WATLOW

Process Heating and Control

Your Source for Proven Electric Heating Solutions
An Industry Leader

Watlow is the world’s largest electric heating and control company with over 2,000 employees worldwide. We operate 10 manufacturing facilities and over 40 technical support centers in Europe, Asia and North America. We have hundreds of factory-trained sales engineers and distributors located throughout the world.

In this age of corporate buyouts and subsequent disappearance of after-sales support, it is reassuring to know Watlow is a strong, independent manufacturer with third generation family management. Watlow is fiercely committed to building on our family traditions of innovation, engineering, quality and stability.

Since 1922, our passion has been designing and manufacturing electric process heating and control solutions. We have over 80 years of experience in designing and manufacturing:

- Electric process heaters
  - Immersion and circulation heaters
  - Duct heaters
  - Over the side tank heaters
  - Specialty heaters
- Temperature sensors and assemblies
- Temperature/process controllers
- Power controllers (SSRs and SCRs)
- Control panels
- Process heating systems

Experience

Thermal Processing/Heat Treat

From primary to secondary metals processing and heat treating, Watlow has experience in providing electric heat and control. Applications include:

- Industrial ovens
- Annealing and tempering furnaces
- Brazing furnaces
- Heating/reheating furnaces
- Diffusion furnaces
- Quenching baths
- Boilers
- Autoclaves
- Heat transfer systems

Watlow’s process heater and controls facilities alone account for over 260,000 square feet (24,000 sq. m) of office and production area.
**A Wide Range of Process Expertise**

Our expertise and leadership have been proven in many industries. This vast experience enables us to define and produce solutions for your demanding applications. We supply products to many industries including chemicals, industrial gas, pharmaceuticals, petrochemicals and refining, oil and gas, power generation, pulp and paper, wastewater and other industries.

We excel at engineering and designing thermal process solutions for your specific application needs. We pride ourselves on the durability and long service life of our products.

Watlow is unique in that we are not limited to using just tubular heater elements to manufacture process heaters and system solutions. We also manufacture process heaters and systems using these types of heating technologies:

- Ceramic fiber heater elements up to 1200°C (2200°F)
- Multicell heaters up to 1100°C (2000°F)
- Radiant heaters up to 760°C (1400°F)

Work with a company you can trust. Work with a partner that has your best interests at the forefront of their concern. **Work with Watlow.**

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**Thermal Processing Case History - Thermal System Assembly for Vacuum Oven**

Vacuum ovens are used to heat treat complex, high-performance metal parts. This thermal system consists of electropolished FIREBAR® heater elements, high-performance thermocouples and an eight zone temperature/power control panel scheme.

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**Table of Contents**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering-based Philosophy</td>
<td>2</td>
</tr>
<tr>
<td>Process Heating and Control Systems</td>
<td>4</td>
</tr>
<tr>
<td>Electric Process Heaters</td>
<td>6</td>
</tr>
<tr>
<td>Control Panels and Process Controllers</td>
<td>10</td>
</tr>
<tr>
<td>Power Controllers and Temperature Sensors</td>
<td>12</td>
</tr>
<tr>
<td>Worldwide Contacts</td>
<td>Back Cover</td>
</tr>
</tbody>
</table>
Engineering-Based Philosophy

Conservative Engineering

Watlow’s focus is on safety, high performance and high reliability. In fact, we were involved in the release of ASME Interpretations VIII, 1-95-128 and VIII, 1-98-95. These state that applying ANSI B16.5 pressure/temperature ratings to Section VIII code stamped flanged immersion heaters is not acceptable. Specific design calculations must be performed to ensure proper pressure vessel and main closure integrity.

Watlow’s process heater division has dozens of design, product and manufacturing engineers along with four dedicated quality control personnel focused on ensuring the highest quality, safest product possible. Watlow uses the latest in process systems and component design software for drafting and manufacturing of products. SolidWorks® and MicroStation®, as well as Advanced Pressure Vessel Design for ASME Section VIII, Div. 1. Watlow’s R&D center also assists in design optimization using tools such as:

- ANSYS®
- FEMLAB®
- Fluent™
- Simulink®
- MATLAB®
- Stateflow®
- StressCheck®
- xPC®

Computer analysis section of a 12 inch Class 300 lb, 80kW, 2000 lb/hr nitrogen gas heater with outlet temperature at 730°C (1350°F). Note how the baffles affect cross flow, velocity and temperature distributions.

Technical Conformance

Our facilities can build assemblies to fit the following standards and approvals:

- ASME
- ANSI
- API
- ASHRAE
- ASTM
- ATEX
- AWS
- CSA
- FM
- IEC
- JIC
- NEC
- NEMA
- NFPA
- PED
- SEMI.S2
- SSPC
- TEMA
- UL®
- US MIL STDS

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Fabrication Expertise

Watlow provides complete fabrication of non-code as well as ASME Section I and Section VIII code stamped heater bundles, circulation vessels and repair. We also comply with European PED requirements. Metal fabrication can be produced in carbon steel, 300 and 400 series stainless and nickel alloys, and other exotic materials such as Hastelloy®, titanium and Monel®.

Heavy lift cranes, hoists and oversize test areas allow for fabrication and testing of very large heaters. Multi-heater skid packages including interconnected control panels allow for quick job site connection of main power and process piping lines. Thermal insulation of vessels and piping connections in addition to blasting and painting can be provided.

Industrial Gas Generation Case History - Trim Heaters

Trim heaters are used in emergency situations when main power is lost to a gas plant. A 16kW, 460V-(ac), three-phase nitrogen heater in a 316 SS vessel is skid mounted with a control panel and instrumentation is shown.

Customer Reference List

Because of our electric heating and control applications expertise, we use our capabilities to cater not only process plants, engineering and construction firms, but also to process equipment OEMs and system integrators. Watlow has provided heaters, control panels and systems to many process industry leaders around the globe. Here is a sampling from A to Z.

- Air Products
- Ansaldo Energia
- BOC Gases
- BOHAI China Natl Offshore
- BP Exploration
- ChevronTexaco
- Chiyoda
- ConocoPhillips
- Daewoo Engineering
- Dow Chemical
- Eli Lilly
- ExxonMobil
- Fluor Daniel
- Foster Wheeler
- GE Power Systems
- Hanwha Chemical
- Howe-Baker
- Hyundai Petrochemical
- Jacobs Engineering
- Korea Gas Corporation (KGC)
- Korean Industrial Gas
- KCC
- Lawrence Livermore Labs
- LG – Caltex Corp.
- LG Engineering
- Mitsubishi Power Systems
- NASA
- PEMEX
- Petrobras
- POSCO
- Saudi Basic Indust. (SABIC)
- SK Engineering (SKEC)
- Samsung Fine Chemicals
- Siemens Power Corp.
- Sinopec International
- SsangYong Oil Refining
- Sverdrup
- Total Austral
- UOP
- Weyerhauser
- Yanbu Petrochem (YANPET)
- Zhenhai Petrochemical

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Process Heating and Control Systems

Expect More From A Leader

Watlow is staffed with a dedicated engineering group to provide the technical support required in designing electric process heaters, vessels, control panels, unit skidding and thermal systems. Our application engineers work hand in hand with our customer’s technical staff, ensuring that detailed system proposals provide a clear technical description of the product, as well as costing options. This close communication and attention to detail continues with detailed approval drawings for customer review and approval before production is started. Production schedules and in-plant production or final review visits by our customers are available based on each customer’s preference. Our systems undergo thorough functional testing before leaving our plant.

Complete technical installation and maintenance (I&M) manuals are provided to support setup of the system once it is shipped. These can be provided in English or translated to the local language of the engineers at the site location. On-site factory training or start-up assistance can also be provided when needed. Local Watlow sales engineers and distributors also provide follow up support.

- Hydrocarbon and hydrogen gas heating
- Hydrowax finishing
- Asphalt heating applications
- Steam superheaters
- Instrument air-drying systems
- Catalyst activation and regeneration
- Mole sieve regeneration heaters/systems
- Process gas (O₂, N₂, CO₂, Ar, etc.) heating
- Bayonet insert and suction heaters on tank farms

Refining and Petrochemical

Fractioning of crudes and chemical polymerization often times need Watlow electric heating systems in ancillary processes such as:

Hydrocarbon and hydrogen-rich gases are heated to 484º and 399ºC (900º and 750ºF) respectively, using dual 320kW, 14 inch Class 300, Alloy 800 flanged heater bundles in ASME Section VIII alloy vessels.

A fuel oil heating system is shown with five heater stages and an interconnected control panel.

This 2.5 MW air heating system consists of five circulation heaters and control panel.

Inconel® is a registered trademark of Special Metals Corporation.
Summary of Heater System Capabilities

Watlow’s reputation has been built on our core competencies: electric heating and control application expertise coupled with innovative products and solutions for our customers. From a systems perspective, we provide the following capabilities:

- Matched set process heater assembly and control panel system
- Multi-heater and multi-vessel “stacked” heater systems
- Heater, vessel (or ducting) and control panel interconnected and skid mounted
- Integration of process temperature sensors, switches, sight glasses, etc.
- Tubular, ceramic fiber, multicell and radiant heater technologies
- Design pressures to 4500 psi (300 bar) +
- Design temperatures from cryogenic to 900°C (1650°F) hot gas generators.
- Special packaging and crating for shipment anywhere in the world
- Complete I&M packages, drawings and nameplates
- On-site technical review, training, commissioning service available

Refining and Petrochemical Industry Case History - CCR Regeneration System

Catalysts initiate/accelerate chemical reactions and must be regenerated or “cleaned” to continue functioning at peak performance. This UOP CCR regeneration heating package for a plant in China consists of a 322kW, 28 inch ANSI Class 300 lb, alloy 800 regeneration heater, two triple stack heating systems for reduction gas heating, air heater and control panels.

Electric fuel gas start up heater systems typically contain an instrumented heater and a NFPA 496 Z purge control panel.
Electric Process Heaters

Immersion and Circulation Heaters

Immersion and circulation heaters are the bulk of our business. For end users and OEMs we have one of the largest stock and standard heater programs in the world. Our catalog highlights thousands of stock and standard products from 0.5kW screw plug immersion heaters for boilers to large 375kW, ANSI 14 inch Class 150 lb circulation heaters. Carbon steel heaters for heating oils, wax and lubricants are also manufactured, as well as stainless and alloy steels for heating acids, caustics, deionized water and other corrosive liquids and gases.

For custom engineered projects, our range of capabilities include:

- ASME Section I and Section VIII code stamps
- ASME Section IX weld procedure qualifications
- ASME “R” stamp for heater and vessel repairs
- NEMA 1, 4, 4X, 4/7, 7 and 12 terminal housings
- NEC/CEC Class 1, Div. 1 and Div. 2 Groups B, C and D conformance
- ATEX hazardous location conformance
- PED conformance through Category IV
- Canadian Registration Numbers (CRN)
- Heaters to 44 inch+ ANSI flanges
- Process connections up to Class 2500 lb flanges
- Vessel fabrication to 60 inch diameter and one inch specialty plate wall
- Heavy wall and/or seamless tubular heating elements
- Carbon, 300 and 400 series stainless steel fabrication
- Exotic metal alloys such as Monel® , Hastelloy®, titanium, etc.
- Heavy vessel saddle supports and lifting lugs
- Segmental baffles for improved crossflow
- Cleaning of wetted surfaces (passivation, etc.)
- Special finishing, painting and conformal coatings
- Integration of temperature sensors

Pharmaceutical and Cosmetics

Watlow has the heating and control answers for:
- Temperature and process control
- Boilers
- Fermenters
- Fluid bed dryers
- Hot oil heat transfer systems
- Hot water/glycol systems
- Process gas dehumidification
- Spheroidizers
- Spray dryers and granulators
This 1500 psi natural gas heater uses a NEMA 7 terminal enclosure and thermocouple connection heads.

Watlow’s 270kW, ASME Section VIII hydrocarbon fluid heater is shown with a vinyl ester coating.

These flanged immersion heaters employ stand off housings to keep the electrical termination area cool.

Pharmaceutical Case History - Heat Transfer System Heaters

Hot oil and glycol/water heat transfer systems are used to power chemical reaction vessels in the production of pharmaceuticals. This 75kW, 480V-(ac), three-phase hot oil circulation heating package has a skidded and interconnected heater, control panel and fittings for a compact heating solution.

This insulated 2.1 MW, 30 inch circulation air heater has a unique terminal connection scheme.

Testing and Certification

Ensuring and documenting the quality of materials and workmanship are an important part of our business. The testing and certification we can provide are:

- ASME calculations
- Brinnel hardness testing
- Charpy impact testing
- Die penetrant testing
- Earthquake calculations
- Helium leak testing
- Hydrostatic pressure testing
- Magnetic particle testing
- Material Test Reports (MTRs)
- Microscopic analysis
- PE stamp documents
- Positive Material Identification (PMI) testing
- Post-weld heat treatment
- Radiography
- Tensile testing
- Ultrasonic thickness testing

Quality assurance personnel witness a hydrostatic test.
Electric Process Heaters

Duct Heaters
Duct heaters are installed in plenums or ducts to heat forced air in industrial process equipment. Besides HVAC heating, they are often used for thermal processing such as furnaces, autoclaves, curing, drying and even batch baking systems. They are also used for gas turbine inlet air heating and exhaust gas heating in power plants to boost temperatures prior to SCR de-NOx emissions control units in power plants.

For quick solutions Watlow offers a wide range of assembly stock and standard sizes from 240V–(ac), 6kW units to 480V–(ac), 190kW heaters. Stock and standard heaters are shipped within three to 10 working days.

Watlow’s design and engineering group also regularly develops custom-engineered duct heaters for a variety of projects into megawatt ranges. The typical scope of supply encompasses:

- Designs to 650°C (1200°F) and above
- Design to 600V–(ac), three-phase and 2.5 MW+
- Standard and airtight terminal enclosure designs
- Insulated (under mounting flange) or uninsulated designs
- Vertical or horizontal mounting
- UL® file E52951 and CSA file 31388 recognition on -NEMA 1 designs
- Process and high-limit thermocouple sensors
- Multi-heater (tandem) duct heater sets
- Modular (field replaceable) heater element sections
- Assemblies including ductwork, frame and mounting flanges
- Complete I&M package, drawings, nameplates, etc.

Electric Power
Whether industrial or municipal power plants, coal or gas-fired systems, Watlow has the experience. Applications include:
- Fuel gas and fuel oil heating
- Lube oil heating
- Turbine inlet and exhaust flow heating
- Water storage tank heating
- Steam superheaters
- Penthouse (ESP) heaters and systems
- Catalyst dehumidification systems
- SCR de-NOx - ammonia vaporizers and controls as well as dilution air heating

This Watlow penthouse heater is used in electrostatic precipitator installations.

Watlow can manufacture a tandem duct heater assembly for SCR de-NOx dilution air heating.

This photo shows Watlow’s skidded process air dehumidification heater and control panel.

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Over The Side (OTS) Heaters

Watlow OTS heaters are commonly used when the heater must be easily removed from open tanks, when draining a tank to remove a heater is not desirable and when potential leaks due to mounting connections must be avoided. These rugged industrial heaters are well suited for heating water, oils, cleaning solutions, solvents, salts, waxes and many caustic and acidic solutions as well. Flange and man hole mounted flange designs are common for permanent installations. Thermostats, sensors and/or controllers are used to ensure proper heating performance. “L” styles are used for standard tank applications, where as “O” loop styles are used for cylindrical tanks and small dimension tanks.

Specialty Heaters

Ceramic fiber heaters and multicell heaters are excellent choices for high temperature heating applications up to 1000°C (1830°F). Ceramic fiber heaters provide lightweight and fast response. Multicell heaters are made for rugged environments such as hot gas generators, fluidized beds and forming presses. CAST-X SERIES 1000 and 2000 heaters are aluminum cast-in heaters ideal for heating volatile, viscous and mildly corrosive liquids. The RAYMAX® 1525 is a rugged tubular radiant heater used for industrial drying, freeze protection and general heating applications.

Electric Power Case History - Flue Gas Heating System

Duct heater assemblies are used for emissions control in power plants ranging from ESP penthouse heaters to flue gas heating to air dilution heating in ammonia-based SCR de-NOx systems. A skidded 375kW duct heater assembly is shown with mating control panels to heat flue gas air to 450°C (850°F) prior to the ammonia injection section of an SCR unit.
Control Panels and Process Controllers

Control Panels

Proper controller schematic and panel design goes a long way toward ensuring the trouble free operation of a process system. Watlow designers, engineers and a dedicated UL® 508 panel shop have built control boxes and panels for a variety of process control applications.

We offer standard design control boxes and panels that are shipped within 10 working days of order placement. Standard panels can drive up to 480V–(ac), three-phase, 240kW heating systems. You can choose from NEMA 1, 4, 4X, 7 or 12 enclosures, as well as enclosures carrying UL® and CE marks. Component installation and wiring conform to all applicable NEC standards.

Custom panels can be designed and configured for virtually every application up to and over 1000 amps. Virtually any option is offered including multi-zone control, sequencers, transformers, conformal coatings, ground fault detection, disconnects, fusing, meters and motor starters. We even offer NFPA 496 Z Purge for NEC Class 1, Div. 2 areas.

Oil and Gas

Whether onshore or offshore, pipelines or FPSOs, Watlow has experience in:

- Fuel gas and fuel oil heaters
- Lube oil heaters
- Service water heaters and systems
- High-pressure cleaning equipment
- HVAC heavy duty duct heaters
- Instrument air-drying systems
- LNG phase change systems
- Gas process heating
- Bayonet and suction line heaters for storage tanks
Process Controllers

Watlow controllers can handle virtually every process variable that is commonly found in processing applications – flow, level, temperature, humidity, etc. Our controllers interface with valve controls, relays, pumps, dampers, heaters, heat exchangers, motors and others. Nothing less than what you would expect from a leader in the controller field.

All of Watlow’s controls are designed with Control Confidence® for user friendly programming with easy-to-read prompts and quick configuration. Enhanced software controllers come with cascade, ratio, differential, multiple PID sets and other unique control scheme setups. Newer innovations include the CPC 400 process controller with built-in PLC capabilities for superior process control. All controllers come with a three-year warranty.

Oil and Gas Case History - Crude Storage Tank Heaters

Bayonet (pipe insert) heaters maintain tank temperature so crude viscosity is low enough to pump efficiently. Alternatively, suction heaters are used to heat the crude as it is drawn from the tank. This pipe insert heater is a carbon steel unit rated at six W/in² (one W/cm²) to prevent coking in a crude storage tank.

This Watlow 24-zone, UL® 508 listed control panel contains an integrated LCD display.

This photo shows a Watlow high amperage SCR power control panel.

The SERIES 988, F4 and CPC 400 controllers feature comms, multiple I/O choices and enhanced software capabilities. The SERIES CPC 400 also provides multi-loop control and PLC for complex controls schemes.
**Power Controllers and Temperature Sensors**

**SSRs and SCR Power Controllers**
Watlow has a full range of SSR and SCR products to provide fast, precise, solid state power switching to electric heaters and transformer-coupled loads. Whether operating an open loop or closed loop control, using a control signal from a temperature controller, PLC, I/O module, or other source, these products are a perfect fit for your process control needs.

Our famous DIN-A-MITE® power controllers offers a UL® 508 listing and CE mark in a compact, touch-safe package. In higher current applications Watlow recommends the QPAC open-board SCR (up to 1000 amps). The state-of-the-art POWER SERIES (up to 250 amps) combines a compact touch-safe package with easy mounting, on-board semiconductor fusing and field programmable settings.

**Temperature Sensors**
Watlow has supplied a wide variety of high reliability, process thermocouples, RTDs and sensor assemblies since 1914. Mineral insulated thermocouples are constructed of matched pair thermoelements, highly compacted MgO insulation and a metal alloy sheath. These rugged sensors can be used in either cryogenic conditions or higher temperature, high vibration applications. Standard MI thermocouples and assemblies with connection heads, fittings, thermowells, transmitters, etc. are available.
Watlow Process Control in Action

This chemical mixing tank application illustrates the power, range and flexibility of Watlow temperature, process and high-limit controllers in action along with our award winning power controls and comms connectivity. Need logic control? No problem. Watlow offers the CPC 400 and PPC-2000 with integrated programmable logic to provide a host of logic configurations. With Watlow you are in control.

Chemical Processing Case History - Reactor Vessel Heating

Reactor vessels in chemical plants often need external heating to start up or drive reactions. This uniquely designed 350kW, 480V–(ac), three-phase ceramic fiber vessel is rated at 800ºC (1450ºF) operating temperature. It has ceramic fiber heater sections installed in removable "rings" for easy assembly and system maintenance.

The SERIES F4D (center) controls the heater in Tank A. It also monitors and controls the liquid flow from Tank A into the Mixing Tank. Tank A liquid level and temperature alarms are used to alert operators.

The SERIES F4P (above the SERIES F4D) monitors and controls the flow rate from Tank B. Based on the flow rate from Tank A (Flow A), the SERIES F4P adjusts Valve B to ensure the proper mixing ratio.

The DIN-A-MITE® power controller (middle left) provides current to the heater while the SERIES SD limit (upper left) provides isolated heater safety shutdown.

A process retransmit or an EIA-485 comms output (connected to an Ethernet EM gateway at upper right) on both controllers allows for remote monitoring, programming and data logging.