# Medium-Mu Triode

GLASS-METAL PENCIL TYPE

FAST WARM-UP TIME    STURDY COAXIAL-ELECTRODE STRUCTURE

**For Cathode-Drive Applications with Full Input up to 1700 Mc and with Reduced Input up to 3000 Mc, and at Altitudes up to 100,000 Feet**

## GENERAL DATA

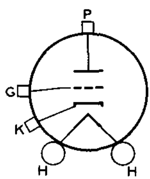
**Electrical:**

| | | |
|---|---|---|
| Heater, for Unipotential Cathode: | | |
| Voltage (AC or DC) | 6.3 ± 10% | volts |
| Current at heater volts = 6.3 | 0.135 | amp |
| Amplification Factor | 20 | |
| Transconductance, for dc plate ma. = 24, dc plate volts = 135 | 6200 | μmhos |
| Direct Interelectrode Capacitances:[a] | | |
| Grid to plate | 1.4 | pf ← |
| Grid to cathode | 2.4 | pf ← |
| Plate to cathode | 0.09 max. | pf |

**Mechanical:**

Operating Position . . . . . Any
Dimensions . . . . . See *Dimensional Outline*
Socket for Heater Pins . . . . . Grayhill No.22-3[b], Cinch 54A16325[c], or equivalent
Terminal Connections (See *Dimensional Outline*):

H – Heater
K – Cathode




G – Grid
P – Plate

**Thermal:**

| | | |
|---|---|---|
| Plate-Seal Temperature | 175 max. | °C |

**RF POWER AMPLIFIER AND OSCILLATOR — Class C Telegraphy** ←

*Key-down conditions per tube without amplitude modulation*[d]

**Maximum CCS[e] Ratings,** *Absolute-Maximum Values:*

*For altitudes up to 100,000 feet and frequencies up to 1700 Mc*

| | | |
|---|---|---|
| DC PLATE VOLTAGE | 300 max. | volts |
| DC GRID VOLTAGE | -90 max. | volts |
| DC CATHODE CURRENT | 30 max. | ma |

← Indicates a change.

| | | |
|---|---|---|
| DC GRID CURRENT | 8 max. | ma |
| PLATE INPUT | 5 max. | watts |
| PLATE DISSIPATION[f] | 5 max. | watts |
| PEAK HEATER-CATHODE VOLTAGE: | | |
| Heater negative with respect to cathode | 90 max. | volts |
| Heater positive with respect to cathode | 90 max. | volts |

**Typical CCS[e] Operation:**

*As oscillator in cathode-drive circuit*

| *At frequency of* | *1700* | *3000* | *Mc* |
|---|---|---|---|
| DC Plate-to-Grid Voltage | 128 | 151.5 | volts |
| DC Cathode-to-Grid Voltage | 8 | 1.5 | volts |
| From a grid resistor of | 2000 | 5000 | ohms |
| DC Plate Current | 25 | 29 | ma |
| DC Grid Current (Approx.) | 4 | 0.3 | ma |
| Useful Power Output (Approx.) | 475 | 50 | mw |

**Maximum Circuit Values:**

| | | |
|---|---|---|
| Grid-Circuit Resistance | 0.1 max. | megohm |

[a] Without external shield.
[b] Grayhill, Inc., 561 Hillgrove Ave., LeGrange, Illinois.
[c] Cinch Manufacturing Company, 1026 South Homan Avenue, Chicago, Illinois.
[d] Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115 per cent of the carrier conditions.
[e] Continuous Commercial Service.
[f] In applications where the plate dissipation exceeds 2.5 watts, it is important that a large area of contact be provided between the plate cylinder and the connector to provide adequate heat conduction.

## CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

| | *Note* | *Min.* | *Max.* | |
|---|---|---|---|---|
| Heater Current | 1 | 0.125 | 0.145 | amp |
| Direct Interelectrode Capacitances: | | | | |
| Grid to plate | - | 1.2 | 1.6 | pf |
| Grid to cathode | - | 2.0 | 2.6 | pf |
| Plate to cathode | - | - | 0.09 | pf |
| Heater-Cathode Leakage Current: | | | | |
| Heater negative with respect to cathode | 1,2 | - | 100 | µa |
| Heater positive with respect to cathode | 1,2 | - | 100 | µa |
| Leakage Resistance: | | | | |
| From grid to plate and cathode connected together | 1,3 | 25 | - | megohms |
| From plate to grid and cathode connected together | 1,4 | 25 | - | megohms |
| Reverse Grid Current | 1,5 | - | 1 | µa |
| Emission Voltage | 6 | - | 14 | volts |
| Amplification Factor | 1,7 | 15 | 25 | |
| Transconductance | 1,7 | 5100 | 7700 | µmhos |

| | | | | |
|---|---|---|---|---|
| Plate Current (1) . . . . . . . . . . | 1,7 | 17 | 31 | ma |
| Plate Current (2) . . . . . . . . . . | 1,8 | – | 100 | μa |
| Power Output. . . . . . . . . . . . . | 1,9 | 300 | – | mw |

Note 1: With 6.3 volts ac or dc on heater.

Note 2: With 100 volts dc between heater and cathode.

Note 3: With grid 100 volts negative with respect to plate and cathode which are connected together.

Note 4: With plate 300 volts negative with respect to grid and cathode which are connected together.

Note 5: With dc plate voltage of 150 volts, dc grid voltage of -2 volts, grid resistor of 0.1 megohm.

Note 6: With dc voltage on grid and plate which are connected together adjusted to produce a cathode current of 30 ma. and with 5.5 volts on heater.

Note 7: With dc plate-supply voltage of 135 volts, cathode resistor of 68 ohms, and cathode bypass capacitor of 1000 μf.

Note 8: With dc plate voltage of 120 volts and dc grid voltage of -25 volts.

Note 9: With dc plate voltage of 120 volts, grid resistor adjusted to give a dc plate current of 25 milliamperes in a cavity-type oscillator operating at 1700 ± 5 Mc.

## SPECIAL TESTS AND PERFORMANCE DATA

### Low-Frequency Vibration Performance:

This test (similar to MIL-E-1D, paragraph 4.9.19.1) is performed on a sample lot of tubes from each production run under the following conditions:

Heater voltage of 6.3 volts, dc plate supply voltage of 150 volts, grid voltage of -2.5 volts, and plate load resistor of 10,000 ohms. The tubes are vibrated in a plane perpendicular to the tube axis at 25 cps at an acceleration of 2.5 g. The rms output voltage across the plate load resistor as a result of vibration of the tube will not exceed 100 millivolts.

### High-Frequency Vibration Performance:

This test (similar to MIL-E-1D, paragraph 4.9.19.2) is performed on a sample lot of tubes every 90 days. The tube is vibrated perpendicular to its axis, with no voltages applied to the tube. Vibration frequency is 40 to 60 cps and acceleration is 10 g. At the end of this test, tubes will meet the following limits:

| | | |
|---|---|---|
| Heater-Cathode Leakage Current. . . . . . | 100 max. | μa |
| For conditions shown under *Characteristics Range Values Notes 1,2.* | | |
| Low-Frequency Vibration (rms) . . . . . . | 100 max. | mv |
| For conditions shown above under *Low-Frequency Vibration Performance.* | | |
| Transconductance. . . . . . . . . . . . . . | 5100 min. | μmhos |
| For conditions shown under *Characteristics Range Values Notes 1,7.* | | |
| Plate Current (2) . . . . . . . . . . . . . | 100 max. | μa |
| For conditions shown under *Characteristics Range Values Notes 1,8.* | | |

**Shorts and Continuity Test:**

This test (similar to MIL-E-1D, paragraph 4.7.3) is performed on all tubes from each production run. Voltage applied between adjacent elements of the tube under test will be between 20 and 70 volts dc or peak ac. Plate and cathode terminals are tied together and connected to the grid terminal through the shorts test equipment. Tubes are tapped with a rubber tapper three times in each of three mutually perpendicular directions. If a short indication is obtained, the tapping cycle is repeated two times for verification. Acceptance criteria is based on the "Resistance vs. Time Duration" curve shown in paragraph 4.7.7 of MIL-I-D, Amendment 5.

**Glass Seal Fracture Tests:**

Fracture tests are performed on a sample lot of tubes every 90 days.

1. Tubes are placed on supports spaced 15/16" ± 1/64" apart with the grid flange centered between these supports. Tubes will withstand gradual application, perpendicular to the tube axis, of a force of 30 pounds upon the grid flange without causing fracture of the glass insulation.

2. Tubes are held by clamping to the cathode cylinder. Tubes will withstand gradual application of a torque of 12.5 inch-pounds upon the plate terminal without causing fracture of the glass insulation.

**Dynamic Life Performance:**

This test (similar to MIL-E-1D, paragraph 4.11.3.2) is performed on a sample lot of tubes from each production run to insure high quality of rf performance. Each tube is life-tested in a cavity-type oscillator at 500 ± 15 Mc under the following conditions:

Heater voltage of 6.3 volts, plate-supply voltage of 300 volts, cathode resistor is adjusted to give a dc plate current of 30 ma and value is recorded. At the end of 500 hours, the tube will not show permanent shorts or open circuits and will be criticized for the total number of defects in the sample lot and for the number of tubes failing to meet the following limit:

Power Output. . . . . . . . . . . . . . . . . . 0.2 min. watt
For conditions shown under *Characteristics Range Values Notes 1,9*.

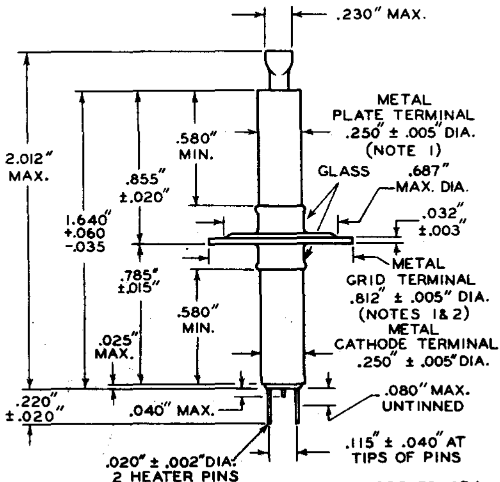
## OPERATING CONSIDERATIONS

The *mounting* for this type in coaxial-line, parallel-line, or lumped circuits may support the tube securely by any one of the three terminals. Connections to the other two terminals must be made by contacts with flexible leads.

The *mounting* for this type in cavity-type circuits should preferably support the tube by the grid flange which should make firm contact to the cavity surface.

The *heater* pins of this type should not be soldered to circuit elements. The heat of the soldering operation may crack the glass seals of the heater pins and damage the tube.

The *cathode* should preferably be connected to one side of the heater. When, in some circuit designs, the heater is not connected directly to the cathode, precautions must be taken to hold the peak heater-cathode voltage to the maximum-rated values.



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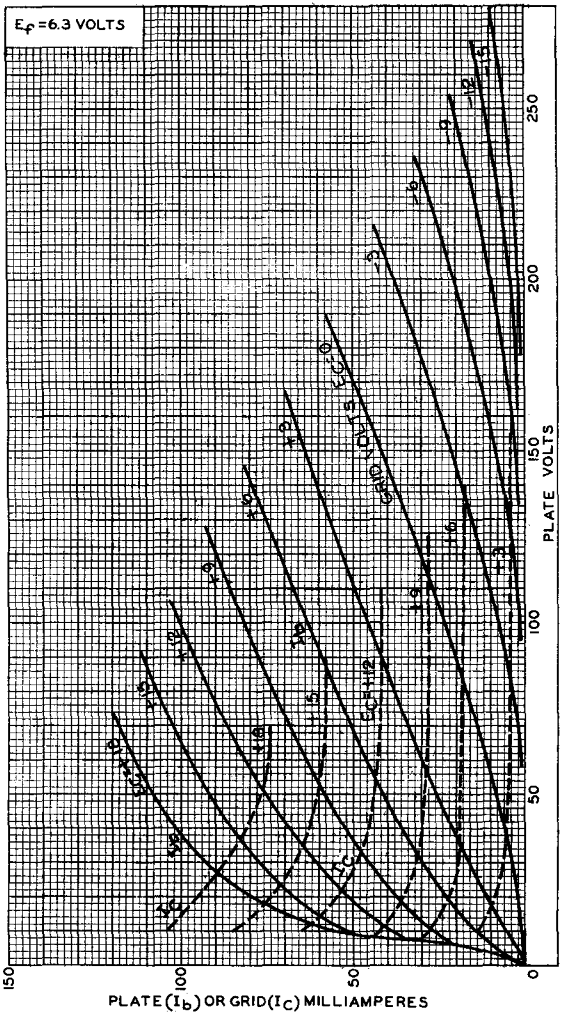
**NOTE 1:** MAXIMUM ECCENTRICITY OF CENTER LINE (AXIS) OF PLATE TERMINAL OR GRID-TERMINAL FLANGE WITH RESPECT TO THE CENTER LINE (AXIS) OF THE CATHODE TERMINAL IS 0.010".

**NOTE 2:** TILT OF GRID-TERMINAL FLANGE WITH RESPECT TO ROTATIONAL AXIS OF CATHODE TERMINAL IS DETERMINED BY CHUCKING THE CATHODE TERMINAL, ROTATING THE TUBE, AND GAUGING THE TOTAL TRAVEL DISTANCE OF THE GRID-TERMINAL FLANGE PARALLEL TO THE AXIS AT A POINT APPROXIMATELY 0.020" INWARD FROM ITS EDGE FOR ONE COMPLETE ROTATION. THE TOTAL TRAVEL DISTANCE WILL NOT EXCEED 0.020".

## AVERAGE CHARACTERISTICS

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