

GL-8513

TETRODE

VHF-UHF
RING-SEAL CONSTRUCTION

GROUNDING-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				Thermal			
	Mini- mum	Begey	Maxi- mum	Type of Cooling—Forced Air			
Cathode				Air Flow Through Radiator, at Sea Level			
Heater Voltage.....	—	6.7	7.0	Plate Dissipation	Air Flow	Static Pressure	
Heater Current at 7.0 Volts				4.0 Kw	135 CFM	2.8 In.	
Without Cathode Bombarding	—	14.5	—	Seals			
With 150 Watts Cathode				Screen-grid to Control-grid,			
Bombarding	—	13.5	—	minimum.....			
Heater Starting Current.....	—	—	25	Heater-to-cathode, minimum.....			
Heater Cold Resistance.....	—	0.041	—	Anode Ceramic, minimum.....			
Cathode Bombarding Power*.....	—	170	195	Incoming Air Temperature,			
Cathode Bombarding Voltage, DC				maximum.....			
For 170 Watts Bombarding				Anode Hub Temperature, maximum.....			
Power.....	—	650	—	Temperature of Anode Ceramic and			
For 195 Watts Bombarding				Seals, maximum.....			
Power.....	—	700	—	Temperature at Any Other Point,			
Cathode Heating Time.....	1	—	—	maximum.....			
Amplification Factor, G_2 to G_1 ;				Forced-air cooling to be applied before and during the applica-			
$E_b = 4000$ volts; $I_b = 0.5$ ampere.....	—	20	—	tion of any voltages. Air flow on heater-to-cathode seals must			
Peak Cathode Current†.....	—	—	6	be maintained for one minute after removal of heater voltage.			
Direct Interelectrode Capacitances				The radiator air ducting can be constructed so that air is forced			
Cathode to Plate§.....	—	0.01	—	along the anode seal and ceramic through the anode contact			
Input, G_2 tied to G_1	—	27.8	—	fingers and additional holes in the plate contact ring to ac-			
Output, G_2 tied to G_1 ¶.....	—	6.7	—	complish 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.			
Mechanical							
Mounting Position—Vertical, Anode-end Up							
Net Weight, approximate.....			12.5				
			Pounds				

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

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	Ampere
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. Bombardment 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

 $E_{g2} = 750$ Volts, $E_f = 7$ Volts AC

Bombarding Power = 180 Watts

All Voltages Referenced to Grid



