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 60,000 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) "μ" 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) gridside rods having high heat conductivity to provide cool operation of the grids, (4) pure-tungsten 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 "quality" as follows: test readings at the end of 1 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.

### GENERAL DATA

**Electrical:**
- Heater for Unipotential Cathodes:
  - Voltage (AC or DC) .............. 6.3 ± 5% volts
  - Current ...................... 0.3 amp
- Direct Inter-electrode Capacitances:
  - Grid to plate .............. 1.4 μf
  - Grid to cathode and heater (each unit) .... 2.1 μf
  - Plate to cathode and heater (unit No.1) .... 1.3 μf
  - Plate to cathode and heater (unit No.2) .... 1.4 μf
  - Grid to grid .............. 0.011 max., 0.013 max.
  - Plate to plate .............. 0.33 max., 0.52 max.

**Mechanical:**
- Operating Position .................... Any
- Maximum Bulb Length .................. 1-3/8" T3
- Length from Button Seal to Bulb Top (excluding tip) .... 1.075 ± 0.060"
- Diameter ...................... 0.366" ± 0.040"
- Leads, Flexible .................. 8
- Minimum Length .................. 1.5"
- Orientation and Diameter ............ See dimensional outline

### AMPLIFIER -- Class A1

Values are for Each Unit

**Maximum Ratings, Absolute Values:**
- For Operation At Altitudes Up To 80,000 Feet

<table>
<thead>
<tr>
<th>Term</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Voltage</td>
<td>165 max.</td>
</tr>
<tr>
<td>Grid Voltage:</td>
<td></td>
</tr>
<tr>
<td>Positive bias value</td>
<td>0 max.</td>
</tr>
<tr>
<td>Negative bias value</td>
<td>-55 max.</td>
</tr>
<tr>
<td>Plate Current</td>
<td>22 max.</td>
</tr>
<tr>
<td>Grid Current</td>
<td>5.5 max.</td>
</tr>
<tr>
<td>Plate Dissipation</td>
<td>1.1 max.</td>
</tr>
<tr>
<td>Peak Heater-Cathode Voltage</td>
<td></td>
</tr>
<tr>
<td>Heater negative with respect to cathode</td>
<td>200 max.</td>
</tr>
<tr>
<td>Heater positive with respect to cathode</td>
<td>200 max.</td>
</tr>
<tr>
<td>Bulp Temperature (At hottest point on bulb surface)</td>
<td>220 max. °C</td>
</tr>
</tbody>
</table>

**Characteristics:**
- Plate Supply Voltage .......... 100 volts
- Cathode Resistor .............. 150 ohms
- Plate Current .................. 6.5 ma
### Amplification Factor
- **Value:** 35

### Plate Resistance (Approx.)
- **Value:** 6500 ohms

### Transconductance
- **Value:** 5400 µhos

### Grid Voltage (Approx.) for plate current of 10 µa
- **Value:** -6.5 volts

### Maximum Circuit Values:
- **Grid-Circuit Resistance:**
  - For cathode-gate operation: 1.1 max. megohm

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

### CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Min.</th>
<th>Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater Current</td>
<td>0.280</td>
<td>0.320</td>
</tr>
<tr>
<td>Heater Current at 500 Hours</td>
<td>0.276</td>
<td>0.328</td>
</tr>
</tbody>
</table>

### Direct Interelectrode Capacitances:
- **Grid to plate:** 2.1 1.8 µf
- **Grid to cathode and plate to cathode:** 2.0 1.8 µf
- **Plate to cathode and heater (Unit No.1):** 0.20 0.36 µf
- **Plate to cathode and heater (Unit No.2):** 0.22 0.42 µf
- **Grid to grid:** 3.0 0.013 µf
- **Plate to plate:** 3.0 0.52 µf

### Amplification Factor
- **Value:** 1.4 to 30 mv

### Plate Current (1):
- **Value:** 1.4 4.5 0.6 ma

### Plate-Circuit Difference Between Units:
- **Value:** 1.6 ma

### Plate Current (2):
- **Value:** 1.5 100 µa

### Transconductance (1):
- **Value:** 1.4 4450 6350 µhos

### Transconductance (1) Change:
- With heater voltage reduced to 5.7 volts:
  - **Value:** 4 - 15 per cent

### Shock Rating:
- **Value:** 2.5 max. g

### Fatigue Rating:
- **Value:** 2.5 max. g

### Variable-Frequency Vibration Performance:
- This test is performed on a sample lot from each production run. The tubes are rigidly mounted and subjected to three cycles to an acceleration of 2.5 g for 30 minutes. At the end of this test, the tubes will not show permanent or temporary distortion 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:
- **Value:** 50 max. mv

### Heater-Cathode Leakage Current:
- **Value:** 7 - 0.5 µa

### Heater-Cycling Life Performance:
- **Value:** 2000 min. cycles

### Audio-Frequency Noise and Microphonic Performance:
- **Value:** 65 max. mv

### Shorts and Continuity Test:
- **Value:** 65 millivolts rms is applied to the plates of the tube.
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. Conditions of life testing are specified under 500-Hour Intermittent Life Performance, except test run at room temperature. Tubes are initially raised to 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 Performance, 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°F. 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, 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 6.3-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 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.
Fig. 1 – Average Characteristics for Each Unit of Type 6021.

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

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