Watlow has demonstrated a true commitment to the nuclear industry through decades of building key relationships and developing world-class products and services. To maintain this commitment, Watlow has established certifications and programs to ensure the quality of our products.

Nuclear Quality Program:
- In accordance with, and audited to, NQA-1 and VGBPGO Agenda G
- ASME Boiler and Pressure Vessel Code, Section III, VIII and IX accreditations
- Compliant to all U.S. Department of Defense Quality Standards

Watlow provides comprehensive documentation, testing, knowledge and historical record preservation:
- Archived design documentation
- Archived manufacturing processes and procedures
- Experienced team members at the engineering, quality and manufacturing level
- Test records and documentation
- Life testing

Watlow has grown in product capability, market experience and global reach. We hold more than 980 patents and have over 2,200 team members working in 12 manufacturing facilities and three technology centers in the United States, Mexico, Europe and Asia. We also have sales offices in 45 countries and a global distributor network. We are where you are to help design, support and provide expert service.

Watlow has been a trusted and reliable partner for the nuclear industry through decades of building key relationships and developing world-class products and services. To maintain this commitment, Watlow has established certifications and programs to ensure the quality of our products.

Nuclear Quality Program:
- In accordance with, and audited to, NQA-1 and VGBPGO Agenda G
- ASME Boiler and Pressure Vessel Code, Section III, VIII and IX accreditations
- Compliant to all U.S. Department of Defense Quality Standards

Watlow provides comprehensive documentation, testing, knowledge and historical record preservation:
- Archived design documentation
- Archived manufacturing processes and procedures
- Experienced team members at the engineering, quality and manufacturing level
- Test records and documentation
- Life testing

Watlow has grown in product capability, market experience and global reach. We hold more than 980 patents and have over 2,200 team members working in 12 manufacturing facilities and three technology centers in the United States, Mexico, Europe and Asia. We also have sales offices in 45 countries and a global distributor network. We are where you are to help design, support and provide expert service.

Watlow has been a trusted and reliable partner for the nuclear industry through decades of building key relationships and developing world-class products and services. To maintain this commitment, Watlow has established certifications and programs to ensure the quality of our products.

Nuclear Quality Program:
- In accordance with, and audited to, NQA-1 and VGBPGO Agenda G
- ASME Boiler and Pressure Vessel Code, Section III, VIII and IX accreditations
- Compliant to all U.S. Department of Defense Quality Standards

Watlow provides comprehensive documentation, testing, knowledge and historical record preservation:
- Archived design documentation
- Archived manufacturing processes and procedures
- Experienced team members at the engineering, quality and manufacturing level
- Test records and documentation
- Life testing

Watlow has grown in product capability, market experience and global reach. We hold more than 980 patents and have over 2,200 team members working in 12 manufacturing facilities and three technology centers in the United States, Mexico, Europe and Asia. We also have sales offices in 45 countries and a global distributor network. We are where you are to help design, support and provide expert service.

Watlow has been a trusted and reliable partner for the nuclear industry through decades of building key relationships and developing world-class products and services. To maintain this commitment, Watlow has established certifications and programs to ensure the quality of our products.

Nuclear Quality Program:
- In accordance with, and audited to, NQA-1 and VGBPGO Agenda G
- ASME Boiler and Pressure Vessel Code, Section III, VIII and IX accreditations
- Compliant to all U.S. Department of Defense Quality Standards

Watlow provides comprehensive documentation, testing, knowledge and historical record preservation:
- Archived design documentation
- Archived manufacturing processes and procedures
- Experienced team members at the engineering, quality and manufacturing level
- Test records and documentation
- Life testing

Watlow has grown in product capability, market experience and global reach. We hold more than 980 patents and have over 2,200 team members working in 12 manufacturing facilities and three technology centers in the United States, Mexico, Europe and Asia. We also have sales offices in 45 countries and a global distributor network. We are where you are to help design, support and provide expert service.

Watlow has been a trusted and reliable partner for the nuclear industry through decades of building key relationships and developing world-class products and services. To maintain this commitment, Watlow has established certifications and programs to ensure the quality of our products.

Nuclear Quality Program:
- In accordance with, and audited to, NQA-1 and VGBPGO Agenda G
- ASME Boiler and Pressure Vessel Code, Section III, VIII and IX accreditations
- Compliant to all U.S. Department of Defense Quality Standards

Watlow provides comprehensive documentation, testing, knowledge and historical record preservation:
- Archived design documentation
- Archived manufacturing processes and procedures
- Experienced team members at the engineering, quality and manufacturing level
- Test records and documentation
- Life testing

Watlow has grown in product capability, market experience and global reach. We hold more than 980 patents and have over 2,200 team members working in 12 manufacturing facilities and three technology centers in the United States, Mexico, Europe and Asia. We also have sales offices in 45 countries and a global distributor network. We are where you are to help design, support and provide expert service.

Watlow has been a trusted and reliable partner for the nuclear industry through decades of building key relationships and developing world-class products and services. To maintain this commitment, Watlow has established certifications and programs to ensure the quality of our products.

Nuclear Quality Program:
- In accordance with, and audited to, NQA-1 and VGBPGO Agenda G
- ASME Boiler and Pressure Vessel Code, Section III, VIII and IX accreditations
- Compliant to all U.S. Department of Defense Quality Standards

Watlow provides comprehensive documentation, testing, knowledge and historical record preservation:
- Archived design documentation
- Archived manufacturing processes and procedures
- Experienced team members at the engineering, quality and manufacturing level
- Test records and documentation
- Life testing

Watlow has grown in product capability, market experience and global reach. We hold more than 980 patents and have over 2,200 team members working in 12 manufacturing facilities and three technology centers in the United States, Mexico, Europe and Asia. We also have sales offices in 45 countries and a global distributor network. We are where you are to help design, support and provide expert service.

Watlow has been a trusted and reliable partner for the nuclear industry through decades of building key relationships and developing world-class products and services. To maintain this commitment, Watlow has established certifications and programs to ensure the quality of our products.

Nuclear Quality Program:
- In accordance with, and audited to, NQA-1 and VGBPGO Agenda G
- ASME Boiler and Pressure Vessel Code, Section III, VIII and IX accreditations
- Compliant to all U.S. Department of Defense Quality Standards

Watlow provides comprehensive documentation, testing, knowledge and historical record preservation:
- Archived design documentation
- Archived manufacturing processes and procedures
- Experienced team members at the engineering, quality and manufacturing level
- Test records and documentation
- Life testing

Watlow has grown in product capability, market experience and global reach. We hold more than 980 patents and have over 2,200 team members working in 12 manufacturing facilities and three technology centers in the United States, Mexico, Europe and Asia. We also have sales offices in 45 countries and a global distributor network. We are where you are to help design, support and provide expert service.

Watlow has been a trusted and reliable partner for the nuclear industry through decades of building key relationships and developing world-class products and services. To maintain this commitment, Watlow has established certifications and programs to ensure the quality of our products.

Nuclear Quality Program:
- In accordance with, and audited to, NQA-1 and VGBPGO Agenda G
- ASME Boiler and Pressure Vessel Code, Section III, VIII and IX accreditations
- Compliant to all U.S. Department of Defense Quality Standards

Watlow provides comprehensive documentation, testing, knowledge and historical record preservation:
- Archived design documentation
- Archived manufacturing processes and procedures
- Experienced team members at the engineering, quality and manufacturing level
- Test records and documentation
- Life testing

Watlow has grown in product capability, market experience and global reach. We hold more than 980 patents and have over 2,200 team members working in 12 manufacturing facilities and three technology centers in the United States, Mexico, Europe and Asia. We also have sales offices in 45 countries and a global distributor network. We are where you are to help design, support and provide expert service.
A Tradition of Excellence
Watlow provides best-in-class engineering expertise and leading thermal products that enable customers to thrive.

We are known for our innovative, performance-driven thermal solutions including electric heaters, temperature sensors, temperature controllers and power controllers— all of the components in a complete thermal system.

A Deep Commitment to the Nuclear Industry
In 1967, Watlow began designing and manufacturing high-performance heaters for commercial reactors in nuclear power plants. We have continuously served the market, providing customers with the high quality and extremely reliable products that make us the preferred supplier of thermal components.

Watlow offers our nuclear customers many benefits including:

- Over 40 years uninterrupted service to the industry
- Dedicated Lean manufacturing cells, together with unparalleled support and program management, ensuring the on-time delivery of all your thermal needs
- Investment in accelerated life testing to accompany our historical data
- Investment in R&D projects directly tied to industry needs

Watlow offers nuclear customers many benefits including:

- SCR power controllers
- Heating element controls
- Instrument air
- Circulation heaters
- Immersion heaters
- Startup heater skid assemblies
- Freeze protection
- Storage systems
- Process thermocouples and RTDs

Thermal System Controls
- SOR power controllers
- (Phase angle and zero cross fired)
- Heating element controls
- Instrument air

Nuclear Island - RCS and Peripheral Systems
- Pressurizer heaters
- Core exit thermocouples
- Hot and cold leg RTDs and thermocouples
- Boro/boron heading
- Hydrogen recombiner heading
- Fuel rod simulators

Diesel Generators and Balance of Plant

Advanced Thermal Technologies
for the Nuclear Industry

for the Nuclear Industry

Thermal Applications

Nuclear Island- RCS
and Peripheral Systems

- Pressurizer heaters
- Core exit thermocouples
- Hot and cold leg RTDs and thermocouples
- Boro/boron heading
- Hydrogen recombiner heading
- Fuel rod simulators

Diesel Generators and Balance of Plant

- Circulation heaters
- Immersion heaters
- Startup heater skid assemblies
- Freeze protection
- Storage systems
- Process thermocouples and RTDs

Thermal System Controls
- SOR power controllers
- (Phase angle and zero cross fired)
- Heating element controls
- Instrument air
Watlow provides best-in-class engineering expertise and leading thermal products that enable customers to thrive. We are known for our innovative, performance-driven thermal solutions including electric heaters, temperature sensors, temperature controllers and power controllers - all of the components in a complete thermal system.

A Deep Commitment to the Nuclear Industry

In 1967, Watlow began designing and manufacturing high-performance heaters for commercial reactors in nuclear power plants. We have continuously served the market, providing customers with the high quality and extremely reliable products that make us the preferred supplier of thermal components.

Watlow offers our nuclear customers many benefits including:

- Over 40 years uninterrupted service to the industry
- Dedicated Lean manufacturing cells, together with unparalleled support and program management, ensuring the on-time delivery of all your thermal needs
- Investment in accelerated life testing to accompany our historical data
- Investment in R&D projects directly tied to industry needs

Watlow offers our nuclear customers many benefits including:

- Over 40 years uninterrupted service to the industry
- Dedicated Lean manufacturing cells, together with unparalleled support and program management, ensuring the on-time delivery of all your thermal needs
- Investment in accelerated life testing to accompany our historical data
- Investment in R&D projects directly tied to industry needs

Nuclear Island - RCS and Peripheral Systems

- Pressurizer Heaters
- Core exit thermocouples
- Hot and cold leg RTDs and thermocouples
- Boron/boron heating
- Hydrogen recombiner heating
- Fuel rod simulations
- SCR power controllers (Phase angle and zero cross fired)
- Heating element controls
- Instrument air
- Circulation heaters
- Immersion Heaters
- Startup heater skid assemblies
- Freeze protection
- Storage systems
- Process thermocouples and RTDs

Advanced Thermal Technologies

Nuclear Island - RCS

Thermal System Controls

- SKI power controllers
- (Phase angle and zero cross fired)
- Heating element controls
- Instrument air

Diesel Generators and Balance of Plant

- Circulation heaters
- Immersion Heaters
- Startup heater skid assemblies
- Freeze protection
- Storage systems
- Process thermocouples and RTDs
Watlow has demonstrated a true commitment to the nuclear industry through decades of building key relationships and developing world-class products and services. To maintain this commitment, Watlow has established certifications and programs to ensure the quality of our products.

Nuclear Quality Program:
- In accordance with, and audited to, NQA-1 and VCMDSI Agenda B
- ASME Boiler and Pressure Vessel Code, Section VIII and IX accreditation
- Compliant to all U.S. Department of Defense Quality Standards

Watlow provides comprehensive documentation, testing, knowledge and historical record preservation:
- Archived design documentation (integral to products)
- Archived manufacturing processes and procedures
- Experienced team members at the engineering, quality and manufacturing level
- Test records and documentation
- Life testing

Watlow has grown in product capability, market experience and global reach. We hold more than 980 patents and have over 2,200 team members working in 12 manufacturing facilities and three technology centers in the United States, Mexico, Europe and Asia. We also have sales offices in 45 countries and a global distributor network. We are where you are to help design, support and provide expert service.

Visit Watlow’s website for a complete listing of capabilities and applications.

www.watlow.com

Watlow... A Trusted and Reliable Partner

Watlow Products and Technical Support
Delivered Worldwide

Watlow has grown in product capability, market experience and global reach. We hold more than 980 patents and have over 2,200 team members working in 12 manufacturing facilities and three technology centers in the United States, Mexico, Europe and Asia. We also have sales offices in 45 countries and a global distributor network. We are where you are to help design, support and provide expert service.

Visit Watlow’s website for a complete listing of capabilities and applications.

www.watlow.com

Watlow has demonstrated a true commitment to the nuclear industry through decades of building key relationships and developing world-class products and services. To maintain this commitment, Watlow has established certifications and programs to ensure the quality of our products.

Nuclear Quality Program:
- In accordance with, and audited to, NQA-1 and VCMDSI Agenda B
- ASME Boiler and Pressure Vessel Code, Section VIII and IX accreditation
- Compliant to all U.S. Department of Defense Quality Standards

Watlow provides comprehensive documentation, testing, knowledge and historical record preservation:
- Archived design documentation (integral to products)
- Archived manufacturing processes and procedures
- Experienced team members at the engineering, quality and manufacturing level
- Test records and documentation
- Life testing

Watlow has grown in product capability, market experience and global reach. We hold more than 980 patents and have over 2,200 team members working in 12 manufacturing facilities and three technology centers in the United States, Mexico, Europe and Asia. We also have sales offices in 45 countries and a global distributor network. We are where you are to help design, support and provide expert service.

Visit Watlow’s website for a complete listing of capabilities and applications.

www.watlow.com
Watlow has grown in product capability, market experience and global reach. We hold more than 980 patents and have over 2,200 team members working in 12 manufacturing facilities and three technology centers in the United States, Mexico, Europe and Asia. We also have sales offices in 45 countries and a global distributor network. We are where you are to help design, support and provide expert service.

Watlow provides comprehensive documentation, testing, knowledge and historical record preservation:

- Archived design documentation (integral documentation)
- Archived manufacturing processes and procedures
- Experienced team members at the engineering, quality and manufacturing level
- Test records and documentation
- Life testing

Watlow has demonstrated a true commitment to the nuclear industry through decades of building key relationships and developing world-class products and services. To maintain this commitment, Watlow has established certifications and programs to ensure the quality of our products.

**Nuclear Quality Program:**

- In accordance with, and audited to, NQA-1 and VSPRSO Agenda II
- ASME Boiler and Pressure Vessel Code, Section III, VIII and IX accreditations
- Compliant to all U.S. Department of Defense Quality Standards

Watlow has grown in product capability, market experience and global reach. We hold more than 980 patents and have over 2,200 team members working in 12 manufacturing facilities and three technology centers in the United States, Mexico, Europe and Asia. We also have sales offices in 45 countries and a global distributor network. We are where you are to help design, support and provide expert service.

Watlow has demonstrated a true commitment to the nuclear industry through decades of building key relationships and developing world-class products and services. To maintain this commitment, Watlow has established certifications and programs to ensure the quality of our products.

**Nuclear Quality Program:**

- In accordance with, and audited to, NQA-1 and VSPRSO Agenda II
- ASME Boiler and Pressure Vessel Code, Section III, VIII and IX accreditations
- Compliant to all U.S. Department of Defense Quality Standards

Watlow provides comprehensive documentation, testing, knowledge and historical record preservation:

- Archived design documentation (integral documentation)
- Archived manufacturing processes and procedures
- Experienced team members at the engineering, quality and manufacturing level
- Test records and documentation
- Life testing

Watlow has demonstrated a true commitment to the nuclear industry through decades of building key relationships and developing world-class products and services. To maintain this commitment, Watlow has established certifications and programs to ensure the quality of our products.
Watlow has demonstrated a true commitment to the nuclear industry through decades of building key relationships and developing world-class products and services. To maintain this commitment, Watlow has established certifications and programs to ensure the quality of our products.

**Nuclear Quality Program:**
- In accordance with, and audited to, NQA-1 and VGB/ISO Agenda D
- ASME Boiler and Pressure Vessel Code, Section III, VIII and IX accreditations
- Compliant to all U.S. Department of Defense Quality Standards
- Archived design documentation (original documents)
- Archived manufacturing processes and procedures
- Experienced team members at the engineering, quality and manufacturing level
- Test records and documentation
- Life testing

Watlow provides comprehensive documentation, testing, knowledge and historical record preservation:

- Archived design documentation (original documents)
- Archived manufacturing processes and procedures
- Experienced team members at the engineering, quality and manufacturing level
- Test records and documentation
- Life testing

Watlow has grown in product capability, market experience and global reach. We hold more than 980 patents and have over 2,200 team members working in 12 manufacturing facilities and three technology centers in the United States, Mexico, Europe and Asia. We also have sales offices in 45 countries and a global distributor network. We are where you are to help design, support and provide expert service.

Visit Watlow's website for a complete listing of capabilities and applications.

www.watlow.com
Watlow® has continuously served the commercial and government nuclear industries with pressurizer heaters since 1967. Watlow designs and manufactures heaters that meet our customers’ most challenging design requirements while adhering to the highest quality standards.

**Performance Capabilities:**
- Operating temperatures: 550-650°F (288-343°C)
- Operating pressure: 1500-2200 psi (10.3-15.2 MPa)
- Power: 18-55kW
- Power supply: 360-480V, single or 3-phase

**Features and Benefits:**
- Parallel heater design operates each heater core independently
  - Maximizes heater life resulting in fewer replacement heaters
- Core heater technology with magnesium oxide insulation swaged inside stainless steel sheath
  - Optimizes the thermal flux by placing element wire closer to external heating surface
  - Results in high dielectric strength
- Nickel-chromium resistance wire
  - Ensures even and efficient distribution of heat to the sheath
- ASME Section III, NPT stamped heater
  - Reduces lead time
  - Decreases the supply chain
- Design allows for a discrete break between heated and un-heated zones
- High temperature/high pressure seal forms secondary level of protection
  - Proven to withstand over 3750 psi (>25.86 MPa)
- Plant mean-time between failures (MTBF) is >30 years
- Built in a state-of-the-art lean manufacturing cell with a dedicated team

**Construction Attributes:**

Wound core and seal technology
Service from Watlow® is unparalleled in the industry. Recognizing that there are other engineering companies, thermal component manufacturers and system integrators, our position is unique. While other companies specialize in one area, our skills encompass all aspects of development and technical service. With intimate knowledge of product performance and manufacturing capability, we are uniquely positioned to provide an independent assessment of your project, measuring our success by yours.

Watlow provides thermal solutions for many nuclear applications including...

**Boric Acid Bath Tanks:**

**Immersion Heaters**
Watlow’s heaters keep the boric acid solution from freezing. Boric acid is used to reduce the probability of thermal fission by absorbing some thermal neutrons.

**Emergency Diesel Generators:**

**Lube Oil Heaters**
Watlow's lube oil heaters protect the engine during start up. The thermostatically-controlled immersion heater is placed either in the lube oil sump or in a bypass tank. The heater maintains the lubricating oil at or near the generator’s normal operating temperature.

**Water Jacket Heaters**
To protect the engine during start up the thermostatically-controlled immersion heater is mounted in the standpipe or separate heating tank. When the engine is in standby mode, the heater is energized. The heated coolant flows through the engine warming the cylinders, cylinder heads and other water-cooled engine components to minimize the high stress and increased wear when the engine is cold.

Watlow offers...

**Engineering Services:**
- Field service commissioning support
- Material selection
- Mechanical calculations
- Thermal calculations
- Corrosion engineering
- Design model services

**Project Management Services:**
- Scheduling
- Milestones
- Critical paths
- Updating

**Documentation Services:**
- Material test reports
- Mechanical calculations
- Thermal calculations
- Factory acceptance test
- As-built drawing