7553

High-Mu Triode

CERAMIC-METAL PENCIL TYPE
FAST WARM-UP TIME — STURDY COAXIAL-ELECTRODE STRUCTURE

For Use as a Low-Noise Amplifier Tube in Receiver Applications up to 1000 Mc

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at 6.3 volts	0.225	amp
Cathode Warm-Up Time to reach 90% of operating plate current: For conditions: heater volts = 6.3, dc plate supply volts = 80, dc grid volts = 0, cathode resistor (ohms) = 0, and load resistor (ohms) = 10.	10 max.	sec
Direct Interelectrode Capacitances:▲		
Grid to plate	2.4	μμf
Grid to cathode and heater	4.4	μμf
Plate to cathode and heater	0.03 max.	μμf
Heater to cathode	2.6	μμf
Cathode to plate	0.03 max.	μμf
Cathode to grid and heater	7	μμf
Plate to grid and heater	2.4	μμf

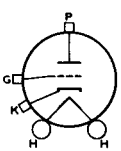
Characteristics, Class A_1 Amplifier:

Plate Supply Voltage	125	volts
Cathode Resistor	50	ohms
Amplification Factor	80	
Plate Resistance (Approx.)	6150	ohms
Transconductance	13000	μmhos
Plate Current	12.5	ma

Mechanical:

Operating Position	Any
Dimensions	See *Dimensional Outline*
Weight (Approx.)	0.3 oz
Sockets:	
Heater-terminals connector	Amerac● No.1018-88★ or Grayhill♦ No.22-5, or equivalent
Cavities (Including heater-terminals connector)	J-V-M No.D-7980♠ Series

Terminal Connections (See *Dimensional Outline*):



H – Heater
K – Cathode
G – Grid
P – Plate

7553

RF AMPLIFIER — Class A$_1$
(Cathode-Drive Service)

Maximum and Minimum CCS♠ Ratings, *Absolute-Maximum Values:*

For altitudes up to 100,000 feet and frequencies up to 1000 Mc

DC PLATE-TO-GRID VOLTAGE	250 max.	volts
DC CATHODE-TO-GRID VOLTAGE	0 min.	volts
DC PLATE CURRENT	25 max.	ma
PLATE DISSIPATION	2.5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	50 max.	volts
Heater positive with respect to cathode	50 max.	volts
PLATE-SEAL TEMPERATURE	225 max.	°C

Typical CCS Operation:

	At 550 Mc	
DC Plate-to-Grid Supply Voltage	125	volts
Cathode Resistor	50	ohms
Input-Signal Level	−70	dbm
DC Plate Current	12.5	ma
Power Gain for a bandwidth of 5 Mc	16.5	db
Noise Factor	6.5	db

Maximum Circuit Values:

Grid-Circuit Resistance:

For fixed-bias operation	Not recommended
For cathode-bias operation	0.25 max. megohm

▲ Without external shield.

● Amerac, Inc., Dunham Road, Beverly, Massachusetts.

★ For use with cavities.

♦ Grayhill, Inc., 561 Hillgrove Ave., LaGrange, Illinois.

♦ J-V-M Microwave Co., 9300 W. 47th St., Brookfield, Illinois. Indicated No. applies to a series of cavities covering range from 220 up to 1000 Mc and above.

♠ Continuous Commercial Service.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	*Min.*	*Max.*	
Heater Current	1	0.205	0.245	amp
Direct Interelectrode Capacitances:				
Grid to plate	–	2.1	2.8	μμf
Grid to cathode	–	3.8	4.8	μμf
Plate to cathode	–	–	0.03	μμf
Transconductance	1,2	10000	16000	μmhos
Reverse Grid Current	1,3	–	0.3	μa
Heater-Cathode Leakage Current	1,4	–	30	μa
Leakage Resistance:				
From grid to plate and cathode connected together	1,5	100	–	megohms
From plate to grid and cathode connected together	1,6	100	–	megohms
Plate Current (1)	1,2	8.5	16.5	ma

Plate Current (2)	1,7	–	50	μa
Plate Current (3)	1,8	100	–	μa
Power Gain	1,9	14	–	db
Noise Factor	1,9	–	7	db
Change in Power Gain	1,9,10	–	-1	db
Change in Noise Factor	1,9,10	–	+0.5	db

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

Note 2: With dc plate supply voltage of 125 volts, and cathode resistor of 50 ohms shunted by 1000 μf.

Note 3: With dc plate voltage of 200 volts, grid resistor of 0.5 megohm, and dc grid voltage of -2 volts.

Note 4: With 60 volts dc between heater and cathode, and heater positive with respect to cathode.

Note 5: With grid 100 volts negative with respect to plate and cathode tied together.

Note 6: With plate 300 volts negative with respect to grid and cathode tied together.

Note 7: With dc plate voltage of 125 volts and dc grid voltage of -5 volts.

Note 8: With dc plate voltage of 125 volts and dc grid voltage of -2.5 volts.

Note 9: In a single-tube rf amplifier of the cavity type having a bandwidth of 5 Mc, signal input of -70 dbm, and operating frequency of 550 Mc.

Note 10: Reduce heater voltage to 5.7 volts. Change in Power-Gain and Noise-Factor values from those obtained with 6.3 volts on heater will not exceed indicated values.

SPECIAL TESTS & PERFORMANCE DATA

Low-Pressure Voltage Breakdown Test:

This test (similar to MIL-E-ID, paragraph 4.9.12.1) is performed on a sample lot of tubes from each production run. Tubes are tested in a chamber at an air pressure equivalent to an altitude of 100,000 feet. Breakdown will not occur when an rms voltage of 300 volts is applied between the plate cylinder and grid flange.

Low-Frequency Vibration Performance:

This test 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 125 volts, cathode resistor of 50 ohms, and plate load resistor of 10,000 ohms. The tubes are vibrated in a plane perpendicular to the tube axis at 40 cycles per second at an acceleration of 10 g. The rms output voltage across the plate load resistor as a result of vibration of the tube will not exceed 100 millivolts.

Variable-Frequency Vibration Performance:

This test is performed on a sample lot of tubes from each production run. Tube operating conditions are the same as for *Low-Frequency Vibration*. The tube is vibrated perpendicular to its major axis through a frequency range from 5 to 2000 cps and back. From 5 to 50 cps, the tube shall be vibrated at a constant displacement of 0.0400 ± 0.0025 inch. From 50 to 2000 cps, the tube shall be vibrated at a constant

acceleration of 10 ± 2 g. Total time to complete a sweep cycle shall be 10 ± 5 minutes. During the test, the tubes will not show an rms output voltage across the plate load resistor in excess of 150 millivolts. Each tube shall be vibrated for 60 seconds at the frequency which gives maximum vibrational noise output. If, at the end of 60 seconds the vibrational noise output is still increasing, the test shall continue until there is no further increase. The rms output voltage across the plate load resistor as a result of the vibration of the tube must not exceed the specified limit at any time during the test.

Shock Test:

This test (similar to MIL-E-1D, paragraph 4.9.20.5) is performed on a sample lot of tubes from each production run. Tubes are held rigid and are subjected in three different positions to an impact acceleration of 500 g, 5 blows in each position.

At the end of this test, tubes will not show permanent or temporary shorts or open circuits, and are required to meet the following limits:

Heater-Cathode Leakage Current. . . . . 60 max. μa

For conditions shown under *Characteristics Range Values, Notes 1,4.*

Low-Frequency Vibration Output. . . . . 200 max. mv

For conditions shown above under *Low-Frequency Vibration Performance.*

Change in transconductance. . . . . 10 max. %

From initial value for conditions shown under *Characteristics Range Values, Notes 1,2.*

Change in Reverse Grid Current. . . . . 1 max. μa

From initial value for conditions shown under *Characteristics Range Values, Notes 1,3.*

Fatigue Vibration Test:

This test (similar to MIL-E-1D, paragraph 4.9.20.6) is performed on a sample lot of tubes from each production run. Tubes are rigidly mounted and subjected to 2.5 g vibrational acceleration in two positions (X1, Y1) for 32 hours each. At the end of this test, tubes will meet the limits specified for the *Shock Test.*

Shorts and Continuity Test:

This test is performed on all tubes from each production run. In this test, a tube is considered inoperative if it shows a permanent or temporary short or open circuit, an air leak, or reverse grid current in excess of 1 microampere for the conditions shown under *Characteristics Range Values, Notes 1,4.*

Heater-Cycling Life Performance:

This test is performed on a sample lot of tubes from each production run. With 6.3 volts on heater and no voltage on plate or grid, the heater is cycled three minutes on and three minutes off for at least 2000 cycles. At the end of this test, tubes will not show temporary or permanent shorts or opens, and are required to meet the following limits:

Grid-to-Cathode Leakage Resistance. . . . 50 min. megohms

For conditions shown under *Characteristics Range Values, Notes 1,5.*

Heater-to-Cathode Leakage Current . . . . 60 max. μa

For conditions shown under *Characteristics Range Values, Notes 1,4.*

1-Hour Stability Life Performance:

This test is performed on a sample lot of tubes from each production run to insure that the tubes have been properly stabilized. Tubes are operated under the following conditions: heater voltage of 6.3 volts, plate supply voltage of 215 volts, and cathode resistor of 150 ohms. At the end of 1 hour, the change in transconductance value for each tube, referred to its initial transconductance reading, will not exceed 15 per cent of the initial value for conditions shown under *Characteristics Range Values, Notes 1,2.*

44-Hour Grid-Emission Life Performance:

This test is performed on a sample lot of tubes from each production run to insure excellent overall performance and to guard against epidemic failures of tubes to meet this test requirement. Tubes are operated under the following conditions: heater voltage of 7.5 volts, dc plate voltage of 215 volts, grid voltage of −2 volts, and grid resistor of 0.5 megohm. At the end of 44 hours, the reverse grid current will not exceed 2 microamperes when grid resistor is shorted and grid voltage is increased to −5 volts, other conditions remaining unchanged from the above values.

100-Hour Survival Life Performance:

This test is performed on a sample lot of tubes from each production run to insure a low percentage of early inoperatives. Life-test conditions are the same as those specified for *1-Hour Stability Life Performance* except that all voltages are cycled at the rate of 110 minutes on and 10 minutes off. At the end of 100 hours, the tubes will meet the following limits:

Transconductance. . . . . 8000 min. μmhos

For conditions shown under *Characteristics Range Values, Notes 1,2.*

Plate Current (2) . . . . . 50 max. μa

For conditions shown under *Characteristics Range Values, Notes 1,7.*

500-Hour Average Life Performance:

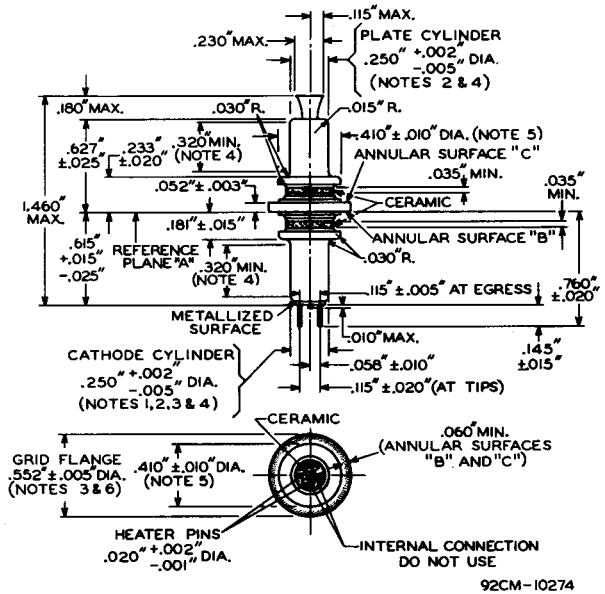
This test is performed on a sample lot of tubes from each production run to insure excellent overall performance and to guard against epidemic failures of tubes to meet any of the characteristics indicated below. Each tube is life tested under the following conditions: heater voltage of 6.3 volts, plate supply voltage of 215 volts, cathode resistor of 150 ohms, heater positive with respect to cathode by 67.5 volts, and plate-seal temperature of 225° C. Heater voltage is cycled at a rate of 110 minutes on and 10 minutes off. 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 pass the following limits:

Reverse Grid Current.	1 max.	μa
For conditions shown under *Characteristics Range Values, Notes 1,3.*		
Insulation Resistance:		
Grid to plate and cathode	60 min.	megohms
Plate to grid and cathode	60 min.	megohms
For conditions shown under *Characteristics Range Values, Notes 1,5, and 1,6, respectively.*		
Change in Noise Factor.	1 max.	db
From initial value for conditions shown under *Characteristics Range Values, Notes 1,9.*		
Change in Power Gain.	-2 max.	db
From initial value for conditions shown under *Characteristics Range Values, Notes 1,9.*		

OPERATING CONSIDERATIONS

Connections to the cathode cylinder, grid flange, and plate cylinder should be made by flexible spring contacts. The connectors should make firm, large-surface contact, yet must be sufficiently flexible to insure that no part of the tube is subjected to excessive strain.

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 shown in the tabulated data.



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REFERENCE PLANE "A" IS DEFINED AS THAT PLANE AGAINST WHICH ANNULAR SURFACE "B" OF THE GRID FLANGE ABUTS.

ANNULAR SURFACE "B" IS ON THE SIDE OF THE GRID FLANGE TOWARD THE CATHODE CYLINDER.

ANNULAR SURFACE "C" IS ON THE SIDE OF THE GRID FLANGE TOWARD THE PLATE CYLINDER.

NOTE 1: WITH ANNULAR SURFACE "B" RESTING ON REFERENCE PLANE "A", THE AXIS OF THE CATHODE CYLINDER WILL BE WITHIN 2^{o} OF A LINE PERPENDICULAR TO REFERENCE PLANE "A".

NOTE 2: THE AXES OF THE PLATE CYLINDER AND CATHODE CYLINDER WILL COINCIDE WITHIN 0.010"

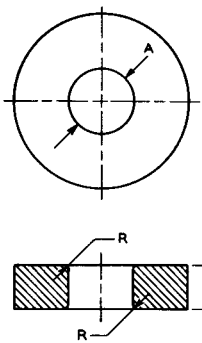
NOTE 3: THE AXES OF THE CATHODE CYLINDER AND GRID FLANGE WILL COINCIDE WITHIN 0.005".

NOTE 4: THE DIAMETER ALONG THE 0.320" MINIMUM LENGTH IS MEASURED WITH "GO" AND "NO-GO" RING GAUGES G_1-1 AND G_1-2, RESPECTIVELY.

NOTE 5: THIS DIAMETER IS MEASURED WITH "GO" AND "NO-GO" GAUGES G_2-1 AND G_2-2, RESPECTIVELY.

NOTE 6: THIS DIAMETER IS MEASURED WITH "GO" AND "NO-GO" GAUGES G_3-1 AND G_3-2, RESPECTIVELY.

GAUGES



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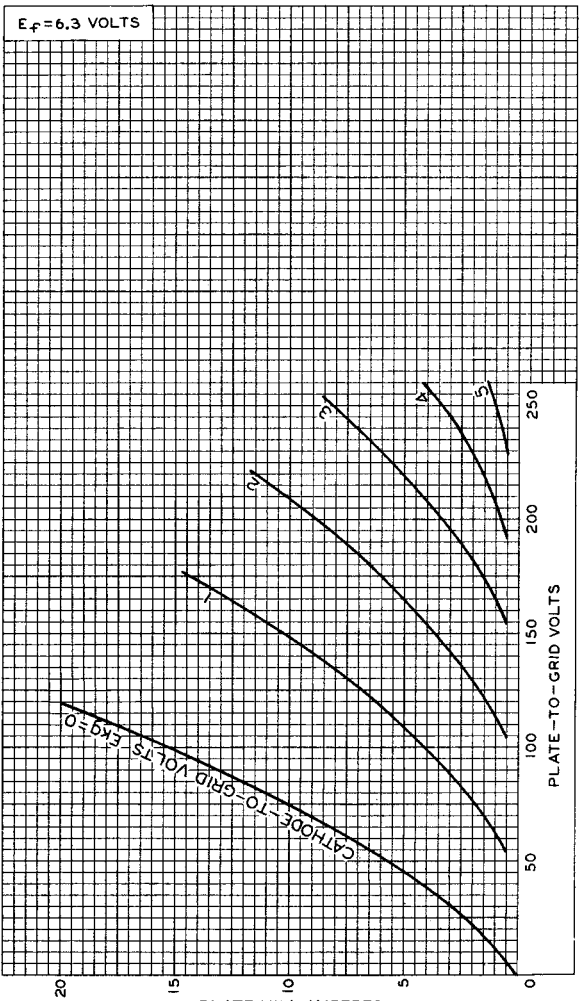
Gauge	Type	Dimension		
		Diameter A	Thickness B	Radius R
G_1-1	GO	0.25200" +0.00000" −0.00007"	0.320" +0.001" −0.000"	0.003" MAX.
G_1-2	NO-GO	0.24500" +0.00007" −0.00000"	–	–
G_2-1	GO	0.42000" +0.00000" −0.00007"	–	–
G_2-2	NO-GO	0.40000" +0.00007" −0.00000"	–	–
G_3-1	GO	0.55700" +0.00000" −0.00007"	–	–
G_3-2	NO-GO	0.54700" +0.00007" −0.00000"	–	–

AVERAGE PLATE CHARACTERISTICS
Cathode-Drive Service



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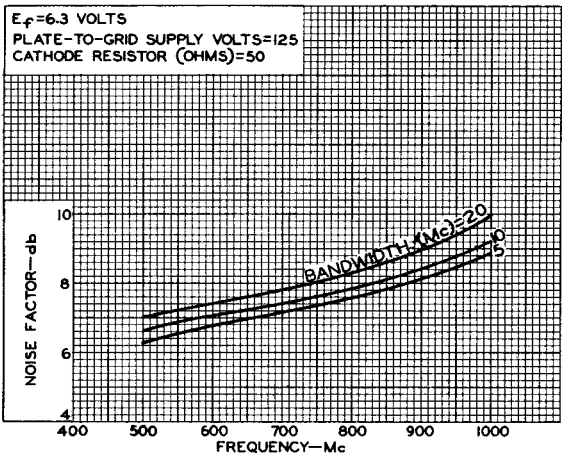
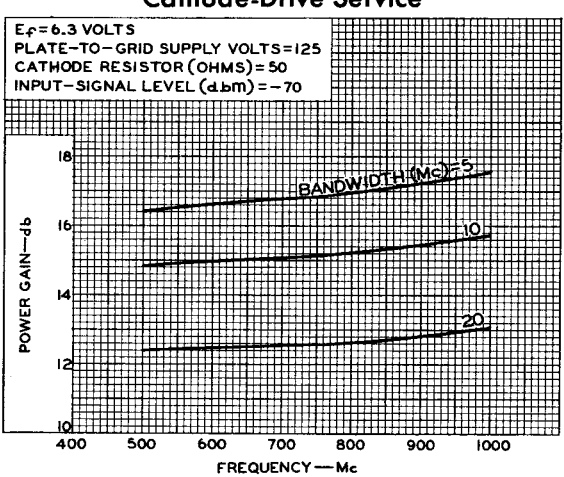
NOISE-FACTOR CHARACTERISTICS
Cathode-Drive Service



92CS-10455

POWER-GAIN CHARACTERISTICS
Cathode-Drive Service



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