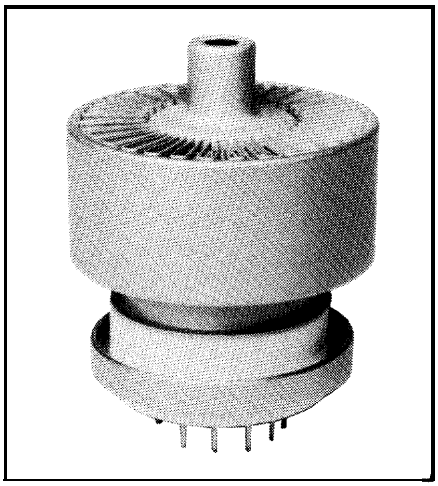
4662
Power Tube



Linear Beam Power Tube

- **Ruggedized**
- **Full Ratings to 500 MHz**
- **300 W CW Output @ 470 MHz**
- **380 W PEP Output @ 30 MHz**
- **Forced-Air Cooled**
- **Ceramic-Metal Seals**
- **Coaxial Electrodes**

The BURLE 4662 is a compact beam power tube designed for use as a linear RF amplifier in applications requiring dependable performance under stringent environmental conditions.

This type is rated for single sideband operation, as an RF amplifier or oscillator in Class C telegraphy or Class C FM telephony, and as an anode-modulated amplifier for Class C telephony. It can be used as a regulator or in distributed amplifier service.

The 4662 features a light weight, cantilever-supported, cylindrical electrode structure within a ceramic-metal envelope. It employs an internal ceramic pin to maintain accurate electrode alignment and spacing when the tube is subjected to mechanical shocks and vibration. To assure compliance with reliability specifications, tube samples are subjected to prescribed shock and vibration tests.

The terminal arrangement of the 4662 facilitates use of the tube with coaxial or strip-line tank circuits. Effective isolation of the output circuit from the input circuit is provided at the higher frequencies by a low-inductance ring terminal for grid-No.2. Base-pin termination for grid-No.2 is also accessible for operating the 4662 at the lower frequencies.

The tripod arrangement of the leads for both the cathode and grid-No.1 enhance electrical characteristics by shortening the inductance path to RF ground and reduce input admittance at high frequencies. The three grid-No.1 contact pins accommodate a split-input circuit for distributed amplifier service.

This data sheet gives application information unique to the BURLE 4662. 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, for Unipotential Cathode:		
Voltage (AC or DC)[1]	13.5 ± 10%	V
Current at 13.5 volts	1.3	A
Minimum heating time	60	s
Mu-Factor, (Grid No.2 to grid No.I)[2]	12	
Direct Interelectrode Capacitances[3] :		
Grid No.1 to anode	0.15 max.	pF
Grid No.1 to cathode	16.3	pF
Anode to cathode	0.01	pF
Grid No.1 to grid No.2	23.3	pF
Grid No.2 to anode	7.0	pF
Grid No.2 to cathode	2.7	pF
Cathode to heater	3.3	pF

BURLE Electron Tubes

General Data (Contd)

Mechanical

Operating Position	Any
Maximum Overall Length	2.26"
Seated Length	1.920"± 0.065"
Greatest Diameter	1.625"± 0.015"
Base	Large-Wafer Elevenar 11-Pin with Ring (JEDEC No. E11-81)
Socket	Jettro[6] @ No. CD77-030, Johnson[4] No. 124-311-100, Erie[5] No. 9813-000, or equivalent
Grid No.2 Bypass Capacitor	Johnson[4] No. 124-0113-001, Erie[5] No. 9812-000, or equivalent
Weight (Approx.)	3.5 oz

Thermal

Terminal Temperature (Ail terminals)	250	max.	°C
Radiator Core Temperature (See Dimensional Outline)	250	max.	°C

Air Flow:

See Figure 5 - Typical Cooling Requirements.

Linear RF Power Amplifier
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 500 MHz	
DC Anode Voltage	2200	V
DC Grid-No.2 Voltage	400	v
DC Grid-No.1 Voltage	-100	v
DC Anode Current at Peak of Envelope	450[7]	mA
DC Grid-No.1 Current	100	mA
Anode Dissipation	400	W
Grid-No.2 Dissipation	8	W
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	150	V
Heater positive with respect to cathode	150	V

Maximum Circuit Values

Grid-No.1 Circuit Resistance Under Any Condition[8]:		
With fixed bias	25,000	ohms
With fixed bias (in Class AB, operation).	100,000	ohms
With cathode bias	Not Recommended	
Grid-No.2 Circuit Impedance[9]	10,000	ohms
Anode Circuit Impedancel[10]	See Note 11	

Typical CCS Operation at 30 MHz with "Two-Tone Modulation"

	AB_1	
DC Anode Voltage	2000	v
DC Grid-No.2 Voltage	400	v
DC Grid-No.1 Voltage	-35	v
Zero-Signal DC Anode Current	100	mA
Effective RF Load Resistance	3050	ohms
DC Anode Current at Peak of Envelope	335	mA
Average DC Anode Current	250	mA
DC Grid-No.2 Current at Peak of Envelope	10	mA
Average DC Grid-No.2 Current		mA
DC Grid-No.1 Current **at** Peak of Envelope	0.05[12]	mA
Peak-Envelope Driver Power Output (Approx.)	0.3	W
Output-Circuit Efficiency (Approx.)	90	%

Distortion Products Level:

Third order	29[13]	dB
Fifth order	32	dB

Useful Power Output (Approx.):

Average	190	W
Peak envelope	380	W

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

Maximum CCS Ratings, Absolute-Maximum Values

	Up to 500 MHz	
DC Anode Voltage	2200	V
DC Grid-No.2 Voltage	400	V
DC Grid-No.1 Voltage	-100	V
DC Anode Current..	300	mA
DC Grid-No.1 Current	100	mA
Grid-No.2 Dissipation	8	W
Anode Dissipation	400	W
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode	150	V
Heater positive with respect to cathode	150	V

Maximum Circuit Values

Grid-No.1 Circuit Resistance Under Any Condition:		
With fixed bias	25,000	ohms
Grid-No.2 Circuit impedance	10,000	ohms
Anode Circuit impedance	See Note 11	

Typical CCS Operation

in Grid-Drive Circuit at 50 MHz					
DC Anode Voltage	700	1000	1500	2000	V
DC Grid-No.2 Voltage	175	200	200	200	V
DC Grid-No.1 Voltage	-10	-30	-30	-30	V
DC Anode Current..	300	300	300	300	mA
DC Grid-No.2 Current	25	20	20	20	mA
DC Grid-No.1 Current	50	40	40	30	mA
Driver Power Output (Approx.)	1.2	2	2	2	W
Useful Power Output..	120	175	275	375	W
in Grid-Drive Circuit at 470 MHz					
DC Anode Voltage	700	1000	1500	2000	V
DC Grid-No.2 Voltage	200	200	200	200	V
DC Grid-No.1 Voltage	-30	-30	-30	-30	V
DC Anode Current..	300	300	300	300	mA
DC Grid-No.2 Current	10	10	5	5	mA
DC Grid-No.1 Current	30	30	30	30	mA
Driver Power Output (Approx.)	5	5	5	5	W
Useful Power Output..	100	165	235	300	W

Anode-Modulated RF Power Amplifier - Class C Telephony

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

MaxImum CCS Ratings, Absolute-Maximum Values

	Up to 500 MHz	
DC Anode Voltage	1800	V
DC Grid-No.2 Voltage	400	V
DC Grid-No. 1 Voltage	-100	V
DC Anode Current..	250	mA
DC Grid-No.1 Current	100	mA
Grid-No.2 input	5	W
Anode Dissipation	280	W

Characteristics Range Values

	Min.	Max.	
Heater Current[14]	1.15	1.45	A
Direct Interelectrode Capacitances:[3]			
Grid No.1 to anode	-	0.15	pF
Grid No.1 to cathode	14.6	18.0	pF
Anode to cathode	0.004	0.016	pF
Grid No.1 to grid No.2	20.0	26.5	pF
Grid No.2 to anode	6.3	7.7	pF
Grid No.2 to cathode	2.1	3.3	pF
Cathode to heater	2.5	4.1	pF
Grid-No.1 Voltage[14,15]	-19	-10	V
Interelectrode Leakage Resistance[16]	50	-	Mohms
Zero Bias Anode Current[14,17]	1.0	1.8	A

Forced-Air Cooling

Air Flow:

Through Radiator - Adequate air flow to limit the anode-core temperature to 250°C should be delivered by a blower through the radiator before and during the application of heater, anode, grid-No.2 and grid-No.1 voltages.

For an anode dissipation of 310 watts, approximately four and one half cubic feet of air per minute at an incoming temperature of 24 °C is required in accordance with the air flow characteristics as shown in **Figure 5.**

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

For further information on forced-air cooling, see TP-105 and TP-118.

1. In operation, as frequency is increased, cathode temperature increases due to electron back-bombardment. For optimum life, heater voltage should be reduced to a value just above that at which tube performance begins to degrade; e.g., at 470 MHz, optimum heater voltage equals approximately 12.5 V.
2. For anode voltage = 450 V
   Grid-No.2 voltage = 325 V
   Anode current = 1.2 A
3. Measured with special shield adapter.
4. E. F. Johnson Co., 299 Johnson Ave., Waseca, MN 56093.
5. Erie Specialty Products, 645 W. 11th St., Erie, PA 16512.
6. Jettron Products, Inc., 65 Route 10, P.O. Box 337, East Hanover, NJ 07938.
7. 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 300 mA. During short periods of circuit adjustment under "Single-Tone" conditions, the average anode current may be as high as 450 mA.
8. A fault current limiting resistor of no less than 20 ohms is to be used between the bias supply output filter capacitance and the tube grid-No.1. The bias supply output filter capacitance is to be no greater than 150 uF.
9. A fault current limiting resistor of no less than 320 ohms is to be used between the screen output filter capacitance and the tube screen. The screen supply output filter capacitance is to be no greater than 80 uF.
10. The tube shall see an effective anode-supply impedance of no less than 750 ohms. A fault current limiting resistor of no less than 15 ohms is to be used between the output filter capacitance and the tube anode. The anode-supply-output-filter capacitance is to be no greater than 10 uF.
11. The tube should see an effective anode supply impedance which limits the peak current through the tube under surge conditions to 15 amperes.
12. This value represents the approximate grid-No. 1 current obtained due to initial electron velocities and contact-potential effects when grid No.1 is driven to zero volts at maximum signal.
13. The value of third order distortion product level shown may be improved by approximately 5 dB by utilizing an unbypassed, non-inductive 20-ohm resistor between the cathode and ground; a slight increase in drive power will be required.
14. With 13.5 volts AC or DC on heater.
15. With DC plate voltage at 700 volts, DC grid-No.2 voltage of 250 volts, and DC grid-No.1 voltage adjusted to give a DC anode current of 185 mA.
16. 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 as measured with a 200-volt Megger-type ohmmeter having an internal impedance of 1 .0 megohm, will be no less than the value specified.
17. With DC anode voltage of 450 volts, DC grid No.2 voltage of 400 volts, DC grid No.1 voltage of -100 volts, grid drive voltage to zero. With pulse duration of 4500 to 5000 us and pulse repetition frequency is 10 to 12 pps.

Warning - Personal Safety Hazards

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

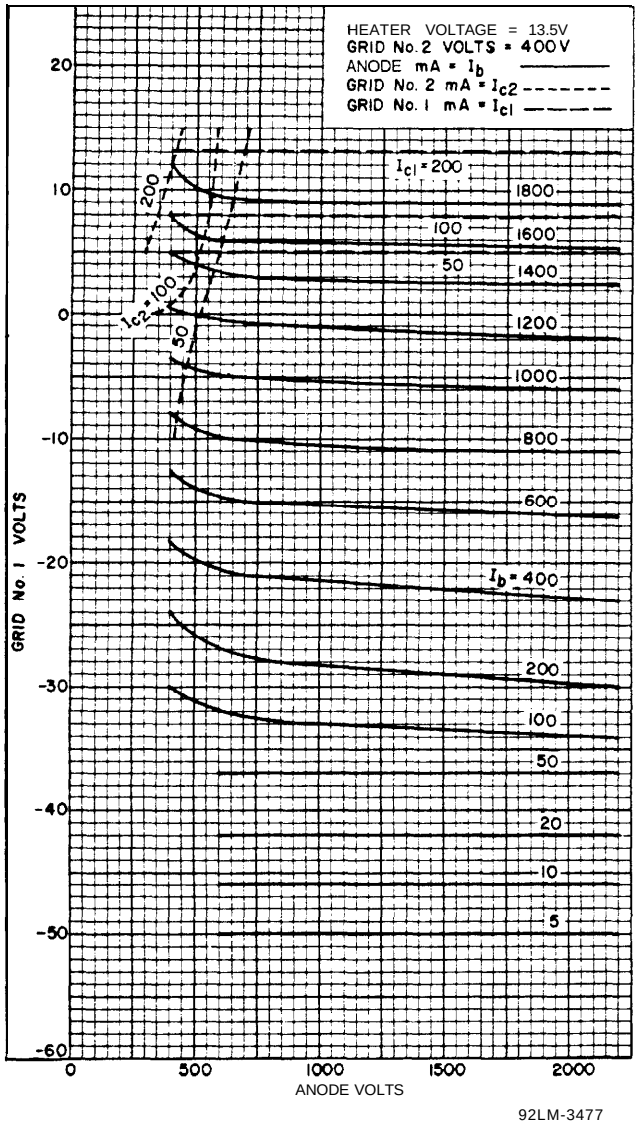


Figure 1 - Typical Constant-Current Characteristics

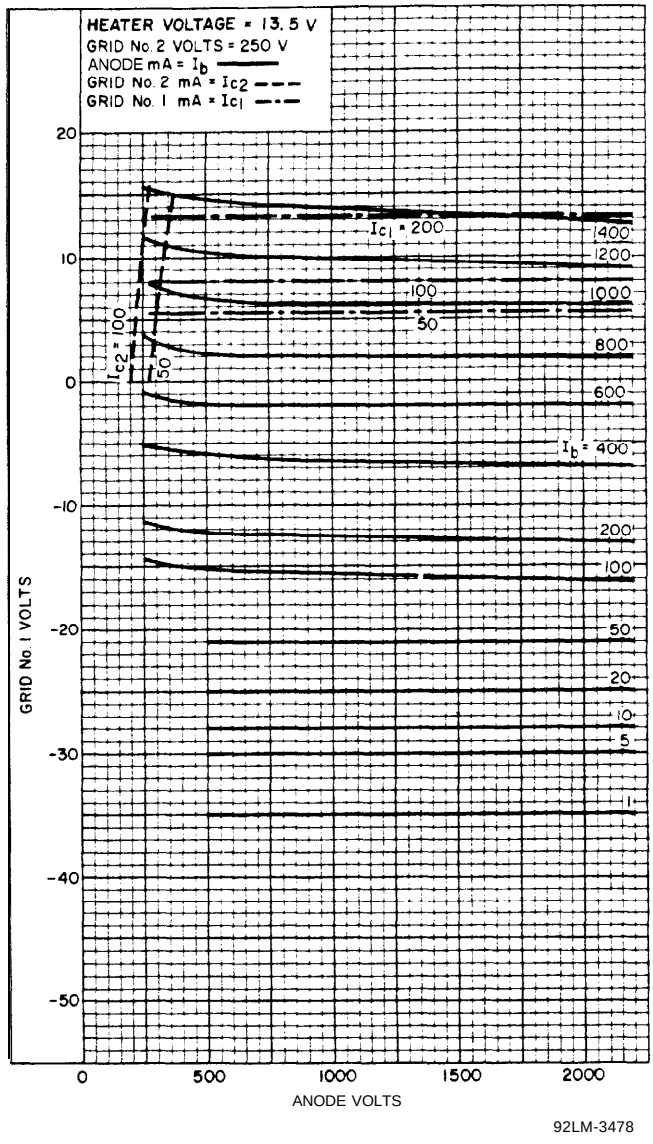


Figure 2 - Typical Constant-Current Characteristics

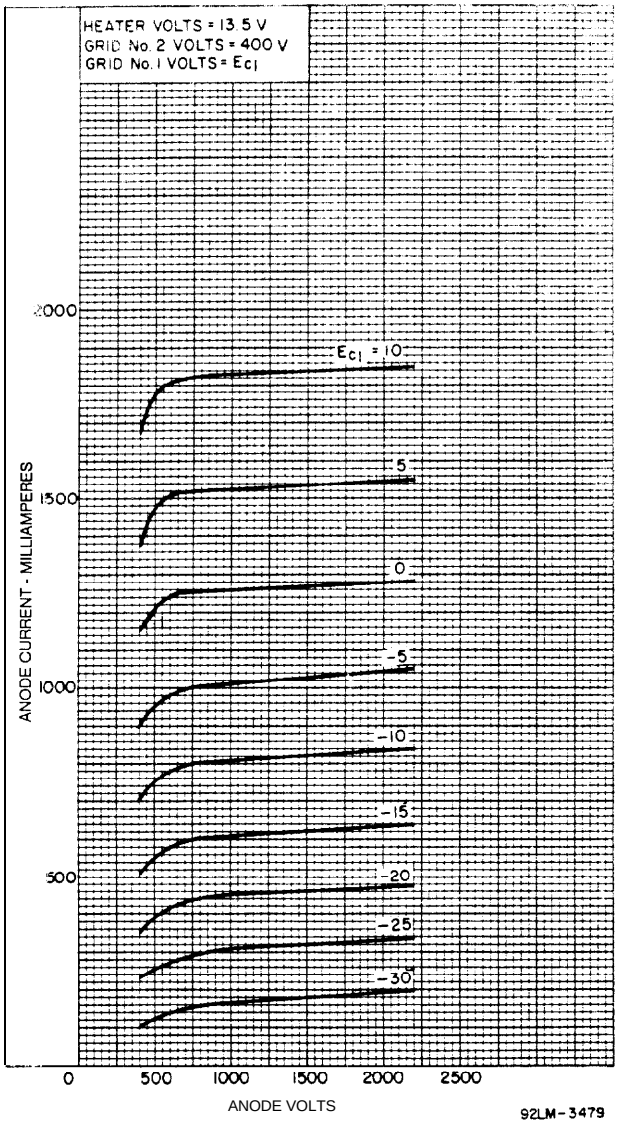


Figure 3 - Typical Anode Characteristics

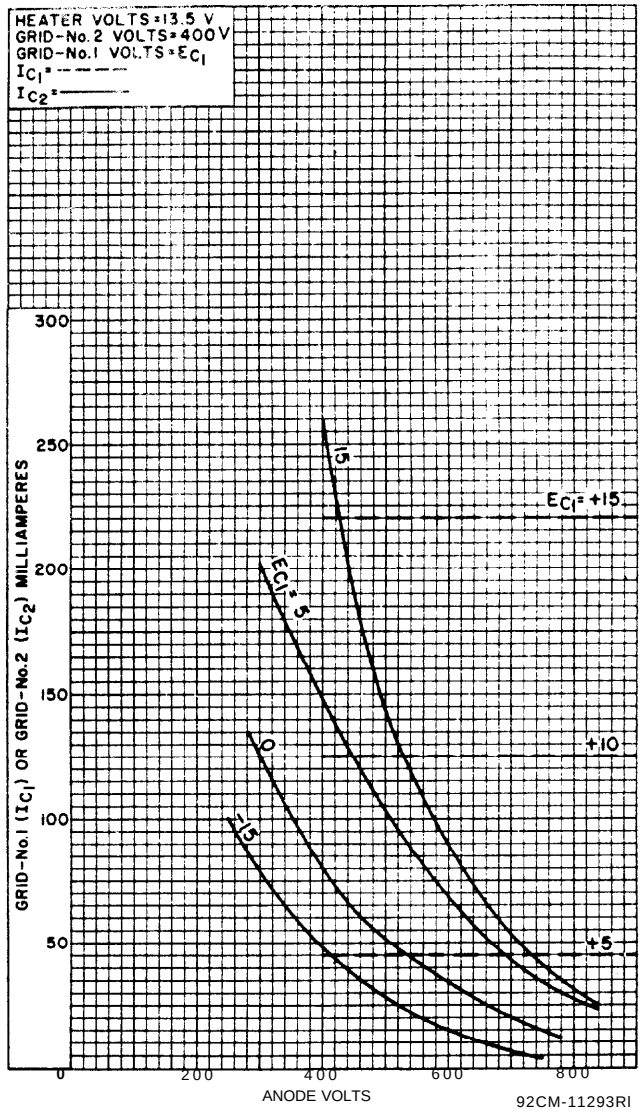


Figure 4 - Typical Grid Characteristics

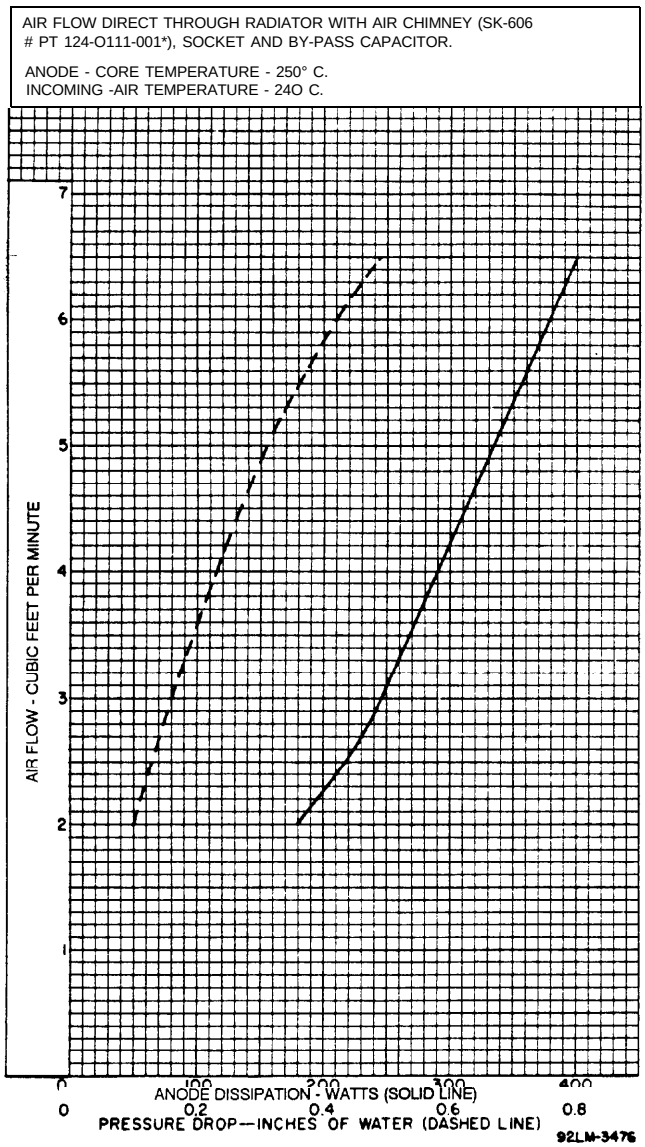


Figure 5 - Typical Cooling Requirements

#May be obtained through Eitel McCullough, Inc., San Carlos, CA 94070

* May be obtained through EF Johnson Co., 299 Johnson Ave., Waseca, MN 56093

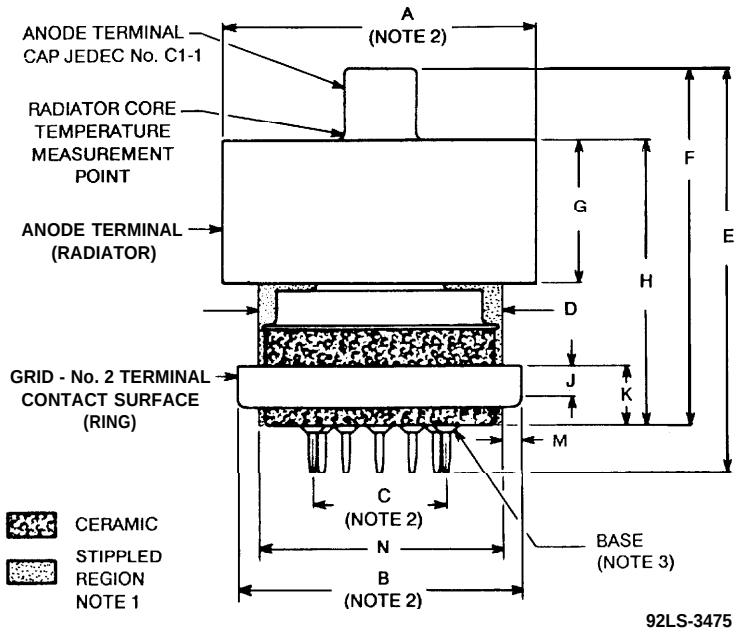


Figure 6 - Dimensional Outline

Tabulated Dimensions

	Millimeters	inches
A Dia.	41.28 ± .38	1.625 ± .015
B Dia.	36.22 ± .25	1.426 ± ,010
C Dia.	17.45 ref.	0.687 ref.
D Dia.	31.75 max.	1.25 max.
E	57.40 max.	2.26 max.
F	48.8 ± 1.7	1.920 ± .065
G	19.0 ± 1.0	0.750 ± .040
H	38.5: 1.1	1.515 ± .045
J	3.81 min.	0.150 min.
K	7.62 + .51	0.300 ± .020
M	2.03 min.	0.080 min.
N	30.48 max.	1.200 max.

Note 1: Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular volumes.

Note 2: The diameters of the radiator, grid-No.2 ring terminal contact, and pin circle shall be concentric within the following values of the maximum full indicator reading:

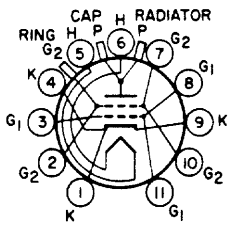
Radiator to Grid-No.2 Terminal Contact Surface ..... 0.030" max.

Radiator to Pin Circle ..... 0.040" max.

Grid-No.2 Terminal Contact Surface to Pin Circle ..... .0.030" max.

The full indicator reading is the deviation of a surface when the tube is rotated about the center of the reference. It is a measure of the total effect of run-out and ellipticity.

Note 3: Base conformsto specification of the Large Wafer, Elevenar, Eleven pin with ring Base No. JEDEC No.E11-81. It may be checked with Gauge JEDEC No.GE11-1.



Cap: Anode Terminal

Radiator: Anode Terminal

Ring: Grid-No.2 Terminal Contact Surface
(For use at higher frequencies)

Figure 7 - Basing Diagram (Bottom View)