) and also pulse (position, amplitude and duration).

The 8791 is also rated for SSB-suppressed carrier service where it can deliver up to 500 watts of peak envelope power at a third order intermodulation of -38 dB when tested with "Two Tone Modulation". It can also supply in excess of 200 watts of useful power output in linear telephony applications.

This bulletin gives application information unique to the BURLE 8791. General information covering the installation and operation of this tube type is given in the "Application Guide for BURLE Power Tubes", TP-105. Close attention to the instructions contained therein will assure longer tube life, safer operation, less equipment downtime, and fewer tube handling accidents.

General Data

Electrical

Heater-Cathode:

Type	Unipotential, Oxide Coated, Matrix Type		
Voltage[1] (ac or dc)	5.5	typ.	V
	6.6	max.	V
Current at 5.5 volts	7.2		A
Minimum heating time	120		s
Mu-Factor, (Grid No.2 to grid No.1)	13		

Direct Interelectrode Capacitances:

Grid No.1 to plate[2]	0.1	1 max.	pF
Grid No.1 to cathode & heater	30		pF
Plate to cathode & heater[2]	0.012	max.	pF
Grid No.1 to grid No.2	38		pF
Grid No.2 to plate	5.5		pF
Grid No.2 to cathode & heater[2]	1.1	max.	pF

Mechanical

Operating Attitude	Any	
Overall Length	62.0 mm (2.44 in)	max.
Greatest Diameter	64.8 mm (2.55 in)	max.
Terminal Connections	See Dimensional Outline	
Sockets	See Mounting Arrangement	
Radiator	Integral part of tube	
Weight (Approx.)	0.3 kg (3/4 lb)	

Thermal

Seal Temperature[3] (Plate, grid No.2, grid No.1, cathode-heater and heater)	250	max.	°C
Plate-Core Temperature[3]	250	max.	°C

BURLE Electron Tubes

Linear RF Power Amplifier[4]
Single-Sideband Suppressed-Carrier Service

Maximum CCS Ratings, Absolute-Maximum Values

	Up to 400 MHz	
DC Plate Voltage[4]	3000	V
DC Grid-No.2 Voltage[4]	750	V
DC Plate Current at Peak of Envelope[5]	700	mA
Grid-No.2 Input[4]	25	W
Plate Dissipation	1000	W

Maximum Circuit Values

Grid-No.1 Circuit Resistance:		
With fixed bias	15,000	ohms
With cathode bias	Not recommended	
Plate Circuit Impedance	See note 4	
Grid-No.2 Circuit Impedance	See note 4	

Typical Class AB, CCS Operation with "Two-Tone Modulation"

			At 30 Mc	
DC Plate Voltage	2000	2000	2500	V
DC Grid-No.2 Voltage	450	450	350	V
DC Grid-No. 1 Voltage[6]	-34	-32	-26	V
Zero-Signal DC Plate Current	250	250	200	mA
Effective RF Load Resistance	1850	1850	2750	ohms
DC Plate Current at Peak of Envelope	535	545	430	mA
Average DC Plate Current	400	410	320	mA
DC Grid-No.2 Current at Peak of Envelope	-1.2	+0.2	-4.0	mA
Average DC Grid-No.2 Current	-4.0	-4.0	-3.0	mA
Peak RF Grid-No.1 Voltage	30	40	22	V
Output-Circuit Efficiency (Approx.)	90	90	90	%
Distortion Products Level:[7]				
Third order	38[8]	42	37[8]	dB
Fifth order	48[8]	54	53[8]	dB
Unbypassed Cathode Resistor	0	10	0	ohms
Useful Power Output (Approx.):				
Average	250	250	250	W
Peak envelope	500	500	500	W

VHF Power Amplifier
Class B VHF-TV or Translator Service[4]

Synchronizing level conditions per tube unless otherwise specified.

Maximum CCS Ratings, Absolute-Maximum Values

DC Plate Voltage[4]	3000	V
DC Grid No.2 Voltage[4]	750	V
DC Plate Current	0.5	A
Plate Dissipation	1000	w
Grid No.2 Input[6]	25	W

Typical CCS Operation for Translator or Video Service

In a cathode-drive circuit at 216 MHz and a -1.0 dB bandwidth of 6.0 MHz.

	Translator	Video	
DC Plate Voltage	2100	2300	V
DC Grid-No.2 Voltage	450	450	V
DC Grid-No.1 Voltage	-34	-37	V
DC Plate Current:			
Zero-signal	0.28	0.20	A
Sync peak level	-	0.47	A
Composite signal	0.5	-	A
DC Grid-No.2 Current (Approx.)[4] (Pedestal Level)	0	-1	mA
DC Grid-No.1 Current (Approx.) (Sync Peak Level)	0	0	mA
RF Drive Power:			
Sync peak level	8	12	W
Typical Linearity	-52	-	dB
RF Power Output:			
Sync peak level	250	500	W
Power Gain, Including Circuit Losses	15	15	dB

RF Power Amplifier & Oscillator - Class C Telegraphy[4] and RF Power Amplifier - Class C FM Telephony[4]

Maximum CCS Ratings, Absolute-Maximum Values

	Up to 400 MHz	
DC Plate Voltage[4]	2500	V
DC Grid-No.2 Voltage[4]	750	V
DC Grid-No.1 Voltage[4]	-250	V
DC Plate Current	500	mA
DC Grid-No.1 Current	100	mA
Grid-No.2 Input[4]	25	W
Plate Dissipation	700	W

Maximum Circuit Values

Grid-No.1-Circuit Resistance	15,000	ohms
Plate-Circuit Impedance	See note 4	
Grid-No.2-Circuit Impedance	See note 4	

Typical CCS Operation in a Cathode Drive Circuit

		At 400 MHz	
DC Plate Voltage	2250	2500	V
DC Grid-No.2 Voltage	400	400	V
DC Grid-No.1 Voltage	-45	-35	V
DC Plate Current	450	500	mA
DC Grid-No.2 Current	1	8	mA
DC Grid-No.1 Current	10	12	mA
Drive Power (Approx.)	30	35	W
Output-Circuit Efficiency (Approx.)	80	80	%
Useful Power Output	650	800	W

Characteristics Range Values

	Min.	Max.	Unit
Heater Current[12]	6.9	8.3	A
Direct Interelectrode Capacitances:			
Grid-No.1 to plate[2]	-	0.11	pF
Grid No.1 to cathode and heater	27.5	31.6	pF
Plate to cathode and heater[2]		0.012	pF
Grid No.1 to grid No.2	34	41	pF
Grid No.2 to plate	4.5	6.0	pF
Grid No.2 to cathode and heater[2]	-	1.1	pF
Reverse Grid-No.1 Current[12,13]	-	-50	uA
Peak Emission[3,14]	80	-	A
Interelectrode Leakage Resistance[15]	8.0	-	Mohms
Cutoff Grid-No.1 Voltage[12,16]	-	70	V

1. For maximum life expectancy, the heater-voltage must be adjusted initially and throughout life to the lowest value that will give the desired performance.

   a. Before the application of any other voltages to a new tube, the heater voltage should be adjusted to 5.5 volts at the tube socket. A true RMS voltmeter should be used for accurate measurement.

   b. Apply voltages and adjust tuning controls as necessary for proper operation as described in the appropriate instruction manual.

   c. Reduce the heater voltage in 0.1-volt increments - repeating Step 2 until performance degradation is noted. Then increase the heater voltage 0.1 volt above this point. Typically, depending upon the application, this voltage will be in the range of 4.8 to 5.5 volts.

   During life when evidence is observed that a tube is becoming emission limited, increasing the heater voltage may extend the useful life of the tube. However, never increase heater voltage to compensate for a decrease in other circuit parameters such as RF drive or video modulating voltage!

2. With special shield adapter.

3. See Dimensional Outline for Temperature Measurement points.

4. See TP-105.

5. During short periods of circuit adjustment, under 'Single Tone" conditions, the average plate current may be as high as 750 mA.

6. Adjust to specified zero-signal dc plate current.

7. Referenced to two equal tones.

8. Measured during open loop operation (no feedback or neutralization employed to enhance performance).

9. Measured across a 50 ohm grid-swamping resistor.

10. Third order IM, with three tone input signal which includes the aural carrier at-10 dB, the color sub-carrier at -17 dB, and the visual carrier at -8 dB below the reference peak power level.

11. Adjust for zero-signal dc plate current of 200 mA.

12. With 6.3 V ac or dc on heater.

13. With dc plate voltage of 2500 volts, dc grid-No.2 voltage of 400 volts, and dc grid-No.1 voltage adjusted to give a plate current of 240 mA.

14. For conditions with grid-No.1, grid-No.2, and plate tied together, and pulse voltage source of 850 peak volts, between plate and cathode. Pulse duration is 2 microseconds, pulse repetition frequency is 60 pps, and duty factor is 0.0012. Peak emission current is read after 1 minute.

15. Under conditions 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 electrodes (except across heater terminals) is measured with a 200-volt Megger-type ohmmeter having an internal impedance of 1.0 megohm.

16. With dc plate voltage of 2500 volts, dc grid-No.2 voltage of 400 volts, and dc grid-No.1 voltage adjusted to give a plate current of 5 mA.

Forced-Air Cooling

Air Flow:

Through radiator - Adequate air flow to limit the plate-core temperature 250° C should be delivered by a blower through the radiator before and during the application of heater, plate, grid-No.2, and grid-No.1 voltages. In typical operation at 750 watts plate dissipation and 200° C plate core temperature 12 cfm at 0.36 inch of water at 22° C ambient air temperature should be sufficient as shown on Air Flow Chart.

To Plate, Grid-No.2, Grid-No-1, Heater Cathode, and Heater Terminals - A sufficient quantity of air should be allowed to flow past each of these terminals so that their temperature does not exceed the specified maximum value of 250° C.

During Standby Operation - Cooling air is required when only heater voltage is applied to the tube.

During Shutdown Operation - Air flow should continue for a few minutes after all electrode power is removed.

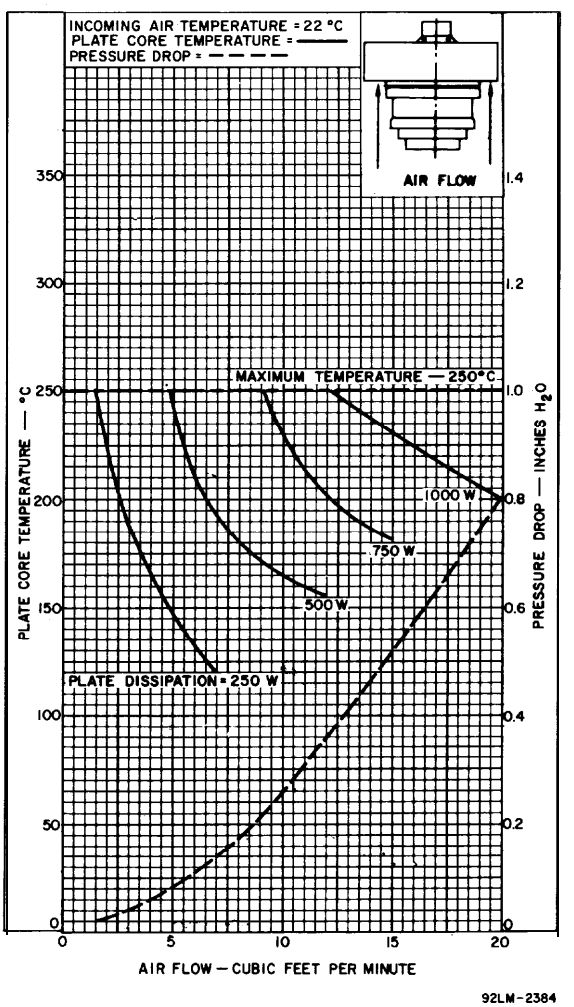


Figure 1 - Typical Cooling Characteristics

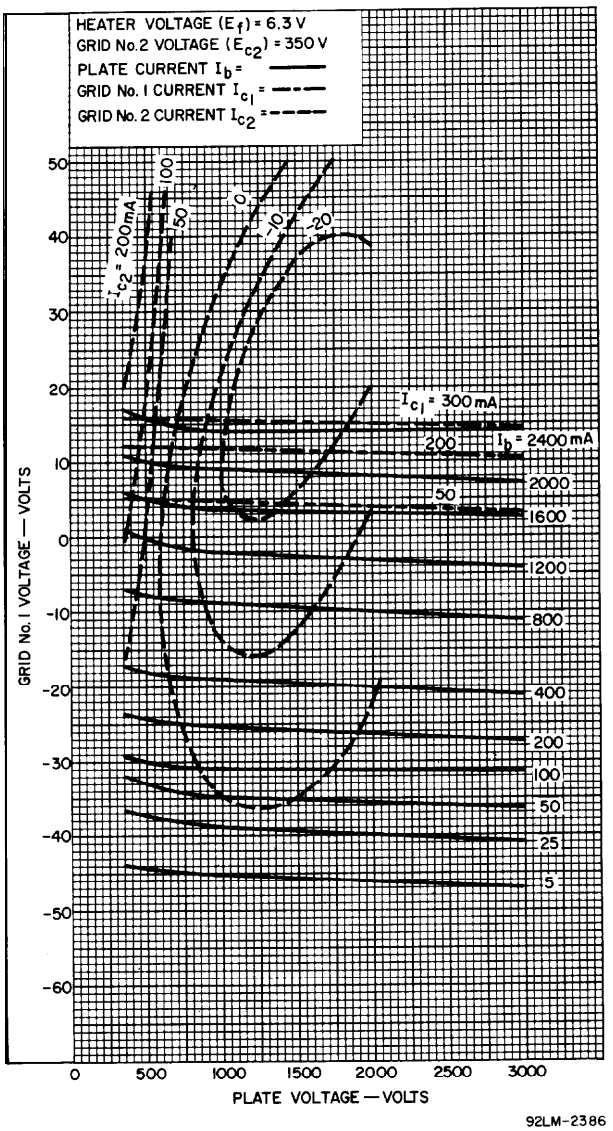


Figure 2 - Typical Constant Current Characteristics (E_{c2} = 350 V)

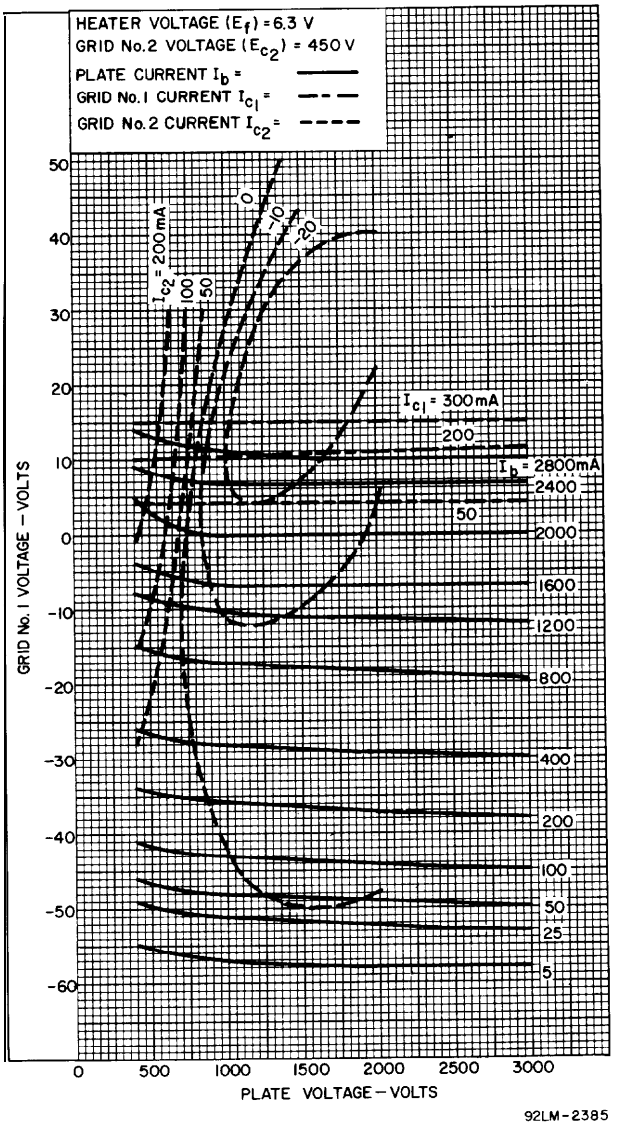


Figure 3 - Typical Constant Current Characteristics (E_{c2} = 450 V)

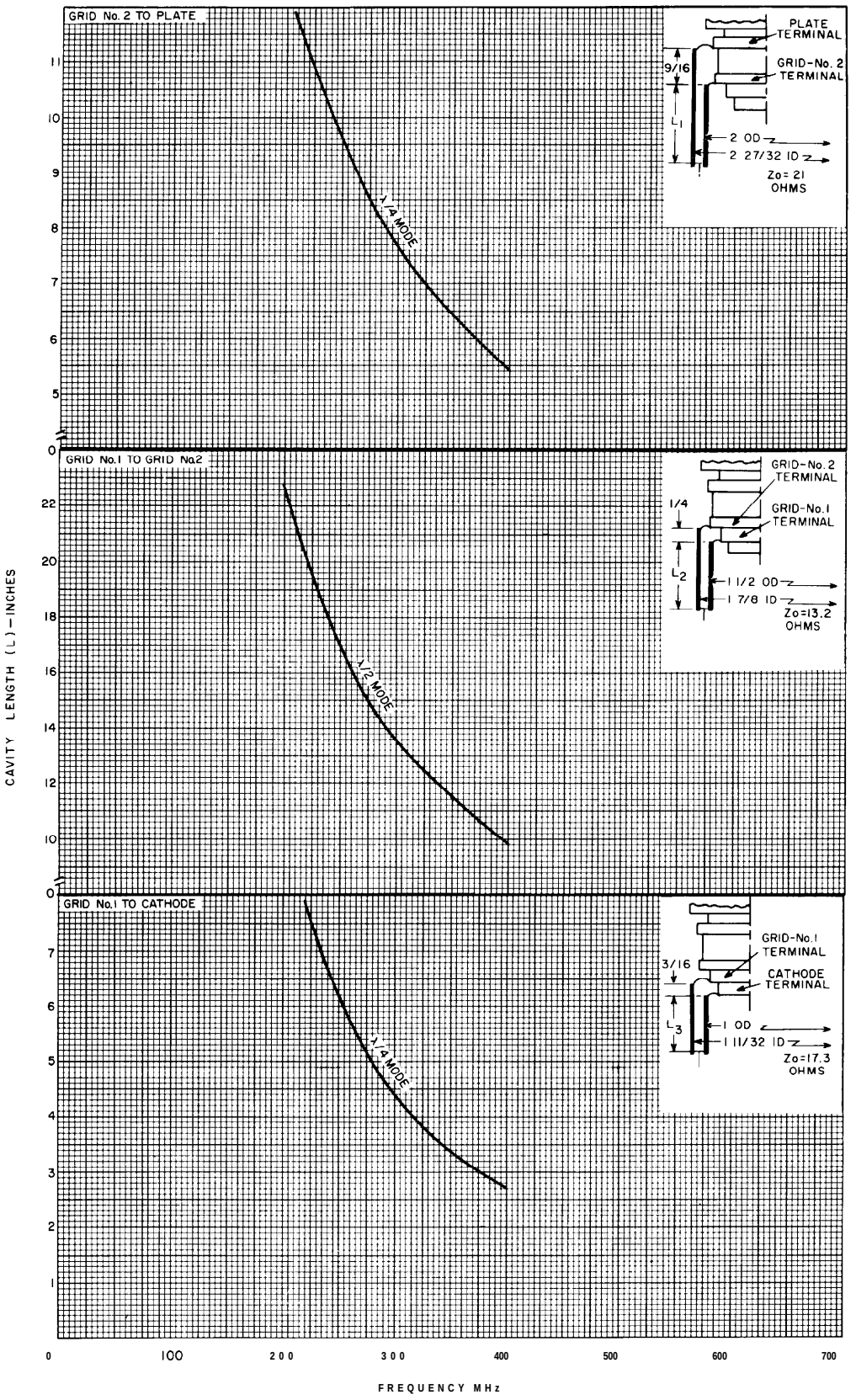


Figure 4 - Electrode Cavity Tuning Characteristics

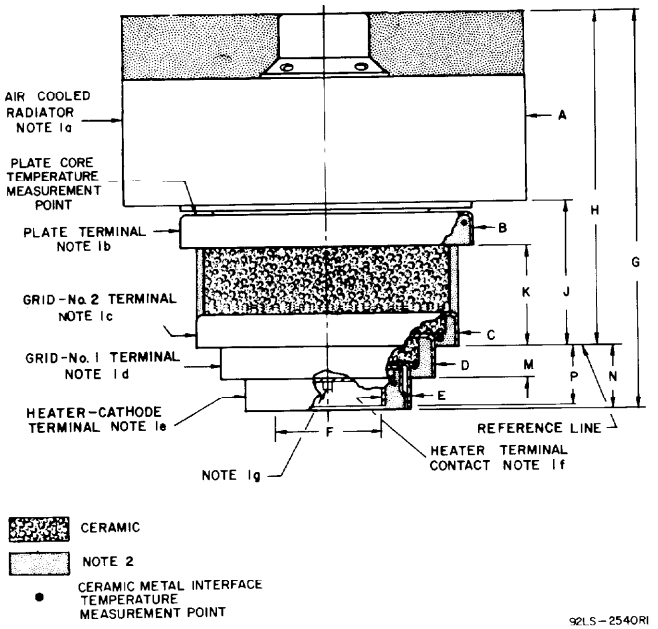


Figure 5 - Dimensional Outline

Tabulated Dimensions*

Dimension	Value		
A Dia.	64.0	(2.52)	Max.
B Dia.	44.32	(1.745)	Min.
C Dia.	40.38	(1.590)	Min.
D Dia.	32.76	(1.290)	Min.
E Dia.	25.14	(0.99)	Min.
F Dia.	17.02	(0.67)	Max.
G	62.0	(2.44)	Max.
H	50.29 ± 1.01	(1.98 ± .04)	
J	21.08 ± .88	(0.830 ± .035)	
K	14.61 ± .63	(0.575 ± .025)	
M	5.08 ± .51	(0.20 ± .02)	
N	10.16 ± .51	(0.40 ± .02)	
P	9.78 ± .63	(0.385 ± .025)	

Note 1 - The contact distance* listed is the indicated, uniform length as measured from the edge of the terminal.

Note	Element	Contact Distance
1a	Radiator	18.5 (0.730) min.
1b	Plate Terminal	3.68 (0.145) min.
1c	Grid-No.2 Terminal	3.81 (0.150) min.
1d	Grid-No. 1 Terminal	4.57 (0.180) min.
1e	Heater-Cathode Terminal	4.06 (0.160) min.
1f	Heater Terminal	2.92 (0.115) max.
1g	Pin	

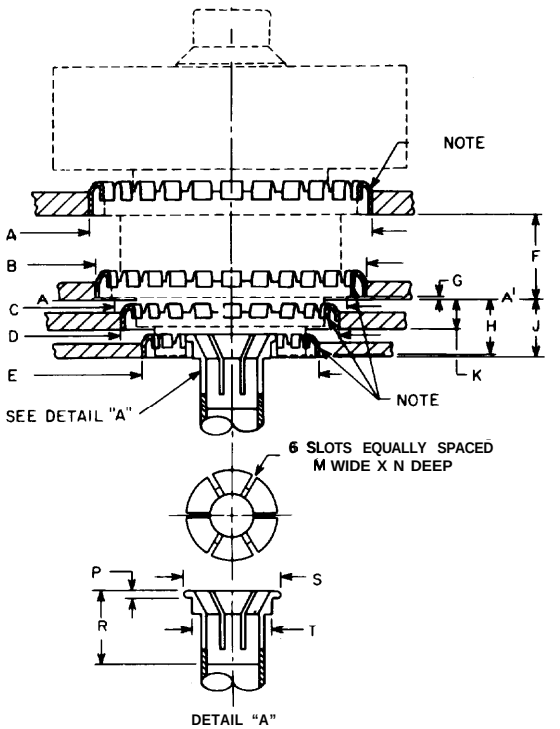
Note 2 - Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular volumes. Diameters of stippled areas above air-cooled radiator, plate terminal contact surface and grid No.2 terminal contact surface shall not be greater than its associated diameter.

* Dimensionsin millimeters. Dimensionsin parentheses are in inches.

Mounting

See the preferred mounting arrangement below. Special sockets are available in production quantities from Jettron Products Incorporated, 65 Route 10, P.O. Box 337, East Hanover, NJ 07938.

Supplier	Part Number
Jettron	CD-89-083



Note - Contact Strip No.97-360A as made by Instrument Specialities Co., P.O. Box A, Delaware Water Gap, PA 18327.

Figure 6 - Preferred Mounting Arrangement and Layout of Associated Contacts

Tabulated Dimensions*

Dimension	Value	
A Dia.	49.225 ± ,025	(1.938 ± .001)
B Dia.	44.348 ± .025	(1.746 ± .001)
C Dia.	39.370 ± .025	(1.550 ± .001)
D Dia.	36.779 ± .025	(1.448 ± .001)
E Dia.	29.159 ± .025	(1.148 ± .001)
F	15.01 ± .13	(0.591 ± .005)
G	1.02 ± .13	(0.040 ± .005)
H	9.78 ± .13	(0.385 ± .005)
J	10.16 ± .13	(0.400 ± .005)
K	4.67 ± .13	(0.184 ± .005)
M	0.51 ± .25	(0.020 ± .010)
N	10.16 ± .13	(0.400 ± .005)
P	1.27 ± .13	(0.050 ± .005)
R	12.70 ± .13	(0.500 ± .005)
S Dia.	17.018 ± .025	(0.670 ± .001)
T Dia.	14.35 ± .13	(0.565 ± .005)