

FIREBAR® Flat Tubular Heaters



heaters | sensors | controllers

FIREBAR® . . . A SOLUTION To Your Heater Problems

For over half a century, people have been using round tubular heating elements for surface heating. The Watlow® FIREBAR® flat tubular heater is an innovative concept that provides a wide array of design improvements.

A SOLUTION TO HEATER POWER AND RESPONSIVENESS PROBLEMS

In oil and other viscous materials, a FIREBAR flat tubular heater operates at a higher watt density than a round tubular heating element without changing the sheath temperature. The FIREBAR heater also enables you to place more wattage into applications at the same watt density without using a longer heating element.

Due to its unique design and geometry, a FIREBAR heater often heats fluids from ambient temperatures faster than round tubular elements, while using the same wattage and lower sheath temperatures.

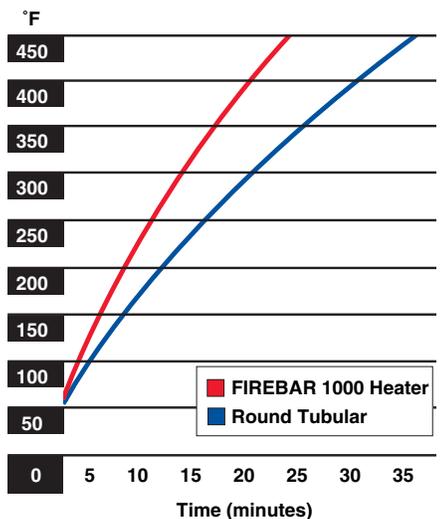
A SOLUTION TO ENERGY EFFICIENCY

FIREBAR flat tubular heater performance in cooking oil instead of a round tubular makes it a perfect choice to combine with Watlow temperature and power controllers for the best solution for energy efficiency. The FIREBAR has been tested in equipment to ASTM F1361. This is the standard test method for the performance of open deep fat fryers.

When direct immersion in liquid is not practical, FIREBAR elements may be clamped to tank walls. FIREBAR's large flat surface area enables it to efficiently transfer heat to the tank walls and into the media. The larger contact area afforded by the FIREBAR design enables the heater to operate at lower coil and sheath temperatures and allows for longer heater life.

A SOLUTION TO HEATER LIFE PROBLEMS

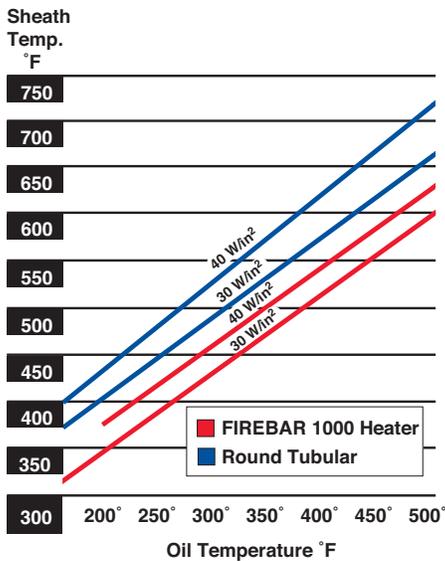
Reducing watt density or sheath temperature extends the life of any heater. The FIREBAR heater allows you to do either without changing equipment performance.



FIREBAR 1000 Heater Oil Test 30 W/in² (4.6 W/cm²)

Immersed in a light oil (liquid shortening), a 30 W/in² (4.6 W/cm²) FIREBAR heating element heated the oil in the work zone from ambient temperatures faster than a 30 W/in² (4.6 W/cm²) round tubular element. The average sheath temperature of the FIREBAR heater was also 50°F (10°C) lower than the round element.

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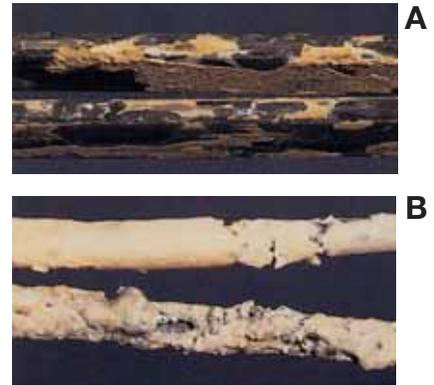
FIREBAR 1000 Heater Oil Test 40 W/in² (6.2 W/cm²)

Tested at different temperatures in light oil, the sheath temperature of a FIREBAR heater is constantly lower than a round tubular element. In fact, the sheath temperature of the FIREBAR heater at a 40 W/in² (6.2 W/cm²) is lower than a 30 W/in² (4.6 W/cm²) round tubular.

A SOLUTION TO HEATER SCALING AND COKING AND FLUID DEGRADING PROBLEMS

The thin profile on top of FIREBAR heating elements provides little space for solids to settle. The velocity of fluid flowing past the flat surface of a FIREBAR element also has a “wiping” effect on the surface of the heater. In oil or similar products where coking is a problem, the round tubular heating element’s sheath temperature may be too high. FIREBAR heaters provide the benefit of a lower sheath temperature than a round tubular element, without reducing wattage or watt density.

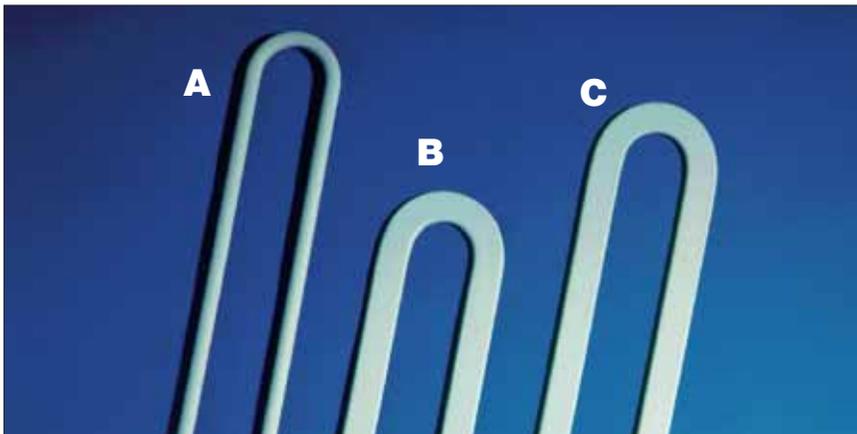
In many applications, scale actually pops off FIREBAR heaters. Because of its geometry, the heater “breathes,” breaking many types of scale and deposits off the heater sheath. This breakage usually depends on heater cycles as well as operation time.



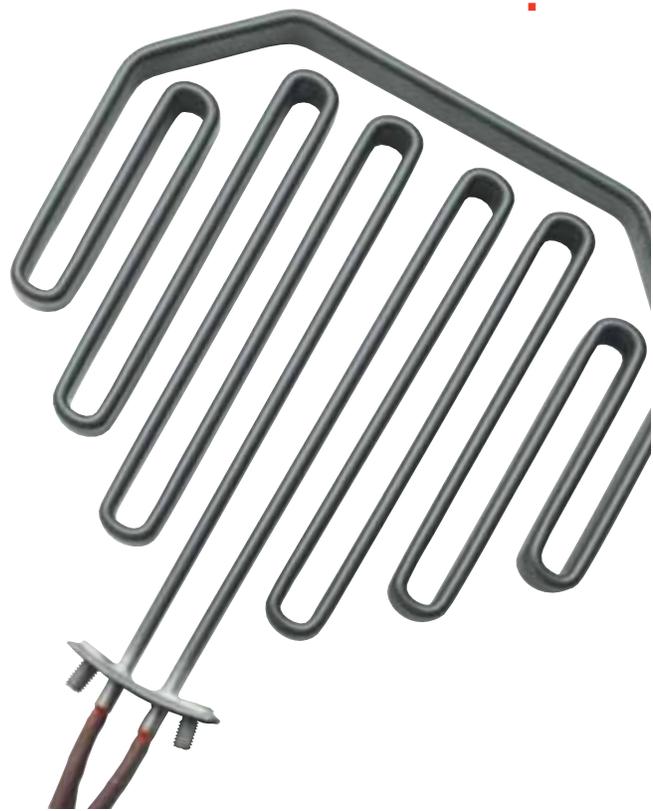
In an accelerated scaling test, researchers operated a 6000 watt FIREBAR heater side-by-side a 6000 watt, 0.315 in. (8 mm) round tubular element in a water heating application. Researchers added dehydrated lime to the water each day to accelerate scaling. Within four days, the scale on the round tubular element (heater B above) was thick enough to cause failure. The scale had built up to a thickness of 1/16 in. (4.1 mm), completely encompassing the sheath. The FIREBAR heater (heater A above) showed no signs of significant scaling other than small patches less than 1/32 in. (8.1 mm) thick. The majority of scale was flaking off the heater.

A SOLUTION TO HEATER SIZE PROBLEMS

Providing the same wattage and watt density, a FIREBAR heater is 41 percent shorter than a 0.430 in. (10.9 mm) diameter round tubular heating element. The FIREBAR heater allows you to add power in equipment designs without needing additional space.



Although it is shorter, the FIREBAR element (heater B) provides the same wattage (800 watts) and watt density 23 W/in² (3.5 W/cm²) as the round tubular element (heater A). An equal length FIREBAR element (heater C) will provide more wattage (1360 watts) at the same watt density, or a lower watt density 13.5 W/in² (2.1 W/cm²) for 800 watts.



UNIQUE DESIGN FEATURES

Watlow's FIREBAR heater is manufactured with three precisely wound resistance wires, arranged side-by-side in a flattened tubular metal sheath and insulated with extremely pure, compacted magnesium oxide (MgO). Flat surface, greater surface area, thin MgO walls and three-coil are all instrumental features provided in the FIREBAR.

CONSTRUCTION

- 1. Nichrome resistance wire:**
High-grade resistance wire is precisely wound to provide the required application heat.
- 2. Magnesium oxide insulation:**
High purity material is compacted around the coils for optimum thermal conductance and dielectric strengths.

- 3. Welded wire-to-pin connections:**
360° fusion weld is used to insure the electrical integrity of the heater.
- 4. Sheath material:** Incoloy® and 304 stainless steel are available. 304 stainless steel 1200°F (650°C) is the maximum sheath temperature. Incoloy® maximum is 1400°F (760°C).
- 5. Lead wire termination:** Ranging from 194°F to 482°F (90°C to 250°C) construction. A standard lavacone seal protects against moisture and contaminants, while providing excellent dielectric strength for operations up to and including 480VAC. Silicone rubber or epoxy resin seals, which are recommended for oil and water heating applications, are also available.

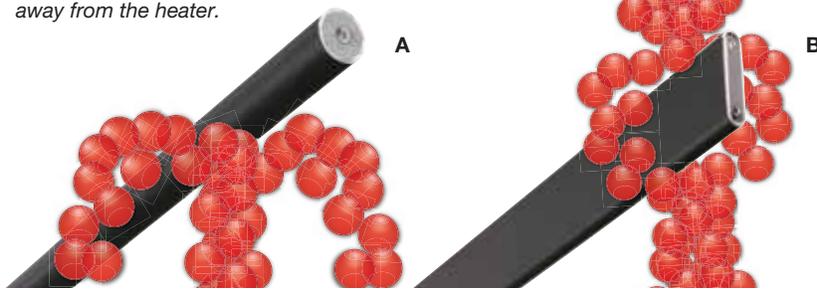
THREE DIFFERENT FEATURES ALLOW THE FIREBAR HEATER TO OPERATE AT A LOWER SHEATH TEMPERATURE THAN AN EQUALLY POWERED ROUND TUBULAR ELEMENT

- 1. Flat surface geometry:** Because of its design and geometry, flat tubular heaters will heat viscous fluids from ambient temperature faster than round tubular elements with the same wattage and at a lower sheath temperature. The benefit of this shape is the enhanced flow of liquid past the surface of the heating element. The round tubular has a much more erratic flow pattern. The currents swirl around and trap heat next to the sheath due to the round shape.

The FIREBAR heater is manufactured with nichrome resistance wire and magnesium oxide insulation.

Heater A traps heat next to the heater due to the fluids swirl pattern.

Heater B has a lower operating sheath temperature because liquid quickly moves away from the heater.



The flow pattern around the flat tubular heater is streamlined; the flat surface has less restriction on the liquid as it moves up and past the heater sides. This efficient and faster flow pattern permits the liquid to move heat away from the sheath very quickly; resulting in the flat tubular heater's lower operating sheath temperature.

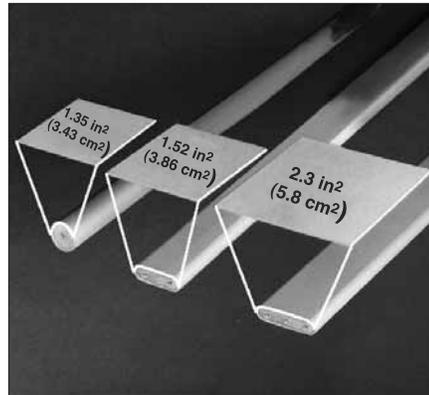
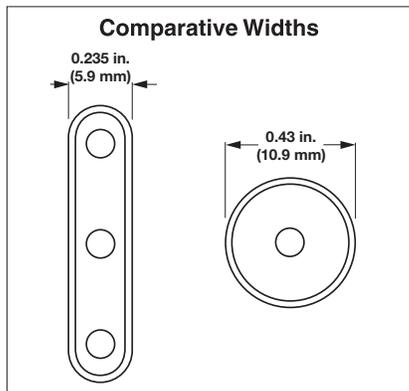
2. Greater "buoyancy force":

Natural convection phenomena depends partially upon the ratio of a buoyant force to the viscous force of the heated fluid. This buoyant force, or flow of liquid up and across the heater surface, is primarily determined by the size of the boundary layer of the heater (the sides of the heater).

The boundary layer of a FIREBAR heater is 1 in. (25.4 mm), compared to the 0.43 in. (10.9 mm) boundary layer of a typical diameter round tubular element. Depending on the material being heated, this creates a buoyancy force up to 10 times greater than a round tubular element.

3. Smaller dimension normal to the flow:

The thin, 0.235 in. (5.9 mm) dimension of the FIREBAR heater normal to flow reduces the drag force on liquid flowing past the heater. Typical commercial round tubular elements have a 0.43 in. (10.9 mm) dimension normal to flow.



THE 70 PERCENT GREATER SURFACE AREA OF A FIREBAR HEATER ALLOWS YOU TO REDUCE WATT DENSITY FROM A ROUND TUBULAR ELEMENT OF THE SAME LENGTH

The surface area per inch of length of a FIREBAR heater is 2.3 in²/in. (5.8 cm²/cm), while it is 1.52 in²/in. (3.86 cm²/cm) for a 0.43 in. (10.9 mm) diameter round tubular element. This surface area design improvement is the key to lowering watt density for the same length heater and reducing the heater size while maintaining the same watt density.

THIN MgO WALLS REMOVE HEAT OUT FROM THE FIREBAR HEATER FASTER

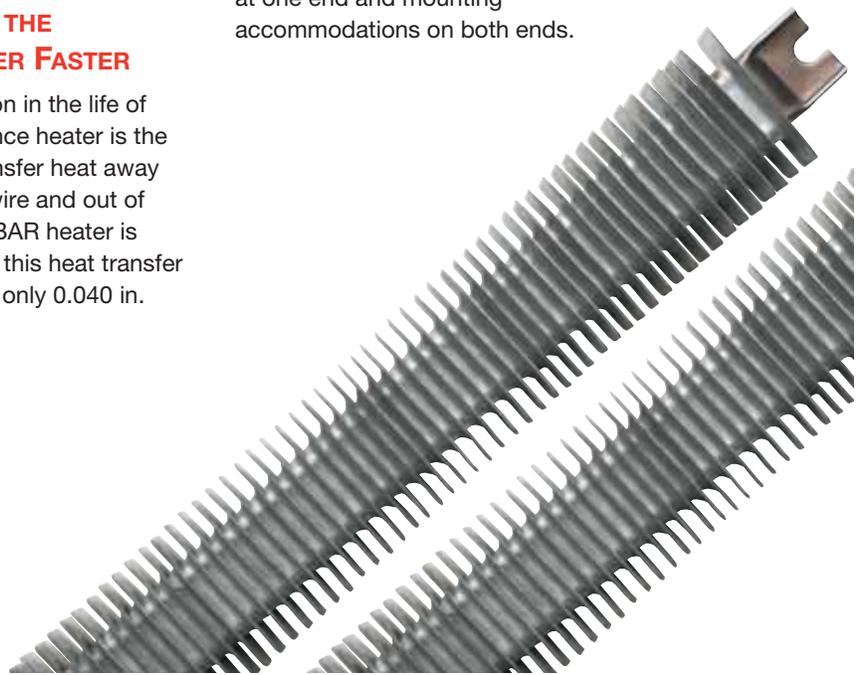
A critical consideration in the life of any electrical resistance heater is the heater's ability to transfer heat away from the resistance wire and out of the heater. The FIREBAR heater is designed to enhance this heat transfer by having MgO walls only 0.040 in. (1.02 mm) thick.

THE FIREBAR 625 (5/8 INCH) DESIGN OPTION PROVIDES INCREASED SURFACE AREA AND LONGER LIFE

The lower profile design of the FIREBAR 625 heater provides 13 percent greater surface area and wattage than an equal length, commonly used round tubular heater, reducing watt density and leading to longer heater life.

FINBAR IS A SPECIAL VERSION OF THE FIREBAR 1000, DESIGNED TO INCREASE SURFACE AREA AND IMPROVE HEAT TRANSFER IN AIR APPLICATIONS

Composed of aluminized steel fins press fitted to 1 in. (25.4 mm), single-ended FIREBAR elements, the FINBAR offers an increased surface area of approximately 16 in² (40.6 cm²) for every 1 in. (25.4 mm) of element length. This unique design maximizes heat transfer in air applications and allows FINBAR to fit in tight spaces without sacrificing power making it ideal for forced air ducts, dryers, incubators and ovens. Installation is simplified by terminations exiting at one end and mounting accommodations on both ends.



IMPROVING YOUR EQUIPMENT DESIGN

The FIREBAR heater provides more than just a menu of immersion heating design improvements. Here are a variety of other benefits you can put to use.

USING A FIREBAR HEATING ELEMENT CAN GIVE YOUR EQUIPMENT THE EDGE OVER YOUR COMPETITION

The multiple performance, flexibility and convenience options the FIREBAR heater provides allow you to improve equipment design in so many different ways. You can make equipment:

- More efficient
- Easier to assemble, install and maintain
- Less expensive
- Lasts longer
- More productive
- More compact

MAINTENANCE IS MINIMAL AND EASY WITH FIREBAR HEATERS

FIREBAR heaters require less cleaning maintenance than round tubular heaters because of diminished scaling and coking. If periodic cleaning is required, the flat sides of a FIREBAR heater are easier to clean, and you will probably have fewer elements to clean.

THE THREE-COIL DESIGN OF A FIREBAR HEATER PROVIDES VOLTAGE AND HEAT OUTPUT VARIETY

By using a special center resistance wire coil, Watlow can build FIREBAR heaters so they can be wired 240VAC or 208VAC with the same kilowatt output. If three-heat capability is needed, operate the center coil only for “low” heat, the two outside coils only for “medium” heat or all three coils for “high” heat.

FIREBAR heaters can also be designed with a built-in thermocouple in place of the center coil.



For 240VAC, 10kW wiring, only the outside coils of a FIREBAR would be wired, each coil providing 5kW. For 208VAC, 10kW wiring, all three coils would be wired; the outside coils providing 3.75kW each and the different resistance center coil 2.5kW.

SELF-SUPPORTING FIREBAR HEATERS OFTEN MAKE SUPPORTING METAL BRACKETS UNNECESSARY

FIREBAR heaters are rigid enough to withstand the turbulence in immersion applications that severely warp unsupported round tubular elements.

FIREBAR HEATERS OFFER THE VERSATILITY OF NUMEROUS MOUNTING OPTIONS

Mounting options for FIREBAR heaters include mounting brackets, threaded bulkheads and water-tight double leg threaded fittings. For air heating, stainless steel mounting brackets are commonly used. For liquid heating, 0.236 in. (6 mm) thick steel or stainless steel brackets are brazed or welded liquid-tight to an element.

Threaded bulkheads have a stainless steel bushing with flange on the heater sheath to provide rigid, leak-proof mounting through tank walls. Water-tight double leg threaded fittings use 1 5/8 in. (41.27 mm)-10 UNC stainless steel with flange on the heater sheath to provide leak-proof mounting. This double leg fitting allows both heater legs to pass through the same opening.

FIREBAR'S SINGLE-ENDED TERMINATION OPTION FACILITATES APPLICATION

For simplified wiring and installation, FIREBAR elements are also available in single-ended termination. A slotted end further eases installations in clamp-on applications.



A SINGLE FIREBAR HEATER CAN BE WIRED THREE-PHASE

Three-phase wiring can simplify your heater installation. By offering three-phase capability, FIREBAR heaters provide a lower amperage solution while delivering the full power needed in a compact heater package. Previously three separate heaters were required for the same job. Because only one element is required, installation time and overall costs are reduced.

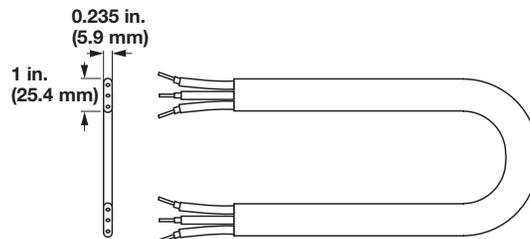
FIREBAR HEATING ELEMENTS CAN BE CONFIGURED INTO A WIDE VARIETY OF SHAPES TO MEET VIRTUALLY ANY APPLICATION

They can be bent on either the major or minor axis, depending on your element design needs.

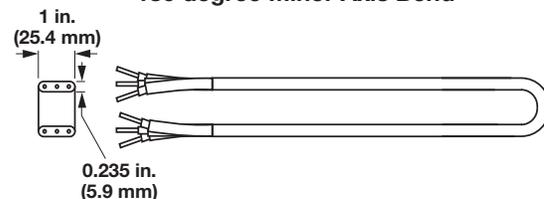
FIREBAR HEATING ELEMENTS CARRY AGENCY RECOGNITION

UL®, and CSA component recognition, CE (Declaration of Conformity) available on request.

1 in. (25.4 mm) FIREBAR 180 degree Major Axis Bend



1 in. (25.4 mm) FIREBAR 180 degree Minor Axis Bend





Find out more about Watlow and how we can provide thermal solutions for your company:

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About Watlow

Watlow designs and manufactures industrial heaters, temperature sensors, controllers and system assemblies – all of the components of a thermal system. Designing and manufacturing the complete thermal system allows Watlow to recommend, develop and deliver the optimum thermal solution for our customers' equipment and process heat requirements.

Watlow manufactures thermal systems for a broad range of industries including but not limited to: semiconductor processing, photovoltaic, aerospace, analytical instrumentation, medical equipment, packaging, foodservice equipment and plastics processing. Watlow customers receive the highest level of technical engineering combined with exceptional customer service.

Since 1922, Watlow has grown in product capability, market experience and global reach. We hold more than 200 patents and employ 2,000 employees working in 12 manufacturing facilities in the United States, Mexico, Europe and Asia. We also have sales offices in 15 countries around the world. Our company has grown at an exponential rate but our commitment remains the same – to provide our customers with superior products and services for their individual needs.

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