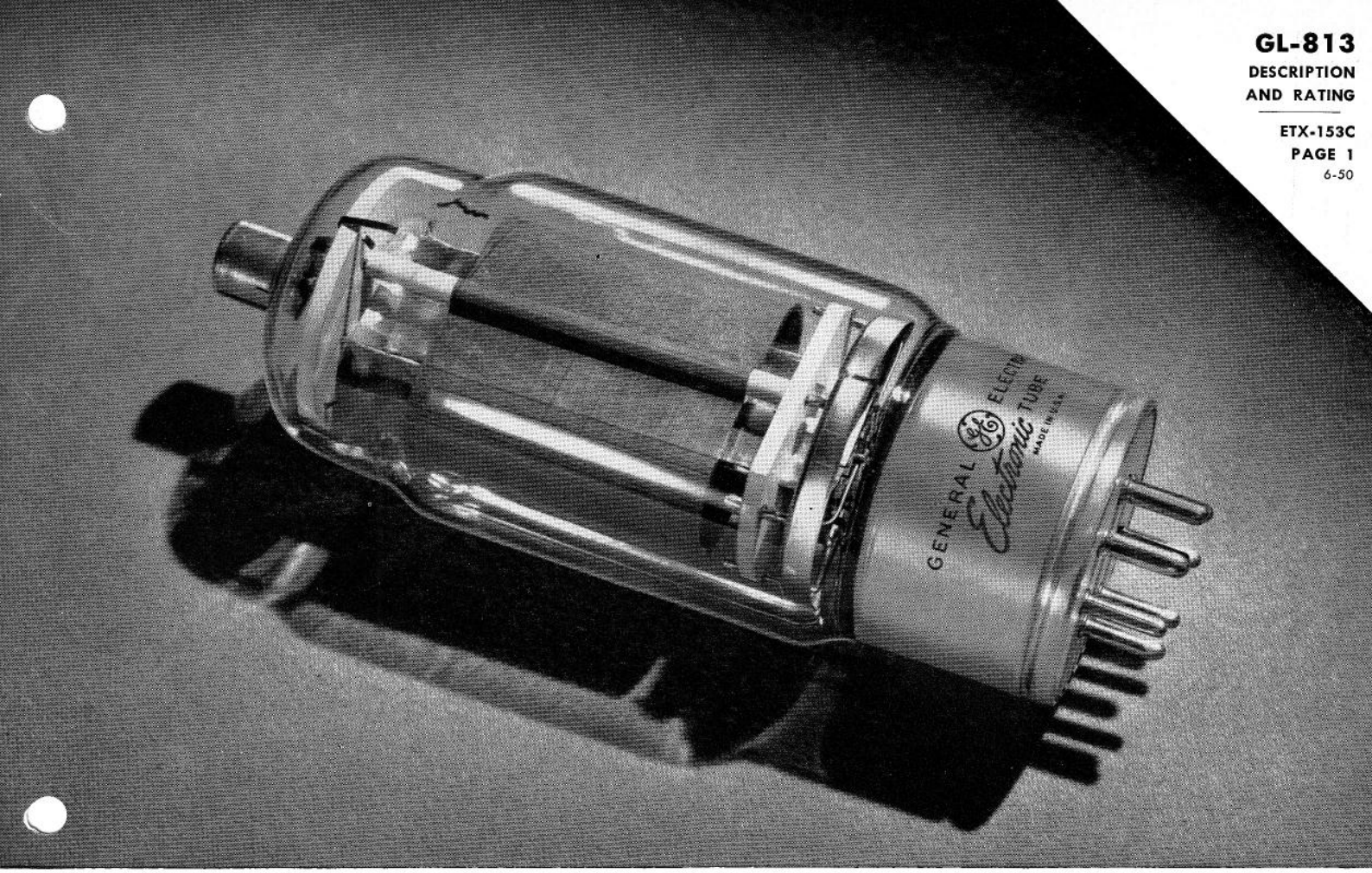



# BEAM POWER TUBE

## ♦DESCRIPTION

The GL-813 is a radiation-cooled five-electrode, beam power transmitting tube with extremely high power sensitivity designed for use as a modulator, amplifier, and oscillator. The cathode is a thoriated-tungsten filament. The anode is capable of dissipating 125 watts and the typical power output for class C telegraph service is 275 watts. Maximum ratings apply up to a frequency of 30 megacycles.

Full power output can be obtained with very little driving power and with a reduced number of driver stages. Neutralization is unnecessary in adequately shielded circuits. The GL-813 makes an excellent power amplifier for the final stage of high-power amateur transmitters where quick band change without neutralizing adjustments is desirable. It is also an excellent high-power frequency multiplier and is capable of giving high harmonic output with unusually high efficiency. The reduced over-all length of the tube provides for short internal leads and minimizes lead inductance.

## TECHNICAL INFORMATION

*These data are for reference only. For design information refer to specifications.*

### GENERAL

| Electrical Data | Minimum | Bogey | Maximum | |
|---|---|---|---|---|
| Filament Voltage | 9.5 | 10 | 10.5 | Volts |
| Filament Current at Bogey Voltage | 4.7 | 5 | 5.3 | Amperes |
| Amplification Factor, Grid No. 1 to Grid No. 2 | | | | |
| $E_b = 2000$ v d-c, $I_b = 50$ ma | .. | 8.5 | .. | |
| Interelectrode Capacitances | | | | |
| Grid-Plate | .. | .. | 0.25 | uuf |
| Input | 13 | 16.3 | 19.6 | uuf |
| Output | 10.5 | 14.0 | 17.5 | uuf |

♦ Description completely revised.

*Supersedes ETX-153B dated 7-48*

Electronic TUBE

GENERAL ELECTRIC

## TECHNICAL INFORMATION (CONT'D)

**Mechanical Data**

Mounting position—Vertical, base up or down; horizontal—plate in vertical plane

| | |
|---|---|
| Net weight, approximate | 8 ounces |

## MAXIMUM RATINGS AND TYPICAL OPERATING CONDITIONS

### AUDIO-FREQUENCY POWER AMPLIFIER AND MODULATOR—CLASS AB2

| Maximum ratings, absolute values | CCS* | ICAS* |
|---|---|---|
| D-c plate voltage | 2250 max | 2500 max volts |
| D-c grid No. 2 voltage | 800 max | 800 max volts |
| Maximum signal d-c plate current** | 180 max | 225 max milliamperes |
| Maximum signal plate input** | 360 max | 450 max watts |
| Maximum signal grid No. 2 input** | 22 max | 22 max watts |
| Plate dissipation** | 100 max | 125 max watts |

| Typical operation | CCS* | | ICAS* |
|---|---|---|---|
| Unless otherwise specified, values are for two tubes | | | |
| D-c plate voltage | 2000 | 2250 | 2500 volts |
| D-c grid No. 3 voltage | 0 | 0 | 0 volts |
| D-c grid No. 2 voltage | 750 | 750 | 750 volts |
| D-c grid No. 1 voltage | −90 | −90 | −95 volts |
| Peak a-f grid No. 1 to grid No. 1 voltage | 230 | 230 | 235 volts |
| Zero-signal d-c plate current | 40 | 45 | 35 milliamperes |
| Maximum signal d-c plate current | 315 | 315 | 360 milliamperes |
| Zero-signal d-c grid No. 2 current | 1.5 | 1.5 | 1.2 milliamperes |
| Maximum signal d-c grid No. 2 current | 58 | 58 | 55 milliamperes |
| Effective load resistance, plate to plate | 16000 | 18500 | 17000 ohms |
| Maximum signal driving power, approximate*** | 0.10 | 0.10 | 0.35 watts |
| Maximum signal power output, approximate | 455 | 515 | 650 watts |

### RADIO-FREQUENCY POWER AMPLIFIER—CLASS B TELEPHONY

*Carrier conditions per tube for use with a maximum modulation factor of 1.0*

| Maximum ratings, absolute values | CCS* | ICAS* |
|---|---|---|
| D-c plate voltage | 2000 max | 2250 max volts |
| D-c grid No. 2 voltage | 400 max | 400 max volts |
| D-c plate current | 100 max | 125 max milliamperes |
| Plate input | 150 max | 200 max watts |
| Grid No. 2 input | 15 max | 20 max watts |
| Plate dissipation | 100 max | 125 max watts |

| Typical operation | CCS* | | ICAS* |
|---|---|---|---|
| D-c plate voltage | 1500 | 2000 | 2250 volts |
| D-c grid No. 3 voltage | 0 | 0 | 0 volts |
| D-c grid No. 2 voltage | 400 | 400 | 400 volts |
| D-c grid No. 1 voltage | −60 | −75 | −60 volts |
| Peak r-f grid No. 1 voltage | 70 | 80 | 70 volts |
| D-c plate current | 100 | 75 | 85 milliamperes |
| D-c grid No. 2 current | 4 | 3 | 3 milliamperes |
| D-c grid No. 1 current, approximate**** | .. | .. | .. milliamperes |
| Driving power, approximate† | .. | .. | .. watts |
| Power output | 50 | 50 | 70 watts |

### GRID-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS B TELEPHONY

*Carrier conditions per tube for use with a maximum modulation factor of 1.0*

| Maximum ratings, absolute values | CCS* | ICAS* |
|---|---|---|
| D-c plate voltage | 2000 max | 2250 max volts |
| D-c grid No. 2 voltage | 400 max | 400 max volts |
| D-c grid No. 1 voltage | −200 max | −200 max volts |
| D-c plate current | 100 max | 125 max milliamperes |
| Plate input | 150 max | 200 max watts |
| Grid No. 2 input | 15 max | 20 max watts |
| Plate dissipation | 100 max | 125 max watts |

## TECHNICAL INFORMATION (CONT'D)

| Typical operation | CCS* | | ICAS* | |
|---|---|---|---|---|
| D-c plate voltage | 1500 | 2000 | 2250 | volts |
| D-c grid No. 3 voltage‡ | 0 | 0 | 0 | volts |
| D-c grid No. 2 voltage | 400 | 400 | 400 | volts |
| D-c grid No. 1 voltage | −140 | −120 | −110 | volts |
| Peak r-f grid No. 1 voltage | 145 | 120 | 135 | volts |
| Peak a-f grid No. 1 voltage | 60 | 60 | 55 | volts |
| D-c plate current | 70 | 75 | 85 | milliamperes |
| D-c grid No. 2 current | 3 | 3 | 2.5 | milliamperes |
| D-c grid No. 1 current, approximate# | —— | —— | —— | milliamperes |
| Driving power, approximate## | —— | —— | —— | milliamperes |
| Power output, approximate | 40 | 50 | 75 | watts |

## PLATE-MODULATED RADIO-FREQUENCY POWER AMPLIFIER—CLASS C TELEPHONY

*Carrier conditions per tube for use with a maximum modulation factor of 1.0*

| Maximum ratings, absolute values | CCS* | ICAS* |
|---|---|---|
| D-c plate voltage | 1600 max | 2000 max volts |
| D-c grid No. 2 voltage | 400 max | 400 max volts |
| D-c grid No. 1 voltage | −300 max | −300 max volts |
| D-c plate current | 150 max | 200 max milliamperes |
| D-c grid No. 1 current | 25 max | 30 max milliamperes |
| Plate input | 240 max | 400 max watts |
| Grid No. 2 input | 15 max | 20 max watts |
| Plate dissipation | 67 max | 100 max watts |

| Typical operation | CCS* | | ICAS* | |
|---|---|---|---|---|
| D-c plate voltage | 1250 | 1600 | 2000 | volts |
| D-c grid No. 3 voltage‡ | 0 | 0 | 0 | volts |
| D-c grid No. 2 voltage | 300 | 300 | 350 | volts |
| D-c grid No. 1 voltage | −160 | −160 | −175 | volts |
| Peak r-f grid No. 1 voltage | 250 | 250 | 300 | volts |
| D-c plate current | 150 | 150 | 200 | milliamperes |
| D-c grid No. 2 current | 35 | 30 | 40 | milliamperes |
| D-c grid No. 1 current, approximate | 13 | 12 | 16 | milliamperes |
| Driving power, approximate | 2.9 | 2.7 | 4.3 | watts |
| Power output, approximate | 140 | 180 | 300 | watts |

## RADIO-FREQUENCY POWER AMPLIFIER AND OSCILLATOR—CLASS C TELEGRAPHY

*Key-down conditions per tube without amplitude modulation¶*

| Maximum ratings, absolute values | CCS* | ICAS* |
|---|---|---|
| D-c plate voltage | 2000 max | 2250 max volts |
| D-c grid No. 2 voltage | 400 max | 400 max volts |
| D-c grid No. 1 voltage | −300 max | −300 max volts |
| D-c plate current | 180 max | 225 max milliamperes |
| D-c grid No. 1 current | 25 max | 30 max milliamperes |
| Plate input | 360 max | 500 max watts |
| Grid No. 2 input | 22 max | 22 max watts |
| Plate dissipation | 100 max | 125 max watts |

| Typical operation | CCS* | | | ICAS* | |
|---|---|---|---|---|---|
| D-c plate voltage | 1250 | 1500 | 2000 | 2250 | volts |
| D-c grid No. 3 voltage‡ | 0 | 0 | 0 | 0 | volts |
| D-c grid No. 2 voltage | 300 | 300 | 400 | 400 | volts |
| D-c grid No. 1 voltage | −75 | −90 | −120 | −155 | volts |
| Peak r-f grid No. 1 voltage | 160 | 175 | 205 | 275 | volts |
| D-c plate current | 180 | 180 | 180 | 220 | milliamperes |
| D-c grid No. 2 current | 35 | 30 | 45 | 40 | milliamperes |
| D-c grid No. 1 current approximate | 12 | 12 | 10 | 15 | milliamperes |
| Driving power, approximate | 1.7 | 1.9 | 1.9 | 4.0 | watts |
| Power output, approximate | 170 | 210 | 275 | 375 | watts |

## TECHNICAL INFORMATION (CONT'D)

### SELF-RECTIFYING OSCILLATOR OR AMPLIFIER—CLASS C

| Maximum ratings, absolute values | CCS* | |
|---|---|---|
| A-c plate voltage (rms) | 2800 | max volts |
| A-c grid No. 2 voltage (rms) | 550 | max volts |
| D-c grid No. 1 voltage | −100 | max volts |
| D-c plate current | 95 | max milliamperes |
| D-c grid No. 1 current | 10 | max milliamperes |
| Plate input | 295 | max watts |
| Grid No. 2 input | 22 | max watts |
| Plate dissipation | 100 | max watts |
| **Typical operation** | **CCS*** | |
| A-c plate voltage (rms) | 2800 | volts |
| D-c grid No. 3 voltage | 0 | volts |
| A-c grid No. 2 voltage (rms) | 530 | volts |
| D-c grid No. 1 voltage | −37 | volts |
| From a grid resistor of | 37000 | ohms |
| D-c plate current | 95 | milliamperes |
| D-c grid No. 2 current | 12 | milliamperes |
| D-c grid No. 1 current, approximate | 1 | milliampere |
| Driving power, approximate△ | 1 | watt |
| Power output, approximate | 230 | watts |
| Useful power output, approximate 75% circuit efficiency | 170 | watts |

### AMPLIFIER OR OSCILLATOR—CLASS C

*With rectified, unfiltered, single-phase, full-wave plate supply*

| Maximum ratings, absolute values | CCS* | |
|---|---|---|
| D-c plate voltage | 1800 | max volts |
| D-c grid No. 2 voltage | 360 | max volts |
| D-c grid No. 1 voltage | −200 | max volts |
| D-c plate current | 190 | max milllamperes |
| D-c grid No. 1 current | 22 | max milliamperes |
| Plate input△△ | 360 | max watts |
| Grid No. 2 input | 22 | max watts |
| Plate dissipation | 100 | max watts |
| **Typical operation** | **CCS*** | |
| D-c plate voltage | 1800 | volts |
| D-c grid No. 3 voltage | 0 | volts |
| D-c grid No. 2 voltage | 250 | volts |
| D-c grid No. 1 voltage | −120 | volts |
| From a grid resistor of | 10000 | ohms |
| D-c plate current | 160 | milliamperes |
| D-c grid No. 2 current | 37 | milliamperes |
| D-c grid No. 1 current, approximate | 12 | milliamperes |
| Driving power, approximate△△△ | 2 | watts |
| Power output, approximate | 280 | watts |
| Useful power output, approximate 75% circuit efficiency | 210 | watts |

Maximum ratings apply up to 30 megacycles. The tube may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced according to the tabulation below (other maximum ratings are the same as shown above). Special attention should be given to adequate ventilation of the bulb at these frequencies.

| Frequency | 30 | 60 | 120 megacycles |
|---|---|---|---|
| Maximum permissible percentage of maximum rated plate voltage and plate input | | | |
| Class B | 100 | 88 | 76 per cent |
| Class C plate-modulated | 100 | 75 | 50 per cent |
| Class C unmodulated | 100 | 75 | 50 per cent |

*Continuous Commercial Service.
Intermittent Commercial and Amateur Service.
**Averaged over any audio-frequency cycle of sine-wave form.

## TECHNICAL INFORMATION (CONT'D)

***Driver stage should be capable of supplying the No. 1 grids of the class $AB_2$ stage with the specified driving power at low distortion.

****Usually negligible. Fixed supply or by-passed cathode resistor bias recommended.

†Usually negligible. Never more than 2 watts. At crest of audio-frequency cycle with a modulation factor of 1.0.

‡Suppressor should be connected to the mid-point of the filament circuit operated on a-c or to the negative end operated on d-c.

#Usually negligible. Fixed supply or unby-passed cathode resistor bias recommended.

##Usually negligible. R-f driving power is never more than 2 watts; A-f power is usually not more than 1.0 watt. At crest of audio-frequency cycle with a modulation factor of 1.0.

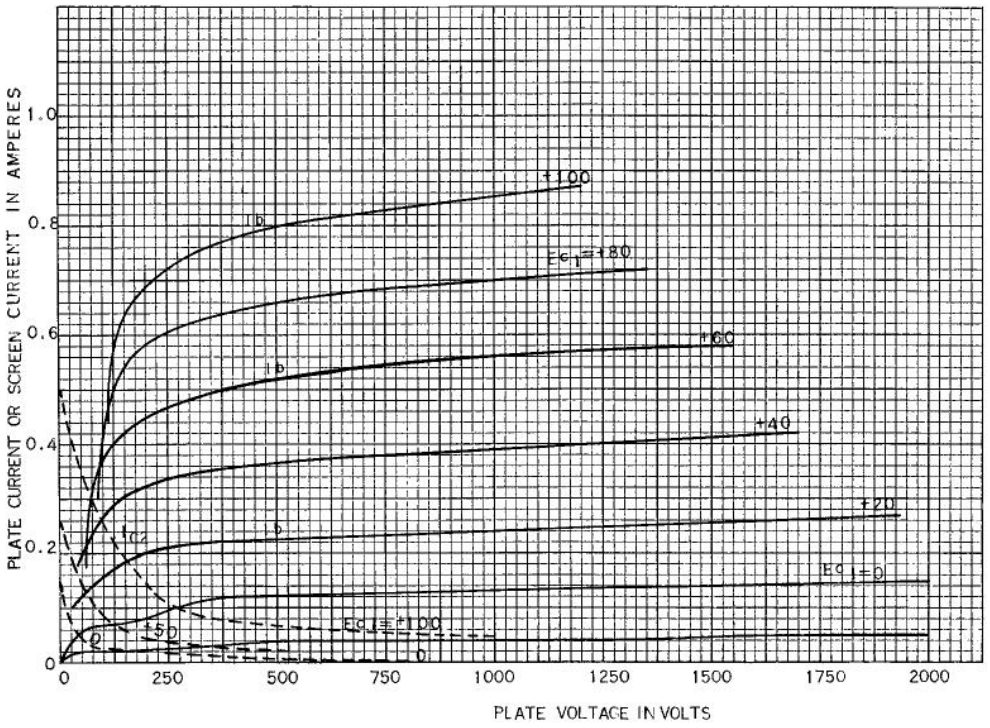
¶Modulation essentially negative may be used if the positive peak of the envelope does not exceed 115 per cent of the carrier conditions.

△From a self-rectified driver.

△△Power input is 1.23 times the product of D-c plate voltage and d-c plate current.

△△△From a driver with a rectified, unfiltered, single-phase, full-wave plate supply.

## GL-813 AVERAGE PLATE CHARACTERISTICS
## $E_f$ = 10 VOLTS D-C, SCREEN VOLTAGE = 300

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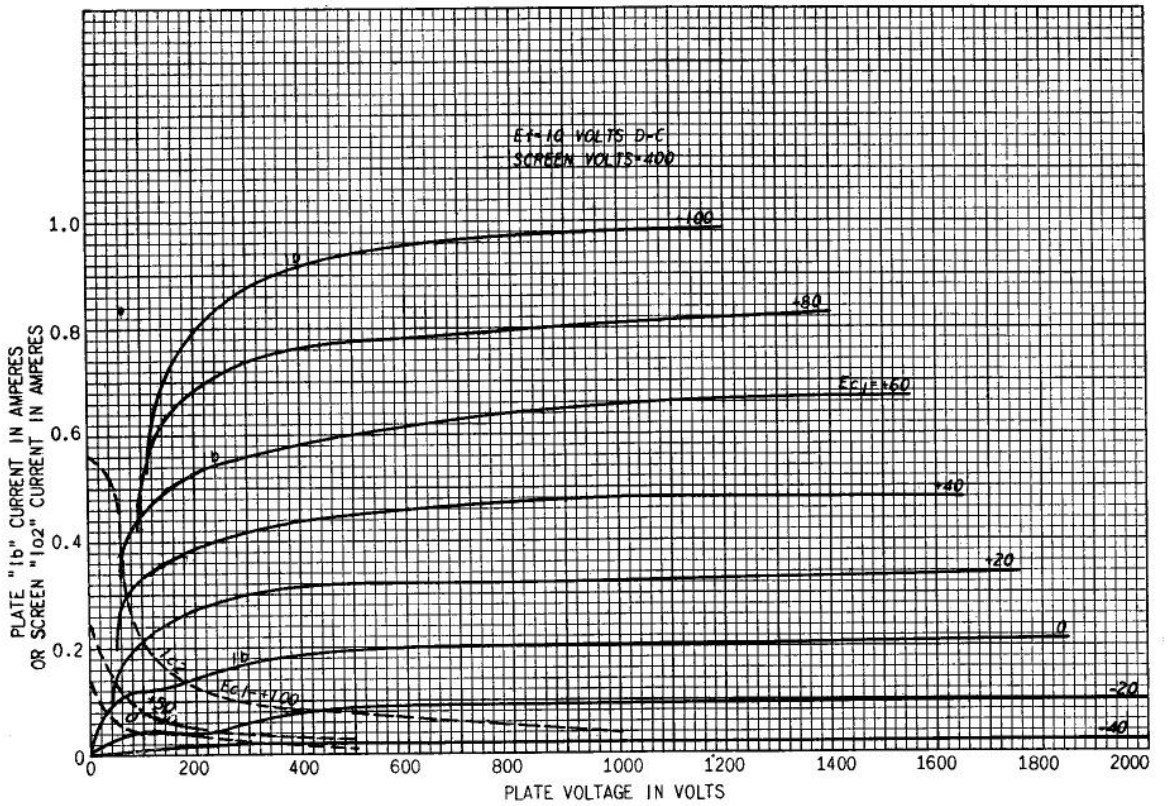
## GL-813 AVERAGE PLATE CHARACTERISTICS

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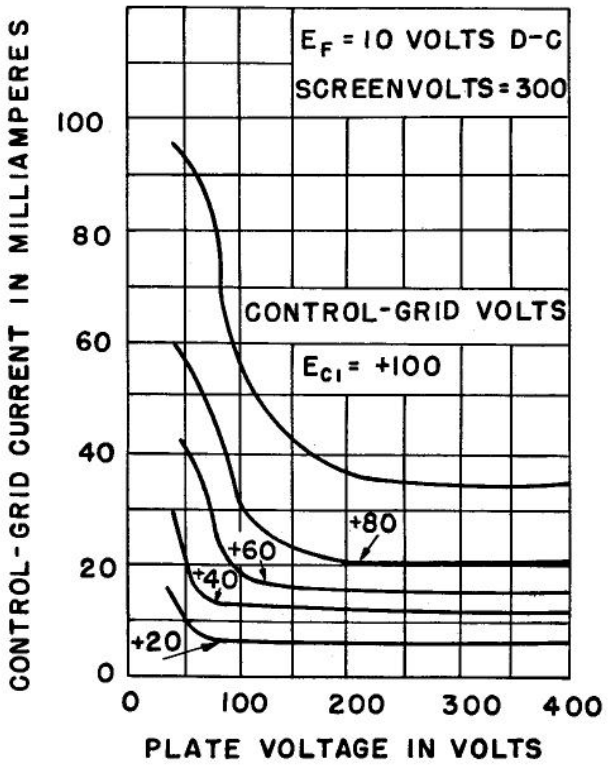
GL-813 AVERAGE PLATE CHARACTERISTICS

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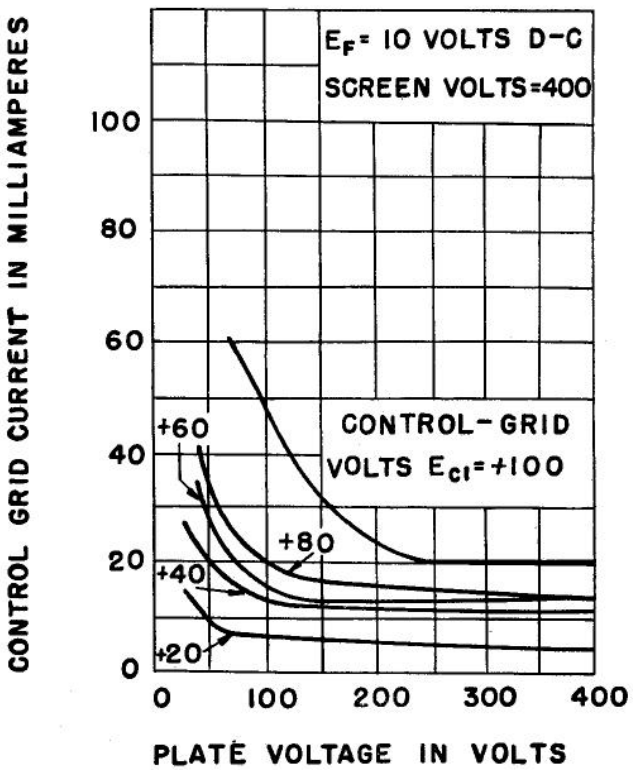
GL-813 AVERAGE CHARACTERISTICS

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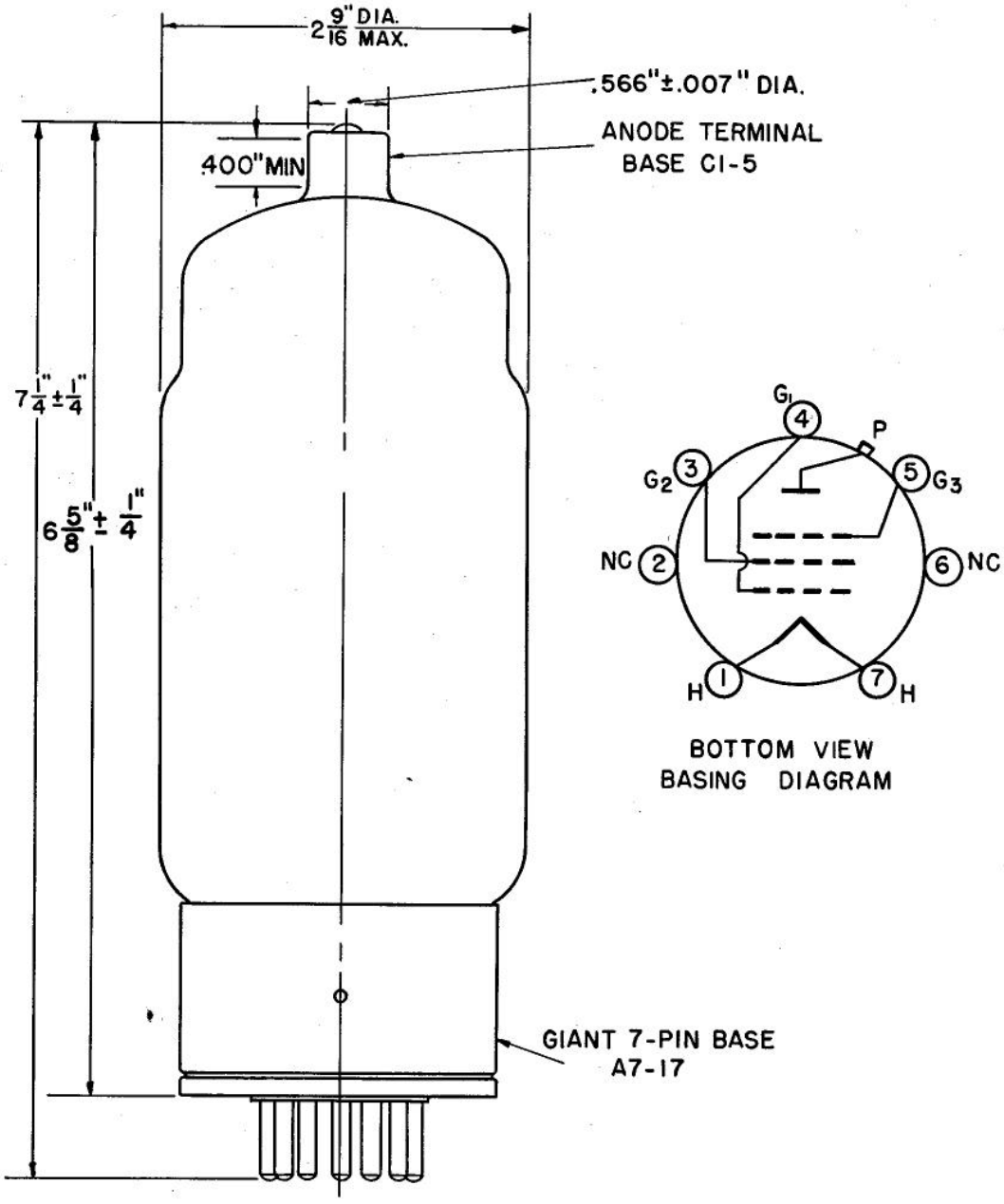


OUTLINE

# GL-813 PLIOTRON

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*Electronics Department*

**GENERAL ELECTRIC**

*Schenectady, N. Y.*