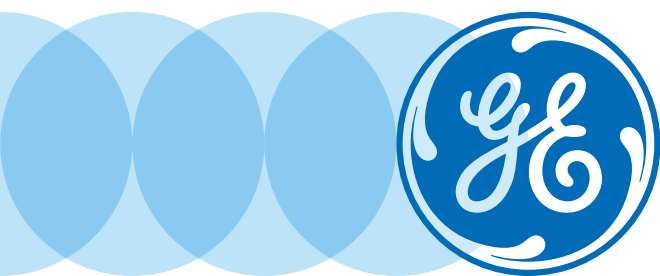


GE
Measurement & Control

Reuter Stokes B10Plus+^{*} Proportional Counter



GE's Reuter Stokes business is introducing the B10Plus+* line of neutron detectors. B10Plus+* is a Boron-10 proportional counter that is filled with a small amount of Helium-3 gas. The Helium-3 functions as a proportional gas while providing additional neutron sensitivity. GE's B10Plus+* detector line provides enhanced neutron sensitivity over standard Boron-10 proportional counters for applications where additional sensitivity is needed. B10Plus+* makes efficient use of the limited remaining Helium-3 in systems where proportional counters are needed. B10Plus+* offers:

- Improved neutron sensitivity over Boron-10 proportional counters (varies based on amount of Helium-3)
- Gamma discrimination comparable to existing Helium-3 detectors
- All the performance benefits of proportional counter technology
- Custom designs for various applications including international safeguards and homeland security
- A safe hazard free detector for easy use and transport

With its legacy dating back to 1956, GE's Reuter Stokes business has designed and developed an impressive collection of neutron detectors. With over 100,000 detectors in service in a variety of neutron sensing systems around the world, Reuter Stokes detectors are among the most proven and well known in the industry.

Reuter Stokes Neutron Detectors

GE's Reuter Stokes business will continue to manufacture its standard line of Boron-10 detectors for reactor control, spent fuel measurement and as a replacement neutron detector for use in existing Helium-3 based systems. However, in some applications Boron-10 detectors alone might fall short in achieving the desired neutron sensitivity. In applications such as these, B10Plus+* may be the best alternative to the existing Helium-3 detector designs.

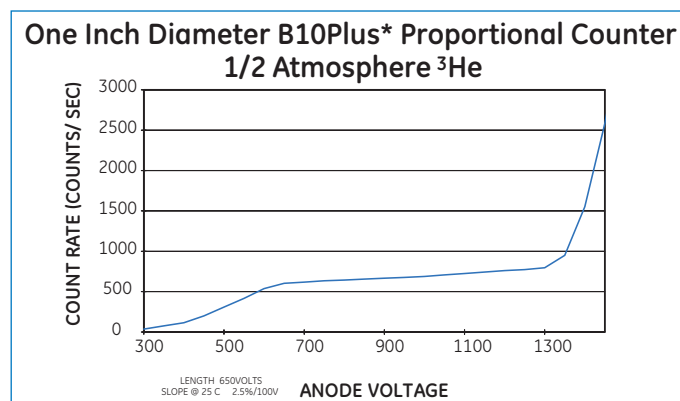
GE's B10Plus+* is ideally suited for projects that have been driven to BF₃ proportional counters. In these instances the B10Plus+* detectors

would have equivalent or higher neutron sensitivity without the hazardous shipping and handling problems that are associated with BF₃ proportional counters.

Operation of the B10Plus+* detector is very similar to that of existing Helium-3 detectors. In a B10Plus+* detector neutrons react with the thin Boron-10 lining on the inside wall of the detector as well as the Helium-3 molecules in the proportional gas. By combining these two neutron absorbing materials into one detector we are able to provide higher neutron sensitivity.

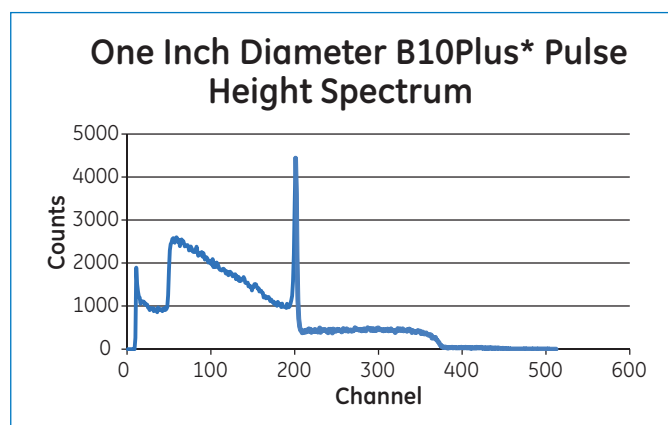
Typical Detector Performance Information

Counting plateau:



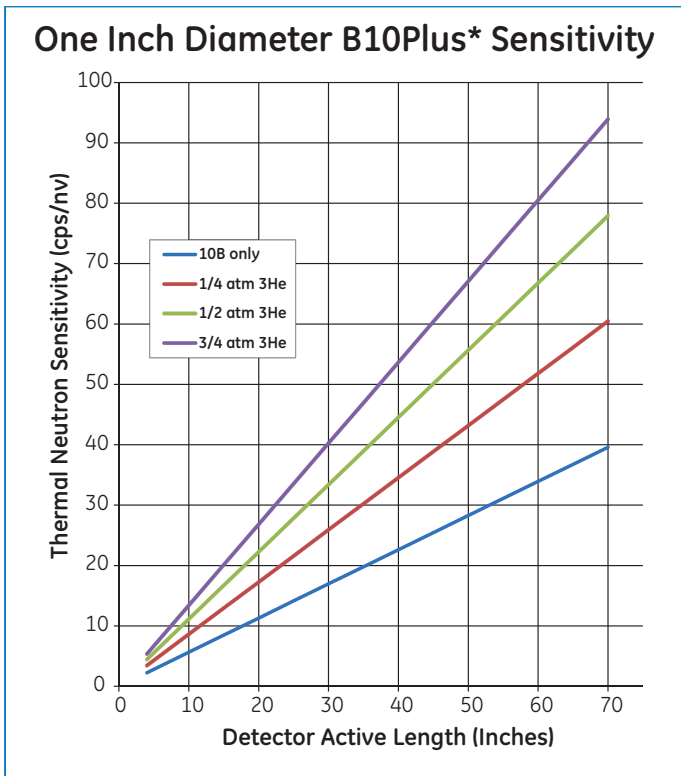
Plateau characteristics will vary depending on the amount of ³He added to the detector. The slope of the plateau is typically <4%/100 volts

Pulse Height Spectrum:

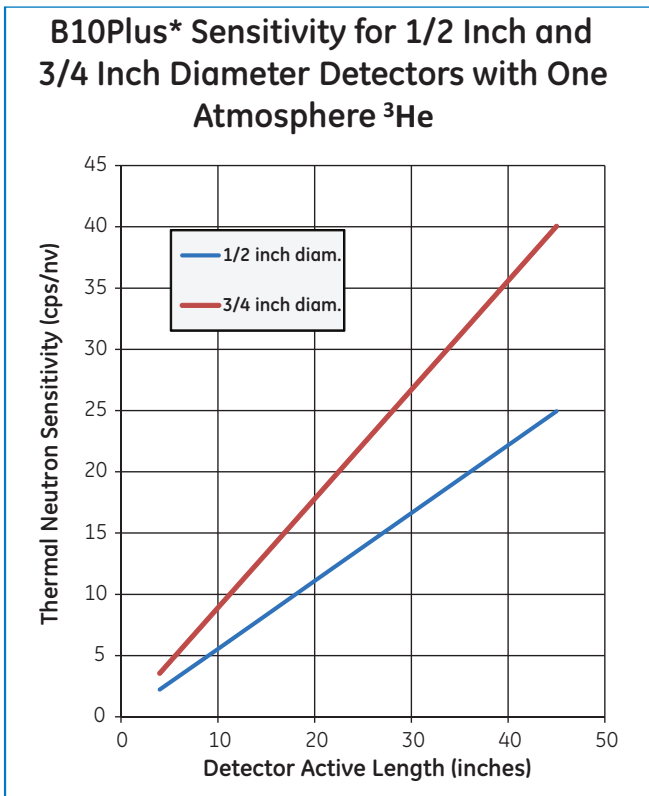


The pulse height spectrum exhibits the combined characteristics of a ³He and ¹⁰B reaction. The edge of the ³He wall effect is a convenient feature to aid in setting the gamma discrimination threshold.

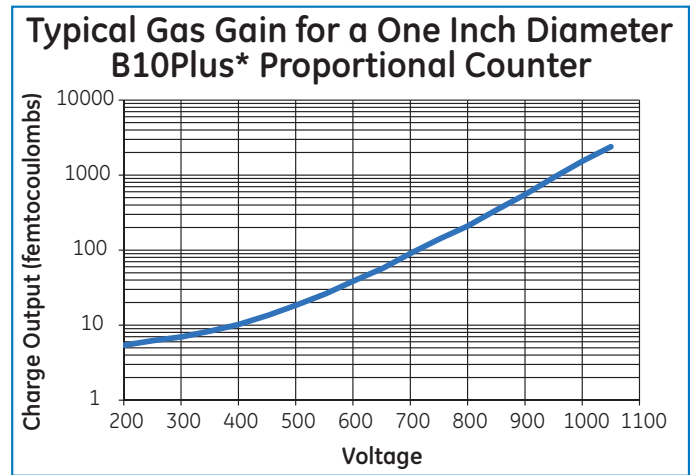
Neutron Sensitivity:



The neutron sensitivity of B10Plus+* detectors is dependent on the surface area of the ¹⁰B coating and the amount of ³He gas present in the detector. Neutron sensitivities for 0.5 and 1 inch diameter detectors is plotted for several ³He gas fill configurations. All sensitivities are reported as measured in an isotropic thermal neutron flux. (Note: "nv" is the abbreviation for "neutrons per centimeter squared per second")



Gas Gain Characteristics:



The gas gain curve for a one inch diameter B10Plus+* detector is provided above. The charge output versus voltage is related to the ³He full energy peak. As a result the maximum alpha energy edge from the ¹⁰B reaction will be approximately twice the charge indicated above, and the lower edge of the ³He wall effect would be approximately one fourth the charge. Gas gain characteristics will vary depending on the detector diameter and ³He pressure.

Specifications

Operating voltage – varies based on ³He partial pressure

Insulation Resistance at 25°C– >1 X 10¹² ohms

Capacitance – ~ 8 to 12 pf

Materials of Construction

Proportional fill gas – Typically ³He + Ar and CO₂ (Fill pressures are generally 1 atmosphere or less, depending on the amount of ³He added.)

Detector – Stainless Steel or Aluminum

Insulators – Alumina Ceramic

Connector Options:

- ≥ 1 inch in diameter HN connectors are standard, SHV, MHV and wire leads optional. Insulators in the connectors are Teflon (for high radiation applications both Rexolite and alumina Ceramic insulators are available)
- < 1 inch in diameter both SHV and MHV connectors are standard, wire leads are optional. Insulators in these connectors are only offered in Teflon

Sizes:

Diameter	0.5 (12.7)	0.75 (19)	1.0 (25.4)	1.125 (28.9)
Maximum active length	"45 (1143)"	"70.5 (1790)"	"70.5 (1790)"	"70.5 (1790)"

Inches
(mm)

Neutron sensitive materials are ³He gas and boron enriched in the ¹⁰B isotope.

Typical Maximum Ratings

Voltage: 1500 volts

Temperature: 55°C

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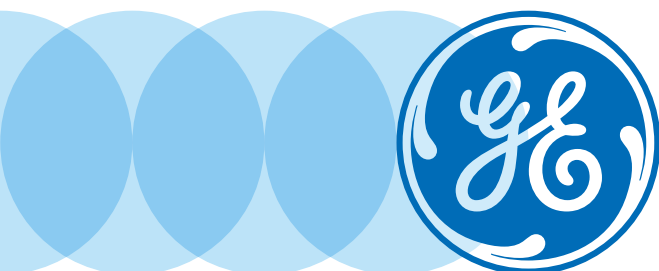
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