GL-8513

TETRODE

VHF-UHF
RING-SEAL CONSTRUCTION

GROUNDED-GRID CIRCUIT

FORCED-AIR COOLED
METAL AND CERAMIC

The GL-8513 is a four-electrode transmitting tube featuring a metal-and-ceramic envelope for use as a power amplifier or oscillator in grounded-grid circuits with both grids maintained at radio-frequency ground potential. The output circuit is connected between the anode and the screen grid. The anode is capable of dissipating 4 kilowatts. Cooling is accomplished by forced air with the radiator an integral part of the anode. The cathode is a unipotential thoriated-tungsten cylinder, heated by electron bombardment. Maximum ratings apply up to 800 megacycles, although higher frequency operation is possible.

As a Class B linear power amplifier the tube will deliver 1500 watts at carrier level.

In narrow band, Class C, grounded-grid, amplitude-modulated service, the GL-8513 has a useful carrier-power output in excess of one kilowatt. In Class C Telegraphy, it has a useful power output of 3 kilowatts of continuous power as an amplifier or oscillator.

Electrical

	Minimum	Bogey	Maximum	
Cathode				
Heater Voltage	–	6.7	7.0	Volts
Heater Current at 7.0 Volts				
Without Cathode Bombarding	–	14.5	—	Amperes
With 150 Watts Cathode Bombarding	–	13.5	—	Amperes
Heater Starting Current	–	—	25	Amperes
Heater Cold Resistance	–	0.041	—	Ohms
Cathode Bombarding Power*	–	170	195	Watts
Cathode Bombarding Voltage, DC				
For 170 Watts Bombarding Power	–	650	—	Volts
For 195 Watts Bombarding Power	–	700	—	Volts
Cathode Heating Time	1	—	—	Minute
Amplification Factor, G_2 to G_1; $E_b = 4000$ volts; $I_b = 0.5$ ampere	–	20	—	
Peak Cathode Current†	–	—	6	Amperes
Direct Interelectrode Capacitances				
Cathode to Plate§	–	0.01	—	μμf
Input, G_2 tied to G_1	–	27.8	—	μμf
Output, G_2 tied to G_1¶	–	6.7	—	μμf

Mechanical

Mounting Position—Vertical, Anode-end Up

Net Weight, approximate	12.5	Pounds

Thermal

Type of Cooling—Forced Air

Air Flow Through Radiator, at Sea Level

Plate Dissipation	Air Flow	Static Pressure
4.0 Kw	135 CFM	2.8 In.

Seals		
Screen-grid to Control-grid, minimum	15	Cubic Feet per Minute
Heater-to-cathode, minimum	7.5	Cubic Feet per Minute
Anode Ceramic, minimum	10	Cubic Feet per Minute
Incoming Air Temperature, maximum	55	C
Anode Hub Temperature, maximum	250	C
Temperature of Anode Ceramic and Seals, maximum	250	C
Temperature at Any Other Point, maximum	200	C

Forced-air cooling to be applied before and during the application of any voltages. Air flow on heater-to-cathode seals must be maintained for one minute after removal of heater voltage. The radiator air ducting can be constructed so that air is forced along the anode seal and ceramic through the anode contact fingers and additional holes in the plate contact ring to accomplish the anode ceramic and anode seal cooling. The volume of cooling air indicated for the various seals is approximate only. Distribution of cooling air will vary with configuration of the cavity about the tube.

RADIO-FREQUENCY POWER AMPLIFIER—CLASS B

Carrier Conditions per Tube for Use with a Maximum Modulation Factor of 1.0

Maximum Ratings, Absolute Values

DC Plate Voltage	9000	Volts
DC Grid-No. 2 Voltage	800	Volts
DC Plate Current	0.800	Ampere
Plate Input	6.0	Kilowatts
Grid-No. 2 Input	25	Watts
Plate Dissipation	4.0	Kilowatts

Typical Operation

Grounded-grid Circuit, 225–400 Megacycles		
DC Plate Voltage	8000	Volts
DC Grid-No. 2 Voltage	750	Volts
DC Grid-No. 1 Voltage, approximate	−50	Volts
DC Plate Current	0.600	Ampere
DC Grid-No. 2 Current	0.010	Ampere
DC Grid-No. 1 Current	0.060	Ampere
Driving Power, approximate	160	Watts
Measured at crest of audio-frequency cycle with modulation factor of 1.0		
Power Output#	1500	Watts
Circuit Efficiency	90	Percent
Plate Dissipation	2500	Watts
Cathode Bombarding Power*	170	Watts
Cathode Bombarding Voltage	650	Volts
Cathode Bombarding Current	0.260	Ampere

GENERAL ELECTRIC

PLATE MODULATED RADIO-FREQUENCY AMPLIFIER—CLASS C TELEPHONY

Carrier Conditions with a Maximum Modulation Factor of 1.0, Screen Modulation Required

Maximum Ratings, Absolute Values		
DC Plate Voltage	4500	Volts
DC Grid-No. 2 Voltage	500	Volts
DC Grid-No. 1 Voltage	−120	Volts
DC Plate Current	0.80	Ampere
DC Grid-No. 1 Current	0.120	Ampere
Plate Input	3.60	Kilowatts
Grid-No. 2 Input	25	Watts
Plate Dissipation	4.0	Kilowatts
Typical Operation		
Grounded-grid Circuit at 400 Megacycles		
DC Plate Voltage	4000	Volts
DC Grid-No. 2 Voltage	400	Volts
DC Grid-No. 1 Voltage	−100	Volts
Peak RF Plate Voltage	2500	Volts
Peak RF Driving Voltage	120	Volts
DC Plate Current	0.570	Ampere
DC Grid-No. 2 Current	0.020	Ampere
DC Grid-No. 1 Current, approximate	0.100	Ampere
Driving Power, approximate	100	Watts
Power Output#	1250	Watts
Output Circuit Efficiency	90	Percent
Cathode Bombarding Power*	165	Watts
Cathode Bombarding Voltage, approximate	630	Volts
Cathode Bombarding Current, approximate	0.260	Ampere

RADIO-FREQUENCY AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

Key Down Conditions per Tube Without Amplitude Modulation

Maximum Ratings, Absolute Values			
DC Plate Voltage	7000		Volts
DC Grid-No. 2 Voltage	750		Volts
DC Plate Current	1.0		Amperes
Plate Input	6.0		Kilowatts
Grid-No. 2 Input	40		Watts
Plate Dissipation	4.0		Kilowatts
DC Grid-No. 1 Voltage	120		Volts
DC Grid-No. 1 Current	0.150		Ampere
Typical Operation			
Grounded-grid Circuit at 400 Megacycles			
DC Plate Voltage	4500	6500	Volts
DC Grid-No. 2 Voltage	600	700	Volts
DC Grid-No. 1 Voltage	−120	−100	Volts
Peak RF Plate Voltage, approximate	3000	—	Volts
Peak RF Grid-No. 1 Voltage	140	140	Volts
DC Plate Current	0.6	0.8	Ampere
DC Grid-No. 2 Current	0.018	0.025	Ampere
DC Grid-No. 1 Current	0.080	0.100	Ampere
Driving Power, approximate	100	100	Watts
Power Output, approximate#	1800	3200	Watts
Output Circuit Efficiency	90	90	Percent
Cathode Bombarding Power*	160	165	Watts
Cathode Bombarding Voltage, approximate	610	630	Volts
Cathode Bombarding Current, approximate	0.260	0.260	Ampere
Grounded-grid Circuit at 800 Megacycles			
DC Plate Voltage	4500		Volts
DC Grid-No. 2 Voltage	600		Volts
DC Grid-No. 1 Voltage	−120		Volts
Peak RF Plate Voltage, approximate	3000		Volts
Peak RF Grid-No. 1 Voltage	140		Volts
DC Plate Current	0.6		Ampere
DC Grid-No. 2 Current	0.018		Ampere
DC Grid-No. 1 Current	0.080		Ampere
Driving Power, approximate	90		Watts
Power Output, approximate#	1250		Watts
Output Circuit Efficiency	83		Percent
Cathode Bombarding Power*	150		Watts
Cathode Bombarding Voltage, approximate	600		Volts
Cathode Bombarding Current, approximate	0.250		Ampere

* The cathode of the GL-8513, because of transit-time effects which raise the temperature of the cathode, is subjected to considerable back bombardment in ultra-high-frequency service. The amount of heating due to bombardment is a function of the operating conditions and frequency, and must be compensated for by a reduction of the cathode power input to prevent overheating of the cathode with resulting short life. In any case it is important from a tube life standpoint to keep the cathode power at as low a level as possible consistent with required performance. Bombarder power should be monitored by a suitable wattmeter or DC voltmeter and milliammeter arrangement. For long life, the tube should be put in operation with about 180 watts bombarding power. After the circuit has been adjusted for proper tube operation, bombarding voltage should be reduced to a value slightly above that at which circuit performance is affected. Minor circuit readjustment may be necessary after the above adjustment. The procedure for determining proper bombarding power should be repeated periodically.

† Represents maximum usable cathode current (plate current plus current to each grid) for any condition of operation.

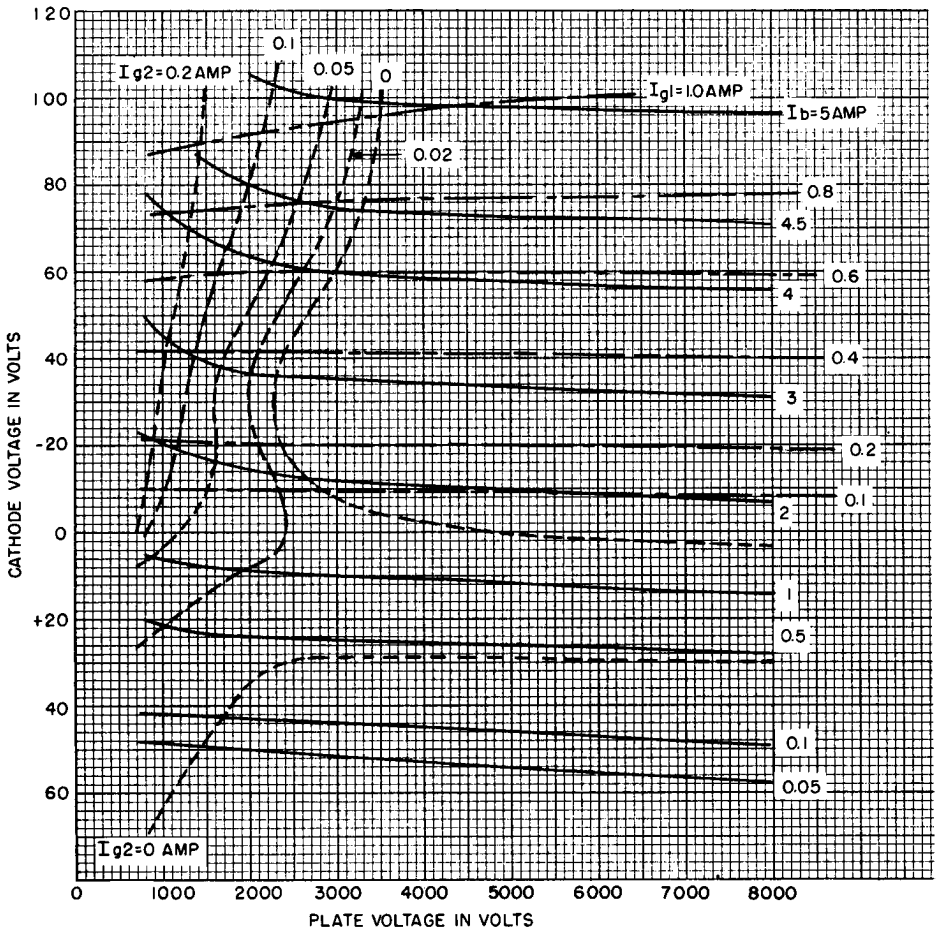
§ Measured with complete isolation between cathode and plate.

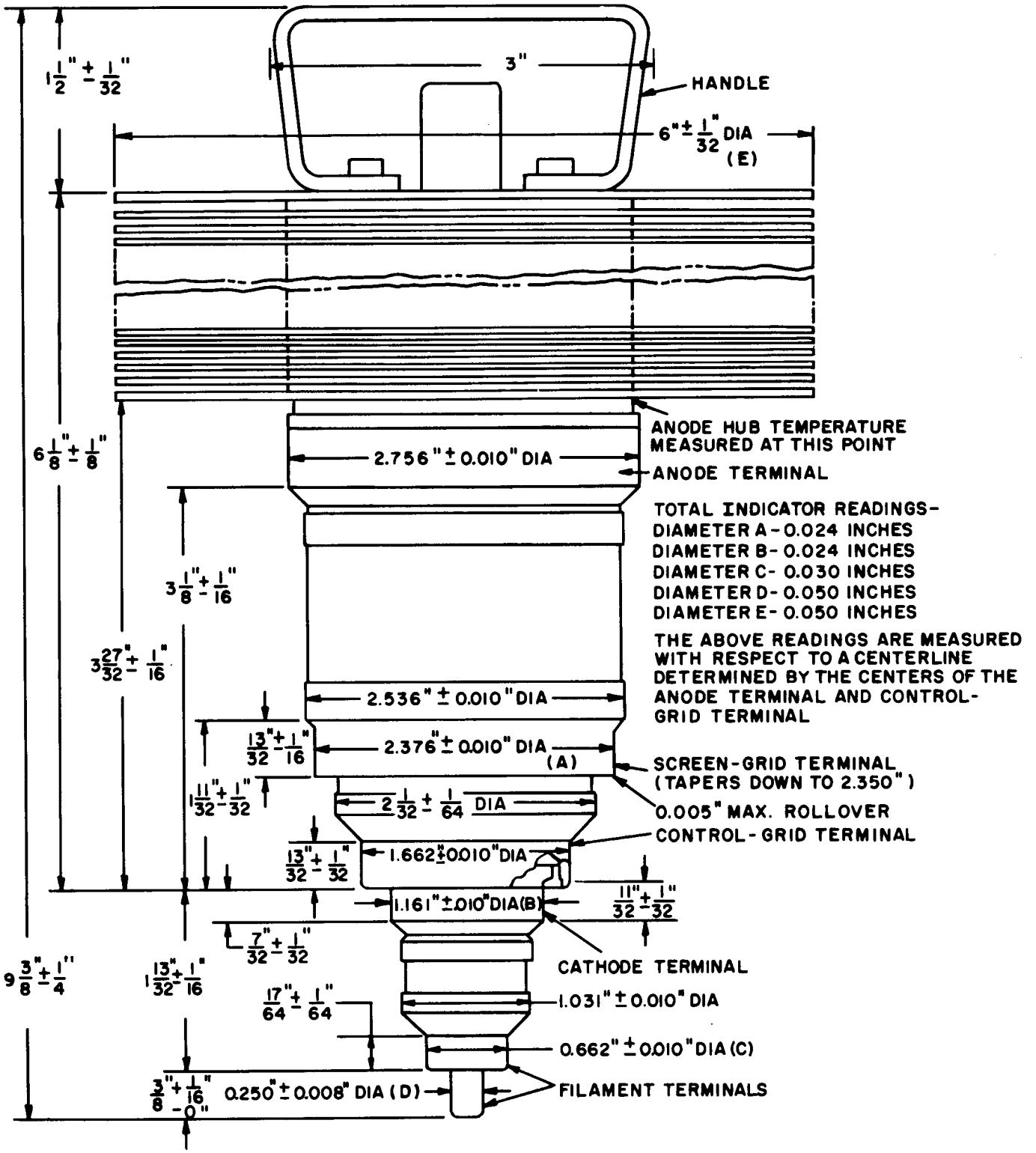
¶ Output capacitance measured between anode and screen grid. Control grid connected directly to screen grid.

\# Useful power output including power transferred from driver stage.

TYPICAL CHARACTERISTICS

Eg2 = 750 Volts, Ef = 7 Volts AC
Bombarding Power = 180 Watts
All Voltages Referenced to Grid




3"
HANDLE
6" ± 1/32" DIA (E)
ANODE HUB TEMPERATURE MEASURED AT THIS POINT
2.756" ± 0.010" DIA
ANODE TERMINAL
TOTAL INDICATOR READINGS-
DIAMETER A - 0.024 INCHES
DIAMETER B - 0.024 INCHES
DIAMETER C - 0.030 INCHES
DIAMETER D - 0.050 INCHES
DIAMETER E - 0.050 INCHES
THE ABOVE READINGS ARE MEASURED WITH RESPECT TO A CENTERLINE DETERMINED BY THE CENTERS OF THE ANODE TERMINAL AND CONTROL-GRID TERMINAL
2.536" ± 0.010" DIA
2.376" ± 0.010" DIA (A)
SCREEN-GRID TERMINAL (TAPERS DOWN TO 2.350")
0.005" MAX. ROLLOVER
2 1/32 ± 1/64 DIA
CONTROL-GRID TERMINAL
1.662" ± 0.010" DIA
1.161" ± 0.010" DIA (B)
CATHODE TERMINAL
1.031" ± 0.010" DIA
0.662" ± 0.010" DIA (C)
0.250" ± 0.008" DIA (D)
FILAMENT TERMINALS
1 1/2" ± 1/32"
6 1/8" ± 1/8"
3 1/8" ± 1/16"
3 27/32" ± 1/16"
13/32" ± 1/16"
1 11/32" ± 1/32"
13/32" ± 1/32"
11/32" ± 1/32"
7/32" ± 1/32"
9 3/8" ± 1/4"
1 13/32" ± 1/16"
17/64" ± 1/64"
3/8" +1/16" -0"