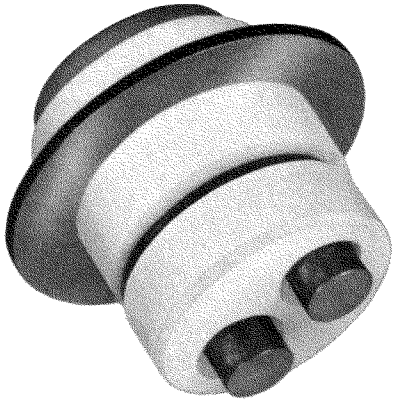
METAL-CERAMIC TRIODE

FOR UHF AMPLIFIER APPLICATIONS



DESCRIPTION AND RATING

The 7077 is a high-mu 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 ± 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	Milliamperes
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.

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

GROUNDED-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.

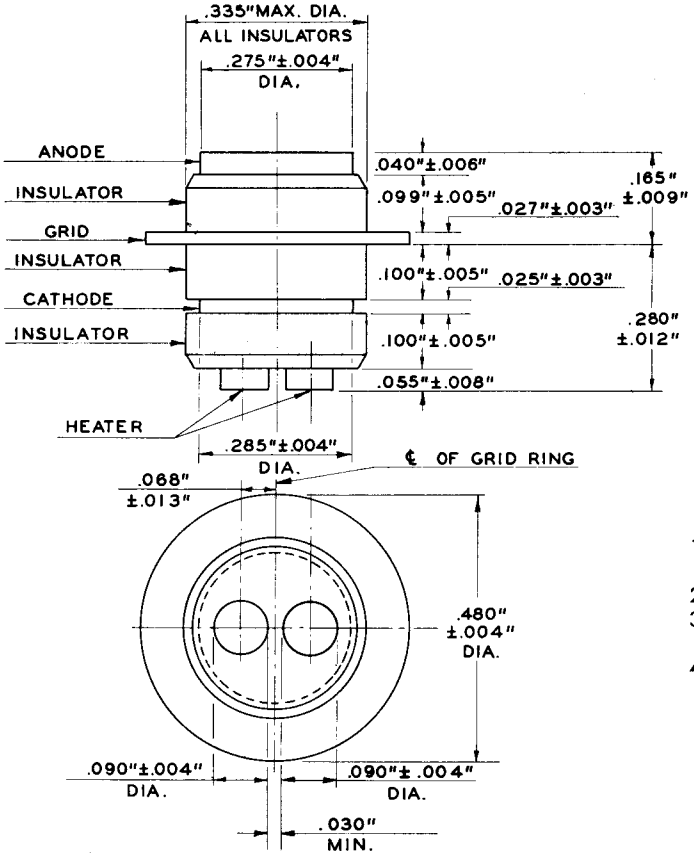
† Heater current of a bogey tube at Ef = 6.3 volts.

‡ Measured using a grounded adapter that provides shielding between external terminals of tube.

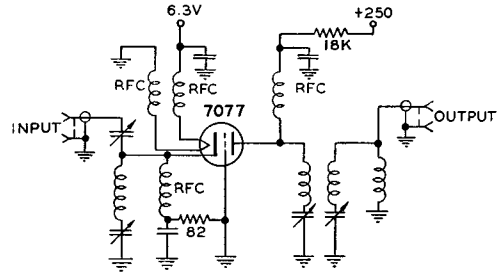
§ Operation below the rated maximum envelope temperature is recommended for applications requiring the longest possible tube life. The 7077 is also capable of operation at envelope temperatures much higher than the rated maximum values. For specific recommendations concerning higher temperature operation, 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 GROUNDED-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, 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, 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)

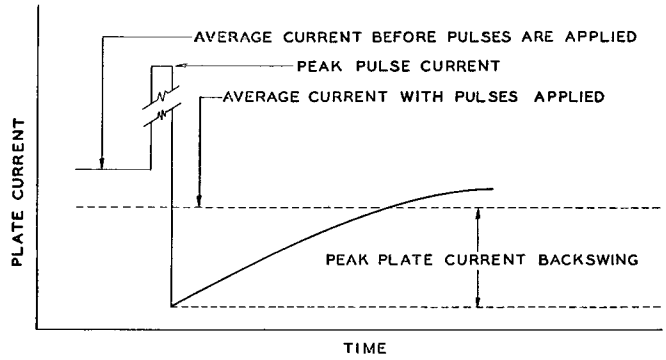
Grid Recovery

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: Ef = 6.3 volts, Ebb = 250 volts, R_L = 0.01 meg. Ec is adjusted for Ib = 3.0 ma.

Upon application to the grid of a 5 volts positive pulse (prr = 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



	Min.	Bogey	Max.	
Low Frequency Vibrational Output			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 Ef = 6.3 volts, Ebb = 150 volts, Rk = 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 Ef = 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 Ef = 6.3 volts, Eb = 150 volts, Ehk = +100 volts, and Rk = 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: Ef = 6.3 volts (cycled—on 1¾ hours, off ¼ hour), Ebb = 300 volts, Ehk = +70 volts d-c, Rk = 82 ohms, R_L = 18000 ohms, and Rg = 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

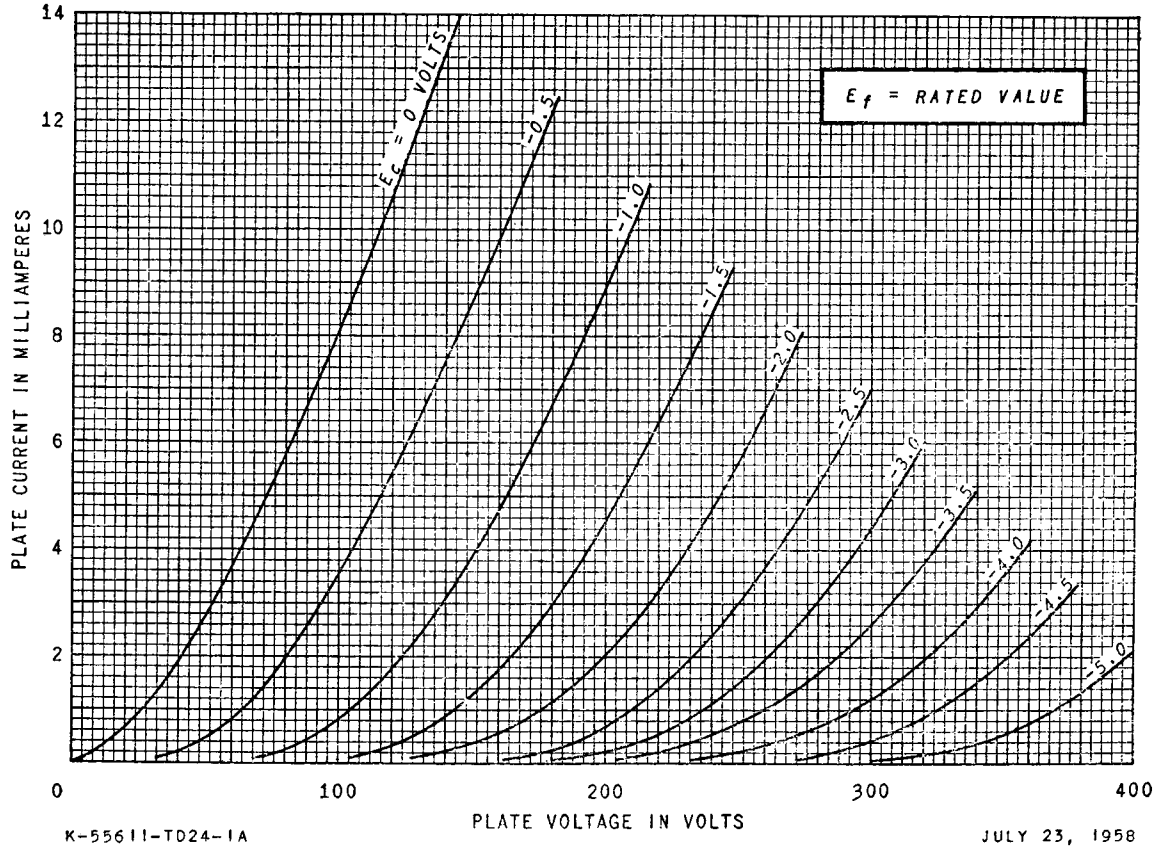
Statistical sample operated for 1000 hours with Ef = 6.6 volts, no other voltages applied, and evaluated for cathode interface resistance following the life test.

Heater-Cycling Life Test

Statistical sample operated for 2000 cycles minimum to evaluate and control heater-cathode defects. Conditions of test include Ef = 7.0 volts cycled for one minute on and one minute off, Eb = Ec = 0 volts, and Ehk = 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.

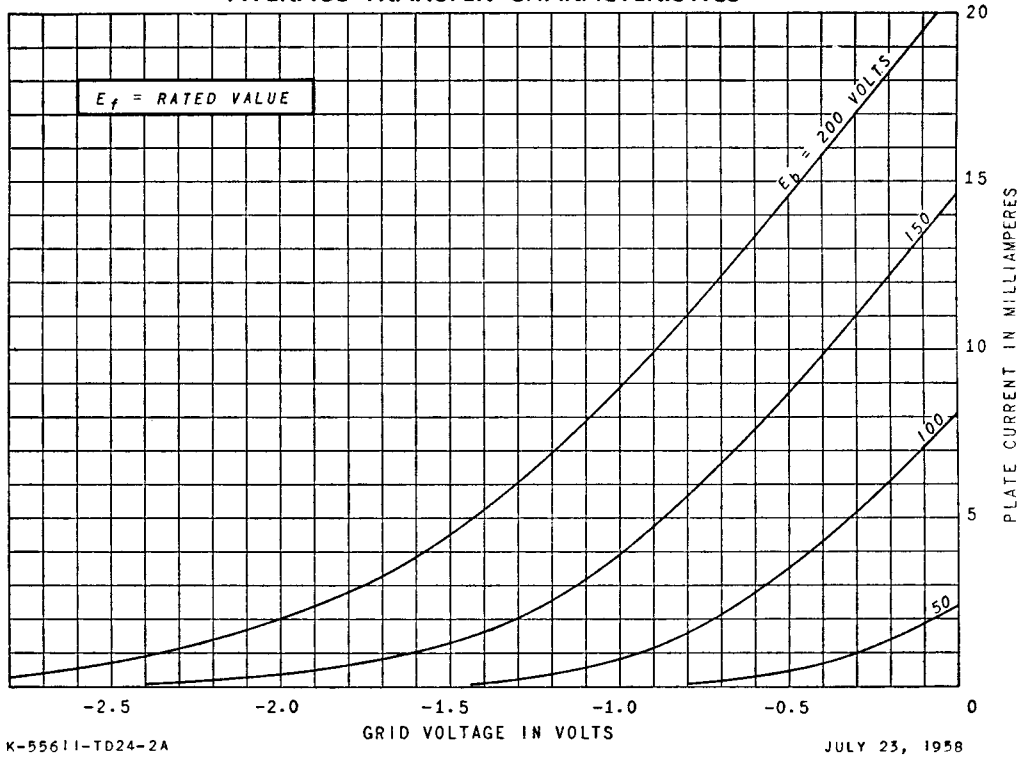
AVERAGE PLATE CHARACTERISTICS



K-5561I-TD24-IA

JULY 23, 1958

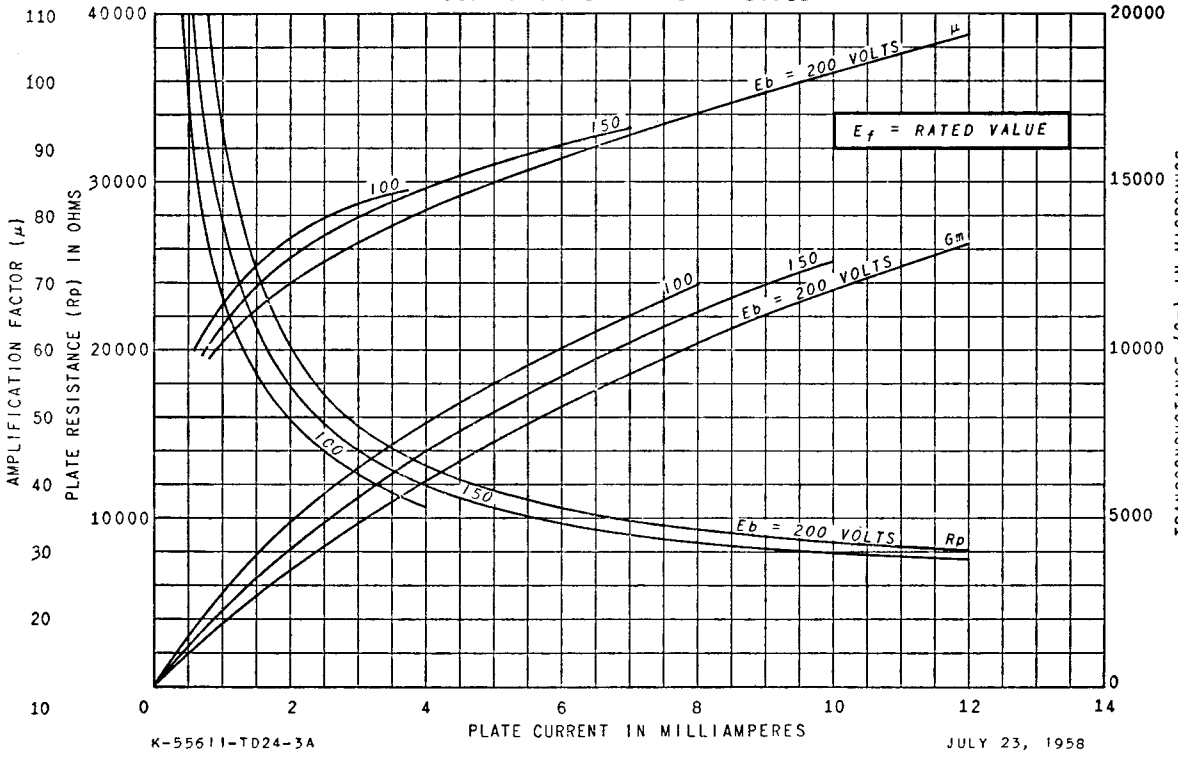
AVERAGE TRANSFER CHARACTERISTICS



K-55611-TD24-2A

JULY 23, 1958

AVERAGE CHARACTERISTICS



K-55611-TD24-3A

JULY 23, 1958

RECEIVING TUBE DEPARTMENT

GENERAL ELECTRIC

Owensboro, Kentucky