



ELECTRONIC TUBE REFERENCE

1533

Rectifier - Full Wave electronic tube

CONSOLIDATED TECHNICAL DATA

3 SECTIONS

CONSTRUCTION

RECTIFIER-RECTIFIER-RECTIFIER

Directly heated Philips three-anode mercury-vapor/gas industrial rectifier for high-current power conversion. Its multi-anode construction and low arc voltage support multiampere industrial rectification.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	—
NOMINAL HEATER	1.9 V / 23 A	PARALLEL HEATER	— / —
HEATING	Direct	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION1 Rectifier	
PEAK INVERSE VOLTAGE	850 V
NOMINAL OUTPUT CURRENT	5 A
FORWARD VOLTAGE DROP	15 V
WARM-UP TIME	120 s
<i>Representative of three identical anode paths.</i>	

SECTION2 Rectifier	
PEAK INVERSE VOLTAGE	850 V
NOMINAL OUTPUT CURRENT	5 A
FORWARD VOLTAGE DROP	15 V
WARM-UP TIME	120 s
<i>Physical rectifier section 2; electrical properties populated from the same published ratings applicable to the identical rectifier path.</i>	

SECTION3 Rectifier	
PEAK INVERSE VOLTAGE	850 V
NOMINAL OUTPUT CURRENT	5 A
FORWARD VOLTAGE DROP	15 V
WARM-UP TIME	120 s
Physical rectifier section 3; electrical properties populated from the same published ratings applicable to the identical rectifier path.	

1533 — Three-Anode Mercury-Vapour and Gas-Filled Rectifying Valve

The **1533** is an industrial, directly heated, three-anode rectifying valve containing both mercury vapour and gas. It is designed specifically for high-power industrial rectification, such as battery charging systems, where it can deliver up to 15 A per valve and support a maximum of 110 lead-acid (Pb) cells. The tube features an oxide-coated filament, an auxiliary ignition electrode, and three separate anodes, housed in a heavy-duty construction designed for vertical mounting.

Mechanical Construction and Physical Dimensions

The 1533 is a physically robust valve with a net weight of 580 g and a shipping weight of approximately 3000 g. It must be operated strictly in a vertical, base-down position to ensure the correct distribution of the mercury-vapour fill.

The physical dimensions and terminal configurations are as follows:

- **Maximum overall height:** 270 mm
- **Maximum bulb diameter:** 74 mm
- **Maximum width (including terminal projections):** 192 mm
- **Anode terminals:** M6 threaded connectors located at the top of the anode structures.
- **Auxiliary ignition terminal (ah):** M4 threaded connector.

Filament and Heating Requirements

The valve utilizes a directly heated, oxide-coated filament designed for AC operation. Because it is a mercury-vapour and gas-filled tube, strict heating time delays (Tw) must be observed before anode voltage is applied to prevent damage to the cathode.

Filament Parameter	Value
Filament Voltage (Vf)	1.9 V
Filament Current (If)	23 A

Filament Parameter	Value
Calculated Filament Power	43.7 W
Heating Method	Direct (by AC)
Recommended Heating Time (Tw)	2 minutes
Minimum Urgent Heating Time	1 minute
Post-Transport / Long Interruption Heating Time	5 minutes

The calculated filament power of 43.7 W is derived from the nominal filament voltage of 1.9 V and filament current of 23 A (1.9 V x 23 A). For automated control of the preheating cycle, the use of the Philips type [4152](#) time delay switch is recommended.

Auxiliary Ignition and Typical Operating Characteristics

The 1533 features an auxiliary ignition electrode (ah) to facilitate reliable starting of the arc discharge. Under typical operating conditions, the tube exhibits the following characteristics:

- **Arc Voltage Drop (Varc):** 15 V
- **Ignition Voltage (Vign):** 45 V

To reliably achieve the 45 V ignition voltage, an auxiliary DC supply unit delivering approximately 100 V at 25 mA must be connected between the auxiliary ignition electrode ah (+) and the cathode (-). This connection must be made via a suitable current-limiting resistor. The Philips Auxiliary Ignition Unit type E3 108 03 is recommended for this purpose.

Electrical Ratings and Limiting Values

The operation of the 1533 is governed by strict limiting values (Grenzdaten) to ensure reliable operation and prevent backfiring or cathode destruction.

Parameter	Minimum	Maximum
Transformer Voltage (Vtr)	60 Veff	275 Veff
Peak Inverse Anode Voltage (Vainvp)	—	850 V
Average Anode Current (Ia)	—	5 A
Peak Anode Current (Iap)	—	45 A
Series Limiting Resistance (Rt)	0.6 ohms	—
Mercury Temperature (thg)	30 °C	80 °C

The transformer voltage limits (Vtr) are specified for a particular circuit configuration (referred to as Circuit c). The minimum series resistance (Rt) of 0.6 ohms is required to limit peak currents during operation. The operating temperature of the mercury (thg) must be maintained between 30 °C and 80 °C to ensure correct vapour pressure and prevent arc-back or failure to ignite.

Technical Summary

The **1533** is a specialized three-anode, mercury-vapour and gas-filled industrial rectifier. It features a high-current 1.9 V, 23 A directly heated filament, requiring a preheating time of 2 minutes under normal conditions, which must be extended to 5 minutes following transport or long service interruptions. With an auxiliary ignition electrode requiring a 45 V ignition supply, the tube provides efficient rectification with a low 15 V arc drop. It supports a maximum peak inverse voltage of 850 V, an average anode current of 5 A, and a peak anode current of 45 A, making it highly suitable for heavy-duty industrial battery charging and power rectification systems.

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

Section 1 · Rectifier

CONSTRUCTION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Filling	Mercury vapour and gas	—

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Arc voltage	15 V	—
Ignition voltage	45 V	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum RMS input voltage	275 V RMS	—
Peak inverse voltage	850 V	—
Maximum average current	5 A	—

1999 PHILIPS 0-D

Section 2 · Rectifier

CONSTRUCTION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Filling	Mercury vapour and gas	—

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Arc voltage	15 V	—
Ignition voltage	45 V	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum RMS input voltage	275 V RMS	—
Peak inverse voltage	850 V	—
Maximum average current	5 A	—

1999 PHILIPS 0-D

Section 3 · Rectifier

CONSTRUCTION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Filling	Mercury vapour and gas	—

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Arc voltage	15 V	—
Ignition voltage	45 V	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum RMS input voltage	275 V RMS	—
Peak inverse voltage	850 V	—
Maximum average current	5 A	—

TUBE TINKER

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