

ELECTRONIC TUBE REFERENCE

CONSOLIDATED TECHNICAL DATA

1710

Rectifier - Half Wave electronic tube

1 SECTION
CONSTRUCTION
RECTIFIER

Philips directly heated mercury-vapor/gas industrial half-wave rectifier for magnetic-chuck power supplies, providing high current with a low conducting voltage drop.

GENERAL CHARACTERISTICS

BASE DESIGNATION	W	BASE PINS	—
NOMINAL HEATER	1.925 V / 7 A	PARALLEL HEATER	— / —
HEATING	Direct	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Common cathode	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION1 Rectifier	
PEAK INVERSE VOLTAGE	470 V
NOMINAL OUTPUT CURRENT	1.5 A
PEAK FORWARD CURRENT	9 A
FORWARD VOLTAGE DROP	10 V
WARM-UP TIME	30 s
Published ratings and characteristics promoted from the approved TESLA source.	

1710 — Double-Anode Mercury-Vapour and Gas-Filled Rectifying Valve

An industrial, double-anode, mercury-vapour and gas-filled rectifying valve designed for medium-power rectification applications. It features a robust construction with a directly heated, oxide-coated cathode and is engineered to deliver high efficiency and long service life under demanding industrial conditions.

The primary applications for the 1710 include powering electromagnetic chucks (typically rated at 3 A per valve), driving DC motors, operating arc lamps, and charging accumulator batteries (up to 40 lead-acid cells or 55 alkaline cells). It is also widely utilized in various electromechanical processes requiring reliable, low-voltage, medium-current DC power supplies.

Construction and Physical Characteristics

The 1710 is constructed with a heavy-duty glass envelope designed to withstand high thermal and mechanical stress. The physical layout separates the high-voltage anode connections from the filament base to ensure electrical isolation and safety.

- **Anode Connections:** The two anodes are brought out to separate M6 screw terminals located at the top of the bulb. The spacing between these two anode terminals is exactly 18 mm.
- **Base and Socket:** The tube utilizes a W-type 4-pin base. The recommended socket for this base is the type 40221.
- **Shielding and Screens:** The internal screens (designated as s) must be connected to the cathode through an external resistor of **10 k Ω , 0.5 W** to ensure stable operation and prevent parasitic discharges.
- **Mounting Position:** The valve must be mounted strictly in a **vertical position with the base down**. This orientation is critical to ensure proper distribution and condensation of the liquid mercury within the envelope.

Physical Dimensions and Weight

Parameter	Value
Maximum overall height	205 mm
Seated height (to top of bulb body)	191 mm to 197 mm
Maximum bulb diameter	69.5 mm to 70 mm
Net weight	170 g
Shipping weight (pack of 10 valves)	3300 g

Filament and Heating Requirements

The 1710 features a directly heated, oxide-coated filament. Because it is a mercury-vapour tube, strict adherence to heating times and commissioning procedures is required to prevent damage to the cathode.

- **Filament Voltage (V_f / U_f):** 1.9 V to 1.95 V (nominal 1.9 V).
- **Filament Current (I_f):** 7 A to 8 A (typically 7 A at mean filament voltage, up to 8 A depending on the manufacturer).
- **Pre-heating Time (T_w):** A minimum pre-heating time of **30 seconds** is recommended before anode voltage is applied. In urgent circumstances, this pre-heating period may be reduced to a minimum of **15 seconds**.

Filament Power Calculation

Based on the nominal filament voltage and current ratings, the calculated filament power consumption is:

- For the 7 A rating: $1.9\text{ V} \times 7\text{ A} = 13.3\text{ W}$
- For the 8 A rating: $1.9\text{ V} \times 8\text{ A} = 15.2\text{ W}$

Seasoning and Commissioning Procedure

Before putting a new or long-stored 1710 valve into active service, it must undergo a specific seasoning (pre-heating) process. This process requires connecting only one of the two anodes at a time for a duration of **15 minutes**. During this seasoning period, the dispersed mercury within the tube is allowed to condense completely in the lower portion of the bulb. Failure to perform this procedure introduces a severe risk of electrical breakdown (arc-back) between the two anodes.

Electrical and Operating Characteristics

The 1710 operates with a low internal voltage drop due to the ionization of the gas and mercury vapour. The typical electrical characteristics of the discharge arc and ignition are as follows:

- **Arc Voltage** (V_{arc} / U_{arc}): Typically 10 V (with a maximum limit of 16 V).
- **Ignition Voltage** (V_{ign} / U_{zap}): Typically 22 V (with a maximum limit of 25 V).

Typical Rectifier Operating Point

Under standard operating conditions in a full-wave rectifier circuit (designated as Circuit "a"), the typical parameters per valve are:

Parameter	Value
Transformer secondary voltage (V_{tr} / E_a)	150 V_{eff} (RMS) per anode
Rectified output voltage (V_o)	110 V
Rectified output current (I_o / I_{ss})	3 A

The minimum recommended AC anode voltage is 25 V_{eff} per anode to ensure reliable ionization and conduction.

Limiting Values and Absolute Ratings

To ensure the longevity of the valve and prevent destructive arc-back or cathode stripping, the operating conditions must be kept within the following absolute limits:

Rating Parameter	Absolute Limit
Maximum peak inverse voltage (V_{ainvp} / E_{inv})	425 V to 470 V

Rating Parameter	Absolute Limit
Maximum average anode current (I_a , averaged over max 5 s)	1.5 A
Maximum peak anode current (I_{ap} / I_{ss} max)	9 A
Minimum anode protection resistance (R_t / R_o)	2.5 Ω
Operating mercury temperature range (t_{Hg})	30 °C to 80 °C

The minimum anode protection resistance (R_t) of 2.5 Ω per anode must be present in the circuit at the maximum anode voltage to limit transient surge currents.

Related and Equivalent Designations

The 1710 can replace several equivalent or similar industrial rectifying valves, though mechanical or electrical modifications may be required depending on the specific application.

- **Direct or Near Equivalents:** The 1710 can replace the types **1119**, **1129**, **1725 A**, **1819**, **GI 3 b**, **Glz 110/3**, **N 110/1.5**, and **N 110/3** after appropriate mechanical or electrical adjustments.
- **Higher Power Configurations:** Two 1710 valves, when configured with an adjusted filament supply voltage, can be used to replace a single **Glz 110/6** rectifying valve.

Technical Summary

The **1710** is a specialized, double-anode, mercury-vapour and gas-filled industrial rectifier. Operating with a low filament voltage of **1.9 V** and a high current of **7 A to 8 A**, it provides efficient full-wave rectification for medium-power industrial DC applications. Delivering up to **3 A** of continuous rectified current at **110 V DC** from a **150 V RMS** AC source, it is highly suited for inductive loads such as magnetic chucks and DC motors. Proper vertical mounting, a 10 k Ω screen-to-cathode resistor, and strict adherence to pre-heating and seasoning protocols are essential to maintain the tube's reliability and prevent inter-anode breakdown.



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

195X Tesla

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

195X TESLA

Section 1 · Rectifier

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
RectifiedCurrent	3 A	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Peak Inverse Voltage	425 V	—
PeakRectifiedCurrent	9 A	—



SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

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 · Rectifier

CHARACTERISTIC		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Arc voltage drop	10 V	GasFilled

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum peak inverse anode voltage	470 V	—

PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Maximum average anode current	1.5 A	—
Maximum peak anode current	9 A	—
Application	magnetic-chuck rectifier service	—
Heater voltage	1.9 V	DirectAC
Heater current	5.5 A	DirectAC



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 average anode current per anode	1.5 A	Tav max 5 s
Minimum series resistance	2.5 ohm	—
Permitted mercury/ambient temperature	30–80 degC	—
DC output voltage	110 V	—
DC output current	3 A	—
RMS anode supply voltage	150 V	CircuitA

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

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