# S.Q. TUBE

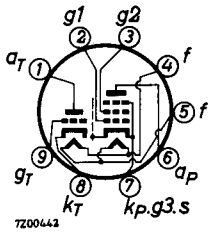
Special quality triode-pentode
The pentode section is designed for use as mixer and R.F. or A.F. amplifier. The triode section is designed for use as oscillator (max. freq. 300 MHz) multivibrator or blocking oscillator.

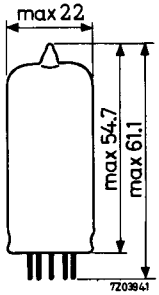
| QUICK REFERENCE DATA | | | |
|---|---|---|---|
| Life test | 10 000 hours | | |
| Low interface resistance | | | |
| Mechanical quality | Shock and vibration resistant | | |
| Base | Noval. Gold plated pins | | |
| Heating | Indirect<br>A.C. or D.C.; parallel supply | | |
| Heater voltage | $V_f$ | 6.3 | V |
| Heater current | $I_f$ | 330 | mA |
| Pentode: Anode current | $I_a$ | 10 | mA |
| Mutual conductance | S | 6.2 | mA/V |
| Amplification factor | $\mu$ | 40 | |
| Triode: Anode current | $I_a$ | 14 | mA |
| Mutual conductance | S | 5 | mA/V |
| Amplification factor | $\mu$ | 18 | |

## DIMENSIONS AND CONNECTIONS

Dimensions in mm

Base: Noval



## CHARACTERISTICS

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

| | | I | II | III | |
|---|---|---|---|---|---|
| Heater voltage | $V_f$ | 6.3 | | | V |
| Heater current | $I_f$ | 330 | 313 - 347 | | mA |
| Pentode section | | | | | |
| Anode supply voltage | $V_{ba}$ | 170 | | | V |
| Grid No.2 supply voltage | $V_{bg_2}$ | 170 | | | V |
| Cathode resistor | $R_k$ | 155 | | | Ω |
| Anode current | $I_a$ | 10 | 7.5 - 12.5 | min. 6 | mA |
| Grid No.2 current | $I_{g_2}$ | 2.8 | 1.55 - 4.05 | | mA |
| Mutual conductance | S | 6.2 | 5.2 - 7.2 | min. 4.3 | mA/V |
| Amplification factor grid No.2 to grid No.1 | $\mu_{g_2g_1}$ | 40 | | | |
| Internal resistance | $R_i$ | 0.4 | min. 0.26 | | MΩ |
| Negative grid No.1 current | $-I_{g_1}$ | | max. 0.5 | max. 1.0 | μA |
| Triode section | | | | | |
| Anode supply voltage | $V_{ba}$ | 100 | | | V |
| Cathode resistor | $R_k$ | 120 | | | Ω |
| Anode current | $I_a$ | 14 | 10 - 18 | min. 8.4 | mA |
| Mutual conductance | S | 5.0 | 4 - 6 | min. 3.5 | mA/V |
| Amplification factor | μ | 18 | | | |
| Negative grid current | $-I_g$ | | max. 0.5 | max. 1.0 | μA |

**CAPACITANCES** Without external shield

| | | I | II | |
|---|---|---|---|---|
| Pentode | | | | |
| Grid No.1 to grid No.2, grid No.3 cathode, heater and screen | $C_{g_1/g_2g_3kfs}$ | 5.6 | 5.2 - 6 | pF |
| Anode to grid No.2, grid No.3 cathode, heater and screen | $C_{a/g_2g_3kfs}$ | 3.4 | 3 - 3.8 | pF |
| Anode to grid No.1 | $C_{ag_1}$ | | max. 25 | mpF |
| Grid No.1 to heater | $C_{g_1f}$ | | max.0.16 | pF |
| Triode | | | | |
| Grid to cathode (triode), cathode (pentode) grid No.3, heater and screen | $C_{g/k_Tk_pg_3fs}$ | 2.5 | 2.2 - 2.8 | pF |
| Anode to cathode (triode), cathode (pentode) grid No.3, heater and screen | $C_{a/k_Tk_pg_3fs}$ | 1.5 | 1.2 - 1.8 | pF |
| Anode to grid | $C_{ag}$ | 1.5 | 1.2 - 1.8 | pF |
| Grid to heater | $C_{gf}$ | | max.0.22 | pF |
| Pentode to triode | | | | |
| Anode (pentode) to anode (triode) | $C_{aP\text{-}aT}$ | | max.0.07 | pF |
| Anode (pentode) to grid (triode) | $C_{aP\text{-}gT}$ | | max.0.02 | pF |
| Grid No.1 (pentode) to anode (triode) | $C_{g_1P\text{-}aT}$ | | max.0.16 | pF |

**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 10 000 hours.

Pentode section

$V_{ba}$ = 170 V
$V_{bg_2}$ = 170 V
$R_k$ = 155 Ω

Triode section

$V_{ba}$ = 100 V
$R_k$ = 120 Ω

**LIMITING VALUES** (Absolute max. rating system)

Pentode section

| | | | |
|---|---|---|---|
| Anode voltage | $V_{a_o}$ | max. 550 | V |
| | $V_a$ | max. 275 | V |
| Anode dissipation | $W_a$ | max. 2.15 | W |
| Grid No.2 voltage | $V_{g2o}$ | max. 550 | V |
| Grid No.2 voltage: | | | |
| Cathode current > 10 mA | $V_{g_2}$ | max. 200 | V |
| Cathode current < 10 mA | $V_{g_2}$ | max. 225 | V |
| Grid No.2 dissipation: | | | |
| Anode dissipation > 1.2 W | $W_{g_2}$ | max. 0.7 | W |
| Anode dissipation < 1.2 W | $W_{g_2}$ | max. 0.8 | W |
| Grid No.1 dissipation | $W_{g_1}$ | max. 0.1 | W |
| Negative grid No.1 voltage | $-V_{g_1}$ | max. 100 | V |
| Cathode current | $I_k$ | max. 18 | mA |
| Voltage between cathode and heater | $V_{kf}$ | max. 100 | V |
| Grid resistor (fixed bias) | $R_{g_1}$ | max. 0.5 | MΩ |

**LIMITING VALUES** (Absolute max. rating system) (continued)

Triode section

| | | | | |
|---|---|---|---|---|
| Anode voltage | $V_{a_o}$ | max. | 550 | V |
| | $V_a$ | max. | 275 | V |
| Anode dissipation | $W_a$ | max. | 1.75 | W |
| Grid dissipation | $W_g$ | max. | 0.1 | W |
| Grid, voltage, peak value | $V_{gp}$ | max. | 30 | V |
| Duty factor max. 0.04 | | | | |
| Pulse duration max. 0.8 ms | | | | |
| Grid voltage | $-V_g$ | max. | 100 | V |
| Cathode current | $I_k$ | max. | 18 | mA |
| Cathode current peak value | $I_{k_p}$ | max. | 100 | mA |
| Duty factor max. 0.04 | | | | |
| Pulse duration max. 0.8 ms | | | | |
| Voltage between cathode and heater | $V_{kf}$ | max. | 100 | V |
| Grid resistor (fixed bias) | $R_g$ | max. | 0.5 | MΩ |
| Bulb temperature | $t_{bulb}$ | max. | 170 | °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 | $V_{ba}$ | 170 | V |
| Grid No.2 supply voltage | $V_{bg_2}$ | 170 | V |
| Cathode resistor | $R_k$ | 155 | Ω |
| Anode current | $I_a$ | 10 | mA |
| Grid No.2 current | $I_{g_2}$ | 2.8 | mA |
| Mutual conductance | S | 6.2 | mA/V |
| Amplification factor grid No.2 to grid No.1 | $\mu_{g_2g_1}$ | 40 | |
| Internal resistance | $R_i$ | 0.4 | MΩ |
| Input resistance at 50 MHz | $r_{g_1}$ | 10 | kΩ |
| Equivalent noise resistance | $R_{eq}$ | 1.5 | kΩ |

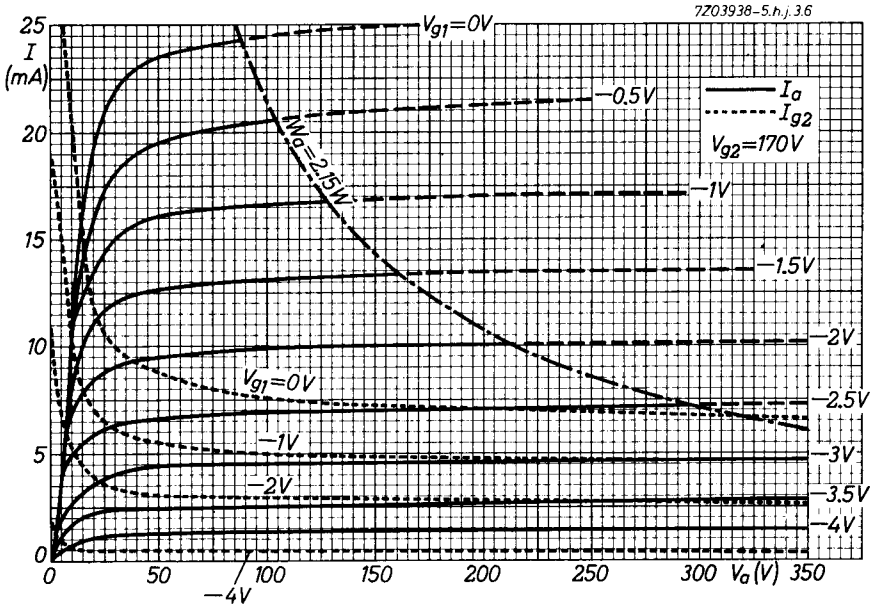
Pentode section as mixer

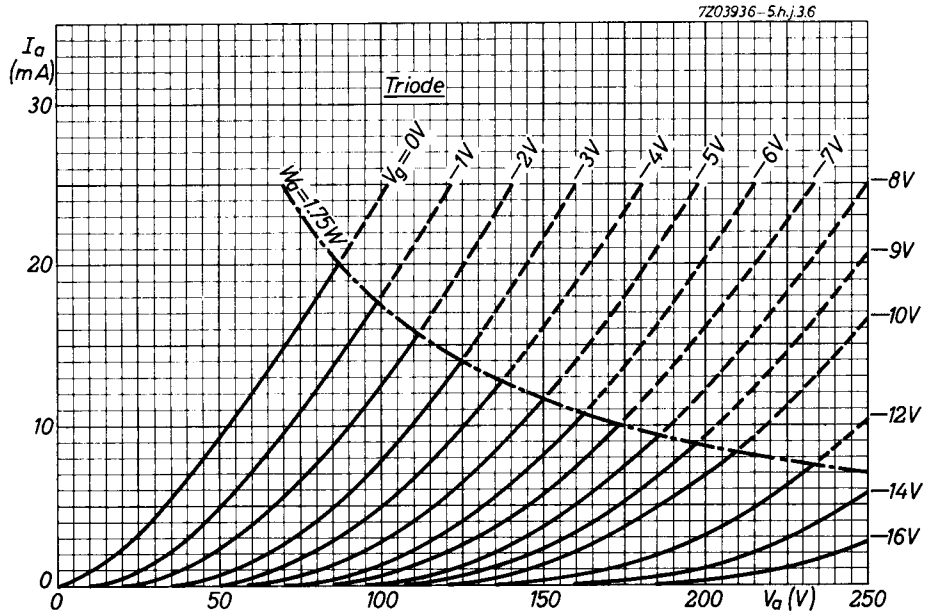
| | | | |
|---|---|---|---|
| Anode supply voltage | $V_{ba}$ | 170 | V |
| Grid No.2 supply voltage | $V_{bg_2}$ | 170 | V |
| Grid No.1 resistor | $R_{g_1}$ | 0.1 | MΩ |
| Cathode resistor | $R_k$ | 330 | Ω |
| Oscillator voltage | $V_{osc}$ | 3.5 | $V_{RMS}$ |
| Anode current | $I_a$ | 8 | mA |
| Grid No.2 current | $I_{g_2}$ | 2.5 | mA |
| Grid No.1 current | $I_{g_1}$ | 12 | μA |
| Conversion conductance | $S_c$ | 2.4 | mA/V |
| Internal resistance | $R_i$ | 0.5 | MΩ |

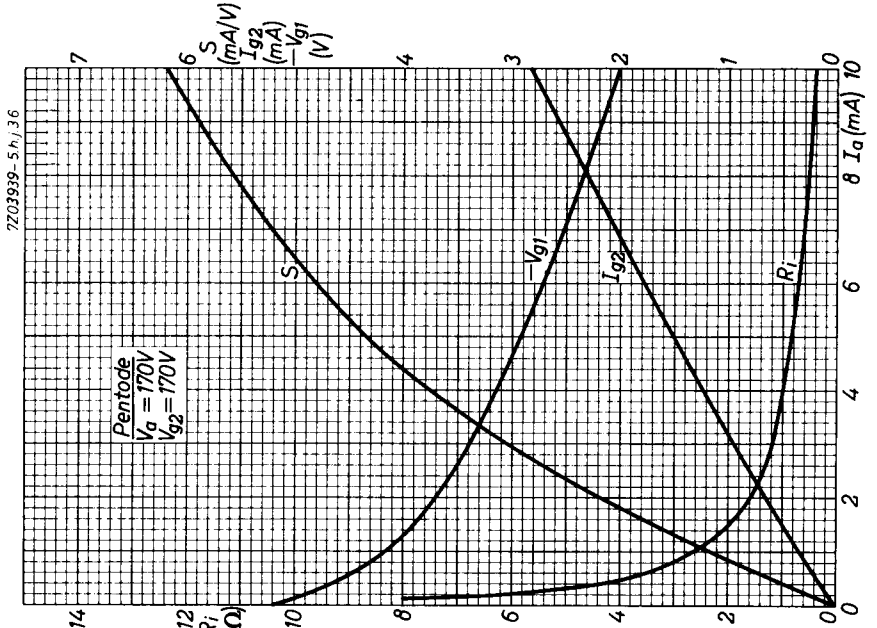
Triode as oscillator

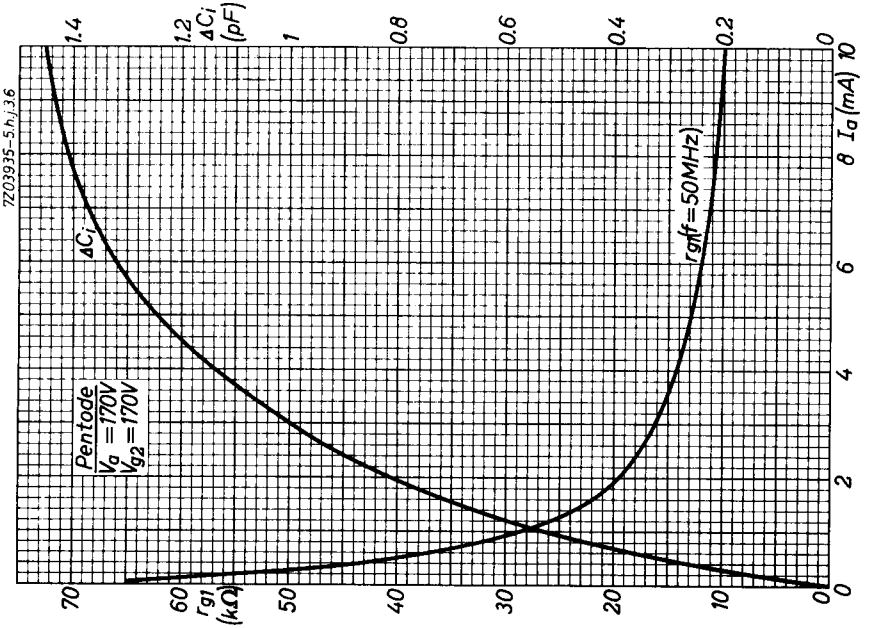
Operation in Colpitts circuit is recommended.

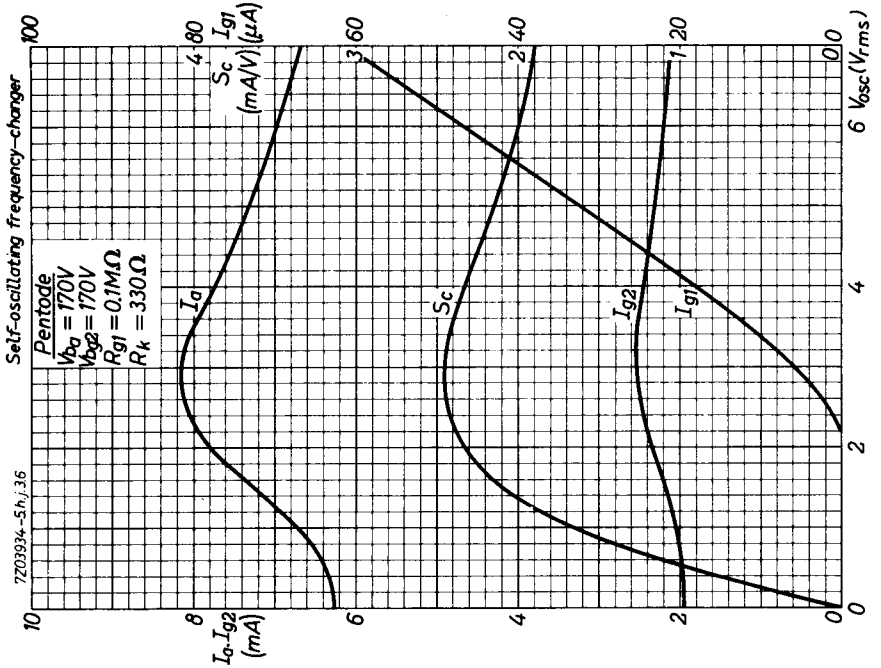
Operation in Hartley circuit is not recommended.

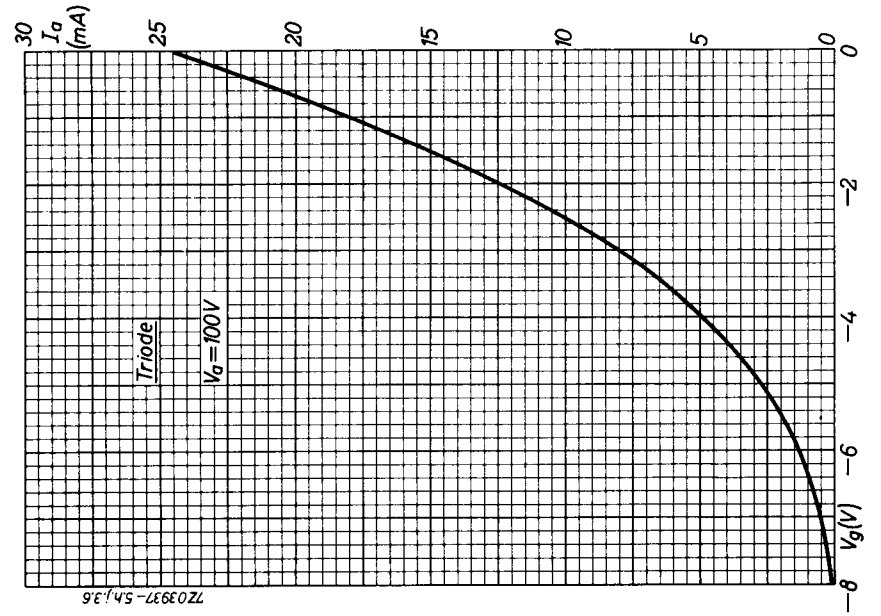

7Z03938-5.h.j.3.6
I (mA)
$V_{g1}$=0V
−0.5V
$I_a$
$I_{g2}$
$V_{g2}$=170V
$W_a$=2.15W
−1V
−1.5V
−2V
−2.5V
−3V
−3.5V
−4V
$V_{g1}$=0V
−1V
−2V
−4V
$V_a$ (V)

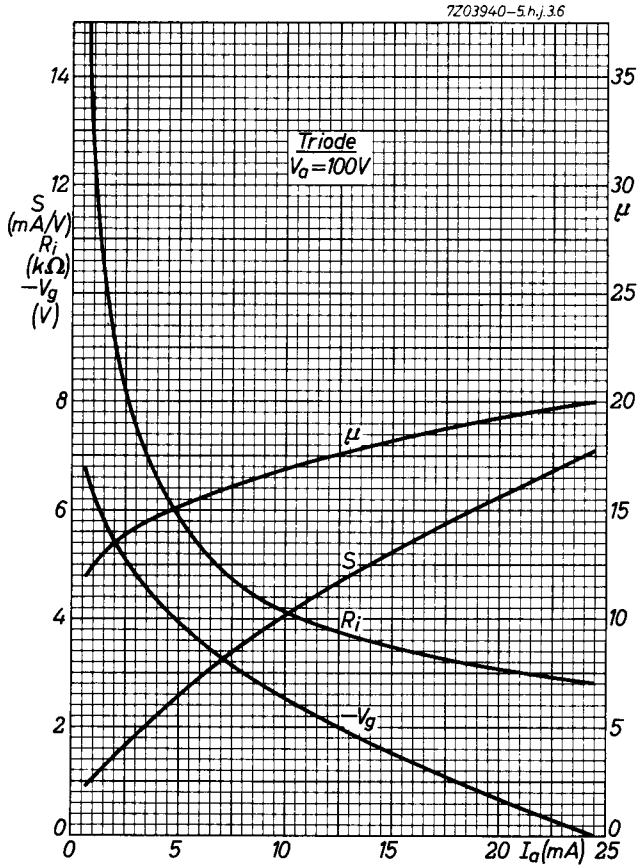

7Z03936-5.h.j.3.6
$I_a$ (mA)
Triode
$W_a$=1.75W
$V_g$=0V
−1V
−2V
−3V
−4V
−5V
−6V
−7V
−8V
−9V
−10V
−12V
−14V
−16V
$V_a$ (V)


7Z03939-5hj36
Pentode
Va = 170V
Vg2 = 170V
S
−Vg1
Ig2
Ri
S (mA/V)
Ig2 (mA)
−Vg1 (V)
Ri (MΩ)
8 Ia (mA)


7Z03935-5hj36
Pentode
Va = 170V
Vg2 = 170V
ΔCi
rgf (f = 50MHz)
rg1 (kΩ)
ΔCi (pF)
8 Ia (mA)


Self-oscillating frequency-changer
Pentode
$V_{b_a}$ = 170V
$V_{b_{g2}}$ = 170V
$R_{g1}$ = 0.1MΩ
$R_k$ = 330Ω
$I_a$
$S_c$
$I_{g1}$
$I_{g2}$
$I_a$-$I_{g2}$ (mA)
$S_c$ (mA/V)
$I_{g1}$ (µA)
$V_{osc}$ ($V_{rms}$)
7Z03934-5h.j.36


Triode
$V_a$ = 100V
$I_a$ (mA)
$V_g$ (V)
7Z03937-5h.j.3.6


7Z03940-5.h.j.36
Triode
$V_a$=100V
S (mA/V)
$R_i$ (kΩ)
$-V_g$ (V)
μ
S
$R_i$
$-V_g$
$I_a$(mA)
0
5
10
15
20
25
2
4
6
8
12
14
30
35

PHILIPS

Data handbook

Electronic components and materials

**E80CF**

| page | sheet | date |
|---|---|---|
| 1 | 1 | 1968.12 |
| 2 | 2 | 1968.12 |
| 3 | 3 | 1968.12 |
| 4 | 4 | 1968.12 |
| 5 | 5 | 1968.12 |
| 6 | 6 | 1968.12 |
| 7 | 7 | 1968.12 |
| 8 | 8 | 1968.12 |
| 9 | 9 | 1968.12 |
| 10 | 10 | 1968.12 |
| 11 | FP | 2000.11.11 |