



ELECTRONIC TUBE REFERENCE

18042

Voltage - Pentode electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

PENTODE

Philips professional pentode designed for long-life telephone-equipment service. Its manufacturer documentation emphasizes dependable small-signal operation in communications installations requiring extended service life and professional reliability.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	9
NOMINAL HEATER	18 V / 100 mA	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION1 Pentode	
TRANSCONDUCTANCE	0.009 S
AMPLIFICATION FACTOR	34
MAXIMUM PLATE VOLTAGE	210 V
MAXIMUM SCREEN VOLTAGE	210 V
MAXIMUM PLATE DISSIPATION	2.1 W
MAXIMUM SCREEN DISSIPATION	0.35 W
MAXIMUM CATHODE CURRENT	16 mA
<i>Special-quality long-life Philips telephone pentode with a specified useful life exceeding 10,000 hours.</i>	

18042 — Special Quality Pentode

The **18042** (also designated as **6086** and associated with the **E83F** design) is a Special Quality (SQ) pentode designed primarily for high-reliability applications in telephone equipment. Engineered for long-

life performance, the tube is rated for a service life exceeding 10,000 hours under specified operating conditions. It features low interface resistance, indirect heating, and a standard Noval base, making it suitable for stable, long-term voltage and power amplification.

Construction, Mechanical Specifications, and Pinout

The 18042 is constructed with a glass envelope and a 9-pin Noval base. Its physical dimensions are compact, with a maximum diameter of 22 mm, a maximum height of 60.3 to 61 mm (excluding the pins), and a maximum overall height of 66.7 to 67 mm.

The pinout configuration provides separate connections for the control grid, screen grid, suppressor grid (which is internally tied to an internal shield), cathode, anode, and heater. Two pins are designated as internal connections and must not be used for external circuit tie points.

The pin connections, viewed from the bottom of the base, are as follows:

- **Pin 1:** Grid No. 2 (g_2 , screen grid)
- **Pin 2:** Grid No. 1 (g_1 , control grid)
- **Pin 3:** Cathode (k)
- **Pin 4:** Heater (f)
- **Pin 5:** Heater (f)
- **Pin 6:** Anode (a)
- **Pin 7:** Internal connection ($i.c.$)
- **Pin 8:** Internal connection ($i.c.$)
- **Pin 9:** Grid No. 3 and internal shield (g_3, s)

Heater Ratings and Long-Life Operation

The 18042 features an indirectly heated cathode designed for either AC or DC operation. It can be integrated into series or parallel heater strings. The nominal heater ratings are:

- **Heater Voltage (V_f):** 18 V
- **Heater Current (I_f):** 0.1 A (100 mA)

To guarantee the specified 10,000-hour operating life, strict supply tolerances must be maintained. Variations in heater voltage exceeding the range of 17.1 V to 18.9 V will shorten the tube's life. The specific supply limits are:

- **Parallel Supply:** The maximum variation of the heater voltage must be kept under $\pm 5\%$ (absolute limits).
- **Series Supply:** The maximum variation of the heater current due to voltage fluctuations and component tolerances must be kept under $\pm 1.5\%$ (absolute limits).

At a heater voltage of 18 V, the initial heater current spread is between 95 mA and 105 mA, with a maximum deviation of ± 0.005 A.

Electrical Characteristics

Under typical test conditions ($V_a = 210$ V, $V_{g3} = 0$ V, $V_{[g2]}(/tubes/G2) = 120$ V, and a cathode bias resistor $R_k = 165$ Ω), the 18042 exhibits the following electrical characteristics:

- **Anode Current (I_a):** Nominal 10 mA, with an initial spread of 8.7 to 11.3 mA. The end-of-life limit is defined as ≤ 7 mA.
- **Screen Grid Current ($I_{[g2]}(/tubes/G2)$):** Nominal 2.1 mA, with an initial spread of 1.7 to 2.5 mA. The end-of-life limit is defined as ≤ 1.25 mA.
- **Mutual Conductance / Transconductance (S):** Nominal 9 mA/V, with an initial spread of 7.8 to 10.2 mA/V. The end-of-life limit is defined as ≤ 6.4 mA/V.
- **Internal Plate Resistance (R_i):** Nominal 0.5 M Ω , with a minimum limit of 0.3 M Ω .
- **Amplification Factor (μ_{g2g1}):** 34 to 38.
- **Equivalent Noise Resistance (R_{eq}):**
 - At Radio Frequencies (RF): Nominal 750 Ω , with a maximum initial spread of 1000 Ω .
 - At Low Frequencies (AF, 0 to 10 kHz): Maximum initial spread of 36 k Ω .
- **Negative Grid Current ($-I_{g1}$):** Maximum 0.5 μ A at a grid resistor $R_{g1} = 0.1$ M Ω . The end-of-life limit is defined as ≥ 1.0 μ A.
- **Cut-off Grid Voltage ($-V_{g1}$):** Maximum 5.25 V to reduce anode current to $I_a = 0.5$ mA.
- **Hum Voltage:** Maximum 0.5 mV RMS measured at $R_{g1} = 0.5$ M Ω .
- **Heater-to-Cathode Insulation:** Minimum insulation resistance of 5 M Ω or a maximum leakage current of 20 μ A at a heater-to-cathode voltage $V_{kf} = 100$ V.

Class A Operating Points and Output Characteristics

The 18042 can be operated as a Class A amplifier under two distinct standard configurations. Both configurations utilize a screen grid series resistor ($R_{[g2]}(/tubes/G2)$) of 5.6 k Ω and a cathode resistor (R_k) of 180 Ω , with the suppressor grid ($g3$) tied to 0 V.

Parameter	Condition I	Condition II
Anode Supply Voltage (V_a)	120 V	210 V
Screen Grid Supply Voltage (V_{bg2})	120 V	120 V
Anode Current (I_a)	8.3 mA	8.3 mA
Screen Grid Current ($I_{[g2]}(/tubes/G2)$)	1.7 mA	1.7 mA
Mutual Conductance (S)	8.2 mA/V	8.2 mA/V
Internal Resistance (R_i)	0.42 M Ω	0.44 M Ω

Parameter	Condition I	Condition II
Load Resistance ($R_{a\sim}$)	10 k Ω	20 k Ω
Output Power (W_o at $d_{tot} = 10\%$)	340 mW	660 mW
Input Voltage (V_i at $d_{tot} = 10\%$)	1.1 V_{eff}	1.1 V_{eff}
Output Power (W_o at $I_{g1} = +0.3 \mu\text{A}$)*	400 mW	870 mW
Input Voltage (V_i at $W_o = 50$ mW)	0.35 V_{eff}	0.25 V_{eff}

**Note: Measured with a control-grid series resistor of 0.33 M Ω .

The transfer characteristics show that at $V_a = 210$ V and $V_{[g2]}(/tubes/G2) = 120$ V, the transconductance peaks near 14 mA/V as the control grid voltage (V_{g1}) approaches 0 V, with the anode current reaching approximately 33 to 35 mA. The anode characteristics display typical pentode knee behavior, with the knee occurring between 50 V and 100 V depending on the grid bias.

Distortion and output power curves indicate that total harmonic distortion rises sharply above 300 mW for a 120 V anode supply, and above 600 mW for a 210 V anode supply. Under Condition II, the output power peaks near 900 mW when using a load resistance of approximately 20 k Ω at the grid current limit of +0.3 μA .

Absolute Maximum Ratings

The limiting values for the 18042 are established under the Design Centre Rating System. Operating the tube beyond these limits may impair its performance and significantly reduce its operating life.

- **Anode Cold Voltage (V_{ao}):** Max 550 V
- **Anode Voltage (V_a):** Max 210 V
- **Anode Dissipation (W_a):** Max 2.1 W
- **Screen Grid Cold Voltage (V_{g2o}):** Max 550 V
- **Screen Grid Voltage ($V_{[g2]}(/tubes/G2)$):** Max 210 V
- **Screen Grid Dissipation ($W_{[g2]}(/tubes/G2)$):** Max 0.35 W
- **Cathode Current (I_k):** Max 16 mA
- **Grid No. 1 Voltage (V_{g1} at $I_{g1} = +0.3 \mu\text{A}$):** Max -1.1 V
- **Grid No. 1 Series Resistor (R_{g1}):** Max 1 M Ω (with automatic grid bias)
- **Heater-to-Cathode Voltage (V_{kf}):** Max 100 V
- **Heater-to-Cathode Circuit Resistance (R_{kf}):** Max 20 k Ω
- **Bulb Temperature (t_{bulb}):** Max 170 $^{\circ}\text{C}$

High-Frequency and Dynamic Behavior

The 18042 is characterized by low interelectrode capacitances, which are critical for high-frequency stability and performance. The capacitance values are defined as follows:

- **Anode to all other electrodes except Grid 1 ($C_{a/g2g3kfs}$):** Typical 3.5 to 3.6 pF, maximum 4.1 to 4.2 pF.
- **Grid 1 to all other electrodes except Anode ($C_{g1/g2g3kfs}$):** Typical 8.0 to 8.5 pF (cold), maximum 8.7 to 9.2 pF.
- **Anode to Grid 1 (C_{ag1}):** Maximum 0.015 pF.
- **Grid 1 to Heater (C_{g1f}):** Maximum 0.15 pF.
- **Cathode to Heater (C_{kf}):** Typical 4 pF.

Under dynamic operating conditions, the input capacitance of Grid 1 (C_{g1}) increases as the tube conducts. At a hot operating point with a cathode current (I_k) of 12.1 mA, the input capacitance rises to a typical value of 11.3 pF. This represents a non-linear input capacitance variation (ΔC_{g1}) of approximately 2.8 to 3.6 pF as the cathode current increases from 0 to 12 mA.

For shielded applications, the radiation capacitances measured to a surrounding cylinder (diameter 52 mm, height 98 mm, with other electrodes earthed) are:

- **Anode to surrounding box (C_{ra}):** Maximum 0.025 pF.
- **Grid 1 to surrounding box (C_{rg1}):** Maximum 0.025 pF.

At high frequencies, input damping becomes a significant factor. The input grid resistance (r_{g1}) decreases sharply with frequency, dropping from approximately 35 to 40 k Ω at 15 to 20 MHz down to approximately 0.2 to 0.3 k Ω at 200 MHz.

Technical Summary

The **18042** is a high-reliability, long-life Special Quality pentode featuring a Noval base and an 18 V, 100 mA heater. Specifically engineered for telephone equipment, it offers a service life exceeding 10,000 hours when heater tolerances are tightly controlled. With a nominal transconductance of 9 mA/V, an anode dissipation rating of 2.1 W, and low interelectrode capacitances, the 18042 provides stable, low-noise performance in both radio-frequency and audio-frequency amplification stages.

SOURCE OPERATING CONDITIONS

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1957 Philips Receiving and Amplifying Tubes

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1957 PHILIPS RECEIVING AND AMPLIFYING TUBES

Section 1 · Pentode

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Anode Voltage	210 V	—
Screen Voltage	120 V	—
Anode Current	10 mA	—
Screen Current	2.1 mA	—

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1963 Philips Electron Tubes Handbook V1

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1963 PHILIPS ELECTRON TUBES HANDBOOK V1

Section 1 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	210 V	—
Screen voltage	120 V	—
Cathode resistor	165 ohm	—
Output power	660 mW	ClassA; PlateVoltage=210V

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate current	8.7–11.3 mA	NewTubeRange
Screen current	1.7–2.5 mA	NewTubeRange
Transconductance	7800–10200 μ S	NewTubeRange
Plate resistance	0.5 M Ω m	—
Amplification factor grid2/grid1	38	—

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Anode capacitance	—4.1 pF	—
Control-grid capacitance	—8.7 pF	—



SOURCE OPERATING CONDITIONS

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1963 Philips Electron Tubes Handbook V3

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1963 PHILIPS ELECTRON TUBES HANDBOOK V3

Section 1 · Pentode

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	210 V	Section1
Screen voltage	120 V	Section1
Cathode resistor	165 Ω	Section1
Plate current	10 mA	Section1
Screen current	2.1 mA	Section1
Transconductance	9000 μ S	Section1
Plate resistance	500000 Ω	Section1
Amplification factor	34	Section1
Cutoff voltage maximum	-5.25 V	Section1

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Hum voltage maximum	0.5 mV	Section1
Heater-cathode insulation minimum	5 GΩ	Section1
Minimum intended life	10000 h	TelephoneService

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate capacitance	3.6 pF	Section1
Grid capacitance	6.5 pF	Section1
Grid-to-plate capacitance maximum	0.015 pF	Section1

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	120 V	ClassA
Screen supply voltage	120 V	ClassA
Cathode resistor	180 Ω	ClassA


SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

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1999 Philips 0-D

Published test conditions and operating points. Values on this page are preserved as reported by this source.

1999 PHILIPS 0-D

Section 1 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Heater voltage	18 V	Nominal
Heater current	100 mA	Nominal
Maximum plate voltage	3550 V	Maximum
Maximum screen voltage	550 V	Maximum

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Transconductance	9000 μS	Typical
Anode current	10 mA	Published datasheet table
Anode current	0.5 mA	Published datasheet table
Anode current	8.3 mA	Published datasheet table
Grid No.2 current	2.5 mA	Published datasheet table
Grid No.2 current	1.7 mA	Published datasheet table
Anode voltage	210 V	Published datasheet table
Anode voltage	3550 V	Published datasheet table
Grid No.2 voltage	120 V	Published datasheet table
Grid No.2 voltage	550 V	Published datasheet table

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