

MEDIUM-MU TWIN TRIODE

"Premium" Subminiature Type For Operation At Altitudes Up To 60000 Feet

TENTATIVE DATA

RCA-6021 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 to 400 Mc. Constructed to give dependable performance under conditions of shock and vibration. this "premium" tube is especially suited for use in mobile and aircraft equipment and is rated for service at altitudes up to 60000 feet without the use of pressurized chambers.



The design of the 6021 incorporates a compact structure in which special attention has been given to the following features: (1) "U" frame construction to keep the mount rigid and prevent distortion of plates. (2) precisely made and accurately fitted tube parts, including new mica design, to lock the parts firmly in place, (3) grid side rods having high heat conductivity to provide cool operation of the grids, (4) puretungsten heater having high mechanical strength, (5) getter shield to prevent

deposit of getter flash on tube elements, and (6) pure nickel plate to minimize evolution of gas.

As a result of its structural design, this tube is characterized by: (1) small spread in electrical characteristics, (2) reduced microphonic effects, (3) reduced grid emission, (4) long life under frequent on-off switching, and (5) low leakage currents and high leakage resistance between the elements. In addition, this tube utilizes separate terminals for each cathode to permit flexibility of circuit arrangement.

Manufactured under rigid controls, the 6021 undergoes rigorous tests during manufacture to insure its "premium" quality as follows: test readings at the end of I hour, 100 hours, and 500 hours to insure that tubes fall within the established tight characteristics limits and that early failures are held to a low percentage.

A-MEA44 BATA

GENERAL DATA						
Electrical:						
Heater for Unipotential Cat	hode	s:				
Voltage (AC or DC)				5.3 ±	5.4	volts
Current				0.3	J #	amp
Direct Interelectrode Capac			'	7.7		amp
birect interesectione capac	Itai					
		Wit			thout	
		Exter			ternal hield	
0-14 41-4-		Die	iu	D /	i i e i u	
Grid to plate (Each unit)		1.4		4	. 5	f
Grid to cathode and	•	1.4		+.	, 3	μμf
heater (Each unit)		2.1		2.	н	μμ.f
Plate to cathode and	•	2.1		2.		1242
heater (Unit No.1)		1.3		0.2	28	μμ.f
Plate to cathode and	•	-•/		• • •		
heater (Unit No.2)		1.4		0.3	32	μμf
Grid to grid	. (0.011	max.		13 max	
Plate to plate					52 max	
•	•	٠.,,	max •	•••	, E max	• μ.μ
Mechanical:						
Operating Position						Any
Maximum Bulb Length						
Length from Button Seal to		- •				- //-
Bulb Top (Excluding tip)				1.0	75" ±	0.060"
Diameter						0.400"
Bulb						T3
Leads, Flexible						8
Minimum Length						
Orientation and Diameter						
J J J J alla planevel					J.,	

AMPLIFIER -- Class A.

Values are for Each Unit					
Maximum Ratings, Absolute Values:					
For Operation At Altitudes Up To	60000 Feet				
PLATE VOLTAGE	165 max. volts				
GRID VOLTAGE:					
Positive bias value	0 max. volts				
Negative bias value	-55 max. volts				
PLATE CURRENT	22 max. ma				
GRID CURRENT	5.5 max. ma				
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)	220 max. ^O C				
Characteristics:					
Plate Supply Voltage	100 volts				
Cathode Resistor	150 ohms				

ma



Amplification Factor Plate Resistance (Approx.) . Transconductance Grid Voltage (Approx.) for plate current of 10 µa	:	:	:	:	35 6500 5400 -6.5	ohms μ mhos volts
Maximum Circuit Values: Grid-Circuit Resistance: For cathode-bias operation						megohm

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

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Values Are For Each Unit (Other unit grounded) and are Initial, Unless Otherwise Indicated.

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	Note	Min.	Max.	
Heater Current	1	0.280	0.320	amp
Heater Current at 500 Hours	1	0.276	0.328	amp
Direct interelectrode	•	0.270	0.720	amp
Capacitances: Grid to plate	2	1.2	1.8	μμf
Grid to cathode and	2	1.8	3.0	
heater Plate to cathode and	2	1.8	2.0	μμ.f
heater (Unit No.1) Plate to cathode and	2	0.20	0.36	$\mu\mu$ f
heater (Unit No.2)	2	0.22	0.42	<i>μμ</i> . f
Grid to grid	3	-	0.013	μμ. f
Plate to plate	3	-	0.52	μμf
Amplification Factor	1,4	30	40	• •
Plate Current (1)	1.4	4.5	8.5	ma
Plate-Current Difference	- , -	4.0	0.0	
Between Units	1,4	-	1.6	ma
Plate Current (2)	1,5	_	100	μa
Transconductance (1)	1.4	4450	6350	μmhos
	1,4	4430	0)30	μιιιτοσ
Transconductance(1)Change: With heater voltage reduced to				
5.7 volts	4	_	15	per cent
Individual at 500 Hours.	1,4	_	25	per cent
Average at 500 Hours	1.4	_	15	per cent
Average at 500 Hours:	1,4		10	po, 00t
With heater voltage reduced to 5.7 volts.	4	_	15	per cent
Reverse Grid Current			0.3	μ a
Reverse Grid Current at	1,6	_	0.)	μα
500 Hours	1,6	_	0.9	μa
Grid Emission Current	7	_	-0.5	μa
Heater—Cathode Leakage	'		0. 5	μ
Current:				
Heater negative with respect to cathode	1	-	5	μ a
Heater positive with respect to cathode	1	_	5	μ a
Heater-Cathode Leakage	*		Ü	-
Current at 500 Hours:				
Heater 100 volts negative				
with respect to cathode	1		10	μа
	•		10	,,,,,
Heater 100 volts positive with respect to				
cathode	1	_	10	μa
Leakage Resistance:				,
Between grid and all				
other electrodes tied				
together	1,3,8	100	-	megohms
Between plate and all				
other electrodes tied				
together	1,3,9	100	-	megohms
Leakage Resistance at 500 Hours:				
Between grid and all				
other electrodes tied				
together	1,3,8	50	-	megohms
Between plate and all				
other electrodes tied				
together	1,3,9	50	-	megohms

- Note 1: With 6.3 volts ac or dc on heater.
- Note 2: Without external shield.
- Note 3: Other electrodes grounded.
- With dc plate supply voltage of 100 volts, cathode resistor of 150 ohms, and cathode-resistor bypass capacitor of 1000 μf .
- With dc plate voltage of 100 volts and grid voltage of -6.5 volts. Note 5:
- Note 6: With dc plate supply voltage of 150 volts, cathode resistor of 300 ohms, and grid resistor of 1 megohm.
- With ac or dc heater voltage of 7.5 volts, dc nlate voltage of 150 volts. grid voltage of -7.5 Note 7: plate voltage of 150 volts, grid voltage of volts, and grid resistor of 1 megohm.
- Note 8: With grid voltage of -100 volts.
- Note 9: With dc plate voltage of -300 volts.

SPECIAL RATINGS AND PERFORMANCE DATA

Shock Rating:

Impact Acceleration. 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.

Variable-Frequency Vibration Performance:

This test is performed on a sample lot from each production run. Tubes are vibrated over the frequency range of 5 to 50 cps at a total excursion of 0.08" for 3 minutes. At the end of this test, tubes are required to meet established limits for low-frequency vibration, heater-cathode leakage current, and transconductance

Low-Frequency Vibration Performance:

RMS Output Voltage 50 max. 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 150 ohms, 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 both cathodes tied together.

Audio-Frequency Noise and Microphonic Performance:

Shorts and Continuity Test:

This test is performed on a sample lot of tubes from each production run. In this test a tube is consid-ered inoperative it 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 condi-tions specified in the Characteristics Range Values for reverse grid current.

I-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. Conditions of life testing are specified under 500-Hour Intermittent Life Performecified under 500-Hour Intermittent E. Tubes are except test run at room temperature. Tubes are for Transconductance (1). At the end ance, except test run at room temperature. Tubes are initially read for Transconductance (1). At the end of 1 hour, the value of transconductance (1) is read. The variation in transconductance (1) from the 0-hour reading will not exceed 15 per cent under the conditions specified in Characteristics Range 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. Conditions of life testing are specified under 500-Hour Intermittent Life Perform ance, except 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, reverse grid current in excess of 1.0 microampere, or a transconductance (1) of less than 4000 micromhos 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 150 ohms, grid 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 in the sample lot and for the number of tubes failing

to pass established initial limits of heater current, individual, average, and 5.7 heater voltage transconductance change, reverse grid current and heater—cathode leakage current shown under Characteristics Range Values.

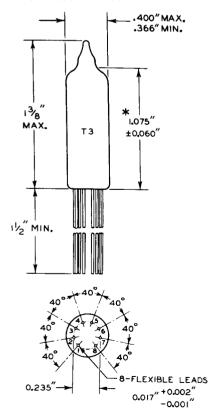
OPERATING CONSIDERATIONS

The maximum ratings in the tabulated data for the 6021 are limiting values above which the serviceability of the 6021 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 6021 are adversely affected by departures from the 6.3volt value. The extent to which life is affected is a function of the amount of these departures and their durations.

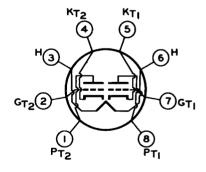
The flexible leads of the 6021 are usually soldered to the circuit elements. Soldering of the connections should be made as far as possible from the glass button. If this precaution is not followed, the heat of the soldering may crack the glass seals of the leads and damage the tube.

DIMENSIONAL OUTLINE



MEASURED FROM BULB SEAT TO BULB-TOP LINE AS DETERMINED BY A RING GAUGE OF 0.210 $^{\circ}$ ± 0.001 $^{\circ}$ 1.0.

LEAD CONNECTIONS Bottom View



LEAD NO.1: PLATE OF TRIODE NO.2

LEAD NO.2: GRID OF TRIODE NO.2

LEAD No.3: HEATER

CATHODE OF TRIODE No.2 LEAD No.4: LEAD NO.5: CATHODE OF TRIODE NO.1

LEAD No.6:

LEAD No.7: GRID OF TRIODE NO.1

LEAD NO.8: PLATE OF TRIODE NO.1



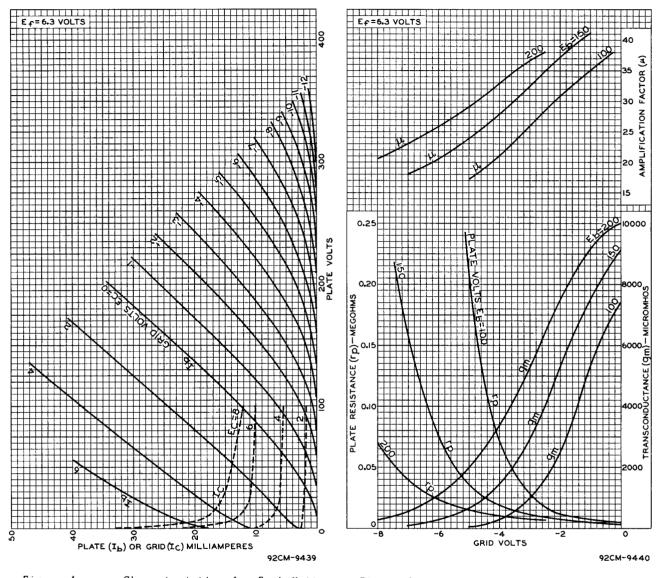


Fig. 1 - Average Characteristics for Each Unit of Type 6021.

Fig. 2 - Average Characteristics for Each Unit of Type 6021.