TRIODE-OUTPUT PENTODE

The triode section is intended for use as frame oscillator and A.F. amplifier. The pentode section is intended for use as frame output tube and A.F. power amplifier.

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<td>Anode current</td>
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<td>Transconductance</td>
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<td>Amplification factor</td>
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<table>
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<td>Anode peak voltage</td>
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<td>Transconductance</td>
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<tr>
<td>Output power</td>
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</tbody>
</table>

**HEATING:** Indirect by A.C. or D.C.; parallel supply

Heater voltage $V_f$ 6.3 V
Heater current $I_f$ 780 mA

**DIMENSIONS AND CONNECTIONS**

Base: Noval

Dimensions in mm
### CAPACITANCES

**Triode section**
- Anode to all except grid: \( C_a(g) \) = 4.3 pF
- Grid to all except anode: \( C_g(a) \) = 2.7 pF
- Anode to grid: \( C_{ag} \) = 4.4 pF
- Grid to heater: \( C_{gf} \) = max. 0.1 pF

**Pentode section**
- Anode to all except grid No.1: \( C_a(g_1) \) = 8.0 pF
- Grid No.1 to all except anode: \( C_g(a) \) = 9.3 pF
- Anode to grid No.1: \( C_{ag_1} \) = max. 0.3 pF
- Grid No.1 to heater: \( C_{g1f} \) = max. 0.3 pF

**Between triode and pentode sections**
- Anode triode to grid No.1 pentode: \( C_{aTg_1P} \) = max. 0.02 pF
- Grid triode to anode pentode: \( C_{gTaP} \) = max. 0.02 pF
- Grid triode to grid No.1 pentode: \( C_{gTg_1P} \) = max. 0.025 pF
- Anode triode to anode pentode: \( C_{aTaP} \) = max. 0.25 pF

### TYPICAL CHARACTERISTICS

**Triode section**
- Anode voltage: \( V_a \) = 100 V
- Grid voltage: \( V_g \) = 0 V
- Anode current: \( I_a \) = 3.5 mA
- Transconductance: \( S \) = 2.2 mA/V
- Amplification factor: \( \mu \) = 70

**Pentode section**
- Anode voltage: \( V_a \) = 170 V
- Grid No.2 voltage: \( V_{g2} \) = 170 V
- Grid No.1 voltage: \( V_{g1} \) = -11.5 V
- Anode current: \( I_a \) = 41 mA
- Grid No.2 current: \( I_{g2} \) = 9 mA
- Transconductance: \( S \) = 7.5 mA/V
- Amplification factor: \( \mu g_2 g_1 \) = 9.5
- Internal resistance: \( R_i \) = 16 kΩ
OPERATING CHARACTERISTICS

Triode section as A.F. amplifier

A. Signal source resistance
   Grid resistor \( R_g \) 3 \( \Omega \)
   Grid resistor of next stage \( R_{g} \) 0.68 \( \Omega \)
Supply voltage \( V_b \) 200 170 V
Cathode resistor \( R_k \) 2.2 2.7 k\( \Omega \)
Anode resistor \( R_a \) 220 220 k\( \Omega \)
Anode current \( I_a \) 0.52 0.43 mA
Voltage gain \( V_o/V_i \) 52 51 -
Max. output voltage \( V_{o \text{ max}} \) 26 25 \( V_{RMS} \)
Distortion \( d_{\text{tot}} \) 1.6 2.3 %

B. Signal source resistance \( R_S \) 0.22 \( \Omega \)
   Grid resistor \( R_g \) 22 \( \Omega \)
   Grid resistor of next stage \( R_{g}' \) 0.68 \( \Omega \)
Supply voltage \( V_b \) 200 200 170 170 V
Cathode resistor \( R_k \) 0 0 0 0 \( \Omega \)
Anode resistor \( R_a \) 100 220 100 220 k\( \Omega \)
Anode current \( I_a \) 1.05 0.61 0.86 0.50 \( \Omega \)
Voltage gain \( V_o/V_i \) 50 55 49 53 -
Max. output voltage \( V_{o \text{ max}} \) 24 25 19 20 \( V_{RMS} \)
Distortion \( d_{\text{tot}} \) 1.5 1.4 1.4 1.4 %

MICROPHONY AND HUM

The triode section can be used without special precautions against microphony and hum in circuits in which an input voltage of minimum 10 m\( V_{RMS} \) is required for an output of 50 m\( W \) of the output stage. \( Z_g \) (50 Hz) = 0.25 \( \Omega \).

1) Measured at small input voltage.
2) At lower output voltages the distortion is proportionally lower.
3) At lower output voltages down to 5 \( V_{RMS} \) the distortion is approximately constant. At values below 5 \( V_{RMS} \) the distortion is approximately proportional to \( V_o \).
OPERATING CHARACTERISTICS

Pentode section

A.F. power amplifier, class A (measured with \( V_k \) constant)

<table>
<thead>
<tr>
<th>Supply voltage ( V_{ba} = V_{bg2} )</th>
<th>200</th>
<th>272</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grid No.2 series resistor (non-decoupled) ( R_{g2} )</td>
<td>470</td>
<td>2200</td>
<td>( \Omega )</td>
</tr>
<tr>
<td>Cathode resistor ( R_k )</td>
<td>330</td>
<td>650</td>
<td>( \Omega )</td>
</tr>
<tr>
<td>Load resistance ( R_{a*} )</td>
<td>4.5</td>
<td>8</td>
<td>( k\Omega )</td>
</tr>
</tbody>
</table>

| Grid No.1 driving voltage \( V_i \) | 0 | 0.66 | 6.7 | 0 | 0.9 | 9.5 | \( V_{RMS} \) |
| Anode current \( I_a \) | 35 | 37 | 28 | 27 | mA |
| Grid No.2 current \( I_{g2} \) | 7.8 | 13.3 | 6.5 | 10.8 | mA |
| Output power \( W_0 \) | 0 | 0.05 | 3.3 | 0 | 0.05 | 3.5 | W |
| Distortion \( d_{tot} \) | - | - | 10 | - | - | 10 | % |

A.F. power amplifier, class AB, two tubes in push-pull

| Anode supply voltage \( V_{ba} \) | 200 | 250 | V |
| Grid No.2 supply voltage \( V_{bg2} \) | 200 | 200 | V |
| Common cathode resistor \( R_k \) | 170 | 220 | \( \Omega \) |
| Load resistance \( R_{a*a*} \) | 4.5 | 10 | \( k\Omega \) |

| Grid No.1 driving voltage \( V_i \) | 0 | 14.2 | 0 | 12.5 | \( V_{RMS} \) |
| Anode current \( I_a \) | 2x35 | 2x42.5 | 2x28 | 2x31 | mA |
| Grid No.2 current \( I_{g2} \) | 2x8 | 2x16.5 | 2x5.8 | 2x13 | mA |
| Output power \( W_0 \) | 0 | 9.3 | 0 | 10.5 | W |
| Distortion \( d_{tot} \) | - | 6.3 | - | 4.8 | % |

Frame output application

The circuit should operate satisfactorily with a peak anode current \( I_{ap} = 85 \text{ mA} \) at \( V_a = 50 \text{ V} \), \( V_g2 = 170 \text{ V} \), \( V_f = 6.3 \text{ V} \). The minimum available \( I_{ap} \) at end of life is:

- 70 mA at \( V_a = 50 \text{ V} \), \( V_g2 = 170 \text{ V} \), \( V_f = 5.5 \text{ V} \)
- 80 mA at \( V_a = 50 \text{ V} \), \( V_g2 = 190 \text{ V} \), \( V_f = 5.5 \text{ V} \).
# LIMITING VALUES (Design centre rating system)

## Triode section

- **Anode voltage**
  - $V_{ao}$: max. 550 V
  - $V_a$: max. 300 V

- **Anode peak voltage**
  - $V_{ap}$: max. 600 V

- **Anode dissipation**
  - $W_a$: max. 1 W

- **Cathode current, average**
  - $I_k$: max. 15 mA

- **Cathode current, peak**
  - $I_{kp}$: max. 100 mA

- **Grid resistor**
  - *for fixed bias*
    - $R_g$: max. 1 MΩ
  - *for automatic bias*
    - $R_g$: max. 3 MΩ

- **Grid impedance at 50 Hz**
  - $Z_g$: max. 0.5 MΩ

- **Cathode to heater voltage**
  - $V_{kf}$: max. 100 V

## Pentode section

- **Anode voltage**
  - $V_{ao}$: max. 550 V
  - $V_a$: max. 300 V

- **Anode peak voltage, positive**
  - $V_{ap}$: max. 2.5 kV

- **Anode peak voltage, negative**
  - $-V_{ap}$: max. 500 V

- **Anode dissipation**
  - *for frame output application*
    - $W_a$: max. 5 W
  - *for A.F. output application*
    - $W_a$: max. 7 W

- **Grid No.2 voltage**
  - $V_{g2o}$: max. 550 V
  - $V_{g2}$: max. 300 V

- **Grid No.2 dissipation, average**
  - $W_{g2}$: max. 2 W
  - $W_{g2p}$: max. 3.2 W

- **Cathode current**
  - $I_k$: max. 50 mA

- **Grid No.1 resistor**
  - *for fixed bias*
    - $R_{g1}$: max. 1 MΩ
  - *for automatic bias*
    - $R_{g1}$: max. 2 MΩ

- **Cathode to heater voltage**
  - $V_{kf}$: max. 150 V

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For curves of the ECL82 please refer to PCL82

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1) Max. pulse duration 4% of a cycle with a maximum of 0.8 msec.
<table>
<thead>
<tr>
<th>page</th>
<th>sheet</th>
<th>date</th>
</tr>
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<td>1969.12</td>
</tr>
<tr>
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<td>1969.12</td>
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<td>1999.08.15</td>
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