



ELECTRONIC TUBE REFERENCE

141

Rectifier - Half Wave electronic tube

CONSOLIDATED TECHNICAL DATA

1 SECTION

CONSTRUCTION

RECTIFIER

Machlett ML-141 high-vacuum industrial rectifier for very-high-voltage service, particularly electrostatic precipitation, with rugged thoriated-tungsten construction and approximately 125 kV inverse-voltage capability.

GENERAL CHARACTERISTICS

BASE DESIGNATION	—	BASE PINS	—
NOMINAL HEATER	5.5 V / 6.5 A	PARALLEL HEATER	— / —
HEATING	Direct	SERIES OPERATION	Not specified
CATHODE ARRANGEMENT	Separate cathodes	SECTION CONSTRUCTION	Similar

SECTION RATINGS

SECTION 1 Rectifier	
MAXIMUM PLATE DISSIPATION	100 W
PEAK INVERSE VOLTAGE	125000 V
PEAK FORWARD CURRENT	750 mA
FORWARD VOLTAGE DROP	650 V
WARM-UP TIME	2 s
<i>Promoted fields populated from explicitly published ratings/characteristics; service-specific data retained as parameters.</i>	

141 — High-Voltage Rectifier Tube

The **ML-141** (also designated as the 141) is a high-vacuum thermionic rectifier tube designed for high-voltage, high-power-level applications. It is particularly suited for electrostatic particle precipitation service with moderately high power requirements, where its design offers a combination of low initial cost, long operating life, and high current capacity.

Construction and Mechanical Design

The construction of the ML-141 incorporates specialized design features engineered for high-power operation, ensuring physical ruggedness and thermal stability.

Cathode and Anode Structure

The tube utilizes a directly heated, low-wattage, thoriated-tungsten filament of a catenary design. This catenary configuration allows for close spacing between the anode and cathode without risking filament distortion from strong electrostatic forces. The anode is a cylindrical structure made of molybdenum, which provides a high rate of heat dissipation and includes a substantial safety factor to protect against accidental thermal overload.

Physical Dimensions and Mounting

The ML-141 is designed for flexible installation and can be mounted in any position (mounting position is optional). The physical dimensions of the tube are as follows:

Dimension Reference	Minimum (inches)	Nominal (inches)	Maximum (inches)
Overall Length (A)	10.65	10.75	10.85
Bulb Diameter (B)	—	—	2.75
Anode Terminal Diameter (C)	0.485	0.500	0.510
Anode Terminal Length (D)	0.44	0.50	0.56
Filament Pin Length (E)	0.82	0.88	0.94
Filament Pin Spacing (F)	1.235	1.250	1.265
Filament Pin Diameter (G)	0.292	0.312	0.332
Base Diameter (H)	—	2.19	—
Bulb Collar Diameter (J)	—	2.25	—

The cathode base of the tube is designed to fit a Machlett mounting socket, part number P-8835. The net weight of the tube is 14.5 ounces.

Cooling and Insulating Medium

The tube can operate in either oil or air as an insulating medium, which directly affects its voltage ratings and cooling requirements:

- **Operation in Oil:** The tube relies on the surrounding oil for insulation and cooling.
- **Operation in Air:** When operated in air, the cooling method must combine radiation and forced-air. A forced-air flow of 50 cubic feet per minute (cfm) must be directed at the glass bulb to ensure adequate heat dissipation.

Electrical and Filament Characteristics

The ML-141 requires specific filament operating conditions to maximize its service life and ensure stable emission.

- **Filament Voltage:** 5.5 Volts. The applied filament voltage must be maintained within $\pm 5\%$ of this rated value under all operating conditions. For maximum tube life, it should be kept as close to 5.5 Volts as possible.
- **Filament Current:** Approximately 6.5 Amperes when operating at the nominal 5.5 Volts.
- **Filament Heating Time:** A minimum heating time of 2 seconds is required after lighting the filament before any anode voltage is applied.
- **Tube Voltage Drop:** The maximum internal voltage drop across the tube is 650 Volts when the instantaneous plate current is at 0.750 Ampere.

Maximum Ratings and Circuit Applications

The maximum ratings of the ML-141 vary depending on the insulating medium and the specific electrical circuit configuration. Operating the tube within these limits prevents premature failure and damage.

Absolute Maximum Ratings

- **Peak Inverse Anode Voltage (Oil Insulation):** 125,000 Volts (125 PKV)
- **Peak Inverse Anode Voltage (Air Insulation):** 80,000 Volts (80 PKV)
- **Peak Anode Current:** 0.75 Ampere (750 mA)
- **Anode Dissipation:** 100 Watts

Average D-C Load Current Ratings

The allowable average direct-current load capacity depends on the rectifier circuit configuration and whether the circuit is unfiltered (based on a sine-wave input and a pure resistance load without inductive or capacitive effects) or filtered (based on a sine-wave voltage input and an inductive choke-input filter):

Circuit Application	Unfiltered Load Current (Amps)	Filtered Load Current (Amps)
Single-phase, two-tube, half-wave	0.200	—
Single-phase, four-tube, full-wave	0.400	0.470
Three-phase, double-Y parallel	1.200	1.200
Three-phase, full-wave	0.600	0.600

Plate Current Characteristics

The relationship between the peak plate voltage and the resulting peak plate current demonstrates the emission capability of the thoriated-tungsten filament. Under typical operating conditions, the peak plate current increases with the applied peak plate voltage as follows:

- At **200 peak volts**, the peak plate current is approximately 0.12 Ampere.
- At **400 peak volts**, the peak plate current rises to approximately 0.35 Ampere.
- At **600 peak volts**, the peak plate current reaches approximately 0.75 Ampere.
- At **800 peak volts**, the peak plate current is approximately 1.05 Amperes.
- At **1000 peak volts**, the peak plate current is approximately 1.22 Amperes.
- At **1200 peak volts**, the peak plate current levels off near 1.28 Amperes.

These values show that the tube can deliver currents well in excess of its 0.75 Ampere maximum peak rating when transient voltage drops occur, though continuous operation must be kept within the specified limits.

Radiation Safety Warning

When operated at high voltages, the ML-141 is capable of producing x-rays. To prevent harmful exposure to personnel, equipment designers must incorporate adequate rayproof shielding around the tube and associated high-voltage circuitry.

Technical Summary

The **ML-141** is a high-vacuum, high-voltage rectifier tube featuring a thoriated-tungsten catenary filament and a cylindrical molybdenum anode. It is rated for a maximum peak inverse voltage of 125,000 Volts in oil (80,000 Volts in air) and a maximum peak anode current of 0.75 Ampere. Operating with a 5.5 V, 6.5 A filament supply, the tube requires a minimum of 2 seconds of preheating before anode voltage is applied. When operated in air, it requires a forced-air flow of 50 cfm directed at the bulb. The ML-141 is primarily intended for electrostatic particle precipitation and other high-voltage rectification applications, requiring proper x-ray shielding during operation.

SOURCE OPERATING CONDITIONS

[SOURCE PDF](#)

1971 Machlette Laboratories

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

1971 MACHLETTE LABORATORIES

Section 1 · Rectifier

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
um inverse voltage rating of	125	um inverse voltage rating of 125 PKV using oil insulation power-level applications. These features insure ruggedness,
or	80 mA	or 80 PKV using air insulation and a maximum peak anode long life, low internal voltage drop and high average-load-
current rating of	750 mA	current rating of 750 MA. It is especially adaptable to elec- current capacity. The cathode is a low-wattage, thoriated-
Filament Current at [1]	5.5 V	Filament Current at 5.5 Volts approx:mate 6.5 Amps
Filament Current at [2]	6.5 V	Filament Current at 5.5 Volts approx:mate 6.5 Amps
Filament Heating Time, minimum	2 s	Filament Heating Time, minimum ... 2 Secs
Tube Voltage Drop, maximum	650 mA	Tube Voltage Drop, maximum 650 Volis
* Applied filament voltage must be held within =+	5 mA	* Applied filament voltage must be held within =+ 5% of rated voltage. For maximum life, filament voltage should be
Peak Anode Current	0.75	Peak Anode Current 0.75 Amp
Anode Dissipation	100 W	Anode Dissipation ... 100 Watts

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