



ELECTRONIC TUBE REFERENCE

18046

Power - Pentode Single (NOT beam) (under 10W) electronic tube

CONSOLIDATED TECHNICAL
DATA

1 SECTION
CONSTRUCTION
PENTODE

Steep-slope long-life output pentode for long-distance communications equipment, also designated EL861.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	9
NOMINAL HEATER	20 V / 135 mA	PARALLEL HEATER	— / —
HEATING	Indirect	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION 1 Pentode	
PLATE RESISTANCE	300000 Ω
TRANSCONDUCTANCE	0.011 S
MAXIMUM PLATE VOLTAGE	550 V
MAXIMUM SCREEN VOLTAGE	550 V
MAXIMUM PLATE DISSIPATION	4.5 W
MAXIMUM SCREEN DISSIPATION	1.2 W
MAXIMUM GRID DISSIPATION	0.1 W
MAXIMUM CATHODE CURRENT	30 mA
Published characteristics audited; remaining numerical data retained in parameter table.	

18046 — High-Reliability Output Pentode

The **18046** is a professional-grade, indirectly heated output pentode (Endpentode) designed specifically for long-distance communications systems (*Weitverkehrsanlagen*). Engineered for high reliability and long operational life, the 18046 features tight manufacturing tolerances, low parameter spread, and exceptional stability over time.

Overview and Key Features

The 18046 is optimized for demanding telecommunications and industrial applications where maintenance-free operation is critical. It guarantees an average service life of 10,000 hours (averaged over a sample of 100 tubes) and exhibits a constant failure rate (P-factor) of approximately 1.5 ‰ per 1000 hours.

To ensure robust electrical contact and prevent oxidation in long-term service, the tube is constructed with gold-plated pins on a standard Noval base.

Mechanical Construction and Base Connection

The 18046 is housed in a glass envelope with a Noval (E9-1) base. It can be mounted in any position (*beliebig*).

Physical Dimensions

- **Maximum Diameter:** 22.2 mm
- **Maximum Height (excluding pins):** 60.3 mm
- **Maximum Pin Length:** 7 mm

Accessories

- **Socket:** B8 700 20
- **Retainer/Holder:** 88 477 A

Pin Configuration

The Noval base connections, viewed from the bottom of the tube, are assigned as follows:

Pin	Symbol	Electrode Connection
1	g1	Control Grid
2	s	Internal Shield
3	k	Cathode
4	f	Heater

Pin	Symbol	Electrode Connection
5	f	Heater
6	s	Internal Shield
7	a	Anode
8	g_2	Screen Grid
9	g_3	Suppressor Grid

Heater Specifications

The 18046 features an indirectly heated cathode that can be operated from either an AC or DC supply, in either parallel or series configurations.

- **Heater Voltage (U_f):** 20 V
- **Heater Current (I_f):** 135 ± 7 mA

To maintain the guaranteed lifetime of 10,000 hours, strict supply tolerances must be observed:

- **Parallel Supply:** The maximum heater voltage fluctuation must not exceed $\pm 5\%$ (absolute limits).
- **Series Supply:** The maximum heater current deviation must not exceed $\pm 1.5\%$ (absolute limits).

Interelectrode Capacitances

The internal capacitances of the 18046 are tightly controlled. The cold capacitances and dynamic variations are specified as follows:

- **Input Capacitance (C_i):** 11.5 ± 0.8 pF
- **Output Capacitance (C_o):** 6.5 ± 0.6 pF
- **Input Capacitance under operating conditions (C_i at $I_k = 25$ mA):** 14.3 pF
- **Anode to Control Grid Capacitance (C_{ag1}):** < 0.02 pF
- **Control Grid to Heater Capacitance (C_{g1f}):** < 0.2 pF
- **Cathode to Heater Capacitance (C_{kf}):** 4.2 pF

Dynamic Capacitance Behavior

The input capacitance varies dynamically with the cathode current. Under typical operating conditions, the change in input capacitance (ΔC_i) increases from 0 pF to approximately 2.5 pF as the cathode current (I_k) rises from 0 mA to 25 mA.

Electrical Characteristics and End-of-Life Limits

The nominal electrical characteristics of the 18046 are measured under the following standard test conditions:

- **Anode Voltage (U_a):** 210 V
- **Suppressor Grid Voltage (U_{g3}):** 0 V
- **Screen Grid Voltage ($U_{[g2]}/(tubes/G2)$):** 210 V
- **Cathode Bias Resistor (R_k):** 120 Ω

Under these conditions, the typical parameters and their end-of-life (EOL) limits are:

Parameter	Nominal Value	End-of-Life Limit
Anode Current (I_a)	20.0 $\pm$ 3.0 mA	$\leq$ 13.5 mA
Screen Grid Current ($I_{[g2]}/(tubes/G2)$)	5.3 $\pm$ 1.2 mA	$\leq$ 3.1 mA
Mutual Conductance (S)	11.0 $\pm$ 1.5 mA/V	$\leq$ 7.8 mA/V
Anode Resistance (r_a)	0.3 M Ω (min. 0.2 M Ω)	—
Amplification Factor (μ_{g2g1})	36	—
Equivalent Noise Resistance (r_{aeq} HF)	1.2 k Ω	—
Negative Grid Current ($-I_{g1}$)	$\leq$ 0.5 μ A (at $R_{g1} = 100\text{extk}\Omega$)	$\geq$ 1.0 μ A
Grid Voltage ($-U_{g1}$)	$\leq$ 1.1 V (at $I_{g1} = +0.3 \mu\text{A}$)	—

Operating Examples

The 18046 can be configured as either a voltage preamplifier or a power output stage.

1. Preamplifier Service (*Vorverstärker*)

In preamplifier applications, the tube is biased for lower current consumption and higher anode resistance:

- **Anode Voltage (U_a):** 210 V
- **Suppressor Grid Voltage (U_{g3}):** 0 V
- **Screen Grid Voltage ($U_{[g2]}/(tubes/G2)$):** 210 V
- **Cathode Bias Resistor (R_k):** 180 Ω
- **Anode Current (I_a):** 15 mA

- **Screen Grid Current ($I_{[g2]}$ (/tubes/G2)):** 4 mA
- **Mutual Conductance (S):** 10 mA/V
- **Anode Resistance (r_a):** 0.4 M Ω
- **Anode Load Resistor (R_a):** 20 k Ω
- **Voltage Gain (v):** 5.15 N (Nepers)

2. Output Amplifier Service (*Endverstärker*)

When configured as a power output stage, the tube delivers up to 1 W of output power:

- **Anode Voltage (U_a):** 210 V
- **Suppressor Grid Voltage (U_{g3}):** 0 V
- **Screen Grid Voltage ($U_{[g2]}$ (/tubes/G2)):** 210 V
- **Cathode Bias Resistor (R_k):** 120 Ω
- **Anode Current (I_a):** 20 mA
- **Screen Grid Current ($I_{[g2]}$ (/tubes/G2)):** 5.3 mA
- **Mutual Conductance (S):** 11 mA/V
- **Anode Resistance (r_a):** 0.3 M Ω
- **Anode Load Resistor (R_a):** 15 k Ω
- **Output Power (N_o):** 1 W
- **Total Distortion (k_{ges}):** 5%

Absolute Maximum Ratings (*Grenzdaten*)

These absolute maximum limits must not be exceeded under any operating conditions:

- **Cold Anode Voltage (U_{a0}):** max. 550 V
- **Anode Voltage (U_a):** max. 210 V
- **Anode Dissipation (N_a):** max. 4.5 W
- **Cold Screen Grid Voltage (U_{g20}):** max. 550 V
- **Screen Grid Voltage ($U_{[g2]}$ (/tubes/G2)):** max. 210 V
- **Screen Grid Dissipation ($N_{[g2]}$ (/tubes/G2)):** max. 1.2 W
- **Control Grid Dissipation (N_{g1}):** max. 0.1 W
- **Cathode Current (I_k):** max. 30 mA
- **Control Grid Resistor (R_{g1}):**
 - With automatic bias: max. 500 k Ω
 - With fixed bias: max. 250 k Ω
- **Heater-to-Cathode Voltage (U_{fk}):** max. 120 V
- **Heater-to-Cathode Resistance (R_{fk}):** max. 20 k Ω
- **Bulb Temperature (t_{kolb}):** max. 170 °C

Qualitative Curve Analysis

Anode Characteristics (I_a vs. U_a)

The pentode family of curves, plotted up to $U_a = 350$ V (with $U_{g2} = 210$ V and $U_{g3} = 0$ V), exhibits a sharp knee between $U_a = 30$ V and 50 V. Above this knee, the curves are highly linear and flat, demonstrating high anode impedance. The absolute maximum anode dissipation boundary ($N_a = 4.5$ W) restricts the permissible operating region in the upper-right quadrant of the characteristic field.

Transfer Characteristics (I_a, I_{g2}, S vs. U_{g1})

Plotted over a control grid bias range of -8 V to 0 V, the transfer curves show that mutual conductance (S) rises smoothly as the grid bias approaches zero, peaking at approximately 15 mA/V at $U_{g1} = 0$ V.

Output Power and Distortion

- **Power vs. Input Voltage:** The relationship between output power (N_o) and effective input voltage ($U_{i\text{ eff}}$) shows that total distortion (k_{ges}) rises gradually with output power, reaching 20% at an output of approximately 2.2 W.
- **Power vs. Load Resistance:** Plots of N_o versus load resistance (R_a) indicate that the optimum power transfer occurs with a load impedance in the range of 10 k Ω to 15 k Ω across various distortion limits.

Triode-Connected Operation

When the 18046 is triode-connected (by strapping the screen grid g_2 to the anode a , and the suppressor grid g_3 to the cathode k), the resulting I_{a+g2} vs. U_a curves exhibit typical triode behavior. In this configuration, the combined maximum dissipation limit (N_{a+g2}) is rated at 5.6 W.

SOURCE OPERATING CONDITIONS

1953 RFT Rundfunk Technik

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

1953 RFT RUNDFUNK TECHNIK

Section 1 · Pentode

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Plate voltage	210 V	—
Screen-grid voltage	210 V	—
Cathode resistance	120 Ω	—
Plate current	20 mA	—
Screen-grid current	5.3 mA	—
Cold plate voltage maximum	550 V	—
Cold screen-grid voltage maximum	550 V	—

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Transconductance	11 mA/V	—
Equivalent noise resistance	1.2 k Ω	—
Voltage gain, preamplifier	175	Preamplifier

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1985 Valvo

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

1985 VALVO

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
VALVO SPEZIAL- VERSTARKERROHREN	8.63	VALVO SPEZIAL-VERSTARKERROHREN 8.63
Published value	1 V	1) Mit automatischer Gittervorspannung
Published value	2 V	2) Mit fester Gittervorspannung
' [1]	3	'3';-(?80 VALVO SPEZIAL- VERSTARKERROHREN
' [2]	80	'3';-(?80 VALVO SPEZIAL- VERSTARKERROHREN
VALVO SPEZIAL- VERSTARKERRUOHREN	4.6	VALVO SPEZIAL-VERSTARKERRUOHREN 4.60
Published value	4.6	4.60 VALVO SPEZIAL-VERSTARKERROHREN
VALVO SPEZIAL- VERSTARKERROHREN	4.6	VALVO SPEZIAL-VERSTARKERROHREN 4,60

TUBE TINKER

An independent reference for electronic tubes, vacuum tubes,
and their source documents.

[Catalog](#) [Tube types](#) [Full books](#) [Blog](#) [Feedback & corrections](#)

© 2026 Tube Tinker