The 5670 is a miniature medium-mu twin triode each section of which has a separate cathode connection. The tube is suited for use in a wide-variety of general-purpose amplifier and mixer circuits as well as numerous multi-vibrator and oscillator applications. The useful operating range extends from low frequencies through the VHF region.

The 5670 is a special-quality tube intended for use in critical industrial and military applications in which operational dependability is of primary importance. Features of the tube include a high degree of mechanical strength and a heater-cathode construction capable of withstanding many-thousand cycles of intermittent operation. When used in on-off control applications, the tube will maintain its emission capabilities after long periods of operation under cutoff conditions.

Analysis of the electrical characteristics of this tube with those of the 2C51 will indicate that the 5670 is essentially similar.

**GENERAL**

**ELECTRICAL**

Cathode—Coated Unipotential

Heater Voltage, AC or DC ........................................ 6.3 ± 10% Volts

Heater Current .................................................. 0.35 Amperes

Direct Inter-electrode Capacitances*

- Grid to Plate, Each Section .......................... 1.1 µf
- Input, Each Section .................................. 2.2 µf
- Output, Each Section ................................ 1.0 µf
- Grid to Grid ............................................... 0.0017 µf
- Plate to Plate .......................................... 0.05 µf

* Without external shield.

**MECHANICAL**

Mounting Position—Any

Envelope—T-6½, Glass

Base—E9-1, Small Button 9-Pin

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**BASING DIAGRAM**

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**TERMINAL CONNECTIONS**

Pin 1—Heater

Pin 2—Cathode (Section 2)

Pin 3—Grid (Section 2)

Pin 4—Plate (Section 2)

Pin 5—Internal Shield†

Pin 6—Plate (Section 1)

Pin 7—Grid (Section 1)

Pin 8—Cathode (Section 1)

Pin 9—Heater

† It is recommended that Pin 5 be grounded.

---

**PHYSICAL DIMENSIONS**
**MAXIMUM RATINGS**

**ABSOLUTE MAXIMUM VALUES, EACH SECTION**
- Plate Voltage: 330 Volts
- Positive DC Grid Voltage: 0 Volts
- Negative DC Grid Voltage: -55 Volts
- Plate Dissipation: 1.35 Watts
- DC Grid Current: 3.0 Milliamperes
- DC Cathode Current: 18 Milliamperes
- Heater-Cathode Voltage
  - Heater Positive with Respect to Cathode: 100 Volts
  - Heater Negative with Respect to Cathode: 100 Volts
- Grid Circuit Resistance: 0.5 Megohms
- Bulb Temperature at Hottest Point: 165°C

**CHARACTERISTICS AND TYPICAL OPERATION**

**CLASS A₁ AMPLIFIER, EACH SECTION**
- Plate Voltage: 150 Volts
- Cathode-Bias Resistor: 240 Ohms
- Amplification Factor: 35
- Plate Resistance, approximate: 6400 Ohms
- Transconductance: 5500 Micromhos
- Plate Current: 8.2 Milliamperes
- Grid Voltage, approximate: 10 Microamperes

**PUSH-PULL CLASS A₁ AMPLIFIER**
- Plate Voltage: 300 Volts
- Cathode-Bias Resistor: 800 Ohms
- AF Grid-to-Grid Voltage, RMS: 14 Volts
- Zero-Signal Plate Current, Each Section: 4.9 Milliamperes
- Maximum-Signal Plate Current, Each Section: 6.3 Milliamperes
- Effective Load Impedance, Plate-to-Plate: 27,000 Ohms
- Total Harmonic Distortion, approximate: 10 Percent
- Maximum-Signal Power Output: 1.0 Watts

**CLASS A RESISTANCE-COUPLED AMPLIFIER**

**LOW IMPEDANCE DRIVE (APPROXIMATELY 200 OHMS)**

<table>
<thead>
<tr>
<th>$R_L$</th>
<th>$R_{gf}$</th>
<th>$E_{bb} = 90$ Volts</th>
<th>$E_{bb} = 180$ Volts</th>
<th>$E_{bb} = 300$ Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$R_K$</td>
<td>$E_0$</td>
<td>Gain</td>
<td>$R_K$</td>
</tr>
<tr>
<td>0.10</td>
<td>0.10</td>
<td>2000</td>
<td>5.7</td>
<td>20</td>
</tr>
<tr>
<td>0.10</td>
<td>0.24</td>
<td>2400</td>
<td>8.2</td>
<td>21</td>
</tr>
<tr>
<td>0.24</td>
<td>0.24</td>
<td>4900</td>
<td>7.4</td>
<td>21</td>
</tr>
<tr>
<td>0.24</td>
<td>0.51</td>
<td>5700</td>
<td>9.7</td>
<td>21</td>
</tr>
<tr>
<td>0.51</td>
<td>0.51</td>
<td>11000</td>
<td>8.5</td>
<td>20</td>
</tr>
<tr>
<td>0.51</td>
<td>1.0</td>
<td>13000</td>
<td>10.2</td>
<td>21</td>
</tr>
</tbody>
</table>

**Notes:**
1. $E_0$ is maximum RMS voltage output for approximately five percent total harmonic distortion.
2. Gain is measured for an output voltage of two volts RMS.
3. $R_K$ is in ohms; $R_L$ and $R_{gf}$ are in megohms.
4. Coupling capacitors (C) should be selected to give desired frequency response. $R_K$ should be adequately bypassed.

**HIGH IMPEDANCE DRIVE (APPROXIMATELY 100K OHMS)**

<table>
<thead>
<tr>
<th>$R_L$</th>
<th>$R_{gf}$</th>
<th>$E_{bb} = 90$ Volts</th>
<th>$E_{bb} = 180$ Volts</th>
<th>$E_{bb} = 300$ Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$R_K$</td>
<td>$E_0$</td>
<td>Gain</td>
<td>$R_K$</td>
</tr>
<tr>
<td>0.10</td>
<td>0.10</td>
<td>2600</td>
<td>9.2</td>
<td>20</td>
</tr>
<tr>
<td>0.10</td>
<td>0.24</td>
<td>3200</td>
<td>12.2</td>
<td>20</td>
</tr>
<tr>
<td>0.24</td>
<td>0.24</td>
<td>6200</td>
<td>11.2</td>
<td>20</td>
</tr>
<tr>
<td>0.24</td>
<td>0.51</td>
<td>7500</td>
<td>14.2</td>
<td>21</td>
</tr>
<tr>
<td>0.51</td>
<td>0.51</td>
<td>13000</td>
<td>12.2</td>
<td>20</td>
</tr>
<tr>
<td>0.51</td>
<td>1.0</td>
<td>15000</td>
<td>15.2</td>
<td>20</td>
</tr>
</tbody>
</table>

**Diagram:**

[Diagram showing component connections and labeling.]

**JANUARY 4, 1954**
CHARACTERISTICS LIMITS

Heater Current
Ef = 6.3 volts ........................................ Initial 330 370 Milliamperes
500 Hr 330 370 Milliamperes
1000 Hr 330 370 Milliamperes

Plate Current, Each Section
Ef = 6.3 volts, Eb = 150 volts, Rk = 240 ohms, (bypassed) ............... Initial 5.9 10.5 Milliamperes

Plate Current Difference between Sections
Difference between plate currents for each section at Ef = 6.3 volts,
Eb = 150 volts, Rk = 240 ohms, (bypassed) ................................ Initial 1.8 Milliamperes

Transconductance (1), Each Section
Ef = 6.3 volts, Eb = 150 volts, Rk = 240 ohms, (bypassed) ............... Initial 4500 6500 Microhmhos

Transconductance Change with Heater Voltage, Each Section
Difference between Transconductance (1), and Transconductance at
Ef = 5.7 volts (other conditions the same) expressed as a percentage of
Transconductance (1) ................................ Initial 15 Percent
500 Hr 15 Percent

Transconductance Change with Operation, Each Section
Difference between Transconductance (1) initially and after operation
expressed as a percentage of initial value .................................. 500 Hr 20 Percent
1000 Hr 25 Percent

Average Transconductance Change with Operation, Each Section
Average of values for "Transconductance Change with Operation"... Initial 15 Percent

Amplification Factor, Each Section
Ef = 6.3 volts, Eb = 150 volts, Rk = 240 ohms, (bypassed) ............... Initial 26 44

Plate Current Cutoff (1), Each Section
Ef = 6.3 volts, Ebb = 150 volts, Ec = -10 volts, Rr = 0.25 meg ........ Initial 45 Microamperes

Plate Current Cutoff (2), Each Section
Ef = 6.3 volts, Eb = 150 volts, Ec = 4.0 volts .......................... Initial 5.0 Microamperes

Interelectrode Capacitances
Grid to Plate (g to p), Each Section ................................ Initial 0.8 1.4 μμf
Input (g to k+h), Each Section ................................ Initial 1.7 2.7 μμf
Output (p to k+h), Each Section ................................ Initial 0.7 1.3 μμf
Plate to Plate (p to p) ................................................ Initial 0.1 μμf
Measured without external shield.

Negative Grid Current, Each Section
Ef = 6.3 volts, Eb = 150 volts, Rk = 240 ohms, (bypassed) Rg = 0.5 meg... Initial 0 0.3 Microamperes
500 Hr 0 0.3 Microamperes
1000 Hr 0 0.3 Microamperes

Heater-Cathode Leakage Current, Each Section
Ef = 6.3 volts, Eth = 100 volts
Heater Positive with Respect to Cathode ................................ Initial 7.0 Microamperes
500 Hr 7.0 Microamperes
1000 Hr 7.0 Microamperes

Heater Negative with Respect to Cathode ................................ Initial 7.0 Microamperes
500 Hr 7.0 Microamperes
1000 Hr 7.0 Microamperes

Interelectrode Leakage Resistance
Ef = 6.3 volts. Polarity of applied d-c interelectrode voltage is such that
no cathode emission results.
Grid (Each Section) to All at 100 Volts DC ................................ Initial 100 Megohms
500 Hr 50 Megohms

Plate (Each Section) to All at 300 Volts DC .......................... Initial 100 Megohms
500 Hr 50 Megohms

CHARACTERISTICS LIMITS CONTINUED ON PAGE 4
CHARACTERISTICS LIMITS (Cont’d)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibrational Noise Output Voltage, RMS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$E_f = 6.3$ volts, $E_{bb} = 150$ volts, $E_c = -3.0$ volts, $R_e = 2000$ ohms, vibrational acceleration = 2.5 G at 25 cps. Sections in parallel Initial</td>
<td>. . .</td>
<td>100 Millivols</td>
</tr>
<tr>
<td>Grid Emission Current, Each Section</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$E_f = 7.5$ volts, $E_b = 150$ volts, $E_{cc} = -10$ volts, $R_g = 0.5$ meg Initial</td>
<td>0</td>
<td>0.5 Microamperes</td>
</tr>
</tbody>
</table>

The indicated 500-hour and 1000-hour values are life-test end points for the following conditions of operation for each section: $E_f = 6.3$ volts, $E_b = 150$ volts, $R_k = 240$ ohms, $R_g = 0.5$ meg, $E_{hk} = 135$ volts with heater positive with respect to cathode, and bulb temperature = 165 C minimum.

SPECIAL TESTS AND RATINGS

Stability Life Test
Statistical sample operated for one hour to evaluate and control initial variations in transconductance.

Survival Rate Life Test
Statistical sample operated for one hundred hours to evaluate and control early-life electrical and mechanical inoperatives.

Heater-Cycling Life Test
Statistical sample operated for 2000 cycles to evaluate and control heater-cathode defects. Conditions of test include $E_f = 7.5$ volts cycled for one minute on and one minute off, $E_b = E_c = 0$ volts, and $E_{hk} = 135$ volts with heater positive with respect to cathode.

Shock Rating—600 G
Statistical sample subjected to five impact accelerations of 600 G in each of four different positions. The accelerating forces are applied by the Navy-type, High Impact (flyweight) Shock Machine for Electronic Devices or its equivalent.

Fatigue Rating—2.5 G
Statistical sample subjected to vibrational acceleration of 2.5 G for 32 hours minimum in each of three different positions. The sinusoidal vibration is applied at a fixed frequency between 25 and 60 cycles per second.

Altitude Rating—60,000 Feet
Statistical sample subjected to pressure of 55 millimeters of mercury to evaluate and control arcing and corona.

Note: The conditions for some of the indicated tests have deliberately been selected to aggravate tube failures for test and evaluation purposes. In no sense should these conditions be interpreted as suitable circuit operating conditions.

In the design of military equipment employing this tube, reference should be made to the appropriate MIL-E-1C specification.