PMJ heaters manufacturing

Specification Sheet

Tubular Heater

Fits Virtually Entire Range of Immersion and Air Heating Application

Available in double-ended termination styles, the versatile and economical VEMA tubular heating element from PMJ lends itself to virtually the entire range of immersion and air heating applications.

The tubular heater, with its round cross-sectional geometry, is highly adaptable for bending—especially when bending is performed in the field. PMJ's double-ended tubular elements offer various combinations of resistor coils inside one sheath.

Tubular heater has many construction features delivering long life—the resistance wire is centered in the heater sheath and electrically insulated with compacted, high-grade magnesium oxide for superior heating performance.

Important and useful characteristics of tubular heaters are that they can be formed into virtually any shape, brazed or welded to any metal surface, can cast into metals.

Construction

The cutaway view as shown in Figure 1 shows the tubular heater's basic construction. A computer-designed helical coil of 80% NIckel 20% Chromium alloy resistance wire is fusion welded to the nickel-coated steel terminal cold pin. This coil assembly is precisely stretched and centered in the element metal sheath, which is filled with top quality Magnesium Oxide (MgO) powder.

The filled tube is then compacted by a roll reduction mill into a solid mass, permanently stabilizing the coil in the center of the tube while providing excellent heat transfer and dielectric strength between the coil and the sheath.

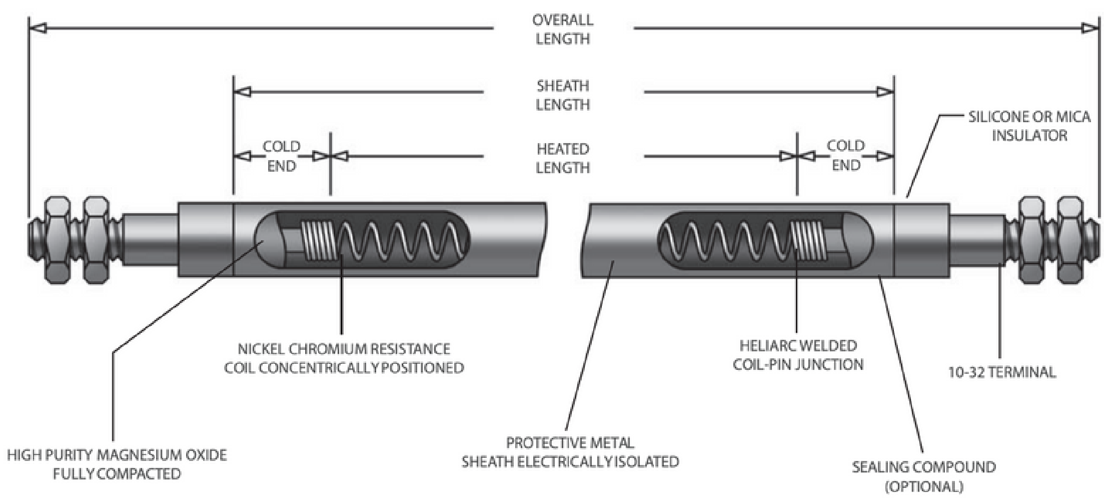


Fig 1. Basic Construction of Tubular Heater

Features

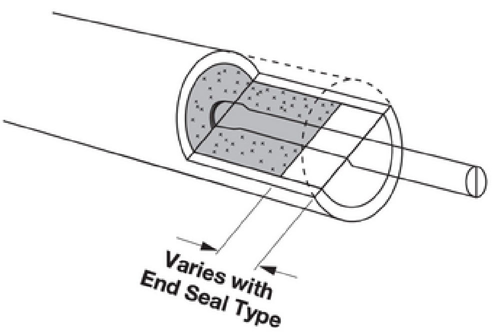
- Standard Diameters: 4.0mm, 5.0mm, 6.7mm, 8.3mm, 11.2mm, 12.5mm, 14.0mm, 16.0mm
- Maximum Length: 8000mm
- Available in broad variety of sheaths and ratings
- Provide superior internal electrical insulation and heat

Benefits

- Easy to install
- Configurable to virtually any shape
- Precise and easy control of heat output
- Compact and durable
- Easy to maintain

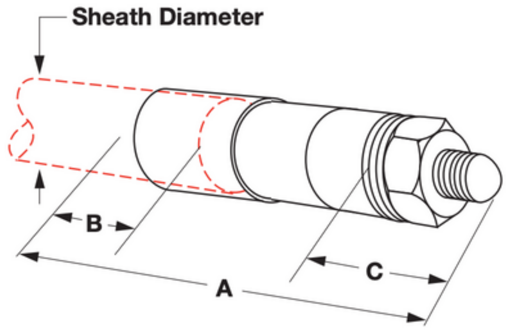
Options

Moisture Resistant Seals



PMJ's MgO insulating material is hygroscopic. To control the rate of moisture entering the heater, an appropriate moisture seal must be used. Choosing the correct seal is important to the life and performance of the heater. All materials have varying rates of gas vapour transmission. Be sure the maximum continuous use temperature is not exceeded at the seal location. Most end seals are applied with a small cavity in the end of the heater. The seal will also help prevent arcing at the terminal ends.

Ceramic-to-Metal End Seals



Ceramic-to-metal end-seals with threaded stud terminations provide an air-tight seal for continuous terminal temperatures up to 260°C. PMJ does not recommend this seal if terminations are exposed to temperatures exceeding 260°C.

Other End Seal Options

End Seal	Colour	Max Cont. Use Temperature	Typical Application
Standard Epoxy	White	130°C	Long term stable insulation resistance
High-Temp Epoxy	Cream	240°C	Long term stable insulation resistance
Silicone Resin	Clear	105°C	General usage on tubular heaters - porous
Silicone Fluid	Clear	200°C	Moisture resistance of the MgO, or high temperature ceramic seal (storage only) - porous
Silicone RTV Rubber	White	220°C	General usage on tubular heaters - porous
High-Temperature Ceramic	White	1400°C	Very high temperature applications - for extremely low vapor transmission rate

External Finishing

Standard Surface Finish

The standard tubular heater element surface finish is a black chrome oxide, produced when the element is annealed prior to forming in an exothermic atmosphere furnace.

Bright Annealing

Bright Annealing is an option where the tubular heater is annealed in a dissociated ammonia atmosphere furnace. This produces a clean metallic appearance without surface-etching the sheath.

Electro-Polishing

Electro-polishing is an electrochemical process that removes surface imperfections and contaminants, enhancing the corrossion resisting ability of the sheath. The resulting surface is clean, smooth and has a bright finish. It is highly recommended for medical, food and other harsh applications.

Passivation

This removes surface contamination, usually iron, so that the optimum corrosion resistance of the stainless steel is maintained.

Factors

Please consider the following factors to select the ideal PMJ's tubular heater for your application:

- Heating element watt density
- Sheath material (corrosive or non-corrosive)
  - Temperature of the corrodent
  - Degree of the aeration of the corrodent
  - Velocity of the corrodent
  - Ambient temperature

Applications	Sheath Material
Water Water solutions non-corrosive to copper	Copper
Oil Grease Alkaline Cleaning Solutions Tars Alsphalt	Stainless Steel 304/316L
Corrosive Liquids Food Processing Equipment	Stainless Steel 304/316L
Air Heating Radiant Heating Cleaning & Degreasing Solutions Plating & Pickling Solutions Corrosive Liquids	Incoloy 840/800/600
Acid Corrosive Liquids	Titanium

Standard Installations

Following shows some of the most popular type of installations. Select the installation that meet your needs and make reference to it before placing an order or requesting prices.

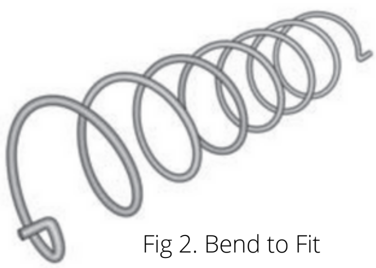


Fig 2. Bend to Fit

Fig 3. Immersed in Liquids

Fig 5. Ovens

Fig 3. Finned Heater Assemblies

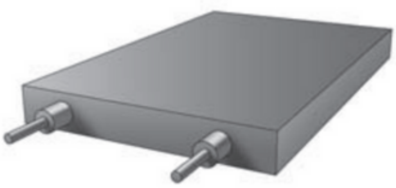


Fig 4. Cast-In Aluminium / Brass

Fig 6. Radiant Heating

Resistance Tolerance

Tubular heating elements have an industry standard tolerance of +10%, -5% which translates to a wattage tolerance of +5%, -10%.

Consult PMJ if tighter tolerances are required for your applications

Watt Density

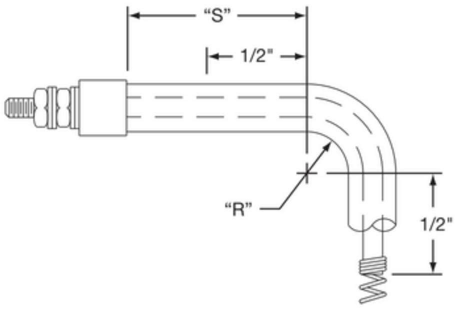
Element Watt Density is the wattage dissipated per square inch of the element sheath surface and is critical to the proper heating of the application and to be life expectancy of the heater. The Watt Density is calculated with the following formula:

$$\text{Watt Density (w/in}^2\text{)} = \frac{\text{Element Wattage}}{\pi \times \text{Element Dia.} \times \text{Element Heated Length}}$$

Forming Tubular Heaters

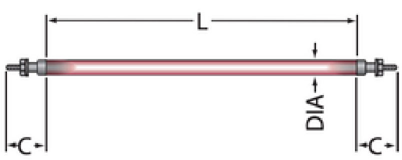
The MgO insulation used in tubular heating elements is compacted by reducing the element diameter in a roll reducing mill. The elements are then annealed in a controlled atmosphere to relieve the metal stressing (work hardening) that takes place during the rolling to size reduction of the sheath. Annealing brings the metal back to a soft state allowing the element to be bent into virtually any configuration.

Following are our standard bending configurations:



Avoid bends within a minimum of 12.7mm (1/2") of the terminal pin and resistance wire junctions unless bending radius is a minimum 75mm (3").

Figure 1A



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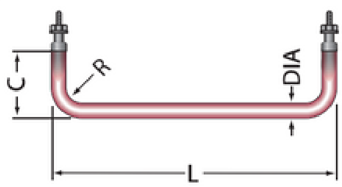

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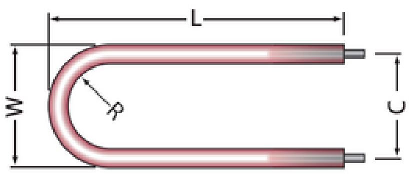

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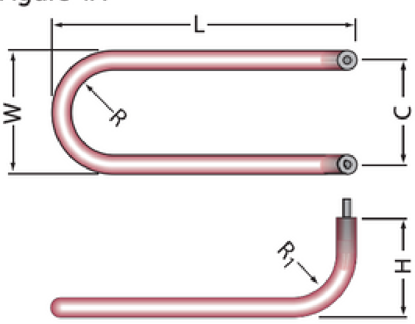
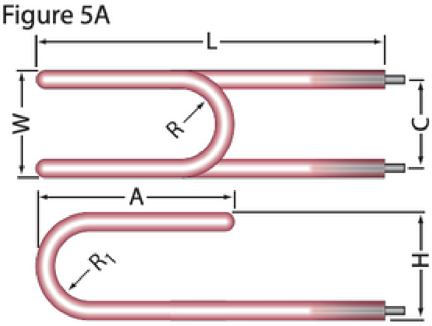


Figure 5A



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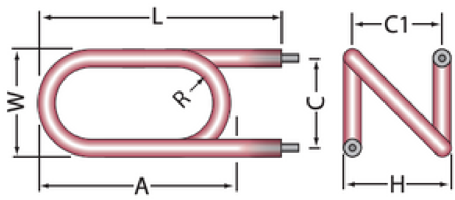


Figure 7A

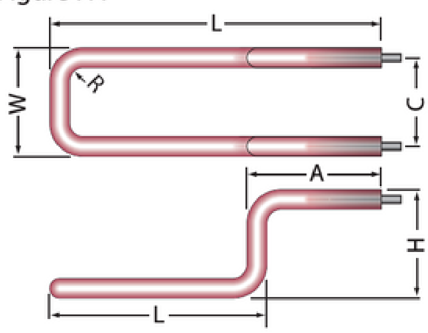


Figure 8A

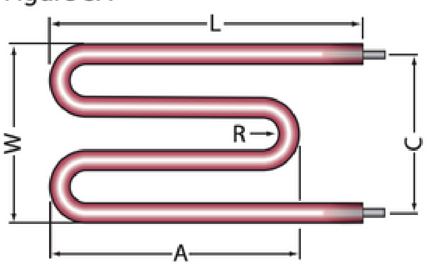
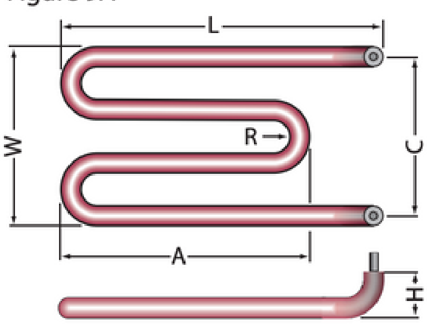


Figure 9A



Standard Bending Configurations

Figure 10A

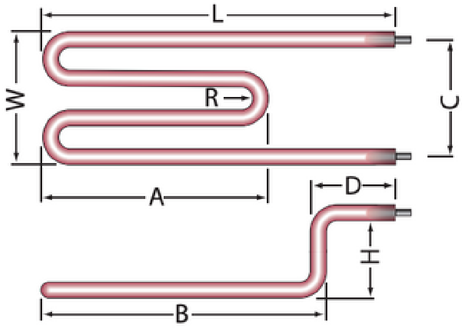
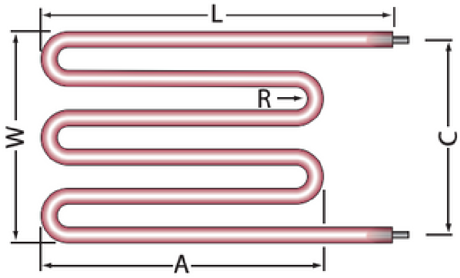


Figure 11A



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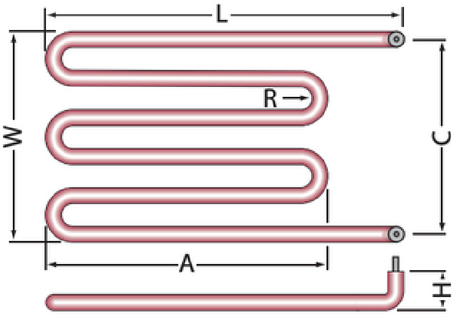


Figure 13A

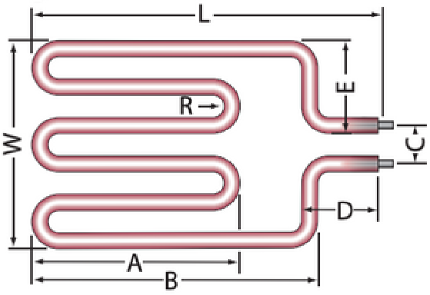
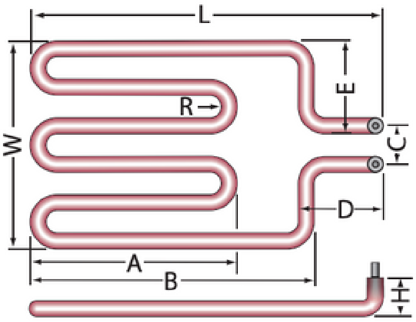


Figure14A



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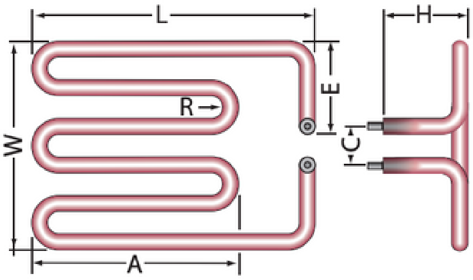

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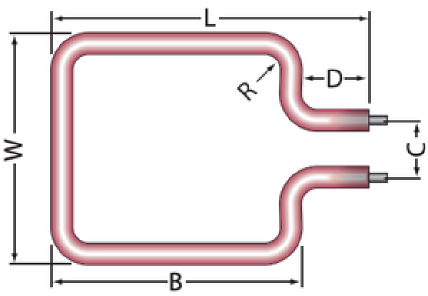

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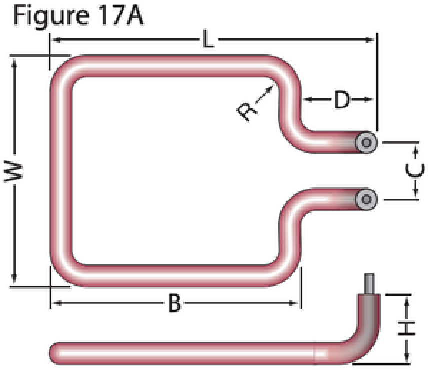

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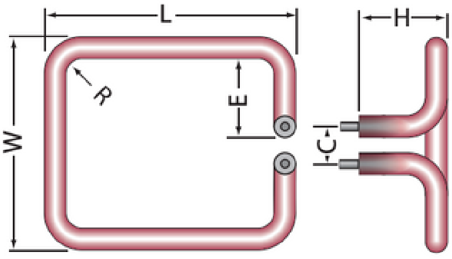


Figure 19A

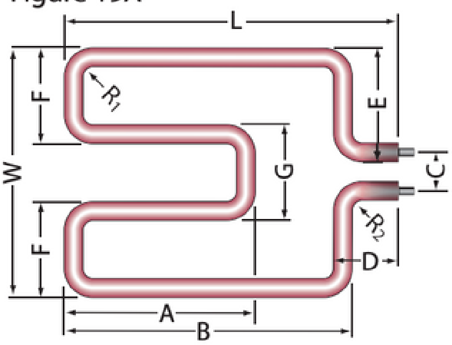
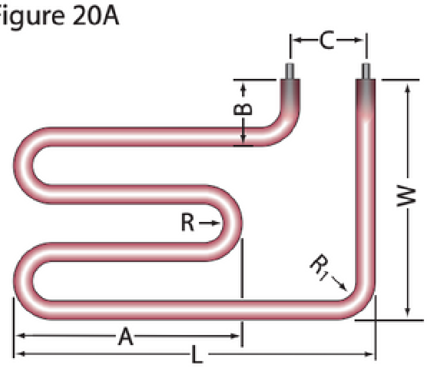


Figure 20A



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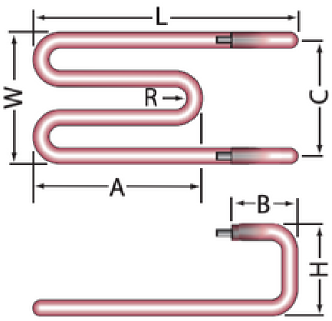


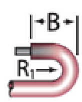


Figure 21A-1

Standard Bending Configurations

Figure 22A

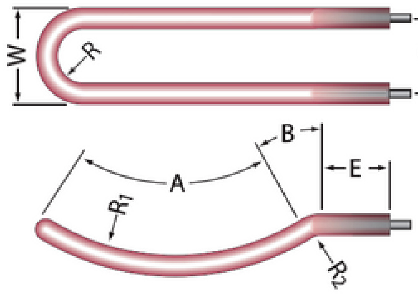


Figure 23A

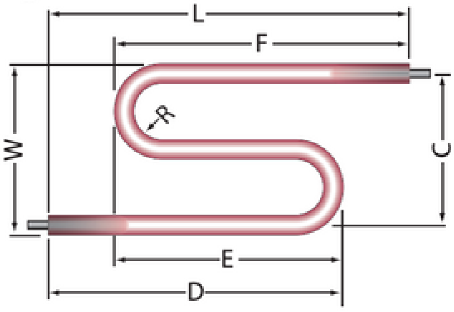


Figure 24A

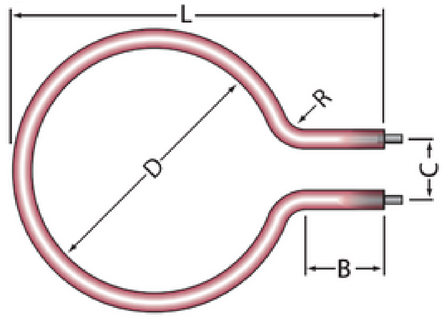
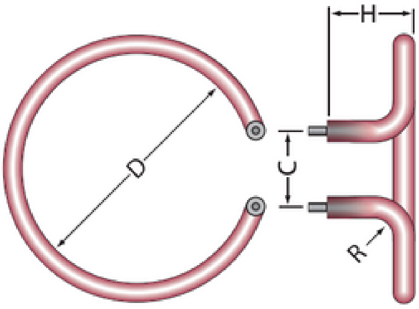


Figure 25A



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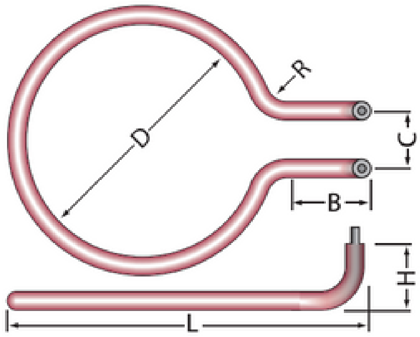
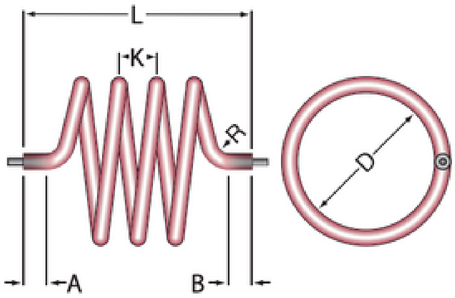


Figure 27A



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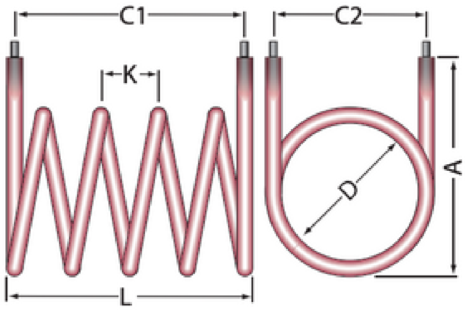

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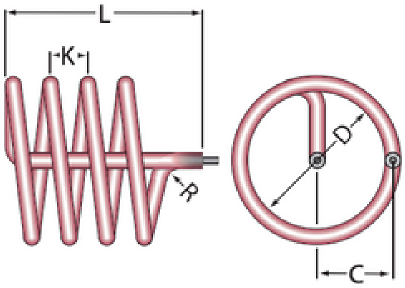

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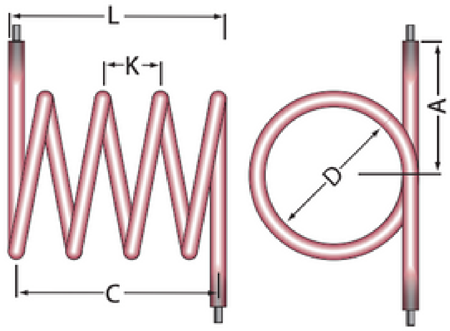

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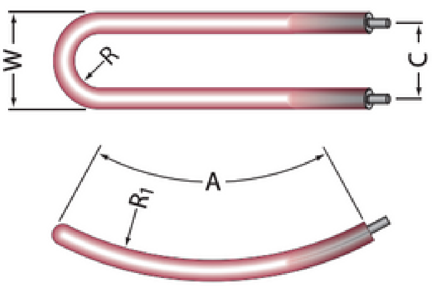

Figure 32A

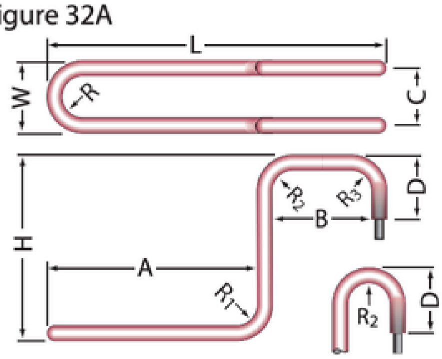

Figure 32A-1

Figure 33A