

METAL-CERAMIC TRIODE

FOR UHF AMPLIFIER APPLICATIONS

DESCRIPTION AND RATING



The 7077 is a high- μ triode of ceramic and metal planar construction primarily intended for use as an r-f amplifier in the UHF range. It features an extremely low noise figure throughout its frequency range. The 7077 is especially suited for use where unfavorable conditions of mechanical shock, mechanical vibration, and nuclear radiation are encountered.

GENERAL

ELECTRICAL

Cathode—Coated Unipotential
 Heater Characteristics and Ratings
 Heater Voltage, AC or DC* 6.3 \pm 0.3 Volts
 Heater Current† 0.24 Amperes
 Direct Interelectrode Capacitances‡
 Grid to Plate: (g to p) 1.0 pf
 Input: g to (h+k) 1.7 pf
 Output: p to (h+k) 0.01 pf
 Heater to Cathode: (h to k) 1.1 pf

MECHANICAL

Mounting Position—Any
 See Outline Drawing on page 3 for dimensions and electrical connections

MAXIMUM RATINGS

ABSOLUTE-MAXIMUM VALUES

Plate Voltage 250 Volts
 Positive Peak and DC Grid Voltage 0 Volts
 Negative Peak and DC Grid Voltage 50 Volts
 Plate Dissipation 1.1 Watts
 DC Cathode Current 11 Milliampères
 Heater-Cathode Voltage

Heater Positive with Respect to
 Cathode 50 Volts
 Heater Negative with Respect to
 Cathode 50 Volts
 Envelope Temperature§ 250 C
 Grid-Circuit Resistance 0.01 Megohms

Absolute-Maximum ratings are limiting values of operating and environmental conditions applicable to any electron tube of a specified type as defined by its published data and should not be exceeded under the worst probable conditions.

The tube manufacturer chooses these values to provide acceptable serviceability of the tube, making no allowance for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The equipment manufacturer should design so that initially and throughout life no absolute-maximum value for the intended service is exceeded with any tube under the worst probable operating conditions with respect to supply-voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of the tube under consideration and of all other electron devices in the equipment.

The tubes and arrangements disclosed herein may be covered by patents of General Electric Company or others. Neither the disclosure of any information herein nor the sale of tubes by General Electric Company conveys any license under patent claims covering combinations of tubes with other devices or

elements. In the absence of an express written agreement to the contrary, General Electric Company assumes no liability for patent infringement arising out of any use of the tubes with other devices or elements by any purchaser of tubes or others.

CHARACTERISTICS AND TYPICAL OPERATION

AVERAGE CHARACTERISTICS

| | |
|---|--|
| Plate Supply Voltage 250 Volts | Transconductance 10000 Micromhos |
| Resistor in Plate Circuit (bypassed) . . 18000 Ohms | Plate Current 6.5 Milliampes |
| Cathode-Bias Resistor 82 Ohms | Grid Voltage, approximate |
| Amplification Factor 90 | Gm = 50 Micromhos -5 Volts |
| Plate Resistance, approximate 9000 Ohms | |

GROUNDING-GRID AMPLIFIER—450 MEGACYCLES

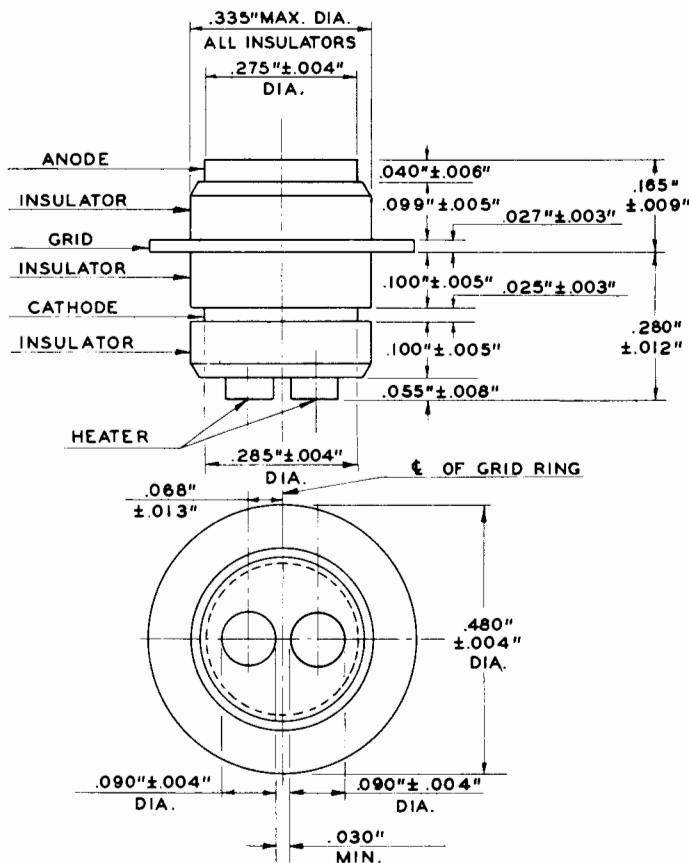
| | |
|--|---|
| Plate Supply Voltage* 250 Volts | Power Gain, approximate 14.5 Decibels |
| Resistor in Plate Circuit (bypassed)* . . 18000 Ohms | Noise Figure (Measured with power- |
| Cathode-Bias Resistor 82 Ohms | matched input, using argon lamp |
| Plate Current 6.5 Milliampes | noise source), approximate 5.5 Decibels |
| Bandwidth, approximate 7.5 Megacycles | |

FOOTNOTES

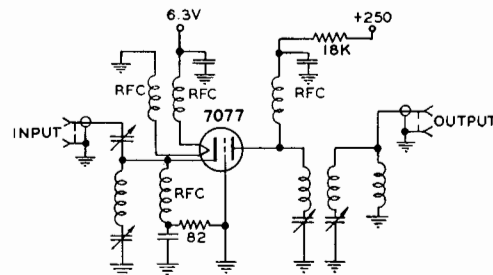
- * The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.
- † Heater current of a bogey tube at Ef = 6.3 volts.
- ‡ Measured using a grounded adapter that provides shielding between external terminals of tube.
- § Operation below the rated maximum envelope temperature is recommended for applications requiring the longest

- possible tube life. The 7077 is also capable of operation at envelope temperatures much higher than the rated maximum values. For specific recommendations concerning higher temperature operation, contact your General Electric tube sales representative.
- ¶ Lower supply voltage and a lower value of resistor may be used in the plate circuit with some sacrifice in uniformity of performance.

OUTLINE DRAWING



TYPICAL GROUNDING-GRID AMPLIFIER CIRCUIT USING THE 7077



- 1—Maximum eccentricity of anode, grid, and cathode 0.005" from center line.
- 2—Maximum eccentricity of insulators 0.010" from center line.
- 3—Center line of grid ring used as reference line for horizontal tolerances.
- 4—Bottom surface of grid ring used as reference line for vertical tolerances.

INITIAL CHARACTERISTICS LIMITS

| | Min. | Bogey | Max. | |
|---|-------|-------|-------|--------------|
| Heater Current | | | | |
| Ef = 6.3 volts | 222 | 240 | 258 | Milliamperes |
| Plate Current | | | | |
| Ef = 6.3 volts, Ebb = 250 volts, $R_L = 18000$ ohms, Rk = 82 ohms (bypassed) | 4.5 | 6.5 | 8.5 | Milliamperes |
| Transconductance | | | | |
| Ef = 6.3 volts, Ebb = 250 volts, $R_L = 18000$ ohms (bypassed), Rk = 82 ohms (bypassed) | 7000 | 10000 | 13000 | Micromhos |
| Transconductance Change with Heater Voltage | | | | |
| Difference between Transconductance measured at Ef = 6.3 and Ef = 6.0 volts (other conditions the same) expressed as a percentage | | | 20 | Percent |
| Amplification Factor | | | | |
| Ef = 6.3 volts, Ebb = 250 volts, $R_L = 18000$ ohms (bypassed), Rk = 82 ohms (bypassed) | 65 | 90 | 115 | |
| Interelectrode Capacitances | | | | |
| Grid to Plate: (g to p) | 0.84 | 1.00 | 1.16 | Picofarads |
| Input: g to (h+k) | 1.25 | 1.70 | 2.15 | Picofarads |
| Output: p to (h+k) | 0.004 | 0.010 | 0.016 | Picofarads |
| Heater to Cathode: (h to k) | 0.80 | 1.10 | 1.40 | Picofarads |
| Heater-Cathode Leakage Current | | | | |
| Ef = 6.3 volts, Ehh = 100 volts | | | | |
| Heater Positive with Respect to Cathode | | | 20 | Microamperes |
| Heater Negative with Respect to Cathode | | | 20 | Microamperes |
| Interelectrode Leakage Resistance | | | | |
| Ef = 6.3 volts, Polarity of applied d-c interelectrode voltage is such that no cathode emission results. | | | | |
| Grid to All at 100 volts d-c | 100 | | | Megohms |
| Plate to All at 300 volts d-c | 100 | | | Megohms |
| Grid Emission Current | | | | |
| Ef = 7.0 volts, Ebb = 250 volts, Ecc = -20 volts, Rk = 82 ohms (bypassed), Rg = 0.1 meg, $R_L = 18000$ ohms (bypassed) | | | 2.0 | Microamperes |

SPECIAL PERFORMANCE TESTS

| | Min. | Bogey | Max. | |
|---|------|-------|------|----------|
| Noise Figure | | | | |
| Ef = 6.3 volts, Ebb = 250 volts, Rk = 82 ohms, $R_L = 18000$ ohms, F = 450 mc. | | 5.5 | 6.6 | Decibels |
| Noise Figure at Reduced Heater Voltage | | | | |
| Ef = 6.0 volts, Ebb = 250 volts, Rk = 82 ohms, $R_L = 18000$ ohms, F = 450 mc. | | | 8.1 | Decibels |
| Power Gain | | | | |
| Ef = 6.3 volts, Ebb = 250 volts, Rk = 82 ohms, $R_L = 18000$ ohms, F = 450 mc. | 12.5 | 14.5 | | Decibels |

SPECIAL PERFORMANCE TESTS (Continued)

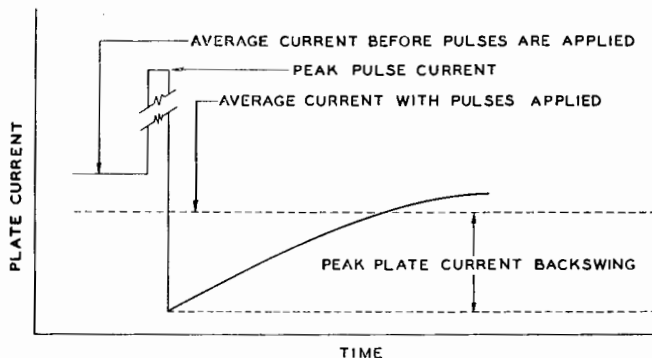
Grid Recovery

| | |
|--------------------------------------|------------------|
| Change in Average Plate Current..... | 0.6 Milliamperes |
| Peak Plate Current Backswing..... | 1.0 Milliamperes |

Tubes with poor grid recovery affect circuit operation, when the grid is driven positive by a pulse of signal or noise, somewhat as if a parallel RC circuit were in series with the grid. This effect may occur in tubes of any type, but is unimportant in many applications. In the majority of 7077 tubes the effect is negligible, but to eliminate the few in which it may be excessive, tubes are tested under the following conditions: $E_f = 6.3$ volts, $E_{bb} = 250$ volts, $R_L = 0.01$ meg. E_c is adjusted for $I_b = 3.0$ ma.

Upon application to the grid of a 5 volts positive pulse (pr = 60 pps, duty factor = 0.0012) the change in average plate current is noted, and the peak plate current backswing is measured. The following diagram shows qualitatively the plate current-time relationship for a tube (with poor grid recovery) subjected to this test.

**PLATE CURRENT VS. TIME
— GRID RECOVERY TEST**



| | | | |
|---------------------------------------|-------------|--------------|-------------------|
| Low Frequency Vibrational Output..... | Min. | Bogey | Max. |
| | | | 10 Millivolts RMS |

Statistical sample is subjected to vibration in each of two planes at 40 cps, with peak acceleration 15G. Tube is

operated with $E_f = 6.3$ volts, $E_{bb} = 150$ volts, $R_k = 82$ ohms (bypassed), $R_L = 10000$ ohms.

Variable Frequency Vibrational Output

The tube is designed to be free of vibrational outputs in excess of 15 mv RMS at any frequency within the range 100-2000 cps, when vibrated in either of two planes at 10G

peak acceleration. Electrical conditions for this test are the same as for Low Frequency Vibrational Output.

Low Pressure Voltage Breakdown Test

Statistical sample tested for voltage breakdown at a pressure of 8mm Hg, to simulate an altitude of 100,000 feet. Tubes shall not give visual evidence of flashover or corona

when 300 volts RMS, 60 cps, is applied between the plate and grid terminals.

DEGRADATION RATE TESTS

Fatigue

Statistical sample vibrated for a total of 96 hours, 48 hours in each of two planes, at a peak acceleration of 10G. Frequency is 60 cps. Tubes are operated during the test with $E_f = 6.3$ volts (no other voltages applied). Following the test, tubes are evaluated for low frequency vibrational output, heater-cathode leakage, heater current, noise figure, and gain.

Shock

Statistical sample subjected to 5 impact accelerations of approximately 450G in each of four positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine using a 30° hammer angle. Tubes are operated during the test with $E_f = 6.3$ volts, $E_b = 150$ volts, $E_{hk} = +100$ volts, and $R_k = 82$ ohms. Following the test, tubes are evaluated for low frequency

DEGRADATION RATE TESTS (Continued)

vibrational output, heater-cathode leakage, heater current, noise figure, and gain.

Stability Life Test

Statistical sample operated under Intermittent Life Test conditions is evaluated for percent change in transconductance of individual tubes, from the initial reading to readings following 2 hours and 20 hours of the life test.

Survival Rate Life Test

Statistical sample operated under Intermittent Life Test conditions is evaluated for shorted and open elements, transconductance, and noise figure following approximately 100 hours of life test.

Intermittent Life Test

Statistical sample operated for 1000 hours under the following conditions: $E_f = 6.3$ volts (cycled—on $1\frac{3}{4}$ hours, off $\frac{1}{4}$ hour), $E_{bb} = 300$ volts, $E_{hk} = +70$ volts d-c, $R_k = 82$ ohms, $R_L = 18000$ ohms, and $R_g = 0.1$ meg. Tubes are evaluated, following 500 and 1000 hours of life test, for shorted or open elements, heater current, transconductance, noise figure, gain, heater-cathode leakage, and interelectrode leakage resistance.

High-Temperature Intermittent Life Test

Statistical sample operated for 1000 hours under Intermittent Life Test conditions except that minimum envelope temperature shall be 250C. Tubes are evaluated, following 500 and 1000 of life test, for shorted or open elements, heater current, transconductance, heater-cathode leakage, and interelectrode leakage resistance.

Interface Life Test

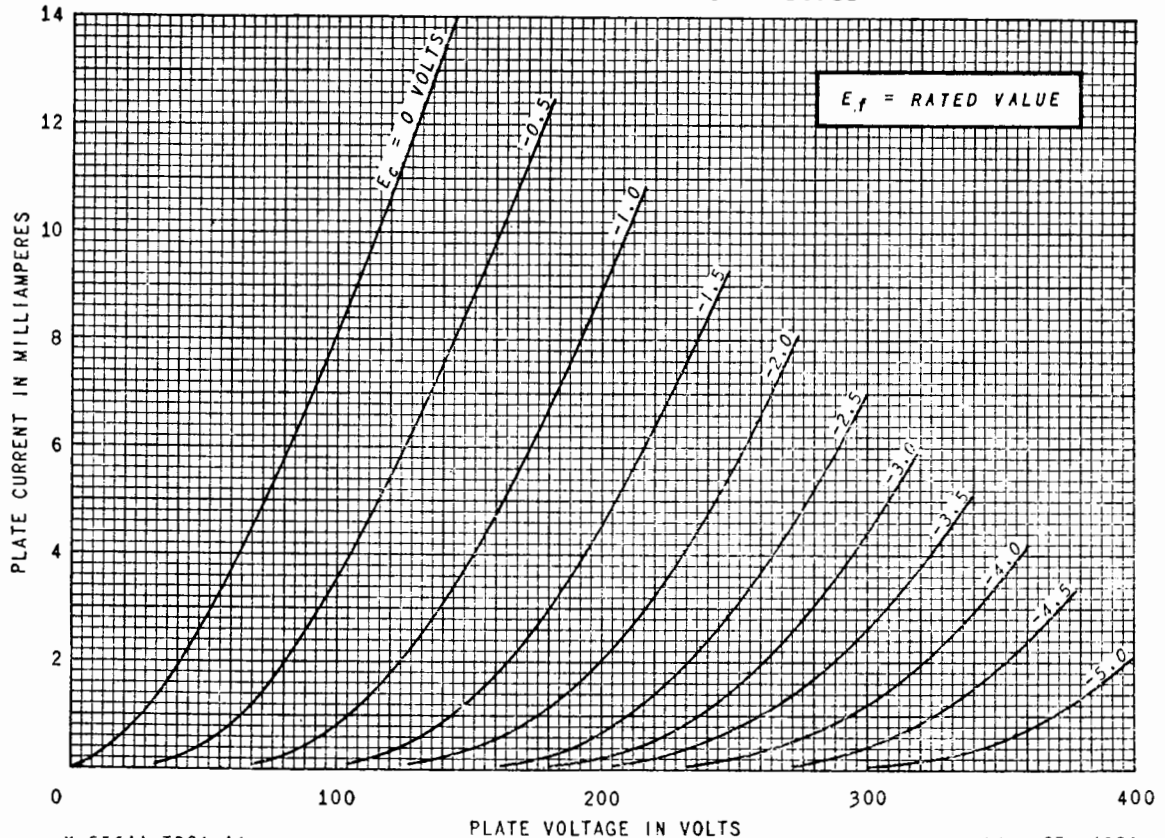
Statistical sample operated for 1000 hours with $E_f = 6.6$ volts, no other voltages applied, and evaluated for cathode interface resistance following the life test.

Heater-Cycling Life Test

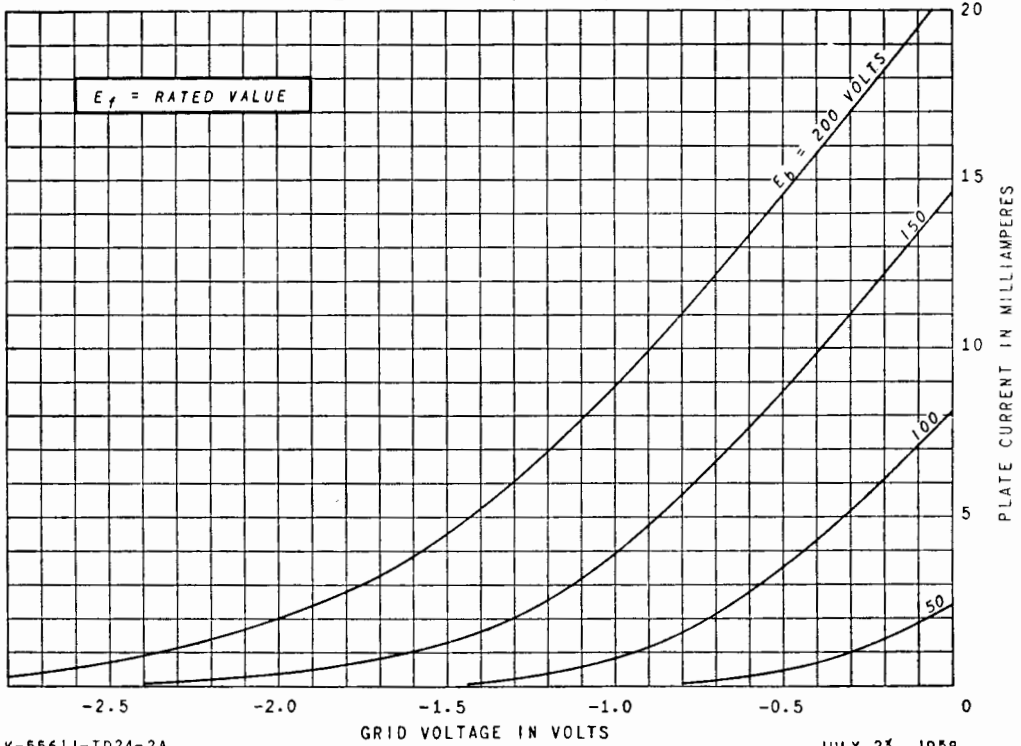
Statistical sample operated for 2000 cycles minimum to evaluate and control heater-cathode defects. Conditions of test include $E_f = 7.0$ volts cycled for one minute on and one minute off, $E_b = E_c = 0$ volts, and $E_{hk} = 70$ volts with heater positive with respect to cathode. Following this test, tubes are evaluated for open heaters, heater-cathode shorts, and heater-cathode leakage current.

Note: The conditions for some of the indicated tests have deliberately been selected to aggravate tube failures for test and evaluation purposes. In no sense should these conditions be interpreted as suitable operating conditions.

AVERAGE PLATE CHARACTERISTICS



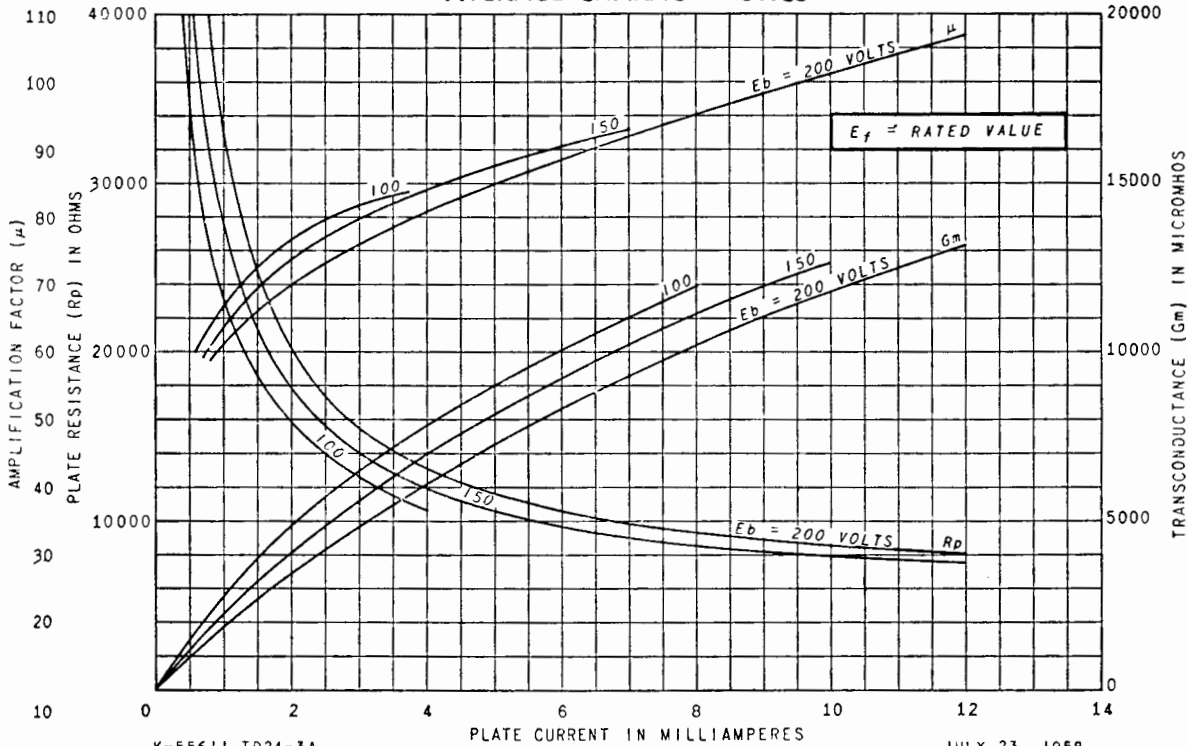
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD24-2A

JULY 23, 1958

AVERAGE CHARACTERISTICS



K-55611-TD24-3A

JULY 23, 1958

TUBE DEPARTMENT

GENERAL  ELECTRIC

Owensboro, Kentucky