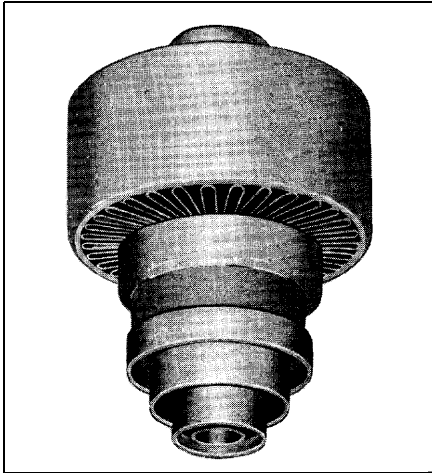


# 4631 Power Tube



## Beam Power Tube

- Cermolox®
- Ruggedized
- Oxide-Coated Cathode
- Forced-Air Cooled
- 80 Watts CW Power Output  
at 400 MHz
- 40 Watts CW Power Output  
at 1215 MHz

BURLE 4631 is a compact, forced-air cooled uhf beam power tube designed for applications in which dependable performance under severe shock and vibration is essential. For that reason, the tube is built with an axial ceramic pin which rigidly holds grid No. 1, grid No. 2, and cathode in fixed positions with respect to each other. The tube features Cermolox construction, a uni-potential, oxide-coated cathode, and an integral radiator.

To assure compliance with the environmental requirements, sample tubes are subjected to 50 g-11 millisecond and 500 g-3/4 millisecond shock tests and to vibration frequencies between 5 and 2000 Hertz at up to 10 g.

The tube is rated for full input up to 1215 MHz as a linear RF power amplifier in single-sideband, suppressed-carrier service, as an RF power amplifier and oscillator in telegraphy service, and as an RF power amplifier in FM telephony service. The 4631 may also be useful in a variety of other applications such as frequency multipliers, linear RF power amplifiers (AM or television), pulse modulators, pulsed RF amplifiers, regulators, or other special services.

This data sheet gives application information unique to the BURLE 4631. 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 17601-5688.

### General Data

#### Electrical

Heater for Matrix-Type, Oxide-Coated, Unipotential Cathode:		
Voltage (ac or dc) .....	26.5 ± 10%	V
Current at 26.5 volts .....	0.54	A
Minimum heating time .....	120	S
Mu-Factor, grid No. 2 to grid No. 1 .....	18	
Direct Interelectrode Capacitances <sup>1</sup> :		
Grid No. 1 to anode .....	0.078 max.	pF
Grid No. 1 to cathode & heater .....	14.8	pF
Anode to cathode & heater .....	0.019 max.	pF
Grid No. 1 to grid No. 2 .....	18.8	pF
Grid No. 2 to anode .....	4.7	pF
Grid No. 2 to cathode & heater .....	1.30 max.	pF

#### Mechanical

Operating Position .....	Any
Overall Length .....	(57.66 mm) 2.270 in
Greatest Diameter .....	(41.66 mm) 1.640 in
Terminal Connections .....	See Dimensional Outline
Radiator .....	Integral part of tube
Weight (Approx.) .....	(0.06 kg) 2.0 oz
For operation up to 400 MHz, Socket including grid No. 2	
Bypass Capacitor .....	Erie <sup>2</sup> 9819-000, or equivalent
Grid No. 2 Bypass	
Capacitor .....	Erie <sup>2</sup> 2926-000, 2929-001, or equivalent
For operation at high frequencies .....	
	See Preferred <b>Mounting Arrangement</b>

#### 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		

## Characteristics Range Values

	Min.	Max.	
Heater Current <sup>3</sup> .....	0.48	0.60	A
Direct Interelectrode Capacitances			
Grid No. 1 to anode <sup>1</sup> .....	-	<b>0.078</b>	pF
Grid No. 1 to cathode & heater <sup>1</sup> .....	13.1	16.5	
Anode to cathode & heater <sup>1</sup> .....	-	0.019	pF
Grid No. 1 to grid No. 2 <sup>1</sup> .....	16.6	21.0	pF
Grid No. 2 to anode <sup>1</sup> .....	4.2	5.2	pF
Grid No. 2 to cathode & heater <sup>1</sup> .....	-	1.30	pF
Grid No. 1 Voltage <sup>3,4</sup> .....	-10	-17.5	V
Grid No. 2 Current <sup>3,4</sup> .....	-8	+2.0	mA
Interelectrode Leakage			
Resistance <sup>5</sup> .....	1.0	-	Mohm
Useful Power Outputs .....	80	-	W

## Anode-Modulated RF Power Amplifier - 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	V
DC Grid No. 2 Voltage .....	300	V
DC Grid No. 1 Voltage .....	-100	V
DC Anode Current .....	200	mA
DC Grid No. 1 Current .....	30	mA
Grid No. 2 Input .....	3	W
Anode Dissipation .....	100	W

### Maximum Circuit Values

#### Grid No. 1 Circuit Resistance

Class AB <sub>2</sub> .....	10000	ohms
Class AB <sub>1</sub> .....	1000	ohms

### Typical CCS Operation

	At 400 MHz	
DC Anode Voltage .....	400	<b>700</b> V
DC Grid No. 2 Voltage .....	200	250 V
DC Grid No. 1 Voltage .....	-20	-50 V
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 W
Useful Power Output (Approx.) .....	16	45 W

## RF Power Amplifier & Oscillator - Telegraphy and RF Power Amplifier - FM Telephony

### Maximum CCS Ratings, Absolute-Maximum Values

	Up to 1215 MHz	
DC Anode Voltage .....	1000	V
DC Grid No. 2 Voltage .....	300	V
DC Grid No. 1 Voltage .....	-100	V
DC Anode Current .....	200	mA
DC Grid No. 1 Current <sup>1</sup> .....	30	mA
Grid No. 2 Input .....	4.5	W
Anode Dissipation .....	150	W

### Maximum Circuit Values

#### Grid No. 1 Circuit Resistance

Class AB <sub>2</sub> .....	10000	ohms
Class AB <sub>1</sub> .....	1000	ohms

## Typical CCS Operation

	At 400 MHz		At 1215 MHz	
DC Anode Voltage .....	<b>400</b>	<b>900</b>	<b>900</b>	V
DC Grid No. 2 Voltage .....	<b>200</b>	<b>300</b>	<b>300</b>	V
DC Grid No. 1 Voltage .....	-35	<b>-30</b>	<b>-22</b>	V
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	<b>3</b>	<b>5</b>	W
Useful Power Output (Approx.) ....	23	80	<b>40</b>	W

## 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 1215 MHz	
DC Anode Voltage .....	1000	V
DC Grid No. 2 Voltage .....	300	V
DC Grid No. 1 Voltage .....	-100	V
DC Anode Current at Peak of Envelope <sup>8</sup> .....	250	mA
DC Grid No.1 Current .....	30	mA
Grid No. 2 Input .....	4.5	W
Anode Dissipation .....	150	W

### Maximum Circuit Values

#### Grid No. 1 Circuit Resistance

With fixed bias, Class AB, .....	1000	ohms
With cathode bias .....	Not recommended	

Grid No. 2 Circuit Impedance .....

### Typical CCS Operation with "Two-Tone" Modulation

	At 30 MHz	
DC Anode Voltage .....	650	850 V
DC Grid No. 2 Voltage .....	300	300 V
DC Grid No. 1 Voltage .....	-18.5	-18.5 V
Zero-Signal DC Anode Current .....	40	40 mA
Effective RF Load Resistance .....	2200	3500 ohm
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 W
Output-Circuit Efficiency (Approx.) .....	90	90 %
Distortion Products Level:		
Third Order .....	35	30 dB
Fifth Order .....	40	36 dB
Useful Power Output (Approx.) :		
Average .....	12.5	20 W
Peak Envelope .....	25	40 W

### Warning - Personal Safety Hazards

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

**Footnotes For General Data, Characteristics Range Values, And Typical Ratings**

1. Measured with special shield adapter.
2. Erie Specialty Products, Inc., 645 West 11th Street, Erie, PA 16512.
3. With 26.5 volts ac or dc on heater.
4. 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.
5. With tube at 20° to 30° for at least 30 minutes without any voltages applied to the tube. The minimum resistance between any two adjacent electrodes except heater-cathode as measured with 200-volt Megger-type ohmmeter having an internal impedance of 1.0 megohm, will exceed the value specified.

6. 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 adjustable for dc anode current of 180 mA maximum, dc grid No. 1 current of 30 mA maximum and driver power output of 3 watts maximum.
7. In applications where the frequency is less than 80 MHz and the bias is less than -50 volts, the maximum value is 40 mA.
8. 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. During short periods of circuit adjustment under "Single-Tone" conditions, the average anode current may be as high as 250 mA.

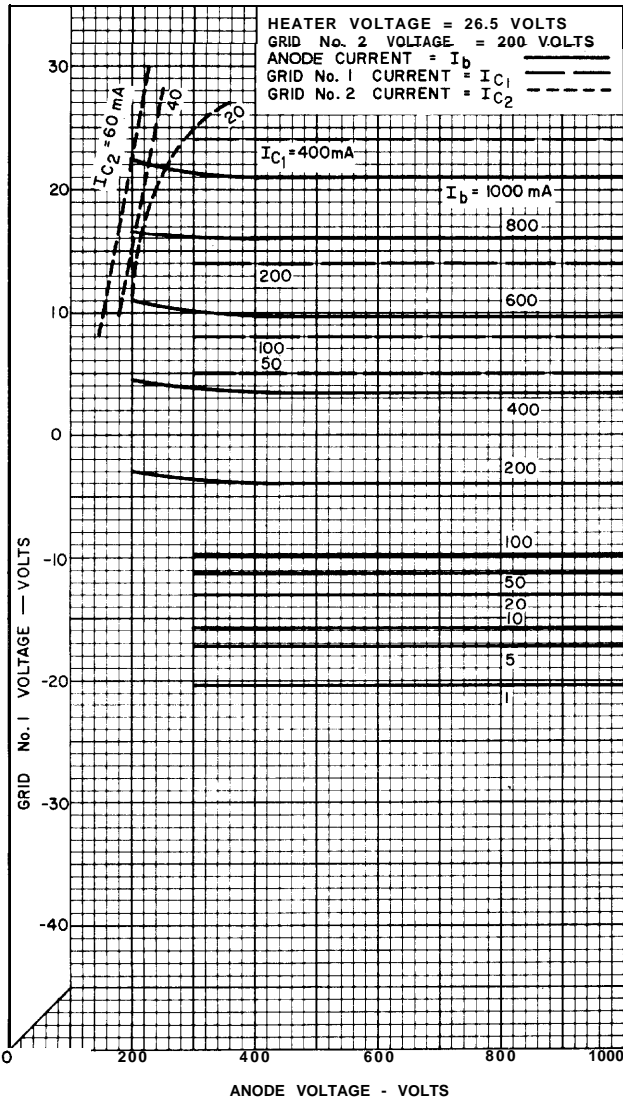


Figure 1 - Typical Constant-Current Characteristics With Grid No. 2 Volts = 200

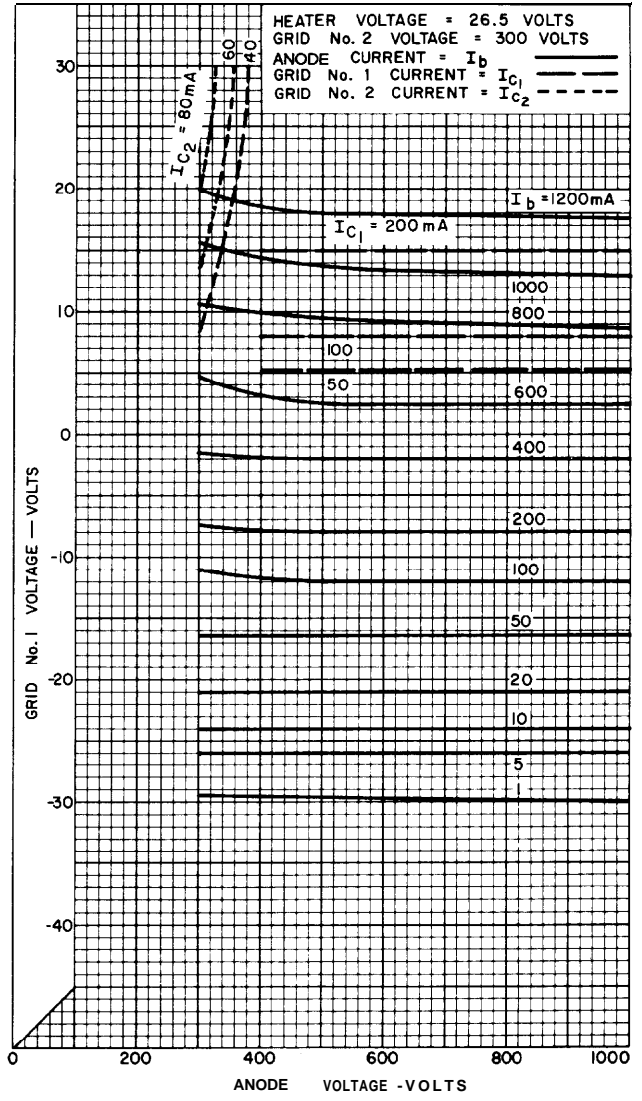
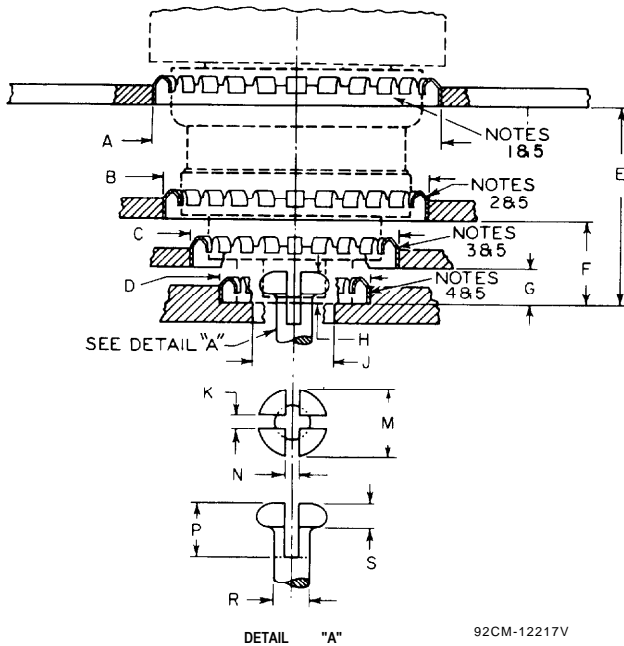


Figure 2 - Typical Constant-Current Characteristics With Grid No. 2 Volts = 300



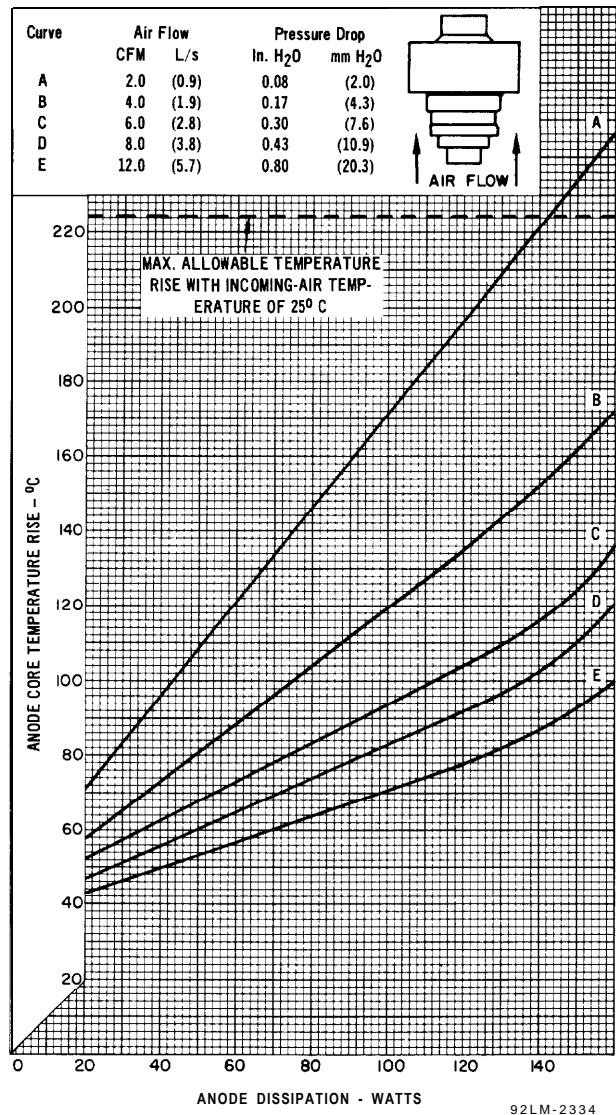
**Tabulated Dimensions\***

Dimensions	Value
A	1.250 ± .001 (31.75 ± .03) Dia.
B	1.155 ± .001 (29.34 ± .03) Dia.
C	0.905 ± .001 (22.99 ± .03) Dia.
D	0.650 ± .001 (16.51 ± .03) Dia.
E	0.850 ± .005 (21.59 ± .13)
F	0.380 ± .005 (9.14 ± .13)
G	0.145 ± .005 (3.68 ± .13)
H	0.146 ± .005 (3.56 ± .13)
J	0.350 ± .001 (8.89 ± .03) Dia.
K	0.051 (1.30)
M	0.260 (6.60) Dia.
N	0.051 (1.30)
P	0.265 ± .005 ( 6.73 ± .13)
R	0.156 ± .001 ( 3.96 ± .03) Dia.
S	0.126 ± .005 (3.20 ± .13)

• Dimensions are in inches unless otherwise stated. Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions (1 inch = 25.4 mm).

- Note 1:** Contact ring No. 97-252 or finger stock No. 97-380.
- Note 2:** Contact ring No. 97-253 or finger stock No. 97-380.
- Note 3:** Contact ring No. 97-254 or finger stock No. 97-380.
- Note 4:** Contact ring No. 97-255 or finger stock No. 97-380.
- Note 5:** Either the specified contact ring of preformed finger stock or finger stock No. 97-380 provide adequate electrical contact, but the finger stock No. 97-380 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 3 - Preferred Mounting Arrangement and Layout of Associated Contacts**



**Figure 4 - Typical Cooling Requirements**

**Forced-Air Cooling**

**Air Flow**

Through radiator - Adequate air flow to limit the radiator core temperature to 250 °C should be delivered by a blower across the radiator before and during the application of anode, grid No. 2, and grid No. 1 voltages. Typical values of air flow directed through the radiator versus anode dissipation are shown in the graph under **Typical Cooling Requirements**.

To Anode, grid No. 2, grid No. 1, Cathode, and Heater Terminals - A sufficient quantity of air should flow across each of these terminals so that their temperature does not exceed the specified maximum value of 250 °C.

During Standby Operation - Cooling air is not normally required when only heater voltage is applied to the tube.

Anode power, grid No. 2 power, heater power, and air flow may be removed simultaneously.

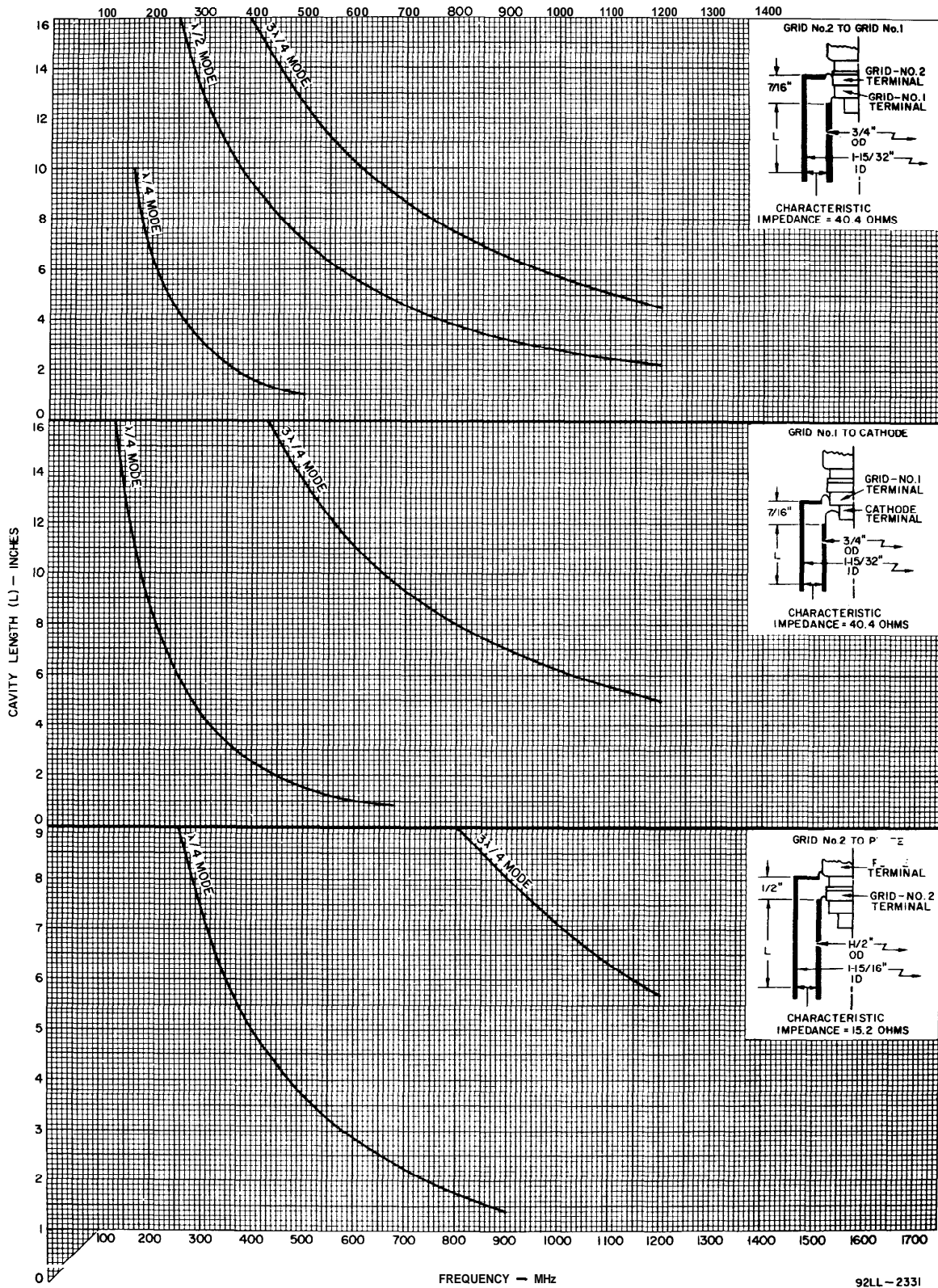
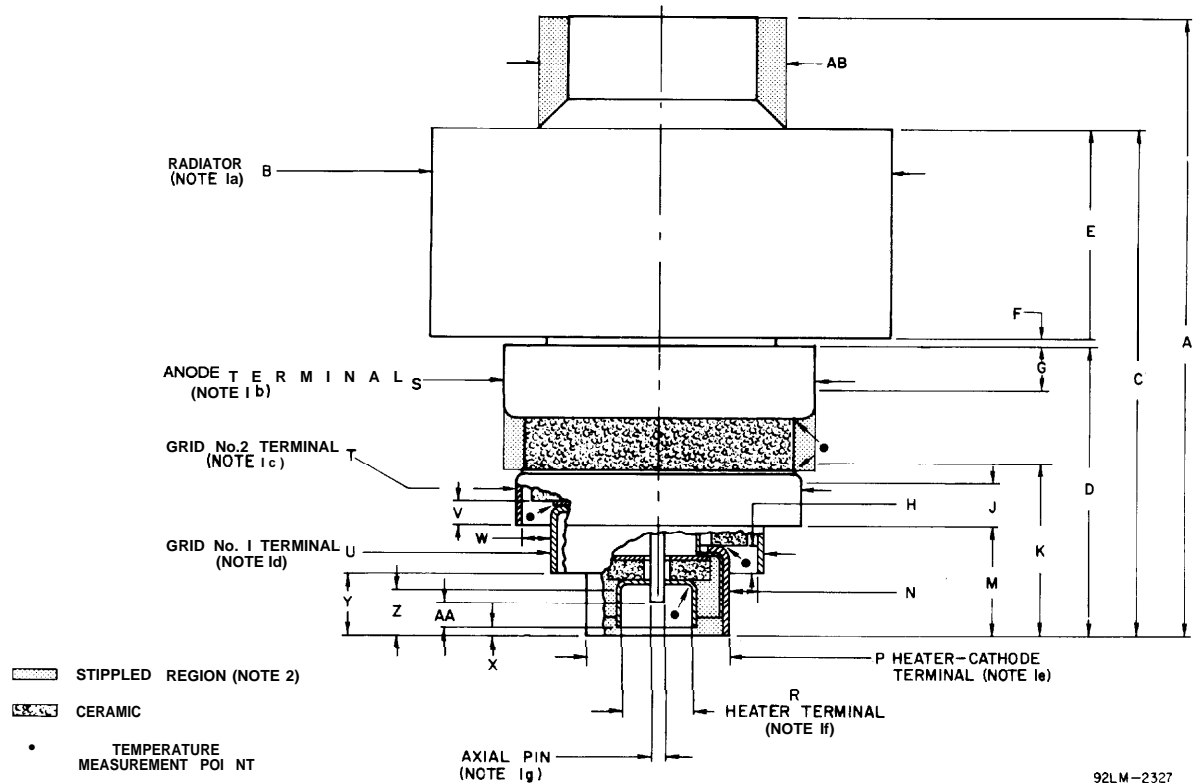


Figure 5 • Typical Tuning Characteristics



**Tabulated Dimensions\***

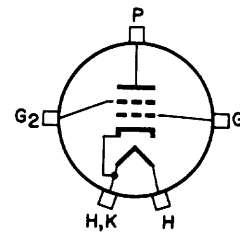
Dimension	Value
A	2.270 (57.66) Max.
B	1.625 ± .015 (41.28 ± .38) Dia. Max.
C	1.840 ± .032 (46.74 ± .81)
D	1.030 ± .030 (26.16 ± .76)
E	0.750 ± .015 (19.05 ± .38)
F	0.030 (0.76) Min.
G	0.165 (4.19) Min.
H	0.120 (3.05) Min.
J	0.140 (356) Min.
K	0.600 (15.24) Min.
M	0.370 ± .020 (9.40 ± .51)
N	0.095 (2.14) Min.
P	0.480 (12.19) Dia. Min.
R	0.260 (6.60) Dia. Max.
S	1.085 (27.56) Dia. Min.
T	0.985 (25.02) Dia. Min.
U	0.735 (18.67) Dia. Min.
V	0.060 (1.52) Min.
W	0.090 (2.29) Min.
X	0.025 ± .025 (0.64 ± .64)
Y	0.175 ± .015 (4.45 ± .38)
Z	0.100 (2.54) Min.
AA	0.054 (1.37) Min.
AB	0.85 (21.6) Dia. Max.

\* Dimensions are in inches unless stated otherwise. Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions (1 inch = 25.4 mm).

**Figure 6 - Dimensional Outline**

- Note 1-** The following diametrical space requirements accommodate the concentricity of the cylindrical surfaces of the radiator fins, axial pin, and each electrode terminal
- a. Radiator Band - 1.690" (42.93)
  - b. Anode Terminal - 1.120" (28.45)
  - c. Grid No. 2 Terminal - 1.020" (25.91)
  - d. Grid No. 1 Terminal - 0.765" (19.43)
  - e. Heater-Cathode Terminal - 0.520" (13.21)
  - f. Heater Terminal - 0.238" (6.05)
  - g. Axial Pin - 0.072" (1.83)

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



See Dimensional Outline for Terminal Connections  
**Figure 7 - Terminal Diagram**