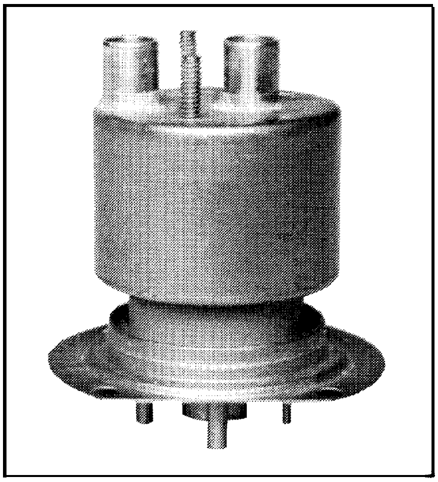
NEXT PAGE | PRINT PAGE | RETURN TO MENU

4636
Beam Power Tube



- UHF Grid-Drive Operation
- Distributed Amplifier Service to 500 MHz
- 300 Watts UHF TV Output at 890 MHz
- 410 Watts PEP Output at 30 MHz
- Matrix-type Unipotential Cathode
- Liquid Cooled

The BURLE 4636 is a compact, liquid cooled, ceramic-metal, beam powertube designed especially for use in broadband uhf amplifier service in stationary and portable equipment. It is rated as an rf power amplifier in distributed amplifier service and Class B television service, and as a linear rf power amplifier in single sideband service.

Grid drive operation of the 4636 becomes practical at uhf frequencies because of the internal grid-No. 2 to cathode bypass capacitor **and** the "cross-over" of the grid-No. 1 and cathode terminals. The large area pins and base configuration combine to give low lead inductance and low input capacitance for uhf service. In addition, the three separate, grid-No. 1 leads accommodate a split input circuit for distributed amplifier service.

Additional features of the 4636 include **a** matrix-type, oxide-coated, unipotential cathode; precision aligned grids; and an integral, liquid cooled jacket.

This data sheet gives application information unique to the BURLE-4636. General information covering installation and operation of this tube type is contained in the following publications:

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.

Close attention to the instructions contained therein will assure longer tube life, safer operation, less equipment downtime, and fewertube handling accidents. 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:	
Voltage (AC or DC)	**6.3 V**
Current (at 6.3 V)	**3.5 A**
Minimum heating time	120 s
Mu-Factor[1] (Grid-No. 2 to Grid-No. 1)	12
Direct Interelectrode Capacitances:[2]	
Grid No. 1 to anode (feedback)	0.100 max. pF
Grid No. 1 to cathode (input)	43.5 max. pF
Plate to cathode (output)	6.5 max. pF
Grid No. 1 to Grid No. 2	19.0 pF
Grid No. 2 to cathode (bypass)	630 max. pF

Mechanical

Operating Position	
Maximum Length	(68.3 mm) 2.69 in
Greatest Diameter	(57.4 mm) 2.26 in
Terminal Connections	See Dimensional Outline
Liquid Cooling Jacket	Integral part of tube
Weight (approx.)	(0.23 kg) 8.0 oz

Thermal

Terminal Temperature (Anode, grid No. 1, grid No. 2 heater)	250 max. °C
Cathode-Heater Flange Temperature	125 max. °C
Anode Seal Temperature	250 max. °C

(See Dimensional Outline for temperature measurement points)

BURLE Electron Tubes

Characteristic Range Values

	Min.	Max.	Unit
Heater Current[3]	3.0	4.0	A
Direct Interelectrode Capacitances:			
Grid No.1 to Anode (feedback)[2]	-	0.100	PF
Grid No.1 to cathode & Heater (input)[2]	33.0	43.5	PF
Anode to Cathode & Heater (output)[2]	5.5	6.5	PF
Grid No.2 to Cathode & Heater (bypass)[2]	450	630	PF
Grid-No.1 Voltage[3]	-13	-28	V
Reverse Grid-No.1 Current[3]	-	-25	mA
Grid-No.2 Current[3,4]	-10.0	+3.5	mA
Interelectrode Leakage Resistance[5]	50	-	Mohms
Useful Power Output[6]	285	-	W
Zero Bias Anode Current[7]	1500	-	mA

RF Power Amplifier
Distributed Amplifier Service

Maximum CCS Ratings, Absolute Maximum Value for frequencies 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:		
Class A Service	600	mA
Class B Service	500	mA
Grid No.1 Current	100	mA
Anode Dissipation	1000	W
Grid No.2 Input	11	W
Maximum Circuit Values:		
Grid No.1 Circuit Resistance to ground	15,000	Ohms
Grid No.2 Circuit Impedance	See Note 8	
Anode Circuit	See Note 9	

Calculated Operation:

Values shown are for the output tube of an 11 tube bandpass[10] distributed amplifier stage with a nominal 250 ohms plate line impedance; Class AB_1 service; CW operation.

	107 - 187 MHz[11]	
DC Anode Voltage	1800	V
DC Grid-No.2 Voltage	400	V
DC Grid-No.1 Voltage	-60	V
DC Anode Current	365	mA
DC Anode Idling Current	100	mA
DC Grid No.2 Current	27	mA
DC Grid No.1 Current	0	mA
Peak RF Drive Voltage	45	V
Tube Output	65	W
Total Useful Power[8] Output from an 11 Tube Stage Distributed Amplifier	2000	W

Footnotes For General Data and Characteristic Range Values

1. For E_b = 450 V
   E_{c2} = 325 V
   E_{c1} adjusted to give plate current I_b = 1.2 A
2. Measured with special shield adapter.
3. With 6.3 V AC or DC on heater.
4. With DC plate voltage of 700 V
   With DC grid-No.2 voltage of 250 V
   With DC grid-No.1 voltage adjusted to give DC plate current of 185 mA.
5. 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: cathode and grid No.1; grid No.1 and grid No.2; cathode and grid No.2; and plate and grid No.2, as measured with a 500 volt Megger-type ohm-meter will be greater than the value specified.
6. In a parallel-line input, coaxial-line output amplifier circuit from 470 to 600 MHz and for conditions with 5.8 volts AC or DC on heater, DC plate voltage of 2000 volts, DC grid-No 2 voltage of 400 volts, DC plate current of 350 mA and DC grid-No.1 current of 3.0 mA.
7. With E_b = 825 V, E_{c2} = 400 V, E_{c1} = -100 V, apply square pulses (P.W. = 2000 usec, rep. rate = 11 pps) to bring grid No.1 to zero volts.
8. For higher reliability and to protect the tube against the build-up of excessive grid-No.2 transient voltages, a spark gap or similar protective, over-voltage device must be used. A series impedance of 1000 ohms must be used to limit the momentary fault currents. A bleeder current of at least 1/10 the required anode current or a shunt regulated supply is also required to keep the DC grid-No.2 voltage from rising due to negative grid-No.2 current.
9. A series impedance of 10 to 500 is required in the anode lead to limit momentary fault currents.
10. Design cutoff frequencies 100 MHz and 200 MHz.
11. Constant K-Type filter with m-derived end sections.
12. Useful power output equals $\frac{11 \times 365}{2}$ due to the division of power between the load and the back termination.
13. The system shall be purged with coolant prior to use.
14. For application information on Coolanol 35 purity see Monsanto publication O/AA-1, Monsanto Co., 800 North Lindberg Blvd., St. Louis, MO., 63166
15. The anode jacket must be free of water before storage or shipment to insure against damage from freezing.

Air or Conduction Cooling

It is important that the temperature of any external part of the tube not exceed the values specified. In general, forced-air cooling of the ceramic insulators and the adjacent contact areas or conduction cooling of each of the terminals except the anode may be required if the tube is used in a confined space without free circulation of air. Under such conditions, provision should be made for blowing an adequate quantity of air across the ceramic insulators and adjacent terminal areas or provision should be made for heat to be conducted from each of the terminals except the anode through an adequate coupler to an adequate heat sink to limit their maximum temperature to the values specified. If air cooling is used, the air flow must start before application of any voltages and preferably should continue for several seconds after removal of all voltages. Interlocking of the air flow with all power supplies is recommended to prevent damage in case of failure of adequate air flow.

Liquid Cooling[13]

Liquid cooling of the anode jacket is required. When tube operation under low ambient temperatures is required, the recommended coolant is Coolanol® 35. When the environmental temperature permits, the coolant may be water; the use of distilled water or filtered deionized water is essential for long-life expectancy. The liquid flow must start before application of any voltages and preferably should continue for several seconds after removal of all voltages. Interlocking of the liquid flow with all power supplies is recommended to prevent tube damage in case of failure of adequate liquid flow.

Coolant flow:

Liquid pressure at any inlet .... 150 max. psi
10.5 max. kg/cm²

Coolant flow through plate jacket in direction shown on Dimensional Outline

	Absolute Min. Flow gpm	Absolute Min. Flow cc/s	Typical Pressure Diff psig	Typical Pressure Diff kg/cm²
Water:[13]				
For plate dissipation up to I.O kW	0.25	15.8	0.4	0.03
Coolanol:[13,14]				
For plate dissipation up to 600 W	0.60	37.8	-	-
For plate dissipation 600 W to 750 W	0.75	47.3	-	-
For plate dissipation 750 W to 1000 W	1.20	75.7	2.5	0.18

Coolant Specifications:

Coolant Outlet:

Temperature

Water .... 70 max. °C

Coolanol .... 135 max. °C

Resistivity at 25° C

Water ....1 megohm-cm min.

Storage Temperature ....See Note 15

Mounting

The special base and terminal configuration of the 4636 will require a unique mounting arrangement depending on the frequency use, type of circuit configuration and equipment arrangement.

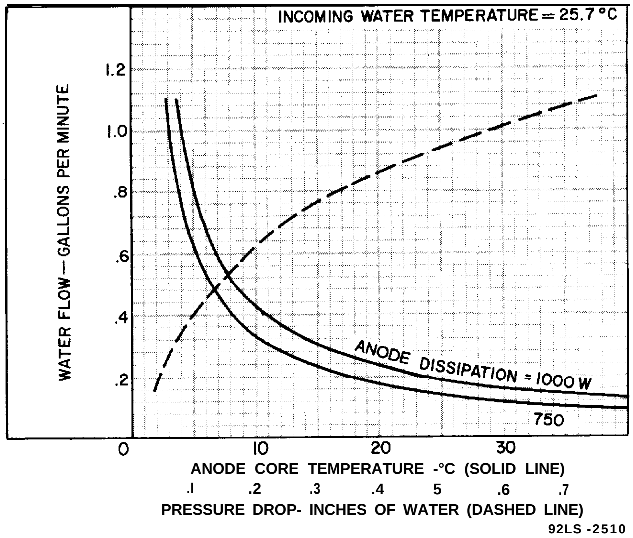


Figure 1 - Cooling Characteristics; Water

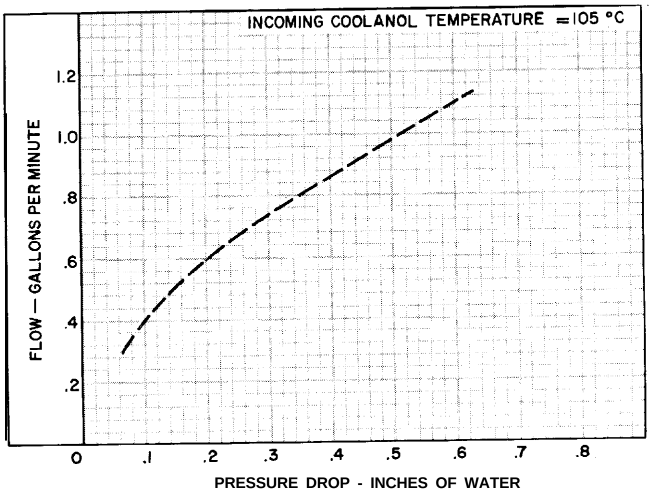
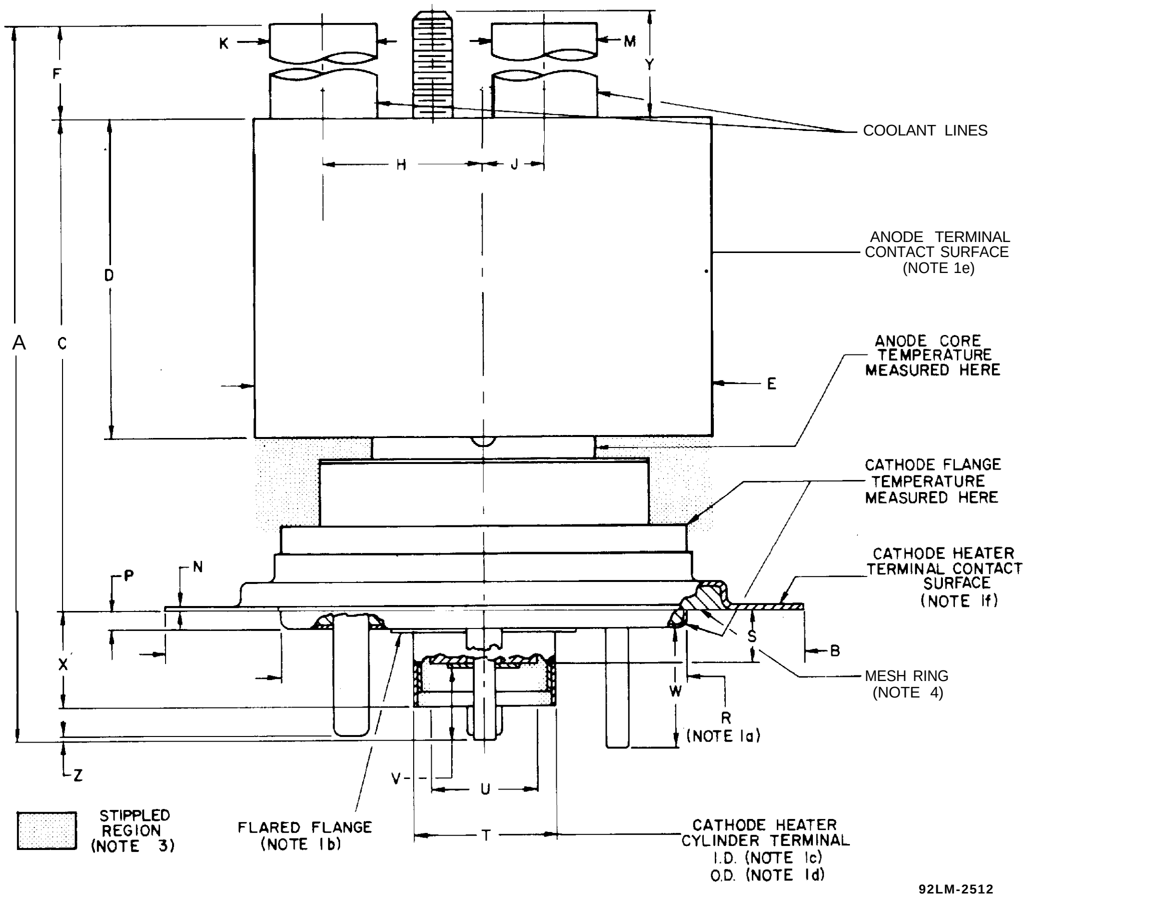
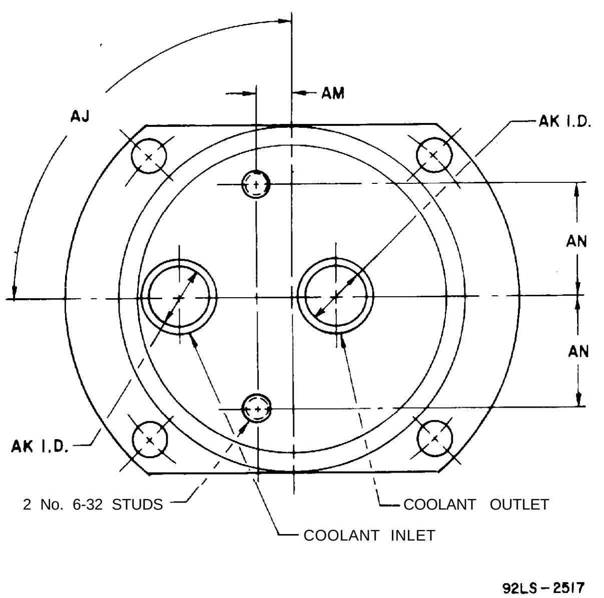


Figure 2 - Cooling Characteristics; Coolanol 35



Top View



Bottom View

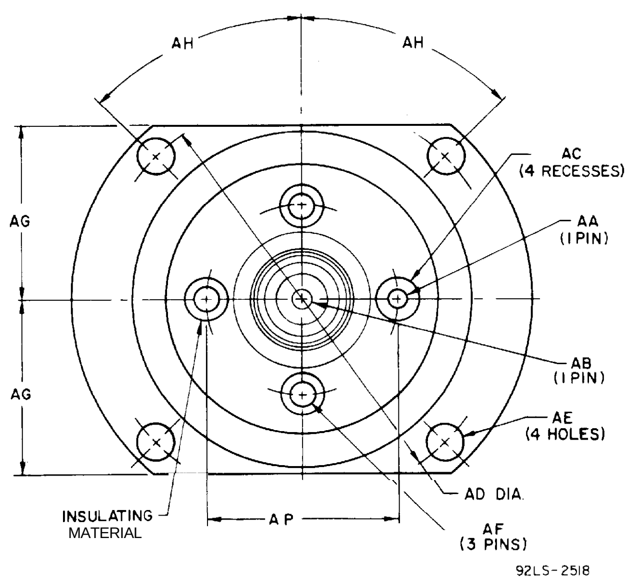


Figure 3 - Dimensional Outline

A 2.830 (71.88) Max.
B 2.262 (57.45) Max. Dia.
C 1.745 ± .025 (44.32 ± .64)
D 1.150 ± .030 (29.21 ± .76)
E 1.625 ± .015 (4.128 ± .38) Dia.
F 0.500 ± .010 (12.70 ± .25)
H 0.560 ± .020 (14.22 ± .51)
J 0.220 ± .020 (5.59 ± .51)
K 0.378 ± .001 (9.60 ± .03) Dia.
M .0378 ± .001 (9.60 ± .03) Dia.
N 0.022 ± .002 (0.56 ± .05)
P 0.058 + .007/- .008 (1.47 + .18/ -.20)
R 1.425 ± .010 (36.20 ± .25) Dia.
S 0.200 (5.08) Max.
T 0.500 ± .010 (12.70 ± .25) Dia.
U 0.400 (10.16) Min. Dia.
V 0.250 (6.35) Min.
W 0.425 (10.80) Max.
X 0.337 +.018/- .017 (8.56 + .46/- .43)
Y 0.416 ± .041 (10.57 ± 1.04)
Z 0.060 (1.12) Max.
AA 0.081 ± .002 (2.06 ± .05) Dia.
AB 0.081 ± .002 (2.06 ± .05) Dia.
AC 0.245 (6.22) Min. Dia.
AD 2.000 ± .010 (50.8 ± .25) Dia.
AE 0.175 ± .005 (4.45 ± .13) Dia.
AF 0.126 ± .002 (3.20 ± .05) Dia.
AG 0.868 + .017/- .018 (22.05 + .43/- .46)
AH 45° ± 5' (0.785 ± .009 radians)
AJ 90° ± 3° (1.571 ± .052 radians)
AK 0.312 ± .005 (7.92 ± .13) Dia.
AM 0.171 ± .010 (4.34 ± .25)
AN 0.562 ± .010 (14.27 ± .25)
AP 0.950 ± .011 (24.13 ± .28)

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).

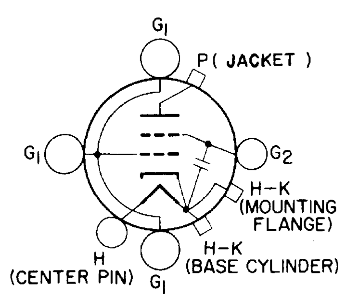


Figure 4 - Terminal Diagram

Note 1: Concentricity between the various diameters on the major tube axis is such that the tube will enter a gauge having suitably spaced concentric apertures and posts of the following diameters:

(a) Base seat - 1
(b) Flared flange of cathode-heater cylinder terminal - 0.680
(c) Cathode-heater cylinder terminal (ID) - 0.400
(d) Cathode-heater cylinder terminal (OD) - 0.525
(e) Radiator - 1.660
(f) Cathode-heater flange terminal contact surface - 1.760

Note 2: Concentricity of the base pins is such that the tube will enter the gauge in Note 1 having suitably spaced apertures of the following diameters:

(a) Grid-No.1 pins - 0.1450
(b) Heater pin - 0.0830 (.123 Dia. x 82° CSK.)
(c) Grid-No.2 pins - 0.0930

Note 3: Keep all stippled regions clear. Do not allow contacts or circuit components to protrude into these annular regions.

Note 4: RF gasket.*

* Silver-plated brass woven wire cloth or e Available from Technical Wire Products, Inc., Cranford, .J.

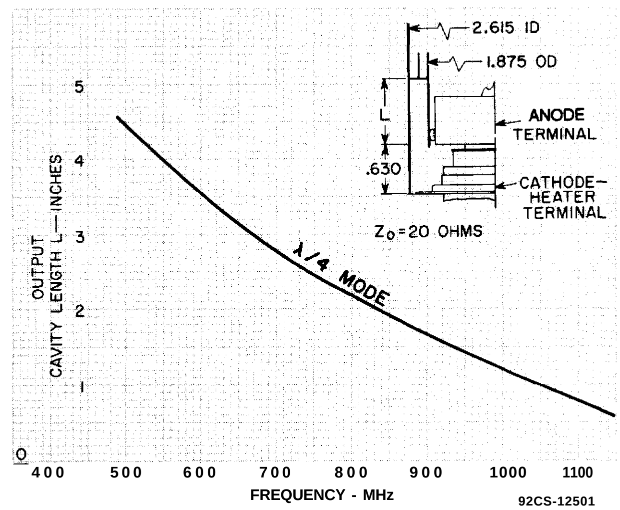


Figure 5 - Typical Output Cavity Tuning Characteristics

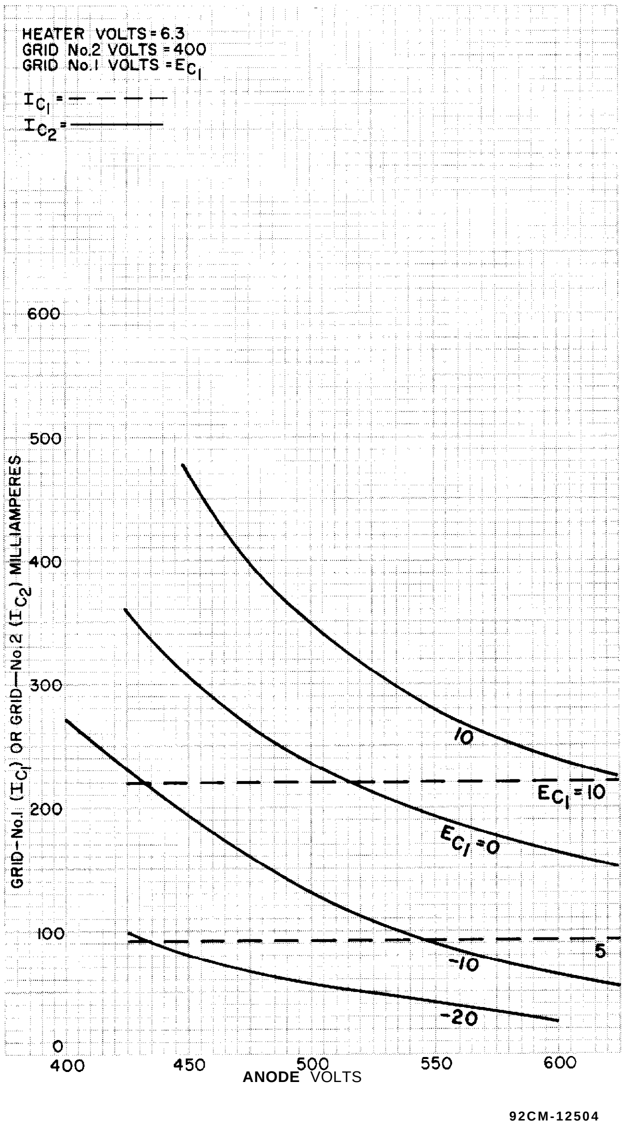


Figure 6 - Typical Characteristics

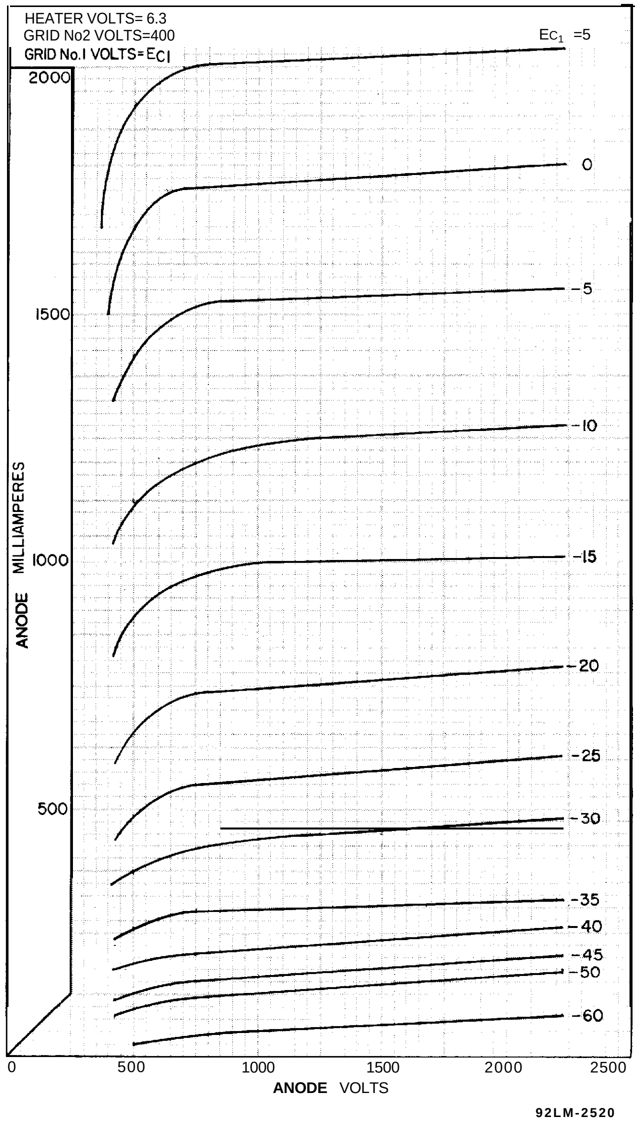


Figure 7 - Typical Anode Characteristics