



ELECTRONIC TUBE REFERENCE

1759

Rectifier - Full Wave electronic tube

CONSOLIDATED TECHNICAL DATA

2 SECTIONS

CONSTRUCTION

RECTIFIER-RECTIFIER

Philips directly heated double-anode mercury-vapor/gas industrial rectifier for very-high-current power conversion. Its heavy filament and low arc voltage support tens of amperes of continuous output.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	—
NOMINAL HEATER	1.9 V / 60 A	PARALLEL HEATER	— / —
HEATING	Direct	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Common cathode	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION1 Rectifier	
PEAK INVERSE VOLTAGE	300 V
NOMINAL OUTPUT CURRENT	50 A
PEAK FORWARD CURRENT	150 A
FORWARD VOLTAGE DROP	10 V
WARM-UP TIME	120 s
Representative of two identical paths; industrial rectifier rated 50 A per valve and published I_a max 25 A per anode.	

SECTION2 Rectifier	
PEAK INVERSE VOLTAGE	300 V
NOMINAL OUTPUT CURRENT	50 A
PEAK FORWARD CURRENT	150 A
FORWARD VOLTAGE DROP	10 V
WARM-UP TIME	120 s
Second physical rectifier section added to represent the full-wave/double-anode structure.	

1759 — Double-Anode Mercury Vapour and Gas Filled Rectifying Valve

A heavy-duty, directly heated, double-anode rectifying valve designed for high-current industrial applications, battery charging, and power rectification.

Overview

The **1759** is a specialized double-anode rectifying valve containing a mixture of mercury vapour and gas. It features a directly heated, oxide-coated cathode designed to deliver high emission currents. Engineered for industrial rectifier service, the 1759 is capable of supplying up to 50 A per valve, making it highly suitable for demanding applications such as charging large banks of lead-acid (Pb) cells.

Due to its mercury-vapour and gas filling, the valve exhibits a low and stable arc voltage drop during conduction, which ensures high efficiency in power rectification. The physical design incorporates robust mechanical terminals to handle the substantial currents required by its filament and anodes.

Mechanical and Physical Construction

The 1759 is a physically large and heavy device, reflecting its high-power industrial rating. It must be operated strictly in a **vertical, base down** position to ensure proper distribution of the mercury vapour and correct operation of the internal electrodes.

Dimensions and Weight

- **Maximum overall height:** 435 mm
- **Maximum diameter:** 141 mm
- **Base to bulb top height:** Maximum 349 mm
- **Net weight:** 1500 g (1.5 kg)
- **Shipping weight:** 3600 g (3.6 kg)

Terminals and Connections

The electrical connections for the anodes and the screen are designed for secure mechanical fastening to minimize contact resistance under high-current loads:

- **Anode Terminals:** Two M8 threaded studs located at the top of the bulb, spaced 33 mm apart.
- **Screen Terminal (s):** An M4 screw terminal located on the side of the envelope.

Screen Connection Requirement

For stable operation, the screen terminal (s) must be connected to the cathode. This connection requires an external current-limiting resistor with a nominal value of **10 kΩ** and a power rating of **0.5 W**.

Filament Heating and Pre-heating Requirements

The 1759 utilizes a high-current, directly heated, oxide-coated filament. Because of the heavy filament structure and the presence of mercury vapour, strict pre-heating protocols must be observed to prevent damage to the cathode emission coating during start-up.

Parameter	Value
Filament Voltage (V_f)	1.9 V
Filament Current (I_f)	60 A
Calculated Filament Power	114 W

The calculated filament power of **114 W** (derived from the nominal 1.9 V filament voltage multiplied by the 60 A filament current) represents a significant thermal input, which is necessary to bring the heavy oxide-coated cathode to its proper operating temperature.

Pre-heating Protocols (T_w)

Before anode voltage is applied, the filament must be allowed to heat fully to vaporize any condensed mercury on the electrodes:

- **Recommended Pre-heating Time:** 2 minutes under normal operating conditions.
- **Urgent Start-up:** The pre-heating time can be decreased to a minimum of 1 minute if urgently required. A specialized time delay switch, such as type [4152](#), may be integrated into the control circuitry to automate this delay.
- **Post-Transport or Long Inactivity:** After transport or a long service interruption, the valve must be pre-heated for at least 5 minutes before applying anode voltage. This extended period ensures that all mercury is completely cleared from the tube elements and properly distributed.

Electrical Characteristics and Operating Limits

The electrical behavior of the 1759 is characterized by a low internal voltage drop once conduction is established, combined with specific limits on voltage, current, and temperature to prevent arc-back or thermal runaway.

Typical Characteristics

- **Arc Voltage (V_{arc}):** 10 V (the typical voltage drop across the valve during conduction).
- **Ignition Voltage (V_{ign}):** 22 V (the minimum voltage required to initiate the arc).

Limiting Values

To ensure reliable operation and prevent premature failure, the following maximum and minimum limits must be maintained:

- **Transformer Voltage (V_{tr}):** Maximum 95 V_{eff} . Minimum 20 V_{eff} (applicable specifically to Circuit a).
- **Peak Inverse Voltage (V_{invp}):** Maximum 300 V.
- **Anode Current (I_a):** Maximum 25 A.
- **Peak Anode Current (I_{ap}):** Maximum 150 A.
- **Surge Limiting Resistance (R_t):** Minimum 0.05 Ω (required in series with the anodes to limit transient surge currents).
- **Mercury Temperature (t_{Hg}):** 30 to 80 °C. The operating temperature of the condensed mercury must be kept within this range to maintain the correct vapour pressure inside the envelope.

Industrial Applications

The primary application of the 1759 is in heavy-duty industrial rectification. Operating as a double-anode rectifier, a single valve can deliver a continuous output of **50 A**.

A typical application is in battery charging installations, where the valve is rated to charge or power a maximum of **36 Pb-cells** (lead-acid accumulator cells) in series. The low internal arc voltage of 10 V ensures high electrical efficiency, minimizing power loss and heat dissipation within the rectifier cabinet during high-current charging cycles.

Technical Summary

The **1759** is a robust, double-anode, mercury-vapour and gas-filled rectifying valve designed for high-current industrial service. It features a directly heated, oxide-coated cathode operating at **1.9 V** and **60 A**. The physical construction includes M8 threaded anode studs and an M4 screen screw terminal, which must be tied to the cathode via a **10 k Ω , 0.5 W** resistor.

With a typical arc voltage of **10 V** and an ignition voltage of **22 V**, the 1759 supports a maximum peak inverse voltage of **300 V**, a maximum continuous anode current of **25 A** (delivering up to **50 A** per valve in full-wave configurations), and a peak anode current of **150 A**. Safe operation requires a vertical, base-

down mounting position, strict adherence to a 1-to-5 minute filament pre-heating schedule, a minimum surge limiting resistance of **0.05 Ω** , and maintenance of the condensed mercury temperature between **30 and 80 °C**.

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

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum RMS anode supply voltage	95 V	—
Minimum RMS anode supply voltage	20 V	—
Maximum average anode current per anode	25 A	—
Minimum series resistance	0.05 ohm	—
Permitted mercury/ambient temperature	30–80 degC	—
DC output current	50 A	—

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Ignition voltage	22 V	—

1999 PHILIPS 0-D

Section 2 · Rectifier

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum RMS anode supply voltage	95 V	—
Minimum RMS anode supply voltage	20 V	—
Maximum average anode current per anode	25 A	—
Minimum series resistance	0.05 ohm	—

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Permitted mercury/ambient temperature	30–80 degC	—
DC output current	50 A	—

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Ignition voltage	22 V	—

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