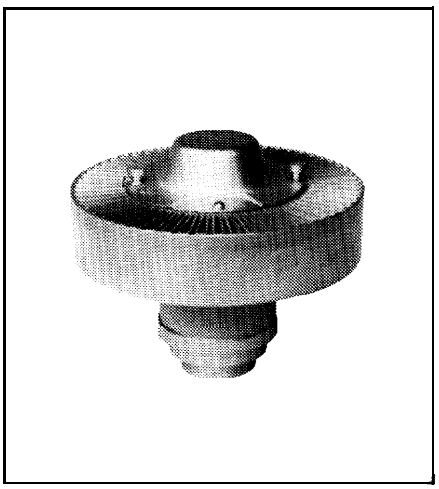
9017
Power Tube



UHF Linear Beam Power Tube

- **Full Input to 860 MHz**
- **Forced Air Cooling**
- **1.1 kW Peak Sync Output**
- **UHF-TV Band**
- **15 dB Gain (Typical)**

The 9017 is designed specifically for use in modern UHF-TV translators and internally diplexed transmitters requiring low third order intermodulation distortion (IMD).

Rated for full input from 470 to 860 MHz, the tube is easily circuited to cover this frequency range. The terminals are coaxial for operation in the TEM mode and the radiator location avoids restricting the resonant cavity circuit in UHF operation. This assures high gain-bandwidth products for the full UHF band.

This new design of a linear tetrode is designed specifically for UHF internally diplexed service. Its high gain CERMOLOX® tube construction and sturdy coaxial electrode alignment assure minimal tube inductance and feed-thru capacitance. The efficient forced-air cooled radiator is designed to minimize blower noise and improve the system reliability and efficiency.

Additional information of a general nature applicable to tubes of this type is given in the following publications:

TP-105 Application Guide for Power Tubes

AN-4020 Screen-Grid Current, Loading and Bleeder Considerations

AN-4865 Handling and Operating Considerations

AN-4872 Broadcast Tube Handling and Installation

AN-4869 Application Guide for Forced-Air Cooling of Power Tubes.

Close attention to the instructions contained in this and the listed publications will assure longer tube life, safer operation, less equipment downtime and fewer tube handling accidents.

General Data

Electrical

Filamentary Cathode - Thoriated-Tungsten Mesh:		
Voltage[1]	5.5	VDC
Current:		
Typical[2]	34	ADC
Maximum surge[3]	70	ADC
Minimum heating time	15	S
Mu-Factor[4] Grid No. 2 to Grid No. 1 (Typ)	8	-
Direct Interelectrode Capacitances:		
Grid No. 1 to plate[5]	0.3	pF
Grid No. 1 to cathode	38	pF
Plate to cathode[5]	0.1	pF
Grid No. 1 to grid No. 2	51	pF
Grid No. 2 to plate	8	pF
Grid No. 2 to cathode[5]	1.1	pF

Mechanical

Operating Attitude	Vertical, Anode Up	
Overall Length (Max.)	4.0	in
Greatest Diameter (Max.)	3.75	in
Radiator	Integral Part of Tube	
Weight	2.0	lbs.

Thermal

Cooling[6]	Forced Air		
Seal Temperature[7] (Plate, Grid-No. 2, Grid-No. 1, Cathode-Filament, Filament)	250	max.	°C
Average Plate-Core Temperature[8]	250	max.	°C

BURLE Electron Tubes

Linear RF Power Amplifier - Class AB1
Combined Visual - Aural Television Service

Absolute-Maximum Ratings - CCS Operation

In accordance with the Absolute Maximum rating system as defined by the Electronic Industries Association standard RS-239A, formulated by the JEDEC Electron Tube Council.

DC Plate Voltage[9]	4500	V
DC Grid No. 2 Voltage[10]	600	V
DC Grid No. 1 Voltage[11]	-100	V
DC Plate Current	1.1	A
Plate Dissipation[12]	3000	W
Grid No. 2 Input	20	W
Grid No. 1 Input	5	W

Typical CCS Operation (In a BURLE Y1400 Cavity)

Frequency	635	635	MHz
Bandwidth -1 dB[13]	8.0	10.0	MHz
Filament Voltage	5.5	5.5	VDC
Filament Current	34	34	ADC
DC Grid No.1 Voltage[14,17]	-40	-40	VDC
DC Grid No. 2 Voltage[17]	450	450	VDC
DC Plate Voltage[17]	4000	4000	VDC
Zero Signal Plate Current	0.5	0.5	ADC
Signal Plate Current[15]	0.80	0.85	ADC
Useful Output Power:			
Synchronizing level[15]	1100	1100	W
Sound[15]	110	110	W
Power Gain	15.6	15.0	dB
Intermodulation Distortion[16]	-54	-54	dB

Notes

1. The typical filament voltage is 5.5 volts DC. The maximum filament voltage, measured at the tube terminals is 6.0 VDC. For maximum life, the filament power should be regulated at the lowest value that will give satisfactory performance.
2. It is recommended that additional current be available to allow for product variation with life. Thus, the filament supply should be designed for a capability of 40 amperes at 6.0 VDC.
3. Recommended starting procedure for maximum stability and longest life:
   1. Standard: Filament heating time of 15 seconds followed by Grid No. 1, Plate, Grid No. 2 and RF Drive.
   2. Emergency Turn-On: (Power interruption of 15 seconds or less.) The tube may be brought back on the air five seconds after power restoration. The sequence of voltage application after filament warm-up is as follows: Grid No. 1, Plate, Grid No. 2, and RF Drive.
4. For plate voltage = 1000 V.
   For plate current = 2.0 A.
5. No external shield.
6. Cooling air is necessary to limit the anode-core and terminal-seal temperatures to values that will assure long reliable life. A sufficient quantity of air should be directed past each of these terminals so that its temperature does not approach the absolute-maximum limit. The absolute-maximum temperature rating for this tube is 250° C. It is recommended that a safety factor of 25° to 50° C be applied to compensate for all probable system and component variations throughout life. Minimum anode airflow is approximately 115 CFM at three inches water pressure for 20° C inlet air temperature and 2500 watts of anode dissipation at sea level.

   The cooling air must be delivered by the blower through the radiator and at the terminal seals during application of all power, including heater power and for a minimum of three minutes after all power has been removed.

   A sufficient quantity of air must be blown directly at the cathode and filament terminal so that their temperature does not exceed the absolute maximum limit of 250° C. A value of 20 CFM is recommended.

   Application of RF energy to the tube-circuit combination produces additional heating in the form of circuit losses. Thus, additional air is required above the minimum anode cooling requirement of 115 CFM at three inches of water pressure. For example, the BURLE Y1400 cavity amplifier was designed specifically for this application. A single blower is required capable of 150 CFM at 4.0 inches water pressure minimum to cool the anode, all tube seals, filament and cavity circuit. This amount of cooling air will maintain all tube seal temperatures to less than 250° C at 3000 watts of plate dissipation at 20° C inlet temperature at sea-level.

   Because the cooling capacity of air varies with its density, factors must be applied to the air flow to compensate for operation at altitude or in high temperature environments.

   During standby operation, cooling air is required when only the filament voltage is applied to the tube.

   For further information on forced air cooling, see TP-105 and also AN-4869 "Application Guide for Forced Air Cooling of Tubes."
7. See Dimensional Outline for temperature measurement points. For good cavity contact-finger life, a maximum temperature of 180° C at the terminals is recommended when using commercially available beryllium-copper socket contacts.
8. The value of 250° C is the average of 4 readings taken 90° apart around the anode core. No one reading may exceed 275° C.
9. The maximum voltage ratings must be modified for operation at altitudes higher than sea level and for temperatures in excess of 20° C. For altitude derating of the plate voltage, use the voltage difference between plate and grid No. 2.

   The energy available for a high-voltage arc or fault must be limited by means of current limiting resistors. This is especially important where high stored energy and large capacitors are used. Recommended series resistors are: Plate- 10 ohms, Grid No. 2 - 50 ohms, and Grid No. 1 - 50 ohms.
10. See TP-105 and AN-4020. Protection devices such as spark gaps should be used.
11. See TP-105. Protection devices such as spark gaps or positive clamping diodes should be used.
12. Permitted plate dissipation is a function of cooling for specific ratings. (See forced air cooling information in this data sheet.)
13. Double tuned output response adjusted for equal peaks at 0.4 dB ripple. Bandwidth measured at -1 dB points with respect to peaks.
14. Adjusted for specified zero-signal plate current.
15. Black level and sound carrier.
16. In-band third order IMD using standard three-tone test with:
    a. Reference level of 1100 W peak power.
    b. Video carrier at 8 dB below reference level.
    c. Sound carrier at 10 dB below reference level.
    d. Variable frequency third carrier at 16 dB below reference level.
    e. 4.5 MHz separation between visual and sound carriers.
    f. Input third order IMD equal to or less than -65 dB.
17. Minimum power supply requirements to achieve specified IMD:
    Plate Supply - 5% p-p ripple and 5% load regulation.
    Grid No. 2 Supply - 1% p-p ripple and 1% load regulation.
    Grid No, 1 Supply - 1% p-p ripple and 0.5% load regulation.

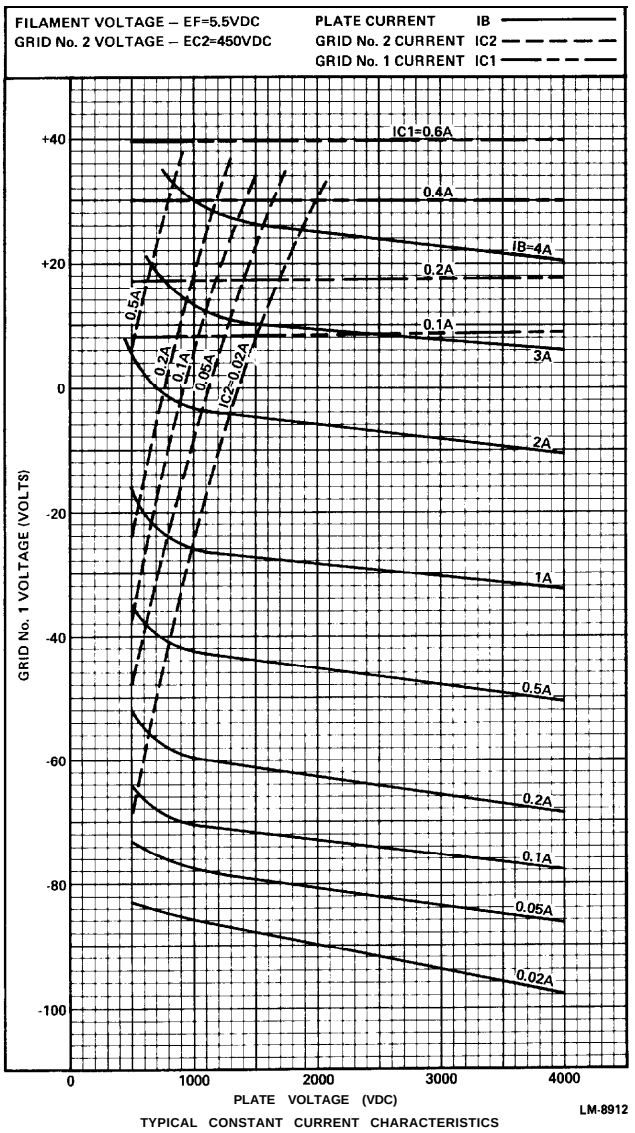


Figure 1 - Typical Constant Current Characteristics

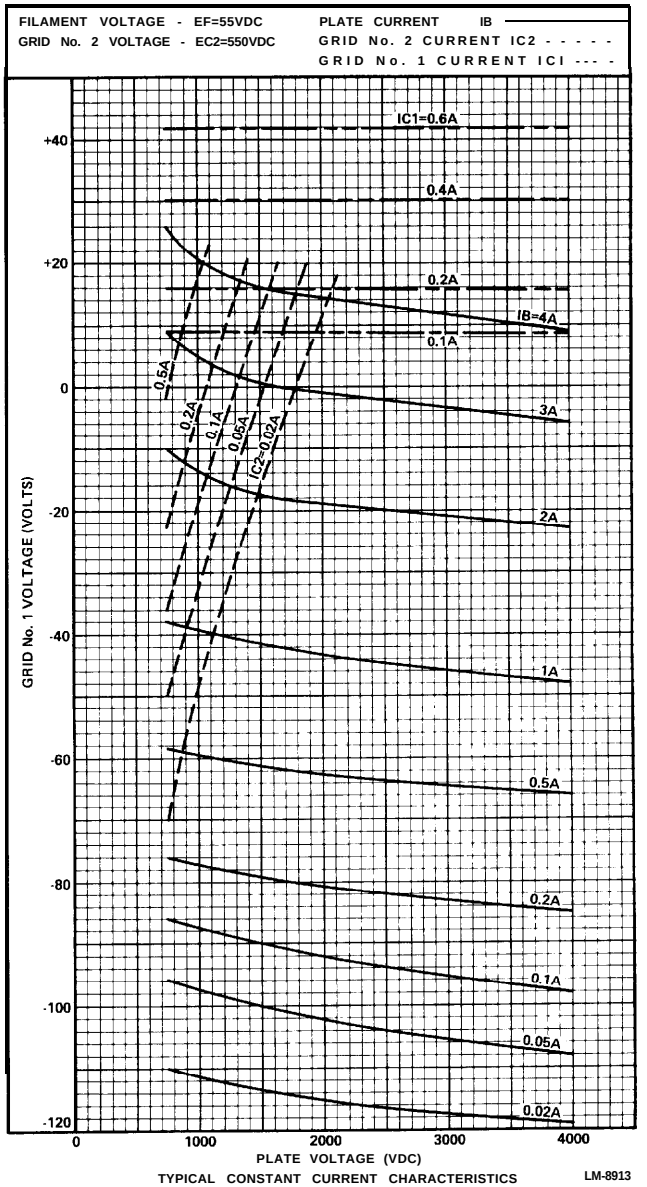
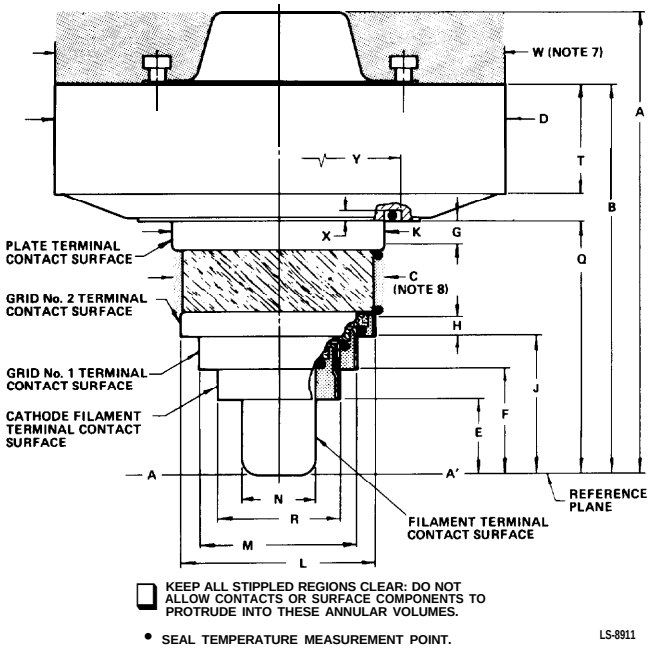


Figure 2 - Typical Constant Current Characteristics



Dim.	Min.	Bogie	Max.
A	-	-	4.000 (101.60)
B			3.400 (86.36)
C[8]			
D[6]	3.690 (93.73)	3.720 (94.49)	3.750 (95.25)
E	0.590 (14.99)	0.630 (16.00)	0.670 (17.02)
F	0.840 (21.34)	0.880 (22.35)	0.920 (23.37)
G	-		0.19 (4.83)
H	0.125 (3.18)		
J	1.100 (27.94)	1.140 (28.96)	1.180 (29.97)
K[5]	1.746 (44.35)	1.755 (44.58)	1.762 (44.75)
L[4]	1.594 (40.49)	1.602 (40.69)	1.610 (40.89)
M[3]	1.294 (32.87)	1.302 (33.07)	1.310 (33.27)
N[1]	0.590 (14.99)	0.600 (15.24)	0.610 (15.49)
Q	2.030 (51.56)	2.080 (52.83)	2.130 (54.10)
R[2]	0.994 (25.25)	1.002 (25.45)	1.010 (25.65)
T	0.850 (21.59)	0.880 (22.35)	0.910 (23.11)
W[7]			
X	0.055 (1.40)	0.085 (2.16)	0.115 (2.92)
Y	1.988 (50.50)	2.000 (50.80)	2.012 (51.10)

Dimensions are in inches. Dimensions in parentheses are in millimeters.

Figure 3 - Dimensional Outline

Notes for Dimensional Outline

1. Dimension "N" applies over length "E" only.
2. Dimension "R" applies over length "F" minus "E".
3. Dimension "M" applies over length "J" minus "F".
4. Dimension "L" applies over length "H" only.
5. Dimension "K" applies over length "G" only.
6. Dimension "D" applies over length "T" only.
7. On any one tube this dimension shall never be greater than "D".
8. On any one tube this dimension shall never be greater than "K".

Operating Considerations

Safety Precautions

Protection circuits serve a threefold purpose: safety of personnel, protection of the tube in the event of abnormal circuit operation, and protection of the tube circuit in the event of abnormal tube operation.

WARNING: Personal Safety Hazard
Electrical Shock: Operating voltages applied to this device present a shock hazard.
RF Radiation: This device in operation produces RF radiation which may be harmful to personnel.

Great care should be taken during the adjustment of the circuit. The tube and its associated apparatus, especially all parts which may be at high potential above ground, should be housed in a protective enclosure. The protective housing should be designed with interlocks so that personnel cannot possibly come in contact with any high-potential point in the system. The interlock devices should function to break the primary circuit of the high voltage supplies and discharge high voltage capacitors when any part of the protective housing is opened, and should prevent the closing of this primary circuit until the protective housing is again closed.

A time delay relay must be provided in the grid-No. 1 supply circuit to delay application of this voltage until the filament has reached normal operating temperature.

An interlock relay system should be provided to prevent application of plate voltage prior to the application of sufficient bias voltage. Otherwise, the resultant high plate current may cause excessive plate dissipation with consequent damage to the tube.

The grid-No. 2 voltage must be interlocked with the plate voltage to prevent over-dissipation of the grid No. 2 due to insufficient plate voltage. Plate voltage must reach operating levels prior to application of grid-No. 2 voltage.