S.Q. TUBE

Special quality triode-pentode
The pentode section is designed for use as mixer and R.F. or A.F. amplifier. The triode section is designed for use as oscillator (max. freq. 300 MHz) multivibrator or blocking oscillator.

<table>
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<th>QUICK REFERENCE DATA</th>
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<td>Life test</td>
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<td>Low interface resistance</td>
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<td>Mechanical quality</td>
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<tr>
<td>Base</td>
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<tr>
<td>Heating</td>
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<tr>
<td>Heater voltage</td>
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<tr>
<td>Heater current</td>
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<tr>
<td>Pentode: Anode current</td>
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<tr>
<td>Mutual conductance</td>
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<tr>
<td>Amplification factor</td>
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<td>Triode: Anode current</td>
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<tr>
<td>Amplification factor</td>
</tr>
</tbody>
</table>

DIMENSIONS AND CONNECTIONS

Base: Noval

Dimensions in mm

December 1968
## CHARACTERISTICS

| Column I | Nominal value or setting of the tube |
| Column II | Range values for equipment design: Initial spread |
| Column III | Range values for equipment design: End of life |

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heater voltage</td>
<td>$V_f$</td>
<td>6.3</td>
<td>V</td>
</tr>
<tr>
<td>Heater current</td>
<td>$I_f$</td>
<td>330</td>
<td>313 - 347 mA</td>
</tr>
<tr>
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<tr>
<td><strong>Pentode section</strong></td>
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<td></td>
</tr>
<tr>
<td>Anode supply voltage</td>
<td>$V_{ba}$</td>
<td>170</td>
<td>V</td>
</tr>
<tr>
<td>Grid No.2 supply voltage</td>
<td>$V_{bg2}$</td>
<td>170</td>
<td>V</td>
</tr>
<tr>
<td>Cathode resistor</td>
<td>$R_k$</td>
<td>155</td>
<td>$\Omega$</td>
</tr>
<tr>
<td>Anode current</td>
<td>$I_a$</td>
<td>10</td>
<td>7.5 - 12.5 min. 6 mA</td>
</tr>
<tr>
<td>Grid No.2 current</td>
<td>$I_{g2}$</td>
<td>2.8</td>
<td>1.55 - 4.05 mA</td>
</tr>
<tr>
<td>Mutual conductance</td>
<td>$S$</td>
<td>6.2</td>
<td>5.2 - 7.2 min. 4.3 mA/V</td>
</tr>
<tr>
<td>Amplification factor</td>
<td>$\mu_{g2g1}$</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>grid No.2 to grid No.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal resistance</td>
<td>$R_i$</td>
<td>0.4</td>
<td>min. 0.26 $\Omega$</td>
</tr>
<tr>
<td>Negative grid No.1 current</td>
<td>$-I_{g1}$</td>
<td>max. 0.5</td>
<td>max. 1.0 $\mu A$</td>
</tr>
<tr>
<td><strong>Triode section</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anode supply voltage</td>
<td>$V_{ba}$</td>
<td>100</td>
<td>V</td>
</tr>
<tr>
<td>Cathode resistor</td>
<td>$R_k$</td>
<td>120</td>
<td>$\Omega$</td>
</tr>
<tr>
<td>Anode current</td>
<td>$I_a$</td>
<td>14</td>
<td>10 - 18 min. 8.4 mA</td>
</tr>
<tr>
<td>Mutual conductance</td>
<td>$S$</td>
<td>5.0</td>
<td>4 - 6 min. 3.5 mA/V</td>
</tr>
<tr>
<td>Amplification factor</td>
<td>$\mu$</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Negative grid current</td>
<td>$-I_g$</td>
<td>max. 0.5</td>
<td>max. 1.0 $\mu A$</td>
</tr>
</tbody>
</table>
CAPACITANCES  Without external shield

<table>
<thead>
<tr>
<th>Pentode</th>
<th>I</th>
<th>II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid No.1 to grid No.2, grid No.3 cathode, heater and screen</td>
<td>( C_{g1/g2g3kfs} )</td>
<td>5.6</td>
</tr>
<tr>
<td>Anode to grid No.2, grid No.3 cathode, heater and screen</td>
<td>( C_{a/g2g3kfs} )</td>
<td>3.4</td>
</tr>
<tr>
<td>Anode to grid No.1</td>
<td>( C_{ag} )</td>
<td>max. 25 mpF</td>
</tr>
<tr>
<td>Grid No.1 to heater</td>
<td>( C_{g1f} )</td>
<td>max 0.16 pF</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Triode</th>
<th>I</th>
<th>II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid to cathode (triode), cathode (pentode) grid No.3, heater and screen</td>
<td>( C_{g/kTkgpg3fs} )</td>
<td>2.5</td>
</tr>
<tr>
<td>Anode to cathode (triode), cathode (pentode) grid No.3, heater and screen</td>
<td>( C_{a/kTkgpg3fs} )</td>
<td>1.5</td>
</tr>
<tr>
<td>Anode to grid</td>
<td>( C_{ag} )</td>
<td>1.5</td>
</tr>
<tr>
<td>Grid to heater</td>
<td>( C_{gf} )</td>
<td>max 0.22 pF</td>
</tr>
</tbody>
</table>

**MICROPHONY**

The pentode section can be used without special precautions against microphony in circuits where an input voltage of more than 50 mV is required for an output of 50 mW.

**SHOCK AND VIBRATION RESISTANCE**

The following test conditions are applied to assess the mechanical quality of the tube. These conditions are not intended to be used as normal operating conditions.

**Shock**

The tube is subjected 5 times in each of 4 positions to an acceleration of 500 g supplied by an NRL shock machine with the hammer lifted over an angle of 30°.

**Vibration**

The tube is subjected during 32 hours in each of 3 positions to a vibration frequency of 50 Hz with an acceleration of 2.5 g.
LIFE

Production samples are tested to be within the end of life values (column III) under the following conditions during 10000 hours.

Pentode section

\[ \begin{align*}
V_{ba} &= 170 \text{ V} \\
V_{bg2} &= 170 \text{ V} \\
R_k &= 155 \text{ } \Omega
\end{align*} \]

Triode section

\[ \begin{align*}
V_{ba} &= 100 \text{ V} \\
R_k &= 120 \text{ } \Omega
\end{align*} \]

LIMITING VALUES (Absolute max. rating system)

Pentode section

Anode voltage

\[ \begin{align*}
V_{a0} &\text{ max. } 550 \text{ V} \\
V_a &\text{ max. } 275 \text{ V}
\end{align*} \]

Anode dissipation

\[ \begin{align*}
W_a &\text{ max. } 2.15 \text{ W}
\end{align*} \]

Grid No.2 voltage

\[ \begin{align*}
V_{g20} &\text{ max. } 550 \text{ V}
\end{align*} \]

Grid No.2 voltage:

- Cathode current > 10 mA
  \[ \begin{align*}
  V_{g2} &\text{ max. } 200 \text{ V}
  \end{align*} \]
- Cathode current < 10 mA
  \[ \begin{align*}
  V_{g2} &\text{ max. } 225 \text{ V}
  \end{align*} \]

Grid No.2 dissipation:

- Anode dissipation > 1.2 W
  \[ \begin{align*}
  W_{g2} &\text{ max. } 0.7 \text{ W}
  \end{align*} \]
- Anode dissipation < 1.2 W
  \[ \begin{align*}
  W_{g2} &\text{ max. } 0.8 \text{ W}
  \end{align*} \]

Grid No.1 dissipation

\[ \begin{align*}
W_{g1} &\text{ max. } 0.1 \text{ W}
\end{align*} \]

Negative grid No.1 voltage

\[ \begin{align*}
-V_{g1} &\text{ max. } 100 \text{ V}
\end{align*} \]

Cathode current

\[ \begin{align*}
I_k &\text{ max. } 18 \text{ mA}
\end{align*} \]

Voltage between cathode and heater

\[ \begin{align*}
V_{kf} &\text{ max. } 100 \text{ V}
\end{align*} \]

Grid resistor (fixed bias)

\[ \begin{align*}
R_{g1} &\text{ max. } 0.5 \text{ M}\Omega
\end{align*} \]
LIMITING VALUES (Absolute max. rating system) (continued)

Triode section

Anode voltage
\[ V_{a_0} \text{ max. } 550 \text{ V} \]
\[ V_a \text{ max. } 275 \text{ V} \]
Anode dissipation
\[ W_a \text{ max. } 1.75 \text{ W} \]
Grid dissipation
\[ W_g \text{ max. } 0.1 \text{ W} \]
Grid, voltage, peak value
\[ V_{gp} \text{ max. } 30 \text{ V} \]
Duty factor max. 0.04
Pulse duration max. 0.8 ms

Grid voltage
\[ -V_g \text{ max. } 100 \text{ V} \]
Cathode current
\[ I_k \text{ max. } 18 \text{ mA} \]
Cathode current peak value
\[ I_{kp} \text{ max. } 100 \text{ mA} \]
Duty factor max. 0.04
Pulse duration max. 0.8 ms

Voltage between cathode and heater
\[ V_{kf} \text{ max. } 100 \text{ V} \]
Grid resistor (fixed bias)
\[ R_g \text{ max. } 0.5 \text{ M\ohm} \]
Bulb temperature
\[ t_{bulb} \text{ max. } 170 \text{ °C} \]

Heater voltage: The average heater voltage should be 6.3 V.
Variation of the heater voltage exceeding the range of 6.0 V to 6.6 V will shorten the tube life.
The tolerance of heater current (column II) should be taken into account.
OPERATING CHARACTERISTICS

Pentode section as R.F. amplifier

Anode supply voltage
Grid No.2 supply voltage
Cathode resistor
Anode current
Grid No.2 current
Mutual conductance
Amplification factor
grid No.2 to grid No.1
Internal resistance
Input resistance at 50 MHz
Equivalent noise resistance

V_{ba} 170 V
V_{bg2} 170 V
R_k 155 Ω
I_a 10 mA
I_{g2} 2.8 mA
S 6.2 mA/V
μ_{g2g1} 40
R_i 0.4 MΩ
r_{g1} 10 kΩ
R_{eq} 1.5 kΩ

Pentode section as mixer

Anode supply voltage
Grid No.2 supply voltage
Grid No.1 resistor
Cathode resistor
Oscillator voltage
Anode current
Grid No.2 current
Grid No.1 current
Conversion conductance
Internal resistance

V_{ba} 170 V
V_{bg2} 170 V
R_{g1} 0.1 MΩ
R_k 330 Ω
V_{osc} 3.5 V_{RMS}
I_a 8 mA
I_{g2} 2.5 mA
I_{g1} 12 μA
S_c 2.4 mA/V
R_i 0.5 MΩ

Triode as oscillator

Operation in Colpitts circuit is recommended.

Operation in Hartley circuit is not recommended.
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