

# Reactor Instrumentation

for the new era of nuclear power



# Pioneering nuclear energy

Reuter-Stokes has been a pioneer in the development of nuclear power since its infancy. Reuter-Stokes was founded in 1956 and was later acquired by GE in 1984. Over the last few years, Reuter-Stokes along with several other GE sensor businesses transitioned from the GE Oil & Gas division to a division of Baker-Hughes.

Now, more than ever, nuclear energy is needed to supply the world with reliable, low emissions power. As demand grows, so do concerns about safety and security. That's where Reuter-Stokes comes in. From neutron monitors to traversing in-core probes, mechanical drive equipment and environmental radiation monitors, Reuter-Stokes provides the nuclear instrumentation you need to operate your reactor safely and reliably. And, as nuclear plants apply for life extensions and power uprates, Reuter-Stokes is also your partner for advanced controls, condition monitoring solutions and comprehensive service agreements.

No matter what your needs in nuclear power generation, we can help. Our local power range monitors (LPRMs), moveable in-core detectors (MIC), in-core and ex-core sensors and accompanying electronics provide quality data, enabling analysis that can result in fewer outages due to equipment failure and the prevention and avoidance of incidents. We are your single source provider for nuclear energy solutions for the 21st century.

Reuter-Stokes has a comprehensive suite of hardware, software and services to keep your reactor operating safely and trouble-free for its entire lifecycle.

- Boiling Water Reactor (BWR)
- Advanced BWR (ABWR)
- Economic Simplified BWR (ESBWR)
- Pressurized Water Reactor (PWR)
- Pressurized Heavy Water Reactor (PHWR)
- Research Reactor

## Nuclear instrumentation – the heart of the reactor

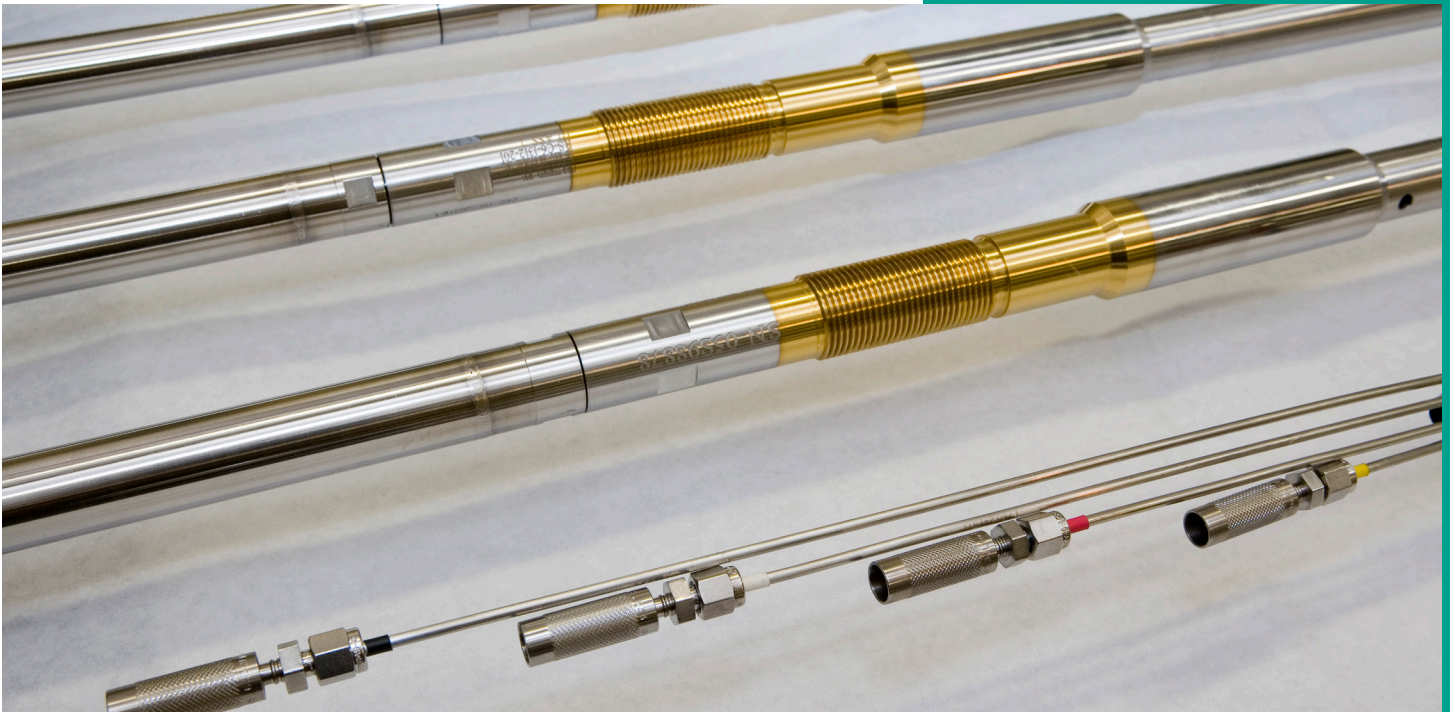
Nuclear instrumentation is integral to the functioning of the nuclear power plant. Without monitoring equipment, operators would not have a feedback loop to ensure that the reactor is operating safely and within specification limits. Nuclear instrumentation enables control room technicians to identify the status of the nuclear reactor power output, as well as alerting the control room immediately if the reactor operates outside of normal conditions. When plant availability is crucial, there is no room for downtime.

For such an essential role, you need reliable instrumentation and equipment. With the majority of our BWR detectors lasting longer than the industry expectation for detector lifespan, you can trust Reuter-Stokes to provide the protection you need, round-the-clock. But, as important as LPRMs and traversing in-core probes (TIPs) are to your plant, the less time you need to spend thinking about them, the better.

From dependable nuclear detectors and inventory management, to comprehensive service agreements, we can help keep your plant running without incident. We were the first to develop this technology, and we're still the best to provide you the peace-of-mind that comes with nuclear instrumentation by Reuter-Stokes.

*Reuter-Stokes' end-of-life analysis ended up saving us two LPRMs. Based on Reuter-Stokes' analysis of our instruments' end-of-life calculations, we didn't need to replace the LPRMs as we had originally thought. This is the first time in 30 years that we were able to start up our unit with all of our detectors in service.*

*— Major U.S. Nuclear Plant Operator*

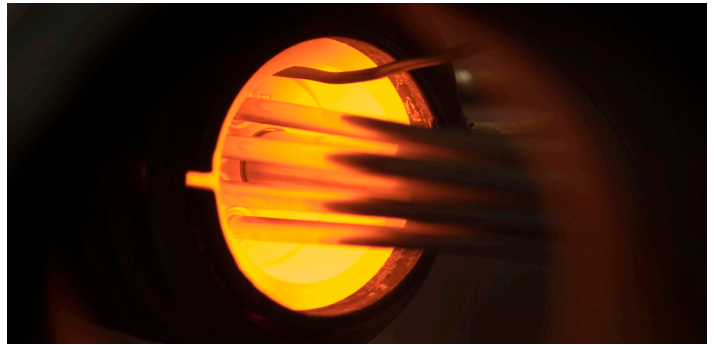


# The best technology to keep you positioned for safe and profitable operation

From research and development of the next technology game-changer to improving our existing hardware components and connections, we are committed to innovation. We have deep domain knowledge of your plant, enabling us to provide better, more detailed support. For more than 50 years, Reuter Stokes, has been designing advanced applications and changing the way energy is produced worldwide. And we continue to invest in technologies to improve the operation of nuclear plants around the globe.

Our nuclear instrumentation also has deep roots. Beginning with the first Reuter Stokes helium-3 neutron detector in 1956 that led to the development of LPRMs, we have been committed to excellence in nuclear instrumentation ever since. Building on our vast success providing sensors and monitoring equipment to BWR customers, we introduced our Moveable In-Core (MIC) detector in 1968 to be used by PWR utilities. Able to map the thermal neutron flux in the water gap between adjacent fuel bundles, our MIC detector has been installed in power plants worldwide. Combining the electronics of reactor controls, we provide a customized, comprehensive solution for all of your BWR and PWR nuclear instrumentation and control needs.





## It's our people that make the difference

Buying nuclear instrumentation from Reuter-Stokes means more than getting the industry's leading technology. With every piece of hardware, you are gaining an engineering and services partner to help develop the right solution for your plant. We provide the utmost in nuclear physics and engineering, manufacturing, technology and testing capabilities. With thousands of detectors (in the field)-to-date, we are the world's only global supplier of nuclear instrumentation. Our experienced scientists, engineers and highly skilled workforce are committed to the highly specialized processes used to manufacture nuclear instrumentation, including ceramic-to-metal brazing, uranium plating, autogenous orbital welding, instrument cable design and processing and electrical connector assembly.

## Designed and built for quality

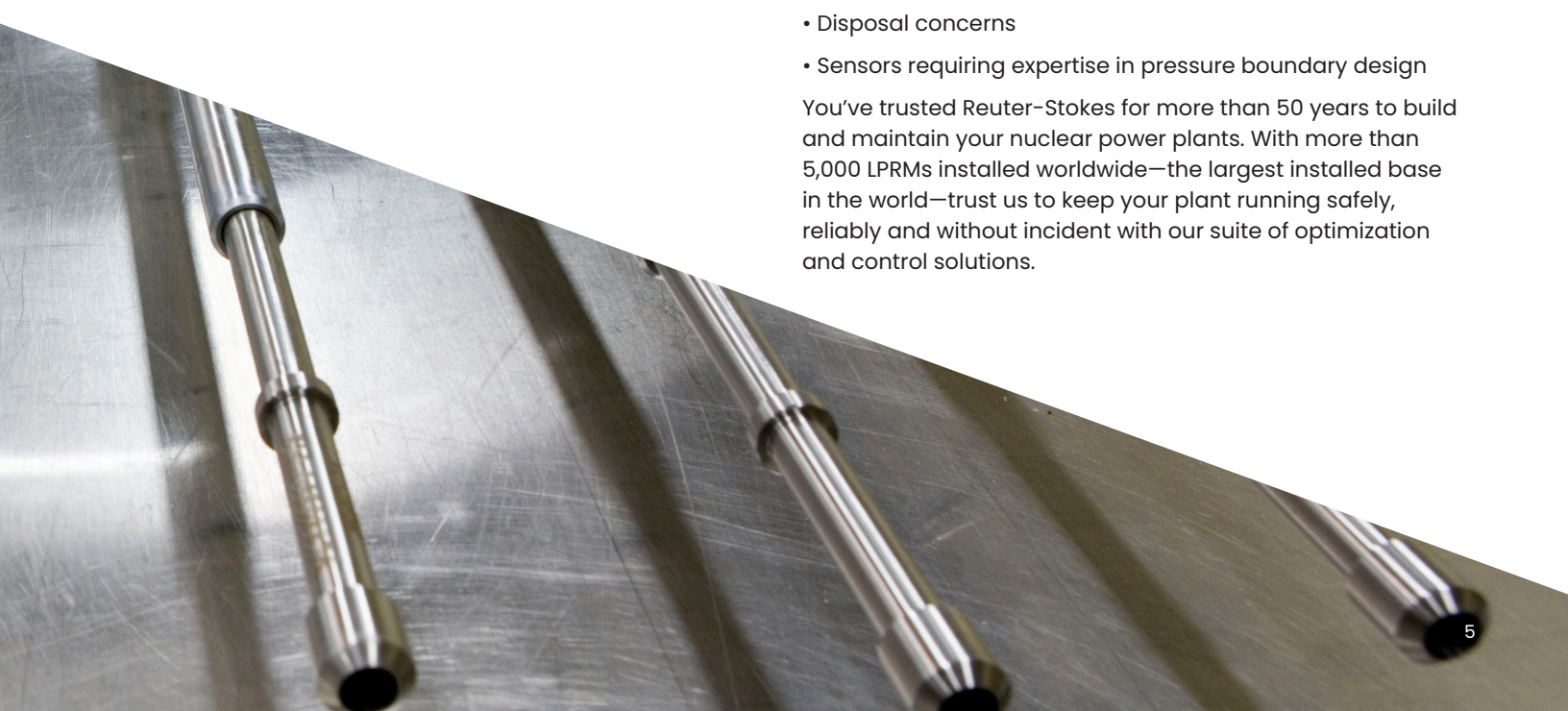
Beginning with our use of Six Sigma® design and manufacturing methodologies, we make product quality and performance our priority in every step of the process. We incorporate rigorous and extensive testing at all stages of the design, production and pre-installation, resulting in ex-core and in-core hardware that are designed to work reliably.

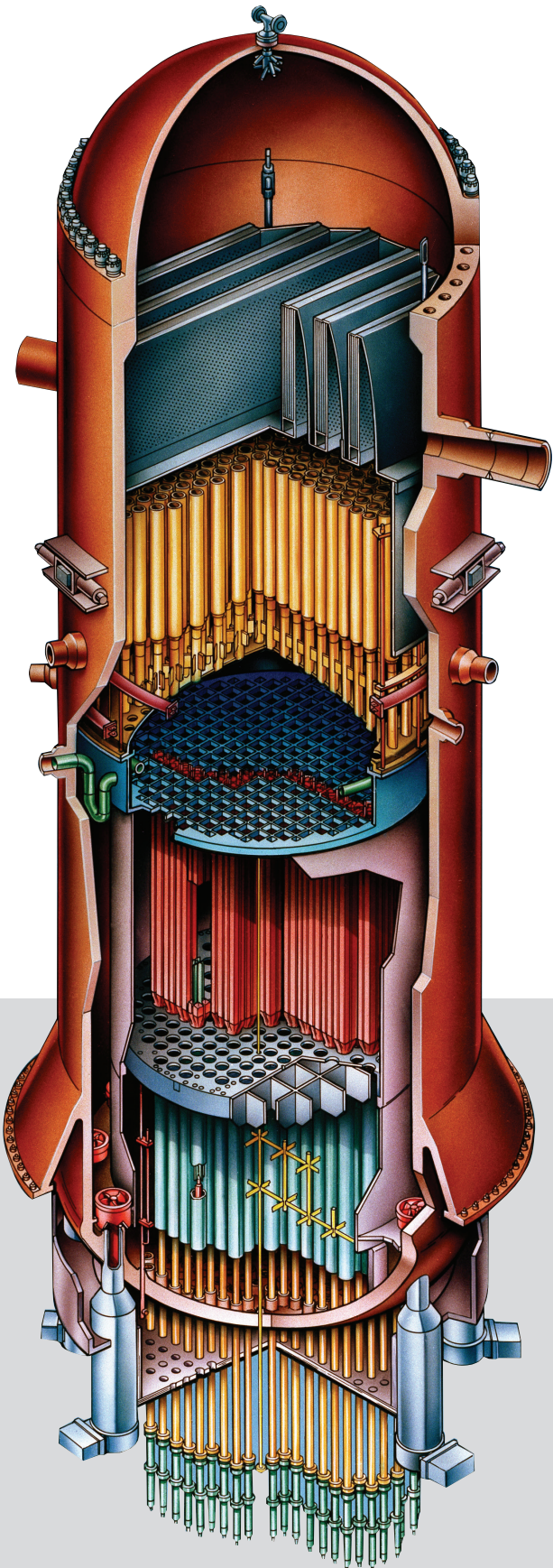
We perform testing at each major milestone, ranging from materials screening, in-process testing and final evaluation, both onsite and in research reactors around the world. This comprehensive testing methodology contributes to detectors that perform accurately and reliably, improving reactor availability as well as reducing maintenance costs. And with one of the best warranty provisions in the industry, we stand behind our products.

Reuter Stokes' technical depth and global presence uniquely qualifies us to respond to special customer needs. Whether there is an immediate, unforeseen outage need, or a request for a custom design, Reuter-Stokes can deliver quality products and services, on-time. Examples of custom monitoring instrumentation include:

- Installation site constraints
- Special material requirements
- Disposal concerns
- Sensors requiring expertise in pressure boundary design

You've trusted Reuter-Stokes for more than 50 years to build and maintain your nuclear power plants. With more than 5,000 LPRMs installed worldwide—the largest installed base in the world—trust us to keep your plant running safely, reliably and without incident with our suite of optimization and control solutions.





## BWR

### Fission Chambers

#### In-Core Fission Chambers

- Local Power Range Monitors
- Source Range Monitors
- Intermediate Range Neutron Monitors
- Wide Range Neutron Monitors
- Neutron Traversing In-Core Probes

### Ion Chambers

- Gamma Traversing In-Core Probes
- Insulated Detectors
- Environmental Radiation Monitors

### Movable In-Core Neutron Detectors

- Neutron Traversing In-Core Probes
- Source Range Monitors
- Intermediate Range Neutron Monitors

### Associated Hardware

- Cables
- Connectors
- Mechanical Drive Equipment
- Disposal Equipment

### Qualifications

- Nuclear Safety-Related
- IEEE Class 1E Qualified
- ASME NPT Stamp

# PWR/PHWR

## Fission Chambers

### Ex-Core Fission Chambers

- Power Range Detectors
- Source Range Monitors
- Intermediate Range Neutron Monitors
- Wide Range Neutron Monitors
- Movable In-Core Detectors

## Ion Chambers

- Boron-10 Lined Ion Chambers
- Insulated Detectors
- Environmental Radiation Monitors

## Movable In-Core Neutron Detectors

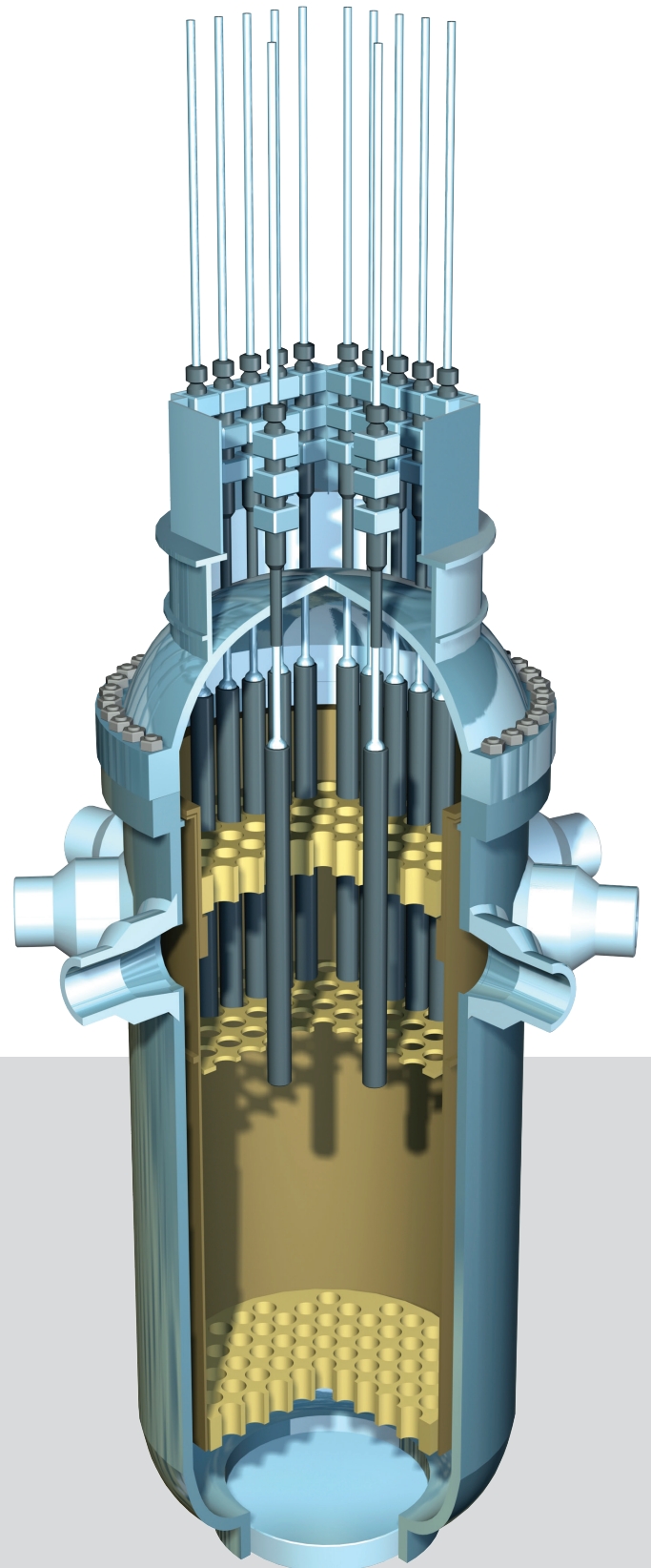
- Movable In-Core Detectors

## Associated Hardware

- Cables
- Connectors
- Mechanical Drive Equipment
- Disposal Equipment

## Qualifications

- Nuclear Safety-Related
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# Supporting services for nuclear instrumentation

At Reuter-Stokes, we realize the importance of reliability and availability. Every minute lost without producing power means lost revenue. That's why reducing non-productive time is the primary focus of our services group. Whether it is reducing your outage duration through pre-outage planning and on-site outage support, or promptly troubleshooting your nuclear instrumentation in real-time to keep your reactor running, the goal of our services group is to improve the reliability and availability of your nuclear instrumentation.

We also realize that reliability and availability represent only one half of the equation for profitable growth; operations and maintenance cost is also an important part of plant operations. When offered within the context of a long-term agreement, Reuter-Stokes' services offering also provides utilities with the benefit of predictable cash flow, a key element in your ongoing cost-control efforts.

Last, but not least, we understand the value you place on knowledge and expertise. As an original equipment manufacturer of nuclear reactors, instrumentation and control systems, Reuter-Stokes is uniquely qualified to offer expert advice to optimize your system performance. Our highly experienced services staff stands ready, not only to tackle the challenges you face today, but also to train and collaborate with your personnel to improve your productivity, enhance your knowledge base and to help you prepare to face tomorrow's challenges.

- Monitoring and diagnostics
- End-of-lifetime calculations
- Trouble-shooting
- System engineering – upgrade or reconfigure
- Engineering services
- Installation
- Post-installation testing
- Long-term service agreements
- Inventory management
- Training
  - Onsite: customized for your reactor
  - Classroom: helping ease the transition of personnel turnover
  - Fully equipped BWR test center
  - Hands on: functional operation and maintenance
  - Nuclear Instrumentation: testing and diagnostics





# The comprehensive nuclear solution

Reuter-Stokes pioneered nuclear power with our invention of the boiling water reactor years ago, but our expertise extends beyond just BWR instrumentation. As the nuclear landscape has grown, so has our portfolio of solutions. Reuter-Stokes can provide the right nuclear instrumentation, condition monitoring and control solutions to help your plant succeed in the new era of nuclear.

