

ELECTRONIC TUBE REFERENCE

CONSOLIDATED TECHNICAL DATA

18524

1 SECTION

CONSTRUCTION

Specialized - Radiation Counter electronic tube

GEIGERMULLERCOUNTER

Halogen-quenched Geiger-Müller counter designed for gamma and beta measurements of liquid samples. Its sample-containing geometry places radioactive liquid close to the sensitive volume for efficient activity counting.

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

SECTION1 GeigerMullerCounter
No fixed ratings recorded.
Gas-filled radiation-counter section; counter-specific electrical characteristics are retained in TUBE_SECTION_PARAMETER.

18524 — Halogen-Quenched Geiger-Müller Radiation Counter Tube

A specialized, glass-envelope, halogen-quenched Geiger-Müller counter tube designed for the precise measurement of beta and gamma radiation in liquid samples.

Overview

The **18524** is a gas-filled radiation detector designed specifically for laboratory and industrial applications involving liquid samples. Unlike conventional thermionic vacuum tubes, the 18524 does not contain a heater or cathode-emitter assembly; instead, it operates as a Geiger-Müller (GM) counter tube.

The tube utilizes a gas filling consisting of neon (Ne) and argon (Ar), along with a halogen quenching agent to facilitate rapid recovery after each ionization event. Its unique physical design features a thin-walled glass section and an integrated chamber to hold liquid samples directly against the active volume, maximizing detection efficiency for low-energy beta and gamma emissions.

Mechanical and Physical Construction

The physical envelope of the 18524 is constructed of glass, featuring a specialized thin-wall section designed to permit the penetration of beta particles. This thin-wall section has a thickness of **25 mg/cm²** and extends over a length of **60 mm**. The tube is designed to accommodate a liquid sample volume of **9 to 10 cm³** directly within its structure.

The mechanical specifications of the tube are highly defined:

- **Total Length:** 203 ± 4 mm (excluding the connection pins)
- **Body Length:** 183 ± 4 mm (measured from the bulb tip to the start of the pin base)
- **Minimum Active Length:** 142 mm
- **Bulb End Diameter:** Maximum 32 mm
- **Main Body Diameter:** Maximum 25 mm
- **Pin Length:** 28 mm
- **Pin Diameter:** Maximum 6 mm
- **Weight:** 35 g

The internal interelectrode capacitance of the tube structure is **2.5 pF**.

Operating and Electrical Characteristics

The 18524 requires an external high-voltage supply to establish the electric field necessary for gas multiplication. At an ambient temperature of **20 °C**, the tube exhibits the following electrical and operating characteristics:

- **Starting Voltage (V_{ign}):** Minimum 335 V, maximum 350 V. This is the threshold voltage at which the gas mixture begins to ionize and produce measurable pulses.
- **Operating Voltage (V_b):** Minimum 400 V.
- **Plateau Length:** Minimum 100 V.
- **Plateau Slope:** Typically 0.06%/V, with a maximum limit of 0.15%/V.

The plateau slope is a critical indicator of detector stability; a lower slope ensures that small drift in the high-voltage power supply will not significantly alter the measured count rate.

Background Noise and Shielding

To achieve accurate measurements of low-level radiation, the 18524 must be operated within a shielded environment. When housed in a shield consisting of **2 inches of lead (Pb)** and **1/4 inch of aluminum (Al)**, the background count rate is reduced to a typical value of **12 counts per minute**.

Service Life and Environmental Limits

The inclusion of a halogen quenching agent ensures a long operational lifetime, as the halogen molecules dissociate during the quenching process and subsequently recombine. The expected life of the tube is a minimum of **5 x 10¹⁰ counts**.

The tube is rated under the absolute maximum rating system for operation across a wide thermal range:

- **Ambient Temperature Range (t_{amb}):** -55 °C to +75 °C

Circuit Configuration

For proper operation, the 18524 must be integrated into a circuit that provides both current limiting and signal extraction. The anode of the tube is connected to the high-voltage supply (+V_b) through two series-connected resistors, each having a nominal value of **2.7 MΩ**.

This configuration yields a total calculated series anode resistance of 2.7 MΩ + 2.7 MΩ = 5.4 MΩ.

The output pulse is taken via a coupling capacitor connected directly to the junction between these two series resistors. This split-resistor arrangement helps isolate the signal-processing electronics from the high-voltage supply while maintaining the necessary load impedance for stable quenching.

Performance Curves and Behavior

The operational behavior of the 18524 is defined by its plateau and dead time characteristics across its voltage range.

Plateau Curve

The plateau curve, which plots the count rate against the applied operating voltage (V_b), shows that the ionization threshold begins between 335 V and 350 V. Once the voltage exceeds this starting threshold, the count rate enters a highly stable, flat plateau region. This plateau remains stable from 400 V up to at least 600 V, providing a reliable operating region where the detection efficiency is virtually independent of voltage fluctuations.

Dead Time Curve

The dead time curve illustrates the recovery period of the tube (the duration during which the tube is insensitive to subsequent ionizing events) as a function of the operating voltage (V_b). The dead time exhibits a non-linear relationship with voltage:

- At **340 V**, the dead time is approximately **55 μsec**.
- As the voltage is increased, the dead time rises, reaching a peak of approximately **95 μsec** at **430 V**.
- Beyond **430 V**, the dead time decreases steadily, falling to approximately **50 μsec** when the voltage reaches **600 V**.

Understanding this dead time behavior is essential for performing coincidence loss corrections in high-intensity radiation fields.

Technical Summary

The **18524** is a specialized halogen-quenched Geiger-Müller radiation counter tube designed for measuring beta and gamma radiation in liquid samples. It features a glass envelope with a thin-wall section of **25 mg/cm²** and an integrated sample capacity of **9 to 10 cm³**. Operating at a minimum voltage of **400 V**, the tube provides a stable plateau of at least **100 V** with a typical slope of **0.06%/V**. The anode circuit requires a split load of two series **2.7 MΩ** resistors, with the output signal coupled from their midpoint. With an expected life of at least **5 x 10¹⁰ counts** and a robust operating temperature range of **-55 °C to +75 °C**, the 18524 is a highly reliable detector for liquid-phase radiation monitoring.

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 · GeigerMullerCounter

CONSTRUCTION		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Filling	Neon, argon and halogen quenching agent	—
Glass wall thickness	25 mg/cm ²	—
Liquid capacity	9-10 cm ³	—

CAPACITANCE		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Interelectrode capacitance	2.5 pF	—

CHARACTERISTICS		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Starting voltage minimum	335 V	—
Starting voltage maximum	350 V	—
Plateau length minimum	100 V	—
Plateau slope typical	0.06 %/V	—
Plateau slope maximum	0.15 %/V	—
Shielded background	12 counts/min	2inPb;1/4inAl
Expected count life minimum	50000000000 counts	—

OTHER		
PARAMETER	PUBLISHED VALUE	CONDITION / NOTE
Operating voltage minimum	400 V	—

TUBE TINKER

An independent reference for electronic tubes, vacuum tubes,
and their source documents.

