

# Ex-core fission chambers for pressurized water reactors

## Peak performance and reliability: Built-in and proven

Reuter-Stokes is a world leader in fission chamber design and manufacture. With over 50 years of design experience, and thousands of fission chambers installed, we have a unique track record of excellent operational performance in some of the harshest environments.

Our fission chambers measure neutron flux in various flux ranges to help manage, control, and protect the nuclear reactor. We offer fission chambers in both guarded and un-guarded styles. The guarded fission chambers are particularly well suited to applications where low signal and anticipated operational environments demand the highest level of immunity against electromagnetic interference.

To help ensure that the critical signal of the fission chamber arrives to the control room, we can utilize safety-related mineral-insulated signal transmission cables (coaxial and tri-axial), as well as safety-related electrical connectors. Both cables and connectors are designed and manufactured to provide high levels of electrical isolation under the demanding environmental conditions present in containment.

Fission chambers designed for critical applications must have the highest level of reliability. With hundreds of instruments installed in the field, reliability for us is more than just a claim, but a proven capability.

## Performance benefits

- Reliable, trouble-free detector operation
- Responsive technical support
- Extensive fission chamber design and manufacturing experience for over 50 years



## Advanced instrumentation, Customized for your plant

At Reuter-Stokes, we understand the need for flexibility and customization. To meet that need, we offer a variety of detector designs to accommodate measurement ranges, interfaces (electrical and mechanical) and operational conditions. We design and build fission chambers to measure neutron flux in the source range, intermediate range, wide range (source and intermediate) or power range. Our fission chambers are also available in a variety of sizes, sensitivities, guarded and unguarded configurations and electrical terminations to satisfy unique customer requirements.

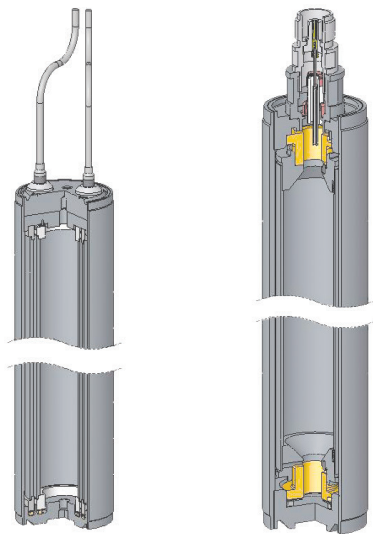
We can also provide safety-related fission chambers; we utilize an established safety-related design as well as certified manufacturing and quality control processes. Reuter-Stokes is an ASME Code NPT-type certificate holder, which allows us to design and manufacture Section III, Class 1 and pressure boundary components. While your specific application might not require this level of certification, you can take comfort in the fact that all of our products are built in the same certified shop, by the same highly skilled personnel, using the same quality processes.

Reuter-Stokes also continues to invest in plant and equipment to remain at the forefront of technology. Enhanced uranium plating, state-of-the-art clean room assemblies and testing processes employed in the manufacture of the Reuter Stokes fission chambers ensures the consistent high level of quality our customers have come to expect.

### Vast global installed base: Our heritage of excellence

With detectors in over 100 commercial nuclear plants worldwide, Reuter-Stokes has an established track record of operational excellence.

Our fission chambers have been installed in countries such as Canada, Finland, Germany, Japan, Mexico, Spain, Sweden, Switzerland, Taiwan and the United States. Our relationships with our customers extend beyond equipment supply to include post-sale technical support and services—both from our home office in Twinsburg, Ohio as well as at the customer site.



### Example specifications

Guarded fission chamber, RS-C3-2540-103

#### Mechanical

Maximum diameter	3.14 in
Maximum overall length	43.84 in
Connectors	Type HN

#### Material

Outer shell and inner electrodes	1100 Aluminum
Connector	6061 Aluminum
Insulation: Detector Connector	Alumina ceramic Alumina ceramic
Neutron-sensitive material	93% U-235 enriched

#### Resistance @ 25 deg C

Signal electrode to shell	$10^{13}$ Ohms (minimum)
High voltage (HV) electrode to shell	$10^{12}$ Ohms (minimum)

#### Capacitance

Signal to ground	512 pf (nominal)
High voltage to ground	917 pf (nominal)
Signal to high voltage	511 pf (nominal)

#### Maximum ratings

Inter-electrode voltage	1000 Volts
Temperature	200 Deg C
Burn-up life for 10% decrease in sensitivity	$3 * 10^{19}$ nvt

#### Typical operating characteristics

Thermal neutron sensitivity	$\sim 1.4 * 10^{-13}$ Amps/nv
Counting sensitivity	0.8 cps/nv
Gamma sensitivity	$\sim 8 * 10^{-11}$ Amps/R/hr (nominal)
Voltage range	800 to 1300 Volts
Saturation 1% at 800 volts	$2 * 10^{10}$ nv

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