7554

High-Mu Triode

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

For Use at Frequencies up to 5000 Mc in Cathode-Drive Circuits under Severe Shock and Vibration

GENERAL DATA

Electrical:

Heater, for Unipotential Cathode:		
Voltage (AC or DC)	6.3 ± 10%	volts
Current at heater volts = 6.3	0.225	amp
Cathode Warm-Up Time (Average) to reach 80% of operating plate current for dc plate supply volts = 80, grid volts = 0, cathode resistor (ohms) = 0, load resistor (ohms) = 10, heater volts = 6.3	10	sec
Amplification Factor	70	
Transconductance for dc plate ma. = 14, dc plate volts = 125, and cathode resistor (ohms) = 50	16000	μmhos
Direct Interelectrode Capacitances:[a]		
Grid to plate	2.4	μμf
Grid to cathode and heater	4.4	μμf
Plate to cathode and heater	0.04 max.	μμf
Heater to cathode	2.6	μμf
Cathode to plate	0.04 max.	μμf
Cathode to grid and heater	7.0	μμf
Plate to grid and heater	2.4	μμf

Mechanical:

Operating Position	Any
Dimensions	See *Dimensional Outline*
Weight (Approx.)	0.3 oz
Sockets:	
Heater-terminals connector	Amerac[b] No.1018-88[c], Grayhill[d] No.22-5, or equivalent
Socket for operation up to about 550 Mc (Including heater-terminals connector)	Jettron[e] No.CD7010, or equivalent
Cavities (Including heater-terminals connector)	Amerac No.1718 (for 4150 Mc), J-V-M[f] No.D-7980 Series, Resdel[g] No.10 Series, or equivalent

◄Indicates a change.

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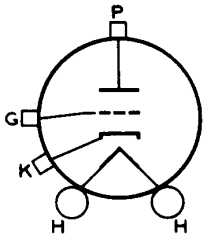
Terminal Connections (See *Dimensional Outline*):

H – Heater
K – Cathode



G – Grid
P – Plate

→ **RF POWER AMPLIFIER & OSCILLATOR — Class C Telegraphy[h]**
and
RF POWER AMPLIFIER — Class C FM Telephony

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

At frequencies up to 5000 Mc and altitudes:

	Up to 80,000 feet	*Between 80,000 and 100,000 feet*	
DC PLATE VOLTAGE	250 max.	200 max.	volts
DC GRID VOLTAGE	−50 max.	−50 max.	volts
DC CATHODE CURRENT	25 max.	25 max.	ma
DC GRID CURRENT	6 max.	6 max.	ma
PLATE DISSIPATION	2.5 max.	2.5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	50 max.	50 max.	volts
Heater positive with respect to cathode	50 max.	50 max.	volts
PLATE-SEAL TEMPERATURE	225 max.	225 max.	°C

Typical CCS[j] Operation in Cathode-Drive Circuit:

As oscillator

	At 500 Mc	*At 1000 Mc*	*At 2000 Mc*	*At 3000 Mc*	*At 4150 Mc*	*At 5000 Mc*	
DC Plate-to-Grid Voltage	205	203	151	125	200	200	volts
DC Cathode-to-Grid Voltage	5	3	1	0.1	0.26	–	volts
From a grid resistor of	1000	600	250	500	130	100	ohms
DC Cathode Current	21	24	24	20	23	25	ma
DC Grid Current	5	5	4	0.2	2	–	ma
Useful Power Output (Approx.)	1.6	1.3	0.5	0.15	0.1	0.03	watts

→ Indicates a change.

As amplifier

	At 500 Mc	At 1000 Mc	
DC Plate-to-Grid Voltage	204	185	volts
DC Cathode-to-Grid Voltage	4	10	volts
From a grid resistor of	800	2000	ohms
DC Cathode Current	21	24	ma
DC Grid Current	5	5	ma
Driver Power Output (Approx.)	0.2	0.2	watt
Useful Power Output (Approx.)	2.2	1.4	watts

Maximum Circuit Values:

Grid-Circuit Resistance	0.25 max.	megohm

FREQUENCY DOUBLER — Class C

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

At frequencies up to 2000 Mc and altitudes:

	Up to 80,000 feet	Between 80,000 and 100,000 feet	
DC PLATE VOLTAGE	250 max.	200 max.	volts
DC GRID VOLTAGE	-50 max.	-50 max.	volts
DC CATHODE CURRENT	22 max.	22 max.	ma
DC GRID CURRENT	6 max.	6 max.	ma
PLATE DISSIPATION	2.5 max.	2.5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	50 max.	50 max.	volts
Heater positive with respect to cathode	50 max.	50 max.	volts
PLATE-SEAL TEMPERATURE	225 max.	225 max.	°C

Typical CCS[j] Operation in Cathode-Drive Circuit:

	Up to 550 Mc		Up to 1000 Mc		
DC Plate-to-Grid Voltage	193	207	218	181	volts
DC Cathode-to-Grid Voltage	18	7	18	6	volts
From a grid resistor of	3600	2300	3600	2000	ohms
DC Cathode Current	20	18	21	19	ma
DC Grid Current	5	3	5	3	ma
Driver Power Output (Approx.)	0.8	0.2	0.8	0.2	watt
Useful Power Output (Approx.)	1.3	0.75	0.9	0.4	watts

Maximum Circuit Values:

Grid-Circuit Resistance	0.25 max.	megohm

← Indicates a change.

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FREQUENCY TRIPLER — Class C

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

At frequencies up to 2000 Mc and altitudes:

	Up to 80,000 feet	*Between 80,000 and 100,000 feet*	
DC PLATE VOLTAGE	250 max.	200 max.	volts
DC GRID VOLTAGE	−50 max.	−50 max.	volts
DC CATHODE CURRENT	20 max.	20 max.	ma
DC GRID CURRENT	6 max.	6 max.	ma
PLATE DISSIPATION	2.5 max.	2.5 max.	watts
PEAK HEATER-CATHODE VOLTAGE:			
Heater negative with respect to cathode	50 max.	50 max.	volts
Heater positive with respect to cathode	50 max.	50 max.	volts
PLATE-SEAL TEMPERATURE	225 max.	225 max.	°C

Typical CCS[j] Operation in Cathode-Drive Circuit:

Up to 645 Mc			
DC Plate-to-Grid Voltage	202	240	volts
DC Cathode-to-Grid Voltage	27	15	volts
From a grid resistor of	9000	25000	ohms
DC Cathode Current	19	13	ma
DC Grid Current	3	0.6	ma
Driver Power Output (Approx.)	0.6	0.2	watt
Useful Power Output (Approx.)	0.7	0.4	watt
Up to 1000 Mc			
DC Plate-to-Grid Voltage	205	185	volts
DC Cathode-to-Grid Voltage	30	10	volts
From a grid resistor of	10000	14000	ohms
DC Cathode Current	19	12	ma
DC Grid Current	3	0.7	ma
Driver Power Output (Approx.)	0.6	0.2	watt
Useful Power Output (Approx.)	0.4	0.15	watt

Maximum Circuit Values:

Grid-Circuit Resistance	0.25 max.	megohm

[a] Without external shield.

[b] Amerac, Inc., Dunham Road, Beverly, Massachusetts.

[c] For use with cavities.

[d] Grayhill, Inc., 561 Hillgrove Avenue, LaGrange, Illinois.

[e] Jettron Products, Inc., 56 Route 10, Hanover, N.J.

[f] J-V-M Microwave Co., 9300 W. 47th St., Brookfield, Illinois. Indicated No. applies to a series of cavities covering range from 220 to 3500 Mc.

[g] Resdel Engineering Corp., 330 South Fair Oaks Avenue, Pasadena, California. This series of cavities covers the range from 215 to 2325 Mc.

[h] Key-down conditions per tube without amplitude modulation. 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.

[j] Continuous Commercial Service.

→ Indicates a change.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

	Note	Min.	Max.	
Heater Current	1	0.205	0.245	amp
Direct Interelectrode Capacitances:				
Grid to plate	-	1.5	2.7	μμf
Grid to cathode	-	3.6	5.0	μμf
Plate to cathode	-	-	0.04	μμf
Heater-Cathode Leakage Current:				
Heater negative with respect to cathode	1,2	-	30	μa
Heater positive with respect to cathode	1,3	-	30	μa
Leakage Resistance:				
From grid to plate and cathode connected together	1,4	100	-	megohms
From plate to grid and cathode connected together	1,5	100	-	megohms
Reverse Grid Current	1,6	-	0.3	μa
Emission Voltage	7	-	4	volts
Amplification Factor	1,8	55	85	
Transconductance	1,8	12500	19500	μmhos
Plate Current (1)	1,8	9	19	ma
Plate Current (2)	1,9	-	50	μa
Power Output	1,10	1.7	-	watts
Change in Power Output	1,11	-	0.2	watt

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

Note 2: With 60 volts dc between heater and cathode, heater negative with respect to cathode.

Note 3: With 60 volts dc between heater and cathode, heater positive with respect to cathode.

Note 4: With grid 100 volts negative with respect to plate and cathode which are connected together.

Note 5: With plate 300 volts negative with respect to grid and cathode which are connected together.

Note 6: With dc plate voltage of 200 volts, dc grid voltage of -2 volts, grid resistor of 0.5 megohm.

Note 7: With dc voltage on grid and plate which are connected together adjusted tp produce a cathode current of 30 ma., and with 5.5 volts on heater.

Note 8: With dc plate supply voltage of 125 volts, cathode resistor of 50 ohms, and cathode bypass capacitor of 1000 μf.

Note 9: With dc plate voltage of 125 volts and dc grid voltage of -5 volts.

Note 10: In a single-tube, cathode-drive amplifier circuit operating at a frequency of approx. 550 ± 10 Mc, and with dc plate to cathode voltage of 250 volts, input-signal power of 0.2 watt, and dc grid voltage adjusted to produce a dc plate current of 20 ma.

Note 11: Reduce heater voltage to 5.7 volts. Change in Power-Output value from that obtained with 6.3 volts on heater will not exceed indicated value.

← Indicates a change.

SPECIAL TESTS & PERFORMANCE DATA

Low-Pressure Voltage-Breakdown Test:

This test (similar to MIL-E-1D, paragraph 4.9.12.1) is performed on a sample lot of tubes every 90 days. Tubes are tested in a chamber at an air pressure equivalent to an altitude of 100,000 feet. Breakdown will not occur when a 60-cycle rms voltage of 300 volts is applied between the plate cylinder and grid flange.

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 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.

At the end of this test, the tubes will not show permanent shorts or open circuits and will meet the following test limit:

Heater Current.	300 max.	ma

For conditions shown under *Characteristics Range Values, Note 1.*

Variable-Frequency Vibration Performance:

This test (similar to MIL-E-1D, paragraph 4.9.20.3) is performed on a sample lot of tubes from each production run. Tube operating conditions are the same as for *Low-Frequency Vibration Performance.* The tubes are vibrated perpendicular to the major axis through a frequency range from 5 to 500 cps and back. From 5 to 50 cps, the tubes are vibrated at a constant displacement of 0.0400 ± 0.0025 inch. From 50 to 500 cps, the tubes are vibrated at a constant acceleration of 10 ± 2 g. Total time to complete a sweep cycle is 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 is 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 is continued until there is no further increase.

The rms output voltage across the plate load resistor as a result of the vibration of the tube will not exceed the specified limit at any time during the test.

At the end of the test, the tubes will not show permanent shorts or open circuits and will meet the following test limit:

Heater Current.	300 max.	ma

For conditions shown under *Characteristics Range Values, Note 1.*

→ Indicates a change.

Shock Test:

This test (similar to MIL-E-ID, 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 shorts or open circuits and will meet the following limits:

Heater Current.	300 max.	ma
For conditions shown under *Characteristics Range Values, Note 1.*		
Heater-Cathode Leakage Current. . . .	60 max.	μa
For conditions shown under *Characteristics Range Values, Notes 1,3.*		
Low-Frequency Vibration Output. . . .	200 max.	mv
For conditions shown above under *Low-Frequency Vibration Performance.*		
Change in Transconductance.	-20 max.	%
From initial value for conditions shown under *Characteristics Range Values, Notes 1,8.*		

Fatigue Vibration Test:

This test (similar to MIL-E-ID, 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 are required to meet the limits specified for the *Shock Test.*

Shorts and Continuity Test:

This test (similar to MIL-E-ID, 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-E-ID, Amendment 5.

At the end of this test, the tubes will not show permanent shorts or open circuits and will meet the following limit:

Heater Current.	300 max.	ma
For conditions shown under *Characteristics Range Values, Note 1.*		

Ceramic-Seal-Fracture Test:

This test is performed on a sample lot of tubes every 90 days. With cathode- and plate-cylinder-supports spaced 15/16" ± 1/64", and with the grid flange centered between these supports, the tubes will withstand the gradual application of a force of 30 pounds, perpendicular to the axis of the tubes,

upon the grid flange, without causing fracture of the ceramic insulation.

Seal Strain Test:

This test (similar to MIL-E-ID, paragraph 4.9.6.3) is performed on a sample lot of tubes every 90 days. Tubes are tested by first immersing in water having a temperature of at least 97° C for at least 15 seconds and then immersing immediately in water at not more than 5° C for 5 seconds. After drying for 48 hours at room temperature, the tubes will meet the following test limit:

Heater Current.	300 max.	ma
For conditions shown under *Characteristics Range Values, Note 1.*		

Heater-Cycling Life Performance:

This test (similar to MIL-E-ID, paragraph 4.11.7) 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 permanent shorts or open circuits and are required to meet the following limits:

Heater Current.	300 max.	ma
For conditions shown under *Characteristics Range Values, Note 1.*		
Heater-to-Cathode Leakage Current . .	60 max.	μa
For conditions shown under *Characteristics Range Values, Notes 1,3.*		
Grid-to-Cathode Leakage Resistance. .	50 min.	megohms
For conditions shown under *Characteristics Range Values, Notes 1,4.*		

1-Hour Stability Life Performance:

This test (similar to MIL-E-ID, paragraph 4.11.3.1a) 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% of the initial value, for conditions shown under *Characteristics Range Values, Notes 1,8.*

In addition, the tubes will not show permanent shorts or open circuits and will meet the following limit:

Heater Current.	300 max.	ma
For conditions shown under *Characteristics Range Values, Note 1.*		

100-Hour Survival Life Performance:

This test (similar to MIL-E-1D, paragraph 4.11.3.1b) 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 not show permanent shorts or open circuits and will meet the following limits:

Heater Current.	300 max.	ma
For conditions shown under *Characteristics Range Values, Note 1.*		
Transconductance.	9000 min.	μmhos
For conditions shown under *Characteristics Range Values, Notes 1,8.*		
Plate Current (2)	50 max.	μa
For conditions shown under *Characteristics Range Values, Notes 1,9.*		

500- and 1000-Hour 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 rf performance. Each tube is life-tested as a class C amplifier in special cavity at 550 ± 10 Mc under the following conditions: Heater voltage of 6.3 volts; plate supply voltage of 250 volts; cathode resistor adjusted to give plate current of 25 ma.; and grid-circuit resistance adjusted to give grid current of 6 ma., 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 tubes will not show permanent shorts or open circuits, and will be criticized for total number of tubes failing to pass the following limits:

Heater Current.	300 max.	ma
For conditions shown under *Characteristics Range Values, Note 1.*		
Leakage Resistance:		
From grid to plate and cathode connected together. . . .	60 min.	megohms
From plate to grid and cathode connected together. . . .	60 min.	megohms
For conditions shown under *Characteristics Range Values, Notes 1,4, and 1,5.*		
Power Output.	1.5 min.	watts
For conditions shown under *Characteristics Range Values, Notes 1,10.*		

At the end of 1000 hours, the tubes will not show permanent shorts or open circuits and will be criticized for total number of tubes failing to pass the following limits:

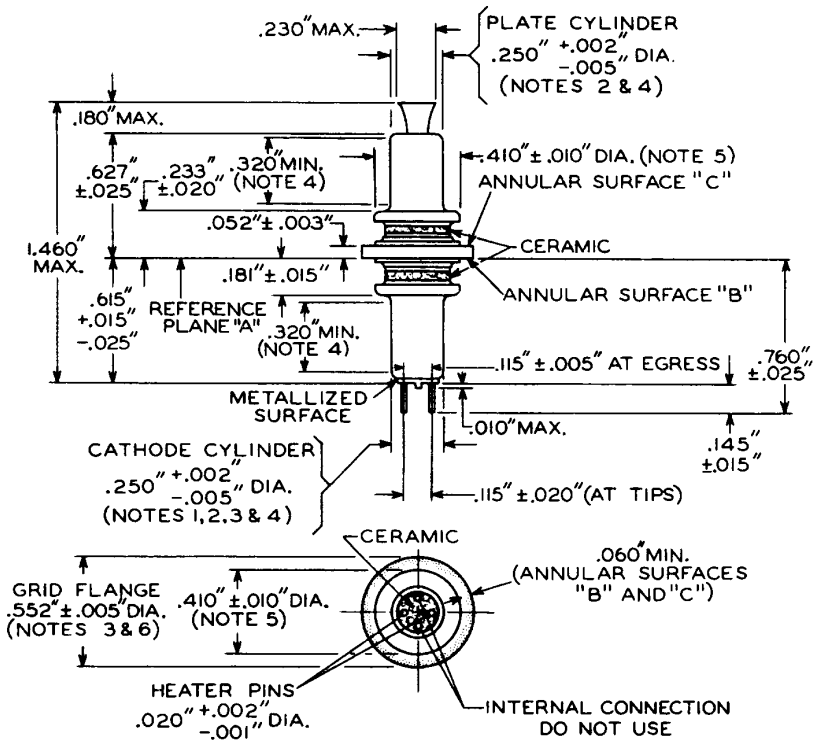
Heater Current.	300 max.	ma
For conditions shown under *Characteristics Range Values, Note 1.*		

Power Output. . . . . 1.3 min. watts
For conditions shown under *Characteristics Range Values, Notes 1, 10.*

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.



92CM-10274RI

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° OF A LINE PERPENDICULAR TO REFERENCE PLANE "A".

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

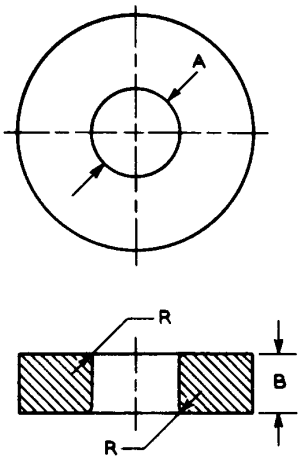
NOTE 3: THE AXES OF THE CATHODE CYLINDER AND GRID FLANGE WILL COINCIDE WITHIN 0.005".

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.

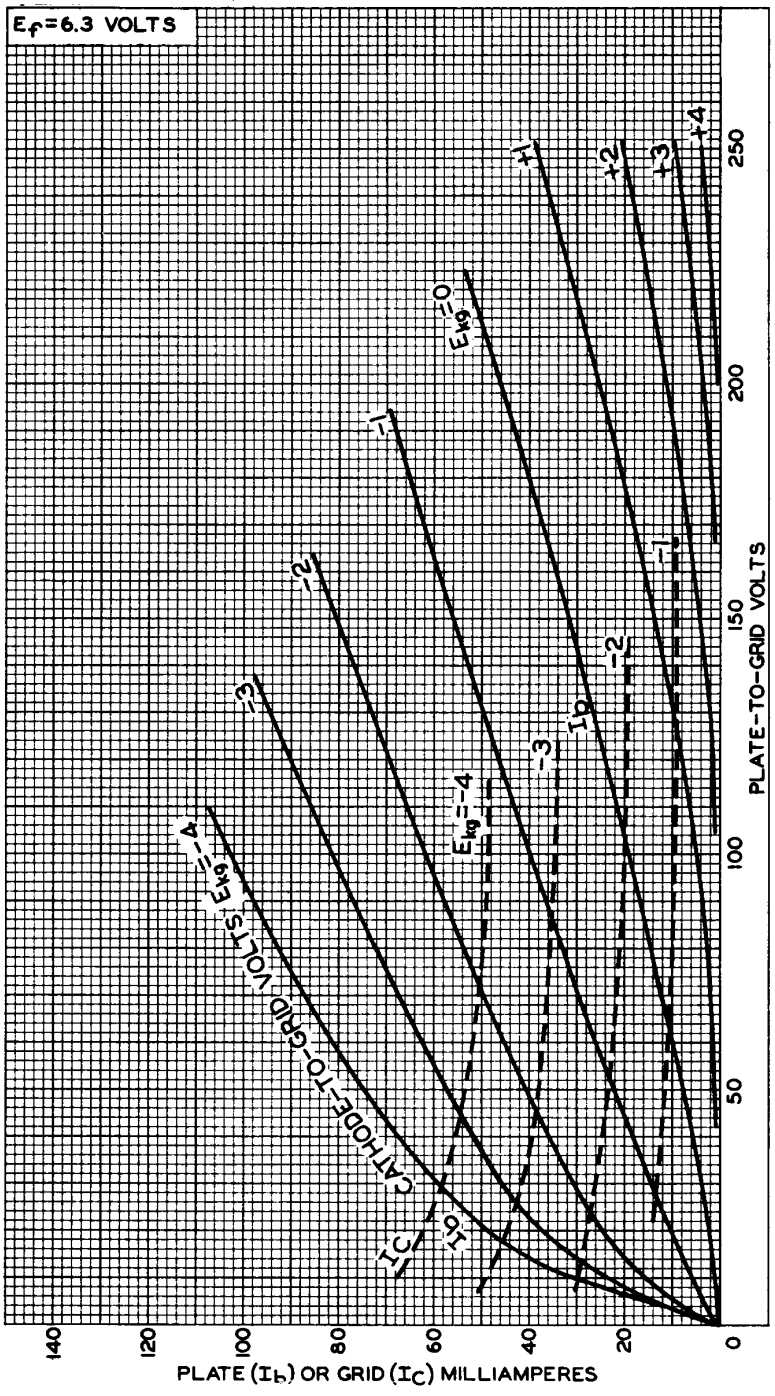
GAUGES



92CS-10370

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 CHARACTERISTICS
Cathode-Drive Service



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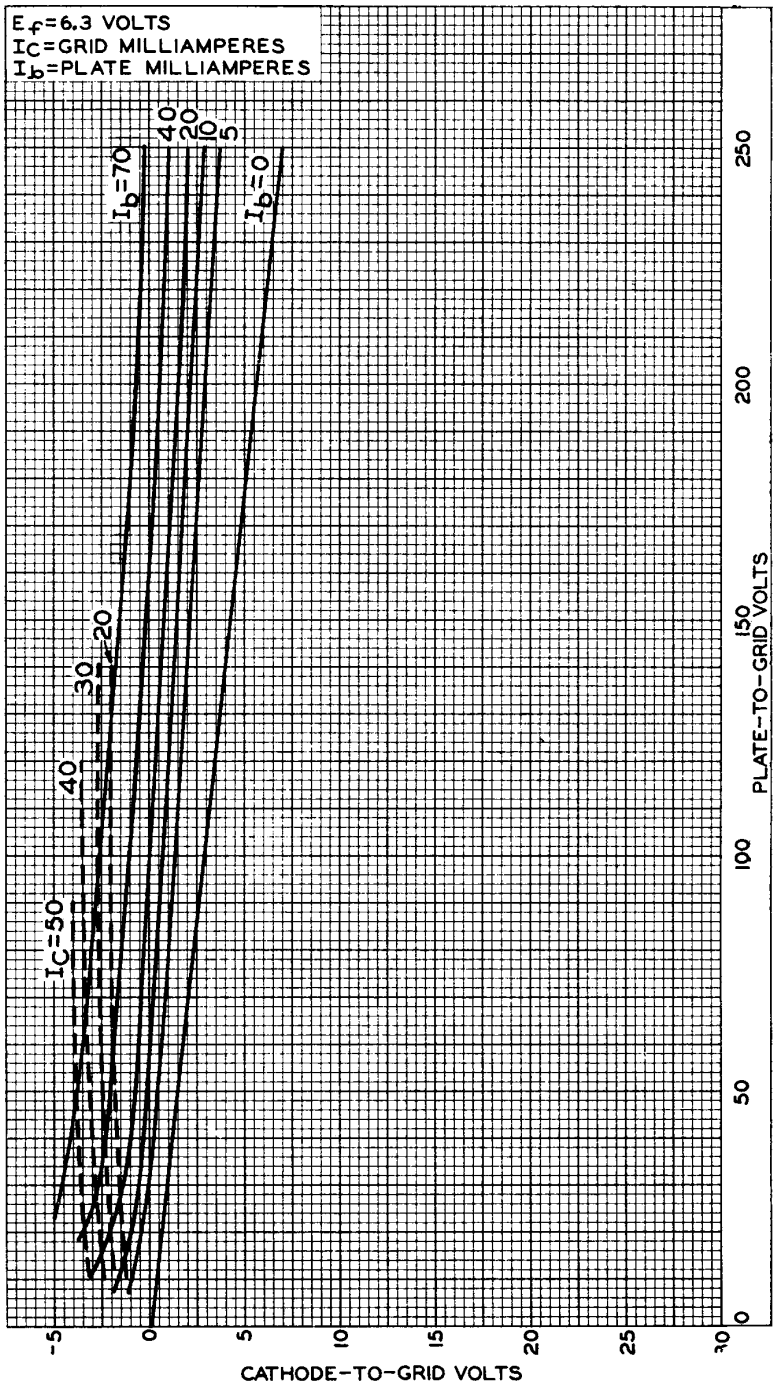
AVERAGE CONSTANT-CURRENT CHARACTERISTICS
Cathode-Drive Service



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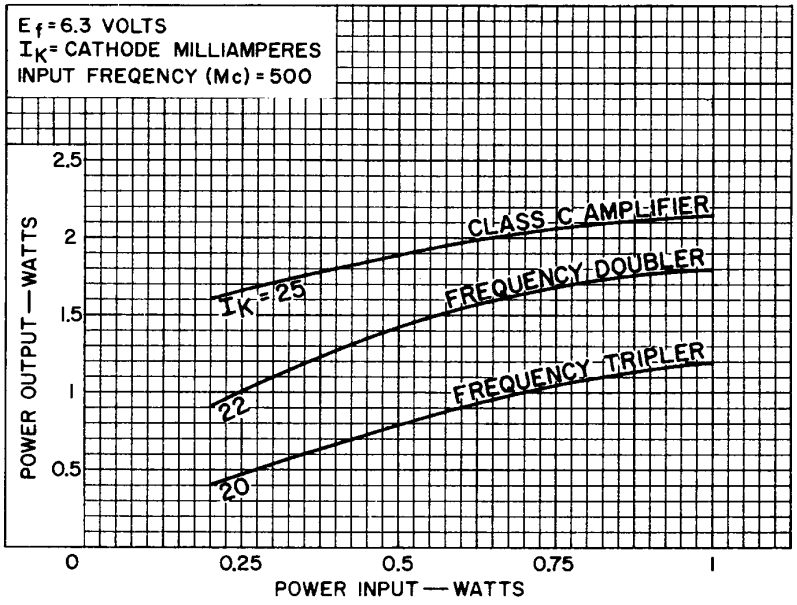
RADIO CORPORATION OF AMERICA
Electron Tube Division Harrison, N. J.

TYPICAL POWER-OUTPUT CHARACTERISTICS
Cathode-Drive Service



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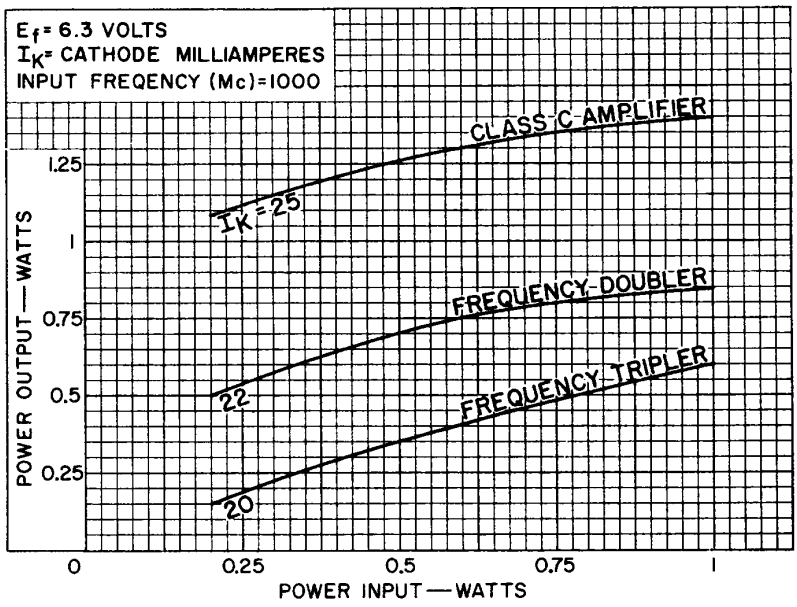

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TYPICAL POWER-OUTPUT CHARACTERISTICS
With Variation in Heater Voltage
Cathode-Drive Service

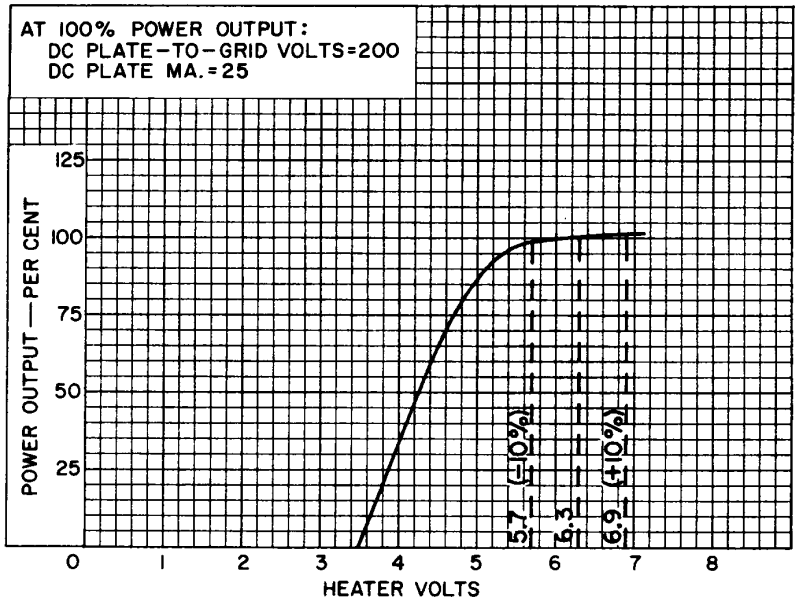

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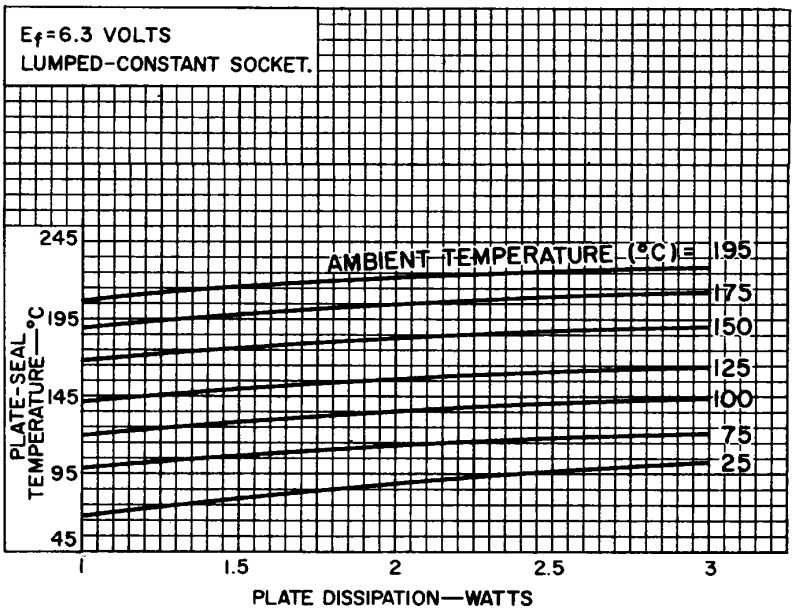
PLATE-SEAL-TEMPERATURE CHARACTERISTICS



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