



**ELECTRONIC
INNOVATIONS**
IN ACTION

TUBES



7077

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 Milliampere
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
Resistor in Plate Circuit (bypassed)	18000	Ohms
Cathode-Bias Resistor	82	Ohms
Amplification Factor	90	
Plate Resistance, approximate	9000	Ohms

Transconductance	10000	Micromhos
Plate Current	6.5	Milliamperes
Grid Voltage, approximate		
Gm = 50 Micromhos	-5	Volts

GROUNDING-GRID AMPLIFIER—450 MEGACYCLES

Plate Supply Voltage [¶]	250	Volts
Resistor in Plate Circuit (bypassed) [¶]	18000	Ohms
Cathode-Bias Resistor	82	Ohms
Plate Current	6.5	Milliamperes
Bandwidth, approximate	7.5	Megacycles

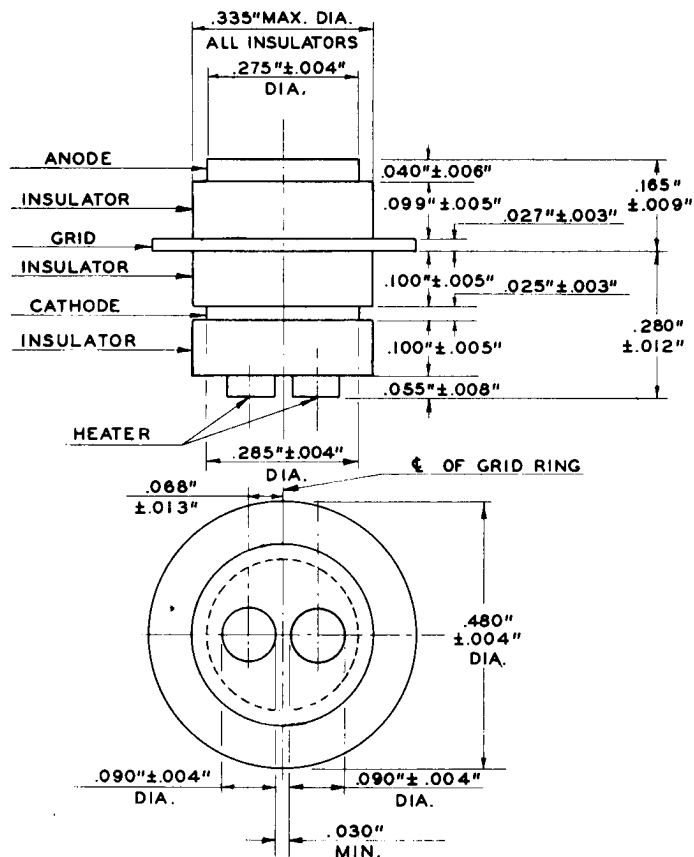
Power Gain, approximate	14.5	Decibels
Noise Figure (Measured with power-matched input, using argon lamp noise source), approximate	5.5	Decibels

FOOTNOTES

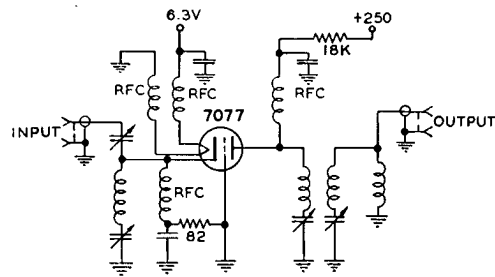
- * The equipment designer should design the equipment so that heater voltage is centered at the specified bogey value, with heater supply variations restricted to maintain heater voltage within the specified tolerance.
- † Heater current of a bogey tube at Ef = 6.3 volts.
- ‡ Measured using a grounded 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, RL = 18000 ohms, Rk = 82 ohms (bypassed)	4.5	6.5	8.5	Milliamperes
Transconductance				
Ef = 6.3 volts, Ebb = 250 volts, RL = 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, RL = 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, Ehk = 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, RL = 18000 ohms (bypassed)			2.0	Microamperes

SPECIAL PERFORMANCE TESTS

	Min.	Bogey	Max.	
Noise Figure				
Ef = 6.3 volts, Ebb = 250 volts, Rk = 82 ohms, RL = 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, RL = 18000 ohms, F = 450 mc			8.1	Decibels
Power Gain				
Ef = 6.3 volts, Ebb = 250 volts, Rk = 82 ohms, RL = 18000 ohms, F = 450 mc	12.5	14.5		Decibels

SPECIAL PERFORMANCE TESTS (Continued)

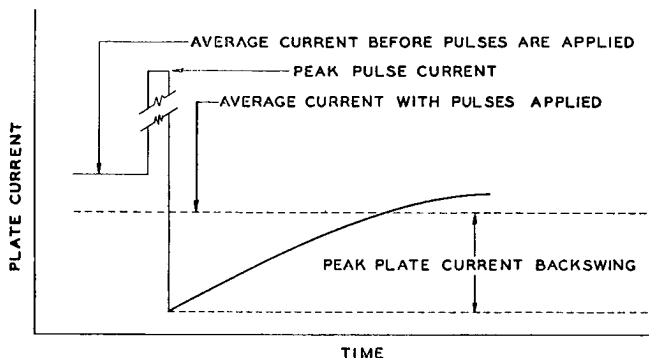
Grid Recovery

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 (prf = 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