W A T L O W

FIREBAR® HEATERS

SHAPING THE FUTURE OF HEATING SOLUTIONS

A Whole Wave Of Design Improvements

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

A Solution To Heater Size Problems

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

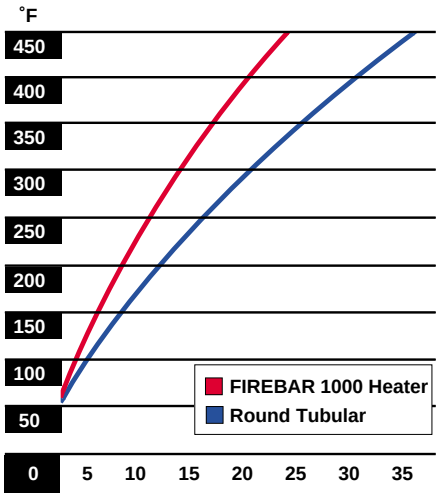
A Solution To Heater Power and Responsiveness Problems

In oil and other viscous materials, a FIREBAR® heater operates at a higher watt density than a 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 tubular elements, while using the same wattage and lower sheath temperatures.

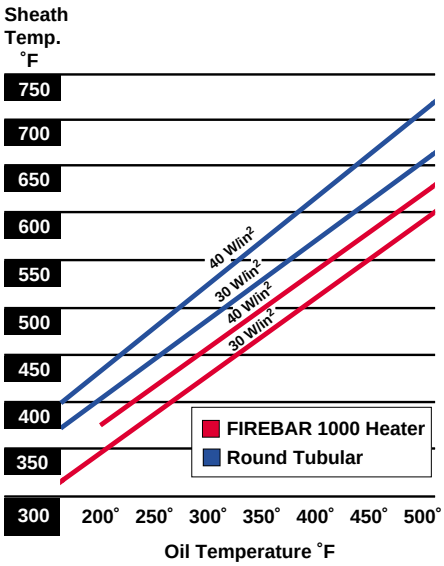
A Solution To Heater Life Problems

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

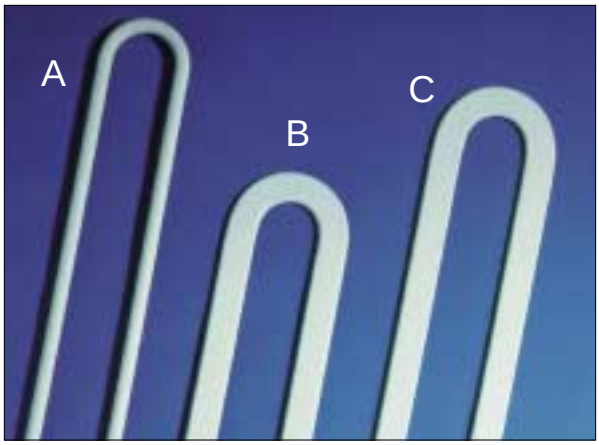


FIREBAR 1000 Heater Oil Test 4.6 W/cm² (30W/in²) Immersed in a light oil (liquid shortening), a 4.6 W/cm² (30W/in²) FIREBAR heating element heated the oil in the work zone from ambient temperatures faster than a 4.6 W/cm² (30W/in²) tubular element. The average sheath temperature of the FIREBAR heater was also 10ºC (50ºF) lower.

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



FIREBAR 1000 Heater Oil Test 6.2 W/cm² (40W/in²)
Tested at different temperatures in light oil, the sheath temperature of a FIREBAR heater is constantly lower than a tubular element. In fact, the sheath temperature of the FIREBAR heater at a 6.2 W/cm² (40 w/in²) is lower than a 4.6 W/in² (30 W/in²) tubular.



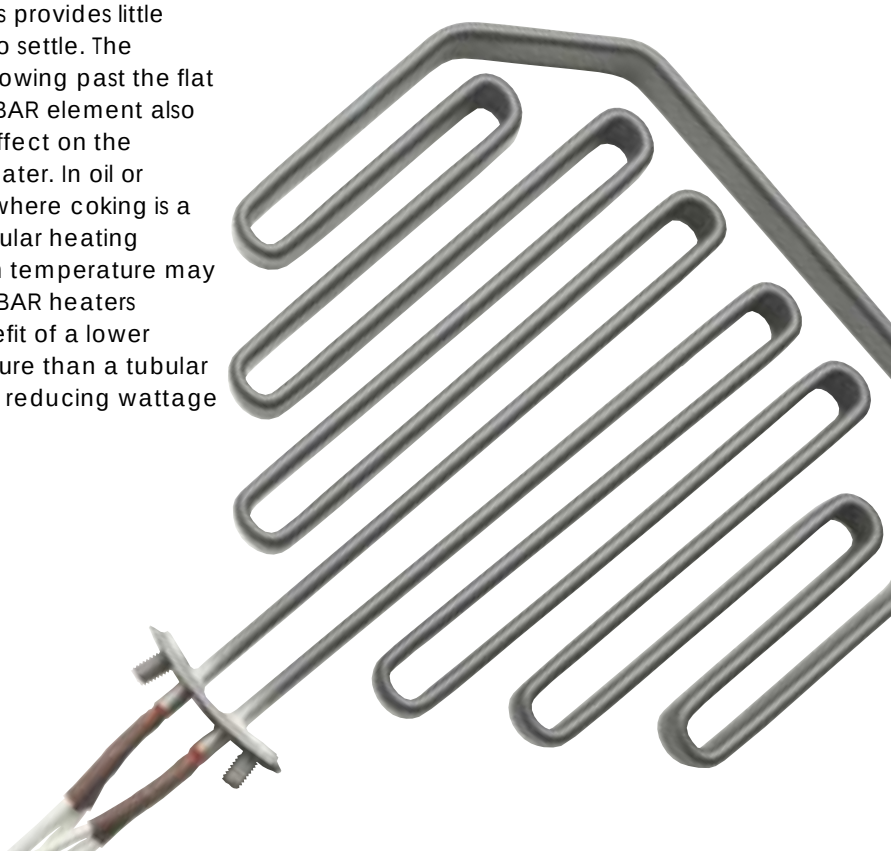
Although it is shorter, the FIREBAR element (heater B) provides the same wattage (800 watts) and watt density 3.5 W/cm² (23 W/in²) as the tubular element (heater A). An equal length FIREBAR element (heater C) will provide more wattage (1360 watts) at the same watt density, or a lower watt density 2.1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

A Solution To Heater Scaling and Coking, And Fluid Degrading Problems

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.

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 tubular heating element's sheath temperature may be too high. FIREBAR heaters provide the benefit of a lower sheath temperature than a tubular element, without reducing wattage or watt density.

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 Revolutionary Design

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). The resulting flat surfaces, greater surface area, thin MgO walls and three-coil features are all instrumental benefits the FIREBAR heater provides.

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 SSTL are available. 304 SSTL is limited to 650˚C (1200˚F) maximum sheath temperature. Incoloy is limited to 760˚C (1400˚F) maximum.
5. Lead wire termination: Ranging from 90˚C to 250˚C (194˚F to 482˚F) construction. A standard lavacone seal protects against moisture and contaminants, while providing excellent dielectric strength for operations up to and including 480 V~(ac). Silicone rubber (RTV) 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 Tubular Element

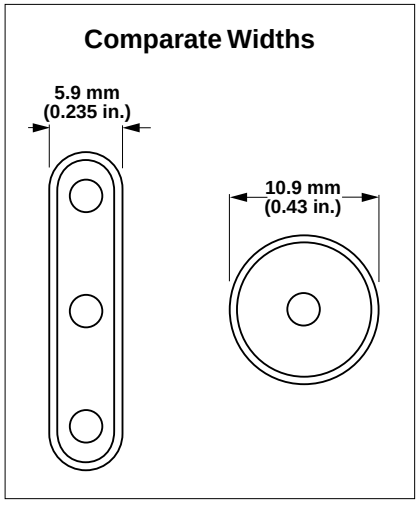
1. Flat surface geometry: The flat vertical surface of an immersed FIREBAR element creates a stream-lined shape which enhances the flow of fluid past the surface of the heating element.

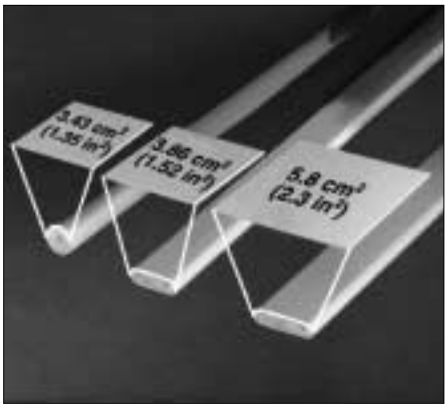
Incoloy® is a registered trademark of the Inco family of companies.

2. Greater "buoyancy force": Natural convection phenomena depends partially upon the ratio of a buoyance force to the viscous force of the heated fluid. This buoyancy 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 25.4 mm (1 in.), compared to the 10.9 mm (0.430 in.) boundary layer of a typical diameter tubular element. Depending on the material being heated, this creates a buoyancy force up to ten times greater than a tubular element.

3. Smaller dimension normal to the flow: The thin, 5.97 mm (0.235 in.) dimension of the FIREBAR heater normal to flow reduces the drag force on a liquid flowing past the heater. Typical commercial tubular elements have a 10.9 mm (0.430 in.) dimension normal to flow.





The 70% Greater Surface Area Of A FIREBAR Heater Allows You To Reduce Watt Density From A Tubular Element Of The Same Length

The surface area per inch of length of a FIREBAR heater is 58.4 mm^2/mm (2.3 in^2/in), while it is 37.84 mm^2/mm (1.49 in^2/in) for a 10.9 mm (0.430 in) diameter 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 Get Heat Out Of A 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 designed to enhance this transfer of heat, having MgO walls only 1.02 mm (0.040 inch) thick.

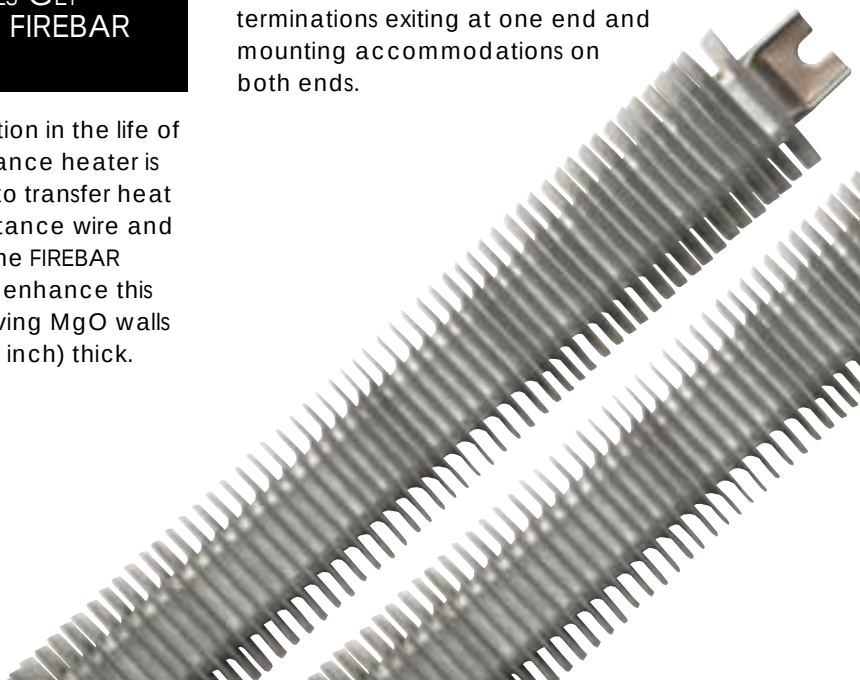
Unique Design Options

The FIREBAR 625 (5/8") Design Option Provides Increased Surface Area and Longer Life

The lower profile design of the FIREBAR 625 heater provides 13% greater surface area and wattage than an equal length, commonly used 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 25.4 mm (1 in.), single-ended FIREBAR elements, the FINBAR offers an increased surface area of approximately 40.6 cm^2 (16 in^2) for every 25.4 mm (in.) 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.

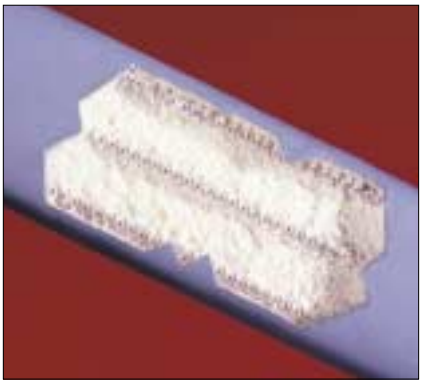


The FIREBAR Heater. . . Your Marketing Edge

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.

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.



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

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 240V~(ac) or 208 V~(ac) 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 the place of the center coil.

Maintenance is Minimal And Easy With FIREBAR Heaters

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

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 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, 6 mm (.236 in.) 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 41.27 mm (1⅝ inch)- 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.

UL® is a registered trademark of the Underwriter's Laboratories, Inc.

Using A FIREBAR Heating Element Can Give Your Equipment The Marketing 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
- Longer lasting
- More productive
- More compact
- Different and better than your competitors'

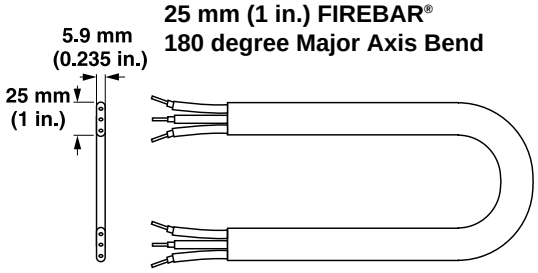
FIREBAR Heating Elements Carry Agency Recognition

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

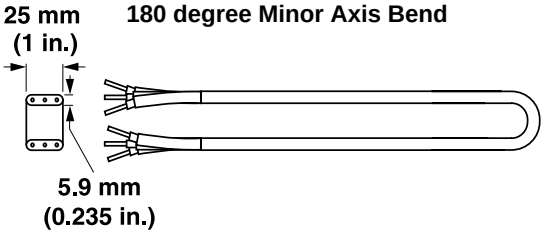
FIREBAR Heating Elements Can Be Configured Into A Wide Variety Of Shapes To Meet Virtually Any Application

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

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



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



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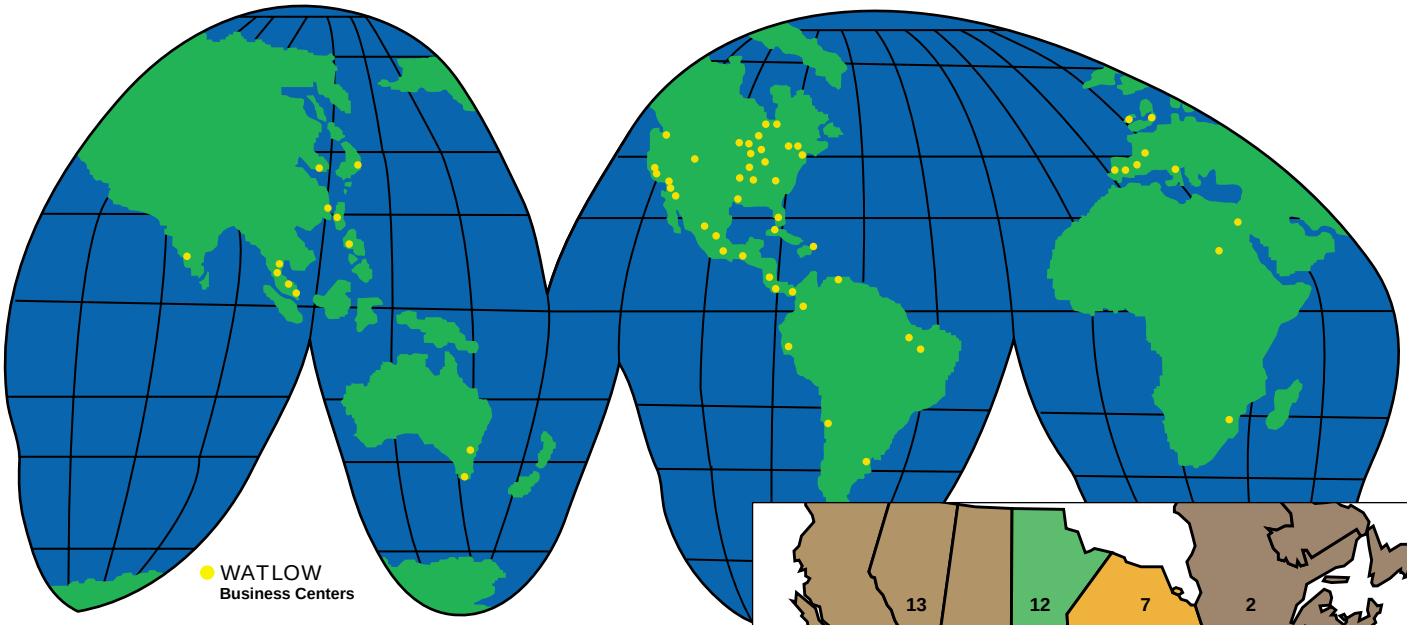

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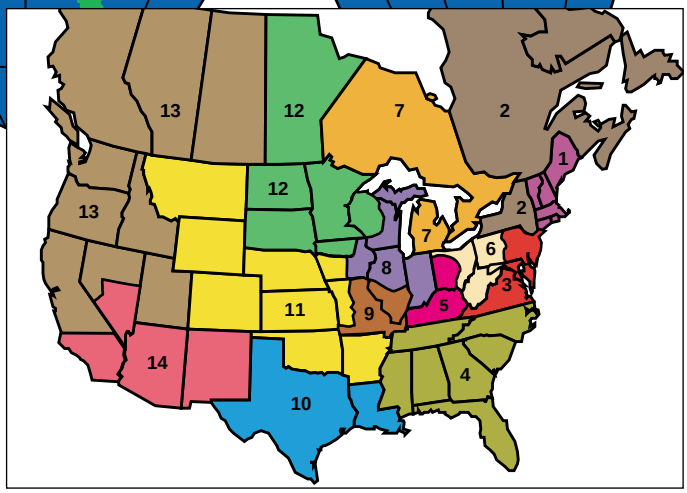

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