



ELECTRONIC TUBE REFERENCE

100E1

Voltage Regulator electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

VOLTAGEREGULATOR

Heavy-current neon voltage stabilizer providing approximately 100 V over roughly 50–200 mA for robust shunt-regulated power supplies.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	—
NOMINAL HEATER	— / —	PARALLEL HEATER	— / —
HEATING	Indirect; cold cathode	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION 1 Voltage Regulator	
REGULATOR VOLTAGE	100 V
MINIMUM REGULATOR CURRENT	50 mA
MAXIMUM REGULATOR CURRENT	200 mA
STARTING VOLTAGE	140 V
MAINTAINING VOLTAGE	100 V
DYNAMIC IMPEDANCE	30 Ω
<i>Cold-cathode gas-filled Philips voltage stabilizer/reference tube.</i>	

100E1 — Neon Voltage Stabilizer Tube

A cold-cathode, gas-filled neon stabilizing tube designed to maintain a constant DC voltage output in electronic power supplies, receivers, and measuring instruments.

Overview

The **100E1** (also designated as **100 E 1**) is a high-current neon voltage stabilizer tube manufactured by Philips and Mullard. Its primary function is to regulate DC voltages, making sensitive circuits—such as the fixed grid bias of amplifiers or measuring instruments—independent of fluctuations in mains supply, battery voltage, or load current. The tube is characterized by its low dynamic AC resistance, high current capacity, and excellent voltage regulation across its entire operating range.

Physical Construction, Base, and Pinout

The 100E1 is constructed in a robust glass envelope. Depending on the manufacturer's specifications, its physical dimensions are as follows:

- **Maximum Overall Length:** 168 mm to 174 mm
- **Maximum Diameter:** 53 mm to 55.5 mm
- **Seated Height:** Up to 150 mm

The tube features a 4-pin base designated as **Base A** (or **A 40**). The electrode arrangement and pin connections are as follows:

- **Pin 1:** Anode (*a*)
- **Pin 4:** Cathode (*k*)
- **Pins 2 and 3:** Unused (blank)

Mechanically, the 100E1 is sensitive to physical stress. To prevent damage and ensure stable operation, the tube must not be subjected to severe shock or continuous vibration. Additionally, the tube is polarity-sensitive and must only be operated with the cathode connected to the negative terminal and the anode connected to the positive terminal of the voltage source.

Electrical Characteristics and Ignition Behavior

The 100E1 maintains a stable burning voltage near its nominal rating. Its key electrical characteristics include:

- **Nominal Operating Voltage (V_a):** 100 V. At the recommended quiescent current of 125 mA, the operating voltage is precisely 100 V.
- **Burning Voltage Range:** 90 V to 105 V (typically measured at a current of 50 mA).
- **Voltage Regulation:** The maximum variation in operating voltage is **4 V** over a current range of 50 mA to 200 mA.
- **Maximum AC Resistance:** 30 Ω . This low dynamic resistance ensures that small changes in voltage result in large, compensating changes in current.
- **Ignition (Starting) Voltage (V_{ign}):** Under normal ambient illumination, the maximum starting voltage is **125 V** to **140 V**.

The ignition mechanism of the 100E1 is photo-sensitive. In the presence of ambient light, the tube ignites reliably within its rated starting voltage. However, in complete darkness, there can be a considerable

delay in igniting the tube. Designers must account for this behavior when placing the tube in light-tight enclosures.

Limiting Values and Ratings

To maintain the integrity of the gas discharge and ensure a reasonable operating life, the tube must be operated strictly within its absolute maximum and minimum limits:

Parameter	Value
Maximum Anode Current (I_a max)	200 mA
Minimum Anode Current (I_a min)	50 mA
Quiescent Current (I quiescent)	125 mA

Power Dissipation Calculations

At the recommended quiescent operating point, the nominal power dissipated by the tube is calculated as:

$$\text{Power} = V_a \times I_{\text{quiescent}} = 100 \text{ V} \times 0.125 \text{ A} = 12.5 \text{ W}$$

At the absolute maximum current limit, the maximum power dissipation is calculated as:

$$\text{Maximum Power} = 100 \text{ V} \times 0.200 \text{ A} = 20.0 \text{ W}$$

Application and Circuit Design Guidelines

The 100E1 operates by rapidly increasing its current conduction in response to small increases in terminal voltage.

Series Resistor Configuration

To achieve stabilization, the tube must be connected to the DC voltage source through a series resistor (or rely on the high internal resistance of the source). When the supply voltage rises, the resulting increase in current through the tube produces a larger voltage drop across the series resistor, thereby neutralizing the voltage rise at the load. Fluctuations in the load current are similarly compensated by opposing current variations within the neon tube.

Series Connection for Higher Voltages

When the voltage to be stabilized exceeds the rating of a single tube, multiple 100E1 tubes can be connected in series. For example, three tubes connected in series can stabilize a nominal 270 V supply. In such configurations, at least one of the tubes must be shunted by a high-value resistor (typically 0.1 M Ω) to ensure reliable sequential ignition of all tubes in the string.

Prohibition of Parallel Connection

Multiple 100E1 tubes must **never** be connected in parallel to handle heavier currents. Because of unavoidable manufacturing tolerances, the ignition voltage varies slightly between individual tubes. The tube with the lowest ignition voltage will always fire first. Once ignited, it immediately draws current and clamps the voltage across the parallel network to its burning voltage (approx. 100 V), which is well below the ignition threshold of the remaining tubes. Consequently, the other tubes will fail to ignite, and the single active tube will be subjected to the entire load current, likely exceeding its 200 mA maximum rating.

AC Impedance and Ripple Smoothing

The 100E1 acts as a low-impedance path for AC ripple, thereby improving the smoothing of rectified DC voltages and reducing radio frequency (R.F.) or audio frequency (A.F.) coupling through the common power supply impedance. While the AC resistance of the neon tube increases with frequency, it does not deviate significantly from its nominal $30\ \Omega$ rating at standard mains power frequencies.

Characteristic Curves and Qualitative Analysis

The voltage-current ($V - I$) characteristic of the 100E1 is exceptionally flat across its active operating region. Upon reaching the ignition voltage, the tube transitions into a stable glow discharge. As the current increases from the minimum limit of 50 mA to the maximum limit of 200 mA, the terminal voltage rises very gradually from approximately 93.5 V to 96.5 V. This flat slope visually demonstrates the low dynamic AC resistance of the tube and confirms that the voltage variation remains well within the specified 4 V maximum regulation limit.

Technical Summary

The **100E1** is a cold-cathode, gas-filled neon voltage stabilizer tube designed for high-current DC voltage regulation. It features a nominal operating voltage of **100 V** over an active current range of **50 mA to 200 mA**, with a recommended quiescent current of **125 mA**. Utilizing a 4-pin **A-type** base, the tube provides excellent regulation with a maximum voltage variation of only **4 V** and a maximum AC resistance of **30 Ω** . It is highly suitable for stabilizing power supply rails and amplifier bias networks, provided that proper series resistance is used, parallel operation is avoided, and the tube is protected from mechanical shock and complete darkness.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

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 · Voltage Regulator

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Operating Voltage	100 V	—
Regulation	4 V	Published current range

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Ignition Voltage Maximum	125 V	—
Minimum Operating Current	50 mA	—
Maximum Operating Current	200 mA	—

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1963 Mullard

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

1963 MULLARD

Section 1 · Voltage Regulator

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Starting voltage maximum	140 V	—
Quiescent current	125 mA	—
Operating current maximum	200 mA	—

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Operating current minimum	50 mA	—

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Burning voltage range	90 to 105 V	—
AC resistance maximum	30 ohm	—

APPLICATION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Application	Neon voltage stabilization	—


SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1963 Philips Electron Tubes Handbook V2

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

1963 PHILIPS ELECTRON TUBES HANDBOOK V2

Section 1 · Voltage Regulator

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maintaining voltage at 125 mA	100 V	—
Voltage regulation	—4 V	I _a =50-200mA


SOURCE DATA APPENDIX

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

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

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
OperatingVoltageRange	90–105 V	At 125 mA quiescent current
QuiescentCurrent	125 mA	—
MaximumACResistance	30 ohm	—

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