SPECIAL QUALITY R.F. PENTODE

Special quality subminiature r.f. 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 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

$$V_h = 6.3 \text{ V}$$
$$I_h = 150 \text{ mA}$$

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 external shield)

$$C_{a-g1} < 20 \text{ mpF}$$
$$C_{a-g3} < 1.1 \text{ pF}$$
$$C_{g1-g3} < 150 \text{ mpF}$$
$$C_{i(n)(g1)} = 4.0 \text{ pF}$$
$$C_{i(n)(g3)} = 3.7 \text{ pF}$$
$$C_{out} = 3.4 \text{ pF}$$

CHARACTERISTICS

$$V_a = 100 \text{ V}$$
$$V_{g3} = 0 \text{ V}$$
$$V_{g2} = 100 \text{ V}$$
$$V_{g1} = -1.4 \text{ V}$$
$$I_a = 5.3 \text{ mA}$$
$$I_{g2} = 4.1 \text{ mA}$$
$$g_{m(g1-a)} = 3.2 \text{ mA/V}$$
$$g_{m(g3-a)} = 1.15 \text{ mA/V}$$
$$U_{g1-g2} = 25$$
$$R_x = 0 \Omega$$
$$V_{g1} (I_n < 10\mu A) = -7.5 \text{ V}$$
$$V_{g0} (I_n < 10\mu A) = -8.0 \text{ V}$$

LIMITING VALUES

(absolute ratings)

$$V_h \max = 6.6 \text{ V}$$
$$V_h \min = 6.0 \text{ V}$$
$$V_{a(b)} \max = 330 \text{ V}$$
$$V_a \max = 165 \text{ V}$$
$$p_a \max = 550 \text{ mW}$$
$$V_{g3} \max = 30 \text{ V}$$
$$V_{g2(b)} \max = 310 \text{ V}$$
$$V_{g2} \max = 155 \text{ V}$$
$$p_{g2} \max = 450 \text{ mW}$$
$$I_{g2} \max = 7.0 \text{ mA}$$
$$V_{g1} \max = 0 \text{ V}$$
$$V_{g1} \max = 55 \text{ V}$$
$$I_k \max = 16 \text{ mA}$$
$$V_{h-k} \max = 200 \text{ V}$$
$$R_{g1-k} \max = 1.1 \text{ M}\Omega$$
Maximum acceleration (continuous operation) 2.5 \text{ g}
Maximum shock (short duration) 500 \text{ g}
$$T_{bulb} \max = 220 \text{ °C}$$
## Test Conditions (unless otherwise specified)

<table>
<thead>
<tr>
<th>$V_h$ (V)</th>
<th>$V_{a-e}$ (V)</th>
<th>$V_{g2-e}$ (V)</th>
<th>$V_{g1-e}$ (V)</th>
<th>$V_{g3-k}$ (V)</th>
<th>$R_k$ (Ω)</th>
<th>$C_k$ (μF)</th>
<th>$V_{h-k}$ (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.3</td>
<td>100</td>
<td>100</td>
<td>0</td>
<td>0</td>
<td>150</td>
<td>1000</td>
<td>0</td>
</tr>
</tbody>
</table>

## Tests

<table>
<thead>
<tr>
<th>Group A</th>
<th>A.Q.L. (%)</th>
<th>Bogey (mA)</th>
<th>Min. (mA)</th>
<th>Max. (mA)</th>
<th>Lot Min. (mA)</th>
<th>Lot Max. (mA)</th>
<th>Lot Standard Deviation (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater current</td>
<td>0.65</td>
<td>150</td>
<td>140</td>
<td>160</td>
<td>144</td>
<td>156</td>
<td>4.2</td>
</tr>
<tr>
<td>Heater-to-cathode leakage current</td>
<td>0.65</td>
<td>—</td>
<td>—</td>
<td>5.0</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>$V_{h-k} = \pm 100\text{V}$</td>
<td>0.65</td>
<td>—</td>
<td>0</td>
<td>0.3</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Reverse grid current $R_{g1} = 1.0M\Omega$</td>
<td>0.65</td>
<td>5.3</td>
<td>3.7</td>
<td>6.9</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Anode current</td>
<td>0.65</td>
<td>3.2</td>
<td>2.7</td>
<td>4.0</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Anode current $V_{g1} = -7.5\text{V}$, $R_k = 0\Omega$</td>
<td>0.65</td>
<td>—</td>
<td>—</td>
<td>100</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Mutual conductance</td>
<td>0.65</td>
<td>3.2</td>
<td>2.7</td>
<td>4.0</td>
<td>2.9</td>
<td>3.5</td>
<td>0.31</td>
</tr>
<tr>
<td>Sub-group quality level</td>
<td>1.0</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Inoperatives</td>
<td>0.4</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>
### GROUP B

#### Insulation

- a-rest, measured at -300V  
- g3-rest, measured at -100V

<table>
<thead>
<tr>
<th></th>
<th>2.5</th>
<th>100</th>
<th>100</th>
<th>15</th>
<th>2.8</th>
<th>5.4</th>
<th>%</th>
<th>mA</th>
<th>μA</th>
<th>mΩ</th>
<th>MΩ</th>
</tr>
</thead>
</table>

#### Change in mutual conductance $V_h = 5.7V$

<table>
<thead>
<tr>
<th></th>
<th>2.5</th>
<th>0</th>
<th>0.5</th>
<th>70</th>
<th>3.5</th>
<th>4.5</th>
<th>μA</th>
<th>mV</th>
<th>pF</th>
<th>mpF</th>
<th>pF</th>
</tr>
</thead>
</table>

#### Screen-grid current

<table>
<thead>
<tr>
<th></th>
<th>2.5</th>
<th>2.8</th>
<th>5.4</th>
<th></th>
<th>1.8</th>
<th></th>
<th>mA</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

#### Anode current $V_{g3-e} = -8.0V$

<table>
<thead>
<tr>
<th></th>
<th>2.5</th>
<th>100</th>
<th>100</th>
<th></th>
<th></th>
<th></th>
<th>μA</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

#### Mutual conductance $(g3-a) V_{g3-e} = -1.0V$

<table>
<thead>
<tr>
<th></th>
<th>2.5</th>
<th>0.5</th>
<th>1.8</th>
<th></th>
<th></th>
<th></th>
<th>mA/V</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

#### Reverse grid current $V_h = 7.5V, V_{g1} = -7.5V$

- $R_{g1} = 1.0MΩ$, $R_k = 0Ω$. Measured after 5 minutes preheat under standard test conditions, except $V_h = 7.5V, R_{g1} = 1.0MΩ$

<table>
<thead>
<tr>
<th></th>
<th>2.5</th>
<th>0</th>
<th>0.5</th>
<th></th>
<th></th>
<th></th>
<th>μA</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

#### A.F. noise at anode, $V_{g3-e} = 19V, R_{g1} = 100kΩ, R_{g2} = 1.0kΩ, R_b = 200kΩ$

<table>
<thead>
<tr>
<th></th>
<th>2.5</th>
<th>70</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>mV</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

#### Capacitances² (shielded). No applied voltages

- $C_{in}$
- $C_{out}$
- $C_{g3-all}$
- $C_{b-g1}$
- $C_{b-g3}$
- $C_{g1-g3}$

<table>
<thead>
<tr>
<th></th>
<th>6.5</th>
<th>3.5</th>
<th>2.9</th>
<th>3.5</th>
<th>3.5</th>
<th>1.1</th>
<th>150</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

#### Low pressure voltage breakdown

- Pressure = 55 ± 5mm Hg
- Voltage = 300V r.m.s. No other applied voltages

<table>
<thead>
<tr>
<th></th>
<th>6.5</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

#### Microphonic noise at the anode at 50 c/s, 15g min. peak acceleration, $R_b = 10kΩ$

<table>
<thead>
<tr>
<th></th>
<th>2.5</th>
<th>60</th>
<th></th>
<th></th>
<th></th>
<th></th>
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<th></th>
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<th></th>
</tr>
</thead>
</table>

(feat.): The valve is tapped with a specified hammer and the output observed on a meter of specified dynamic response.
GROUP C

Lead fragility test\textsuperscript{13B} 4 arcs

<table>
<thead>
<tr>
<th>A.Q.L.\textsuperscript{5} (%)</th>
<th>Individuals\textsuperscript{6} Min.</th>
<th>Max.</th>
<th>Lot average\textsuperscript{7} Min.</th>
<th>Max.</th>
<th>Lot standard deviation\textsuperscript{8} Max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

**Fatigue\textsuperscript{14}**

\( V_h = 6.3\text{V} \). No other voltages applied. 2.5g

min. peak acceleration, fixed frequency \( f = 25\text{c/s min. 60c/s max. for 32 hours in each of 3 mutually perpendicular planes} \)

**Post fatigue tests**

\[
\begin{align*}
V_{h-k} &= \pm 100\text{V} \\
\text{Change in mutual conductance} &\quad 6.5 \% \\
\text{Microphonic noise as in group B} &\quad 6.5 \%
\end{align*}
\]

| — | — | 20 | — | — | — | \( \mu\text{A} \) |
| — | — | 20 | — | — | — | \( \% \) |
| — | — | 200 | — | — | — | mV |

**Shock\textsuperscript{15}**

\( V_{h-k} = 100\text{V (cathode negative)}, \quad R_{g1} = 100k\Omega, 500\text{g} \)

**Post shock tests**

\[
\begin{align*}
V_{h-k} &= \pm 100\text{V} \\
\text{Change in mutual conductance} &\quad 20 \% \\
\text{Microphonic noise as in group B} &\quad 20 \%
\end{align*}
\]

| — | — | 20 | — | — | — | \( \mu\text{A} \) |
| — | — | 20 | — | — | — | \( \% \) |
| — | — | 200 | — | — | — | mV |

**Glass strain test\textsuperscript{11B}. No applied voltages**

| 6.5 | — | — | — | — | — | — |

\textsuperscript{5}A.Q.L.: Acceptable Quality Level; \textsuperscript{6}Individuals; \textsuperscript{7}Lot average; \textsuperscript{8}Lot standard deviation.
GROUP D

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

2.5  

Stability life test
Running conditions \( R_g1 = 1.0\Omega \),
\[ V_{h-k} = 200V \text{ (cathode negative), } T_{ambient} = \]
Room temperature

Stability life test end points
Change in mutual conductance after 1 hour 1.0  

Survival rate life test
Running conditions \( R_g1 = 1.0\Omega \),
\[ V_{h-k} = 200V \text{ (cathode negative),} \]
\[ T_{ambient} = \text{Room temperature} \]

Survival rate life test end points (100 hours)
Inoperatives 0.65  
Mutual conductance 1.0  

\[ \text{mA/V} \]

A.Q.L. \( \% \)  Min.  Max.

Intermittent life test
Running conditions, \( R_g1 = 1.0\Omega \),
\[ V_{h-k} = 200V \text{ (cathode negative),} \]
\[ T_{bulb min} = 220^\circ\text{C} \]

Intermittent life test end points (500 hours)
Inoperatives 4.0  
Heater current 6.5  
Heater-to-cathode leakage current \( V_{h-k} = \pm 100V \)  
Reverse grid current \( R_g1 = 1.0\Omega \)  
Change in mutual conductance (individuals) 4.0  
Change in mutual conductance \( V_h = 5.7V \)  
Insulation as in group B. 6.5  
Average change in mutual conductance 10  
Sub-group quality level \( \% \)
The bulb and base dimensions of this valve are in accordance with BS.448, Section B8D/F.
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST ANODE VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER
ANODE AND SCREEN-GRID CURRENTS, MUTUAL CONDUCTANCE AND ANODE IMPEDANCE PLOTTED AGAINST CONTROL-GRID VOLTAGE
ANODE AND SCREEN-GRID CURRENTS PLOTTED AGAINST SUPPRESSOR-GRID VOLTAGE
MUTUAL CONDUCTANCE \( (g_{3-a}) \) PLOTTED AGAINST SUPPRESSOR-GRID VOLTAGE WITH CONTROL-GRID VOLTAGE AS PARAMETER

\[
V_0 = V_{g2} = 100V \\
R_k = 0\Omega
\]