6111

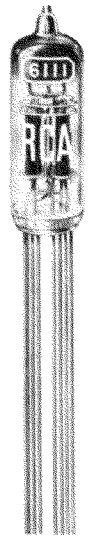
MEDIUM-MU TWIN TRIODE

"Premium" Subminiature Type

For Operation at Altitudes Up to 60000 Feet

TENTATIVE DATA

RCA-6111 is a subminiature medium-mu twin triode of the heater-cathode type having flexible leads. It is intended for use in oscillator and amplifier applications at frequencies up through the vhf region. Constructed to give dependable performance under conditions of shock and vibration, this "premium" tube is especially suited for use in critical industrial applications and in aircraft equipment. Full ratings may be used at altitudes up to 60000 feet without the use of pressurized chambers.



Actual Size

In the 6111, special attention has been given to structural features which improve its strength for resistance to both shock and vibration. These features include a special "U" frame construction to keep the mount rigid, and special tube parts which are precisely made and accurately fitted to lock the parts firmly in place and thus eliminate variations in electrical characteristics. Other features include grid rods having high heat conductivity to provide cool operation thereby minimizing grid emission, a pure-tungsten heater having high mechanical strength to give long life under conditions of frequent on-off switching, and a special getter shield to prevent deposit of getter flash on tube elements. These features in addition to rigid controls and rigorous tests to insure "premium" quality, make this tube especially useful in military and critical industrial applications.

GENERAL DATA

Electrical:

Heater, for Unipotential Cathodes:		
Voltage (AC or DC)	6.3 ± 5%	volts
Current	0.3	ampere

Direct Interelectrode Capacitances:

	*With External Shield**	*Without External Shield*	
Grid to plate (Each unit)	1.4	1.5	μμf
Grid to cathode and heater (Each unit)	2.1	1.9	μμf
Plate to cathode and heater (Unit No.1)	1.3	0.28	μμf
Plate to cathode and heater (Unit No.2)	1.4	0.32	μμf
Grid to grid	0.010 max.	0.011 max.	μμf
Plate to plate	0.30 max.	0.50 max.	μμf

Mechanical:

Operating Position	Any
Maximum Bulb Length	1-3/8"
Length from Button Seal to Bulb Top (Excluding tip)	1.075" ± 0.060"
Diameter	0.400" max. - 0.366" min.
Bulb	T3
Leads, Flexible	8
Minimum Length	1.5"
Orientation and Diameter	See Dimensional Outline

AMPLIFIER -- Class A_1

Maximum Ratings, *Absolute Values:*

For Operation at Altitudes Up to 60000 Feet

Values are for Each Unit

PLATE VOLTAGE	165 max.	volts
GRID VOLTAGE:		
Positive bias value	0 max.	volts
Negative bias value	55 max.	volts
PLATE DISSIPATION	1.1 max.	watts
PEAK HEATER-CATHODE VOLTAGE:		
Heater negative with respect to cathode	200 max.	volts
Heater positive with respect to cathode	200 max.	volts
BULB TEMPERATURE (At hottest point on bulb surface)	250 max.	°C

Characteristics:

Plate Supply Voltage	100	volts
Cathode Resistor	220	ohms
Amplification Factor	20	
Plate Resistance (Approx.)	4000	ohms
Transconductance	5000	μmhos
Plate Current	8.5	ma
Grid Voltage (Approx.) for plate current of 10 μa	-9	volts

Maximum Circuit Values:

Grid-Circuit Resistance:		
For cathode-bias operation	1.2 max.	megohms

* With 0.405" internal diameter shield connected to cathode of unit under test.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Values are for Each Unit and are Initial, Unless Otherwise Specified

	Note	*Min.*	*Max.*	
Heater Current	1	280	320	ma
Direct Interelectrode Capacitances:				
Grid to plate	2	1.2	1.8	μμf

ELECTRON TUBE DIVISION
RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

	Note	Min.	Max.	
Grid to cathode and heater	2	1.4	2.4	μμf
Plate to cathode and heater (Unit No.1) . .	2	0.20	0.36	μμf
Plate to cathode and heater (Unit No.2) . .	2	0.22	0.42	μμf
Grid to grid	2	–	0.011	μμf
Plate to plate	2	–	0.50	μμf
Amplification Factor . . .	1,3	17	23	
Plate Current (1).	1,3	6	11	ma
Plate-Current Difference Between Units.	1,3	–	2	ma
Plate Current (2).	1,4	–	100	μa
Transconductance:				
With heater volts = 6.3.	3	4100	5900	μmhos
Individual change from 0 to 500 hours	1,3	–	20	per cent
Individual change at end of 500-hour life test with heater voltage reduced to 5.7 volts .	3	–	15	per cent
Difference between average transconductance initially, and average after 500 hours, expressed as a percentage of the initial average.	1,3	–	15	per cent
Reverse Grid Current . . .	1,5	–	0.3	μa
Grid-Emission Current. . .	6,7	–	-0.5	μa
Heater-Cathode Leakage Current:				
Heater negative with respect to cathode . . .	1,8	–	5	μa
Heater positive with respect to cathode . . .	1,8	–	5	μa
Heater-Cathode Leakage Current at 500 Hours:				
Heater negative with respect to cathode . . .	1,8	–	10	μa
Heater positive with respect to cathode . . .	1,8	–	10	μa
Leakage Resistance:				
Grid to all other electrodes tied together .	1,9	100	–	megohms
Plate to all other electrodes tied together .	1,10	100	–	megohms
Leakage Resistance at 500 Hours:				
Grid to all other electrodes tied together .	1,9	50	–	megohms
Plate to all other electrodes tied together .	1,10	50	–	megohms

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

Note 2: With no external shield.

Note 3: With supply voltage of 100 volts, cathode resistor of 220 ohms, and cathode bypass capacitor of 1000 μf. Each unit is tested separately. Elements of unit not under test are grounded.

Note 4: With plate voltage of 100 volts and grid voltage of -9 volts. Each unit is tested separately. Elements of unit not under test are grounded.

Note 5: With plate voltage of 100 volts, grid resistor of 1 megohm, and cathode resistor of 200 ohms. Each unit is tested separately. Unit not under test is grounded.

Note 6: With 7.5 volts dc on heater.

Note 7: With plate voltage of 100 volts, grid resistor of 1 megohm and grid voltage of -9 volts. Preheated prior to testing for 5 minutes at heater voltage of 7.5 volts ac or dc, plate voltage of 100 volts, grid resistor of 1 megohm, and cathode resistor of 220 ohms.

Note 8: With 100 volts between heater and cathode. Each unit is tested separately. Unit not under test is grounded.

Note 9: With grid 100 volts negative with respect to all other electrodes tied together.

Note 10: With plate 300 volts negative with respect to all other electrodes tied together.

SPECIAL RATINGS AND PERFORMANCE DATA

Values are for Each Unit, Unless Otherwise Specified

Shock Rating:

Impact Acceleration. . . . . 450 max. g

This test is performed on a sample lot of tubes from each production run. Tubes are held rigid and are tested in four different positions. At the end of this test, tubes will not show permanent or temporary shorts or open circuits, and are required to meet established limits for low-frequency vibration, heater-cathode leakage current, and transconductance change.

Fatigue Rating:

Vibrational Acceleration . . . . . 2.5 max. g

This test is performed on a sample lot of tubes from each production run. Tubes are rigidly mounted and subjected in each of three positions to 2.5 g vibrational acceleration at 60 cycles per second for 32 hours. At the end of this test, tubes will not show permanent or temporary shorts or open circuits, and are required to meet established limits for low-frequency vibration, heater-cathode leakage current, and transconductance change.

Low-Frequency Vibration Performance:

RMS Output Voltage . . . . . 100 max. mv

This test is performed on a sample lot of tubes from each production run under the following conditions: Heater voltage of 6.3 volts, plate supply voltage of 100 volts, cathode resistor of 220 ohms, cathode-bypass capacitor of 1000 μf, plate load resistor of 10000 ohms and vibrational acceleration of 15 g at 40 cps.

Heater-Cycling Life Performance:

Cycles of Intermittent Operation . . 2000 min. cycles

Under the following conditions: Heater voltage of 7.0 volts cycled one minute on four minutes off, heater 140 volts rms with respect to cathode, and all other elements grounded. At the end of this test, tubes will not show heater-cathode shorts or open circuits.

Audio-Frequency Noise and Microphonic Performance:

Output Voltage . . . . . 65 max. mv

This test is performed on a sample lot of tubes from each production run under the following conditions: Units connected in parallel, heater voltage of 6.3 volts, plate supply voltage of 100 volts, cathode resistor of 100 ohms, plate load resistor of 0.01 megohm, and cathode-bypass capacitor of 1000 μf. The output voltage of a tube, when tapped, will not cause a reading on a vu meter greater than that produced when a calibrating signal of 65 millivolts rms is applied to the plates of the tube.

Shorts and Continuity Test:

This test is performed on a sample lot of tubes from each production run. In this test a tube is considered inoperative if it shows a permanent or temporary short or open circuit, or a value of reverse grid current in excess of 1.0 microampere under the conditions specified in the Characteristics Range Values for reverse grid current.

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. Life-test conditions are the same as those specified under 500-Hour Intermittent Life Performance, except that the test run at room temperature. At the end of 1 hour, the value of transconductance is read. The variation in transconductance from the 0-hour reading will not exceed 10 per cent.

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 under 500-Hour Intermittent Life Performance, except that the test run at room temperature. At the end of 100 hours, a tube is considered inoperative if it shows a permanent or temporary short or open circuit or a value of reverse grid current in excess of 1.0 microampere under the conditions specified in Characteristics Range Values.

500-Hour Intermittent Life Performance:

This test is performed on a sample lot of tubes from each production run to insure high quality of the individual tube and to guard against epidemic failures of any of the characteristics indicated below. Life testing is conducted under the following conditions: Heater voltage of 6.3 volts, plate supply voltage of 100 volts, heater-cathode voltage of 200 volts (heater positive with respect to cathode), cathode resistor of 220 ohms, grid-No.1 resistor of 1 megohm and bulb temperature of 220° C. At the end of 500 hours, 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 established initial limits of heater current, individual transconductance change, transconductance change with heater voltage of 5.7 volts, and 500 hour limits for reverse grid current, heater-cathode leakage current, leakage resistance, and the difference in transconductance between the initial value and average value shown under Characteristics Range Values.

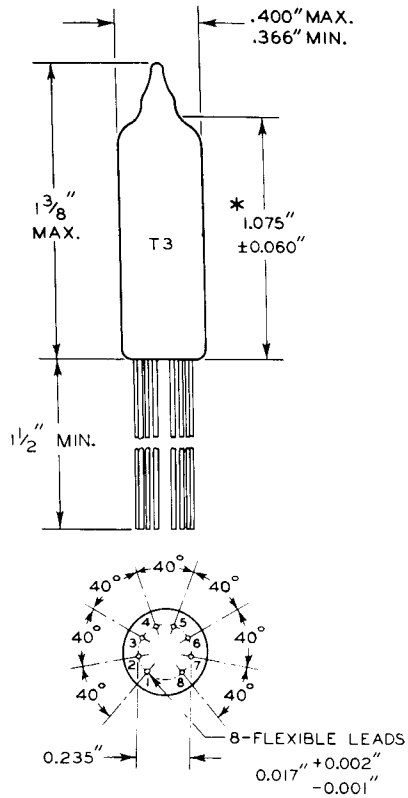
OPERATING CONSIDERATIONS

The *maximum ratings* in the tabulated data for the 6111 are limiting values above which the serviceability of the 6111 may be impaired from the viewpoint of life and satisfactory performance. Therefore, in order not to exceed these absolute ratings, the equipment designer has the responsibility of determining an average design value below each absolute rating by an amount such that the absolute values will never be exceeded under any usual condition of supply-voltage variation, load variation, or manufacturing variation in the equipment itself.

The *heater supply* should be well regulated because life and reliability of the 6111 are adversely affected by departures from the 6.3 volt value. The extent to which life is affected is a function of the amount of these departures and their durations.

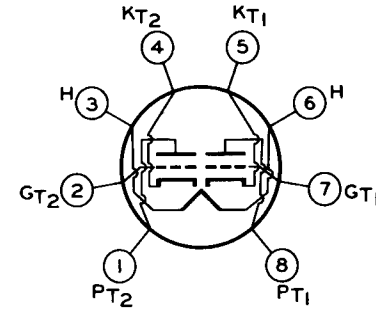
The *flexible leads* of the 6111 are usually soldered to the circuit elements. Soldering of the connections should be made as far as possible from the glass button. If this precaution is not followed, the heat of the soldering may crack the glass seals of the leads and damage the tube.

DIMENSIONAL OUTLINE



* MEASURED FROM BULB SEAT TO BULB-TOP LINE AS DETERMINED BY A RING GAUGE OF 0.210" ± 0.001" I.D.

TERMINAL CONNECTIONS



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LEAD No.1: PLATE OF TRIODE UNIT No.2
LEAD No.2: GRID OF TRIODE UNIT No.2
LEAD No.3: HEATER
LEAD No.4: CATHODE OF TRIODE UNIT No.2
LEAD No.5: CATHODE OF TRIODE UNIT No.1
LEAD No.6: HEATER
LEAD No.7: GRID OF TRIODE UNIT No.1
LEAD No.8: PLATE OF TRIODE UNIT No.2

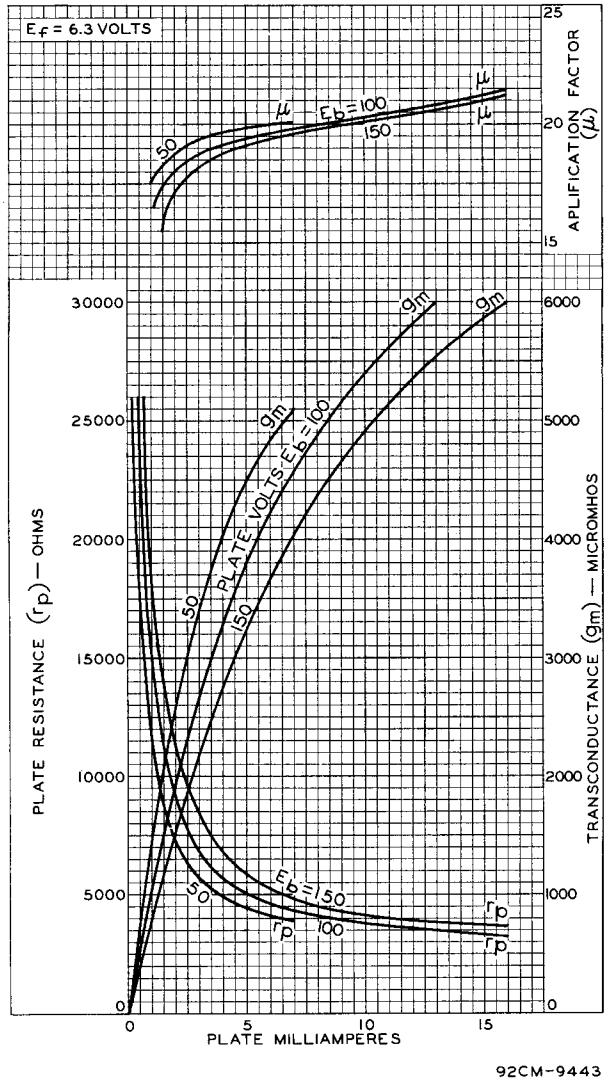

Fig. 1 - Average Characteristics for Each Unit of Type 6111.

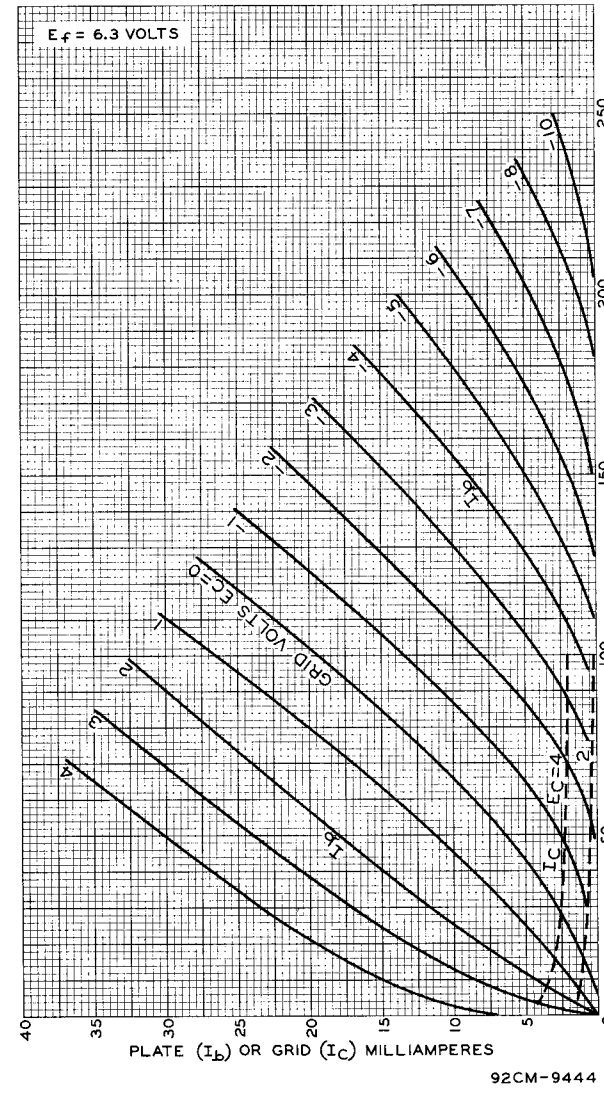

Fig. 2 - Average Characteristics for Each Unit of Type 6111.