SPECIAL QUALITY OUTPUT PENTODE

Special quality subminiature audio output pentode for use in equipment where high ambient temperatures, mechanical vibration and shocks are unavoidable and where statistically controlled major electrical characteristics are required.

This data should be read in conjunction with the GENERAL NOTES—SPECIAL QUALITY VALVES which precede this section of the handbook, and the index numbers are used to indicate where reference should be made to a specific note.

HEATER

\[ V_h = 6.3 \text{ V} \]
\[ I_h = 450 \text{ mA} \]

MOUNTING POSITION

Any

Note—Direct soldered connections to the leads of this valve must be at least 5mm from the seal and any bending of the valve leads must be at least 1.5mm from the seal.

CAPACITANCES (measured with an external shield)

\[ C_{g1} = \begin{array}{c} <200 \text{ mF} \\ 6.5 \text{ pF} \\ 7.5 \text{ pF} \end{array} \]

CHARACTERISTICS

\[ V_a = 100 \text{ V} \]
\[ V_{g2} = 30 \text{ mA} \]
\[ I_a = 1.2 \text{ mA} \]
\[ g_m = 4.2 \text{ mA/V} \]
\[ \mu_{g1-g2} = \begin{array}{c} 6.0 \text{ kΩ} \end{array} \]
\[ r_a = \begin{array}{c} >10 \text{ kΩ} \end{array} \]
\[ V_{g1} = -8.3 \text{ V} \]
\[ R_k = 0 \text{ Ω} \]
\[ V_{g1} (I_h = 100\mu A) = -40 \text{ V} \]

LIMITING VALUES (absolute ratings)

\[ V_h \text{ max.} = 6.6 \text{ V} \]
\[ V_h \text{ min.} = 6.0 \text{ V} \]
\[ V_{ak(b)} \text{ max.} = 330 \text{ V} \]
\[ V_a \text{ max.} = 165 \text{ V} \]
\[ p_a \text{ max.} = 3.7 \text{ W} \]
\[ V_{g2(b)} \text{ max.} = 310 \text{ V} \]
\[ V_{g2} \text{ max.} = 155 \text{ V} \]
\[ p_{g2} \text{ max.} = 400 \text{ mW} \]
\[ +V_{g1} \text{ max.} = 0 \text{ V} \]
\[ -V_{g1} \text{ max.} = 55 \text{ V} \]
\[ I_h \text{ max.} = 50 \text{ mA} \]
\[ R_{g1-k} \text{ max.} = 550 \text{ kΩ} \]
\[ V_{h-k} \text{ max.} = 200 \text{ V} \]

Maximum acceleration (continuous operation)

Maximum shock (short duration)

Temperature bulb max.
## TEST CONDITIONS (unless otherwise specified)

<table>
<thead>
<tr>
<th>$V_h$</th>
<th>$V_{a-e}$</th>
<th>$V_{g2-e}$</th>
<th>$V_{g1-e}$</th>
<th>$R_k$</th>
<th>$C_k$</th>
<th>$V_{h-k}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(V)</td>
<td>(V)</td>
<td>(V)</td>
<td>(V)</td>
<td>(Ω)</td>
<td>(μF)</td>
<td>(V)</td>
</tr>
<tr>
<td>6.3</td>
<td>110</td>
<td>110</td>
<td>0</td>
<td>270</td>
<td>1000</td>
<td>0</td>
</tr>
</tbody>
</table>

## TESTS

<table>
<thead>
<tr>
<th>A.Q.L.(^5)</th>
<th>Individuals(^6)</th>
<th>Lot average(^7)</th>
<th>Lot standard deviation(^8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>0.65</td>
<td>450</td>
<td>420</td>
<td>480</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>0.65</td>
<td>---</td>
<td>---</td>
<td>15</td>
</tr>
<tr>
<td>0.65</td>
<td>30</td>
<td>23</td>
<td>37</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>0.65</td>
<td>---</td>
<td>---</td>
<td>100</td>
</tr>
<tr>
<td>0.65</td>
<td>750</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

### GROUP A

- **Heater current**
  - 0.65 %
  - Bogey: 450 mA, Min.: 420 mA, Max.: 480 mA
  - Lot average: 432 mA, Lot standard deviation: 12.5 mA

- **Heater-to-cathode leakage current**
  - $V_{h-k} = \pm 100V$
  - 0.65 %
  - Min.: 15 μA

- **Reverse grid current**
  - $R_{g1} = 1.0\,\text{MΩ}$
  - 0.65 %
  - Bogey: 0 mA, Min.: 0 mA, Max.: 1.0 mA

- **Anode current**
  - $V_{g1} = -40V$, $R_k = 0\,\text{Ω}$
  - 0.65 %
  - Bogey: 30 mA, Min.: 23 mA, Max.: 37 mA

- **Power output**
  - $V_{id(e.m.s.)} = 6.4V$, $R_a = 3.0\,\text{kΩ}$
  - 0.65 %
  - Bogey: 750 mW

- **Sub-group quality level\(^10\)**
  - 1.0

- **Inoperatives\(^16\)**
  - 0.4
### Group B

<table>
<thead>
<tr>
<th>Insulation</th>
<th>$\text{M}^\Omega$</th>
<th>$\text{M}^\Omega$</th>
<th>%</th>
<th>mA</th>
<th>mA</th>
<th>mAV</th>
<th>0.33 mAV</th>
</tr>
</thead>
<tbody>
<tr>
<td>a-rest, measured at $-300\text{V}$</td>
<td>50</td>
<td>50</td>
<td>15</td>
<td>4.0</td>
<td>4.9</td>
<td>3.85</td>
<td>4.55</td>
</tr>
</tbody>
</table>

Reverse grid current $V_a = 7.5\text{V}$, $V_{an} = 10\text{V}$, $R_{ga} = 1.0\text{k}^\Omega$, $R_a = 500\text{k}^\Omega$. Measured after 5 minutes preheat at $V_a = 7.5\text{V}$, $V_{an} = 10\text{V}$. $R_{ga} = 1.0\text{k}^\Omega$, $R_a = 500\text{k}^\Omega$, $R_{ga} = 1.0\text{k}^\Omega$, $R_a = 500\text{k}^\Omega$.

Mutual conduction $I_{ga} = 10\text{mA}$, $V_{an} = 10\text{V}$, $R_{ga} = 1.0\text{k}^\Omega$, $R_a = 500\text{k}^\Omega$, $R_{ga} = 1.0\text{k}^\Omega$, $R_a = 500\text{k}^\Omega$.

Capacitance $C_{gs} = 0.4\mu\text{F}$, $C_{as} = 0.005\mu\text{F}$. No applied voltages.

Note: The value is tapped with a specified hammer and the output observed on a meter of specified dynamic response.
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(%)</td>
<td>Bogey(^9)</td>
<td>Min.</td>
<td>Max.</td>
</tr>
<tr>
<td>GROUP C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead fragility test(^{13B}). 4 arcs</td>
<td>2.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Fatigue\(^{14}\)**

- \(V_h = 6.3\, \text{V}\). No other voltages applied. 2.5g
- min. peak acceleration, fixed frequency
- \(f = 25\, \text{c/s min.} 60\, \text{c/s max. for 32 hours in each of 3 mutually perpendicular planes}\)

**Post fatigue tests**

- Heater-to-cathode leakage current
  \(V_{h-k} = \pm 100\, \text{V}\)
  \(-6.5\) \(\mu\text{A}\)
- Change in power output
  \(-6.5\) \(\%\)
- Microphonic noise as in group B
  \(-6.5\) \(\text{mV}\) (r.m.s.)

**Shock\(^{15}\)**

- \(V_{h-k} = 100\, \text{V (cathode negative)}, \ R_g = 100k\Omega, 500g\)

**Post shock tests**

- Heater-to-cathode leakage current
  \(V_{h-k} = \pm 100\, \text{V}\)
  \(-20\) \(\mu\text{A}\)
- Change in power output
  \(-20\) \(\%\)
- Microphonic noise as in group B
  \(-20\) \(\text{mV}\) (r.m.s.)

**Glass strain test\(^{11B}\). No applied voltages**

- 6.5
GROUP D

Heater cycling life test
- $V_h = 7.0V$, 1 minute on, 4 minutes off
- $V_{h-k} = 140V_{r.m.s.}$ (continuous). No other applied voltages

Heater cycling life test end point
- Heater-to-cathode leakage current $V_{h-k} = \pm 100V$

Stability life test
- Running conditions $R_g = 470k\Omega$, $R_k = 220\Omega$
- $V_a = V_{g2} = 100V$, $V_{h-k} = 200V$ (cathode negative)
- $T_{ambient} = $ Room temperature

Stability life test end point
- Change in power output after 1 hour

Survival rate life test
- Running conditions $R_g = 470k\Omega$, $R_k = 220\Omega$
- $V_{h-k} = 200V$ (cathode negative)
- $T_{ambient} = $ Room temperature

Survival rate life test end points (100 hours)
- Inoperatives: 0.65
- Power output: 1.0

A.Q.L.5
- Min. Max. mW

Intermittent life test
- Running conditions, $R_g = 470k\Omega$, $R_k = 220\Omega$, $V_a = V_{g2} = 100V$
- $V_{h-k} = 200V$ (cathode negative), $T_{bulb, min.} = 220^\circ C$

Intermittent life test points (500 hours)
- Inoperatives: 4.0
- Heater current: 6.5
- Heater-to-cathode leakage current $V_{h-k} = \pm 100V$
- Reverse grid current $R_g = 1.0M\Omega$
- Change in power output (individuals)
- Change in power output $V_h = 5.7V$
- Insulation as in group B
- Average change in power output
- Sub-group quality level

5902
The bulb and base dimensions of this valve are in accordance with BS448, Section B8D/F.
ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE.
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER.