

Reuter Stokes Boron-10 Lined Proportional Counter



New Line of B-10 Proportional Counters

GE's Reuter Stokes business is introducing a new line of Boron-10 proportional counters. The new line of detectors offers:

- Custom designs for a wide set of applications, including international safeguards and homeland security
- a 30% improvement in neutron sensitivity, and
- comparable neutron sensitivity to a one-inch diameter BF_3 proportional counter (without the associated hazards).

With a rich history dating back to 1956, GE's Reuter Stokes line has become an industry leader in the research, design and manufacturing of quality detectors for a variety of radiation monitoring applications. With over 100,000 detectors in service around the world supporting instrumentation ranging from reactor monitoring and security applications to neutron research and oil exploration, no company understands your radiation measurement requirements better than Reuter Stokes.

Sustainable Neutron Detection Technology

GE has developed a new line of Boron-10 lined proportional counters for use in systems and instruments that have previously used helium 3 gas-filled detectors.

Operation of the new Boron-10 detectors is very similar to that of the existing helium 3 technology. Although the neutron interaction is different because the neutrons react with the boron 10 layer lining the inner wall of the boron 10 detector instead of the gas volume in the helium 3 detector, both detectors operate as proportional counters. Boron 10 and helium 3 detectors use similar electronics and methods of gamma discrimination. In fact, in gamma backgrounds exceeding 1R/hr, the gamma discrimination of a boron 10 lined detector is superior to that of a helium 3 gas-filled detector. GE's new Boron-10 lined detectors are a viable replacement technology in many instruments and systems that historically used helium 3 detectors.

The new line of Boron-10 detectors is available in both stainless steel and aluminum designs, in diameters ranging from 0.5 inch to 1.125 inches, and for active lengths up to 71 inches. While aluminum detectors provide a lower gamma response which results in a slightly higher neutron sensitivity, stainless steel has a lower inherent alpha background and therefore a correspondingly lower background count. The Boron-10 coating thickness can be varied to optimize performance in some systems. GE engineers will work with you to tailor a solution that best optimizes performance in your specific neutron detection application.



Reuter Stokes RS-“B1” Boron-10 Detectors

Features

- **Excellent Gamma Discrimination** – exceeds GARRn specification for radiation portal monitors. Superior to helium 3 gas-filled detectors.
- **High Neutron Sensitivity** – sensitivity of one inch diameter Boron-10 detector is comparable to the sensitivity of a similar size BF₃ detector
- **Low voltage operation** – operating voltage typically less than 1,000 VDC
- **Custom Designs** – available in a variety of diameters, lengths, and materials to optimize performance for your specific application
- **Built-in Quality** – incorporates many of the proven design features of today’s helium 3 detectors

Specifications

Mechanical

- Stainless steel or aluminum detector
- Alumina ceramic insulators
- Inner wall coated with enriched boron 10
- Lengths up to 71 inches
- Fill gas: argon mixture
- Pressure: less than 1 atmosphere (typical)

Electrical

- Connectors:
 - HN (Standard for detectors one inch diameter and greater)
 - MHV, SHV (Standard for detectors < one inch diameter)
 - Flying lead wire
- Operating range: 500 – 1,000 VDC
- Voltage: 750 VDC typical (varies with electronics gain and time constant)
- Capacitance: 7 - 15 pF (typical)
- Resistance: >10¹² ohms

Ratings

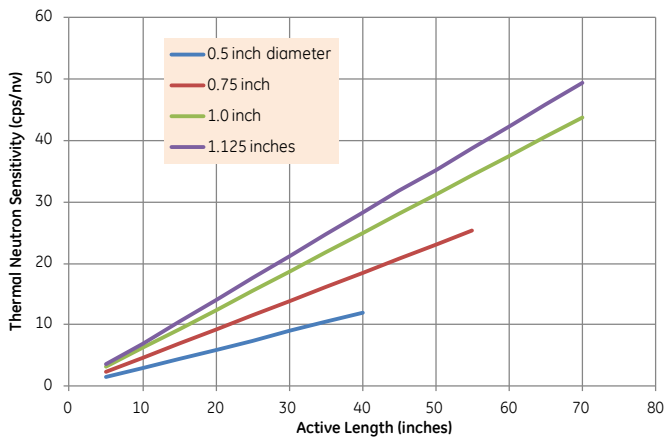
- Temperature: -40 to +55°C
- Relative Humidity: 60%



Typical Operating Characteristics

Thermal neutron sensitivity:

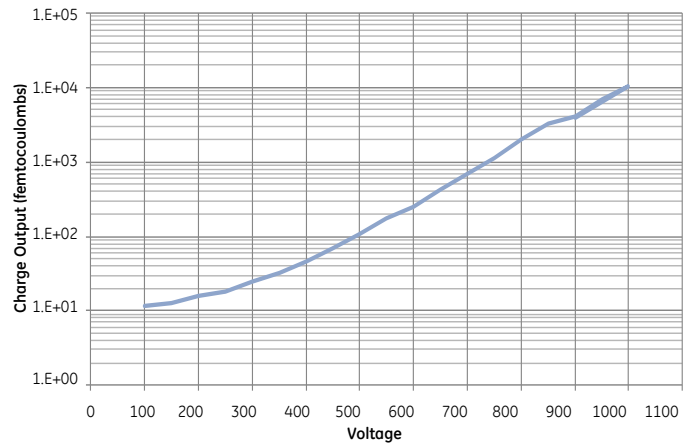
Sensitivity for various diameters and detector active lengths



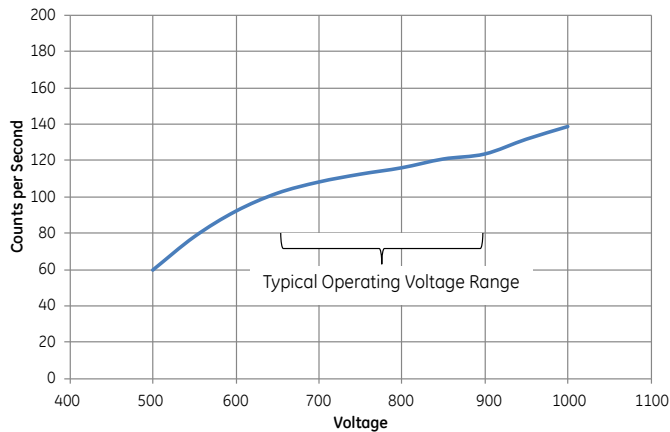
Thermal neutron sensitivity above determined for boron coating optimized for individual detector sensitivity. Sensitivity values above are for gamma dose rates <10 mR/hr.

(Note: nv is abbreviation for neutrons per square centimeter per second)

Typical Gas Gain for a 25 mm Diameter ¹⁰B Detector

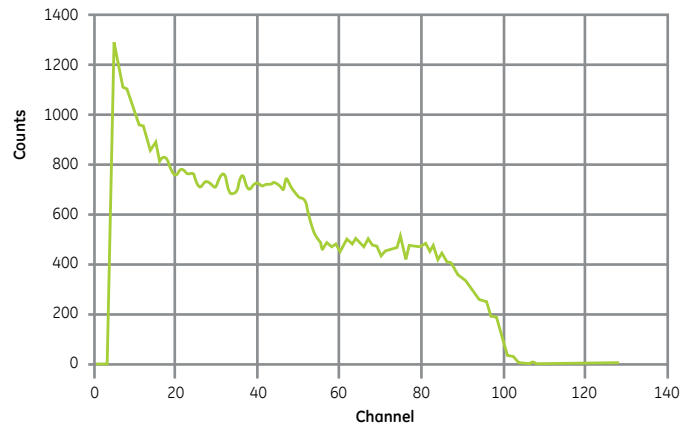


Typical Counting Curve for a 25 mm Diameter ¹⁰B Proportional Counter



Gamma discrimination and determining threshold:

Pulse Height Spectrum with ²⁵²Cf Source



Typical pulse height spectrum for a 25 mm diameter detector

(Note: Spectral characteristics may vary with smaller diameter detectors)

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