BUCAN ELECTRIC HEATING DEVICES INC.

STRAIGHT & FORMED TUBULAR HEATERS

Typical Heating Applications:

- *Forming Machines*
- *Heating Molds & Platens*
- *Immersion Into Liquids*
- *Radiant & Convection Heating*
- *Embedded or Cast Into Metal*

Tubular heaters are the main heating source in most applications where electric heat is required. They are highly adaptable to the requirements of many applications. Tubular heaters can be used in their straight form, or can be bent into various shapes. They can be used in free air, clamped to a surface, embedded, or cast into metals. Tubular heaters can provide heat up to 1500°F.

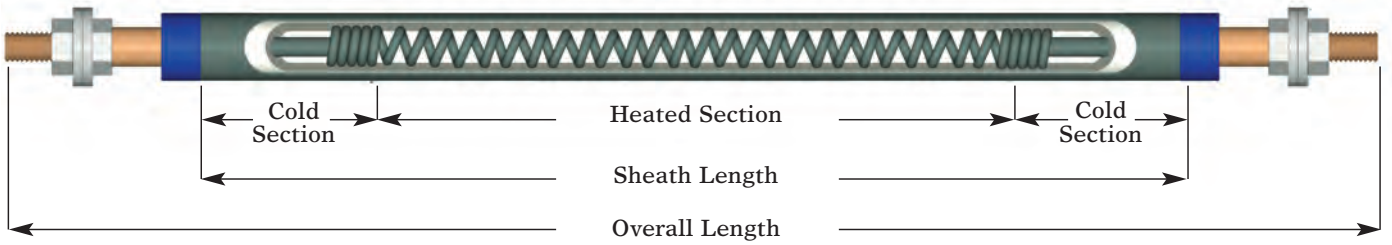
Construction

Bucan tubular heaters use 80% Nickel 20% Chromium high grade coiled resistance wire as a heating core. This core is welded at both ends to pins that provide a cold section that varies in length depending on the application requirements. The coil-pin assembly is precisely centered inside a heavy gauge, oversize metal tube, and embedded inside a 96% pure, high-grade MgO insulating medium.

Tubular diameter (in)	Max. Voltage	Max. Amps.	Min. Ohms per heated length (in)	Max. Ohms per heated length (in)	Min. Sheath length (in)	Max. Sheath length (in)
0.260	240	15	0.1	17	11	240
0.315	300	30	0.06	20	11	240
0.375	600	30	0.05	20	11	240
0.430	600	40	0.05	20	11	240
0.475	600	40	0.05	20	11	240

This assembly is then compacted through a roll-reducing process that reduces the outside tube diameter to its final size, and transforms the MgO matrix into a rock-hard solid that acts as an excellent heat transferring medium, as well as an electrical insulation with high dielectric strength. Finally, heaters are annealed inside a high-temperature furnace to eliminate internal stresses accumulated during the cold-forming roll-reducing process to make them soft. Heating elements are then formed into special shapes, or supplied in their straight form. Proper electrical terminations are added to the final product.

Overall length (in)	11-20	21-40	41-70	71-100	101-140	141-170	171-200	201 +
Tolerance in sheath length (+/- in)	0.1	0.125	0.16	0.19	0.22	0.25	0.375	0.5
Tolerance in heated length (+/- in)	0.25	0.5	0.9	1.130	1.4	1.65	2	2.38
Min unheated length (in)	1	1.25	1.5	1.625	1.75	2.25	2.25	2.5



Watt Density & Sheath Material

The two most critical factors that affect the durability of a tubular heater are:

- **The sheath material**
- **The watt density**

The corrosivity of the medium and its operating temperature are critical in determining the sheath material type. Table 1 lists various sheath materials, maximum allowable temperatures and mediums within which they are recommended to operate.

The watt density determines the temperature that a heating element sheath will attain within specific application conditions.

Sheath Material	Max. Sheath Temp	Applications
Copper	350°F	Immersion into water and non corrosive low viscosity liquids
Steel	750°F	Oil, wax, asphalt, cast in aluminum or iron
Stainless Steel 304-316	1200°F	Corrosive liquids, food industry, sterilizers
Incoloy	1500°F	Air, corrosive liquids, clamped to surfaces

Table 1

The watt density is determined with the following formula:

$$\text{Watt Density } (W/in^2) = \frac{\text{Rated Wattage}}{3.14 \times \text{Elem. Dia.} \times \text{Heated Length}}$$

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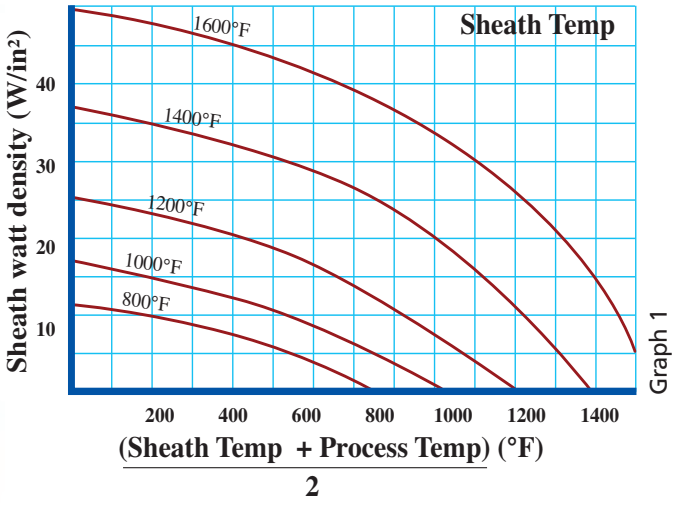
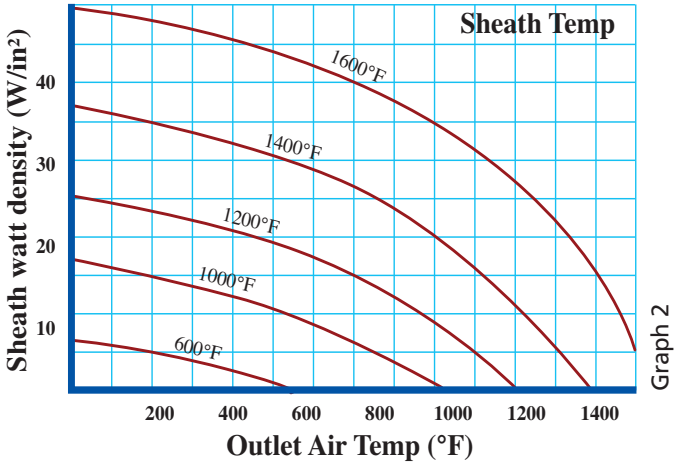
Clamp-on applications



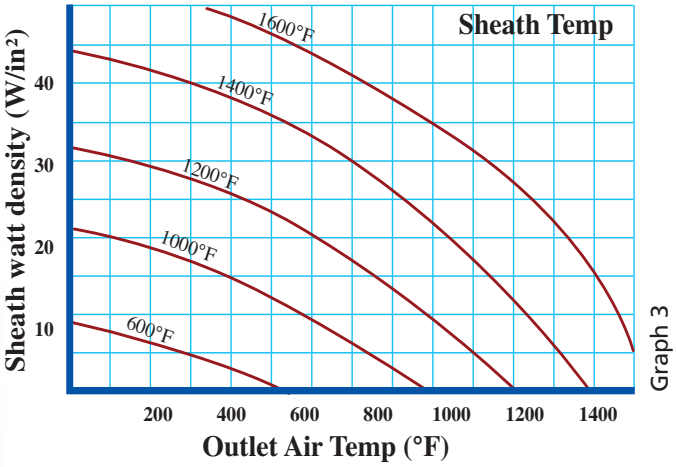
Graph 1

Elements in 60 FPM forced air



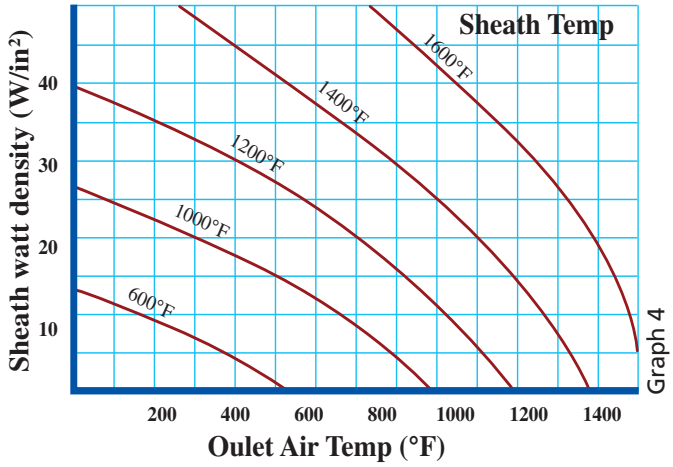
Graph 2

Elements in 240 FPM forced air



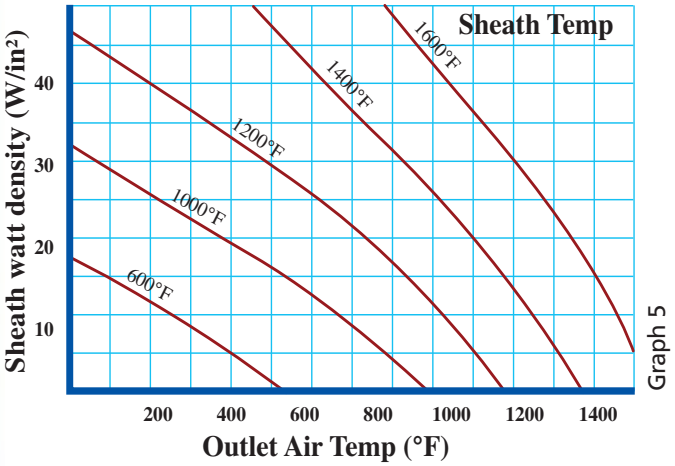
Graph 3

Elements in 540 FPM forced air



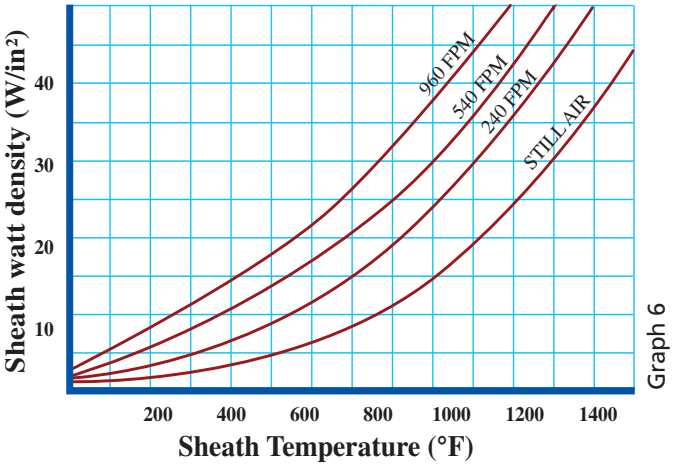
Graph 4

Elements in 960 FPM forced air



Graph 5

Elements in still or forced air at 75°F



Graph 6

Factors to be considered when selecting watt densities

- Application temperature
- Application conditions
- The maximum recommended temperature for the selected sheath material (table 1).
- The maximum watt density recommended for the material being heated. Table 2 shows some popular materials with their maximum recommended operational temperatures and watt densities.
- In the case of possible scale or sludge formation, heater elements should run at lower watt densities.
- In clamp-on applications, graph 1 (page 3) shows the relationship between the watt density of the heating elements, the required operating temperature, and the maximum targeted sheath temperature.
- When heating gases, the speed of the incoming gas and its outlet temperature should be considered in watt density calculations. Graphs 2, 3, 4 and 5 (page 3) show the relationship between the flow rate of air, its outlet temperature, the sheath temperature of the heating element selected and its corresponding watt density.
- When operating in vacuum, the watt density should be 20% to 30% lower. Because of the absence of air, heaters in vacuum mostly conduct heat through radiation.

Maximum Watt Density Ratings for Various Solutions

Solution	Max W/in²	Max Operating Temp (°F)
Acetic acid	40	180
Chromic acid	40	180
Citric acid	23	180
Nitric acid	20-25	167
Phosphoric acid	25-28	180
Alkaline solutions	40	212
Asphalt, tar	4-10	200-500
Bunker C fuel oil	10	160
Caustic Soda 2%	45	210
Caustic Soda 10%	25	210
Caustic Soda 75%	10	180
Ethylene glycol	30	300
Fuel oil pre-heating	9	180
Gasoline	20	300
Machine oil, SAE 30	18	250
Mineral oil	16-26	200-400
Molasses	4-5	100
Heat transfer oils	12-20	500-650
Vegetable oil	30-50	400
Degreasing solution	23	275
Hydraulic oil	12-15	100
Sodium phosphate	40	212
Trichlorethylene	23	150
Clean water	55-80	212
Deionized water	60	212
Demineralized water	60	212

Table 2

Moisture Resisting Seals

The MgO insulating medium inside a tubular heater is highly hygroscopic and can absorb moisture from its terminal ends. Moisture resisting seals are barriers that resist or stop moisture and contamination.

Silicone Resin

This seal is a silicone-based resin that is applied to tubular heater terminal ends. The seal penetrates a short length of the MgO insulation and transforms it into a moisture and contamination resistant medium suitable for temperatures below 390°F.

RTV Seal

This is a silicone room temperature vulcanizing seal that can resist moisture and contamination for up to 450°F.

Epoxy Seal

This is a liquid resin which is thermally cured to reach solid state. This moisture barrier is adequate for temperatures up to 250°F.

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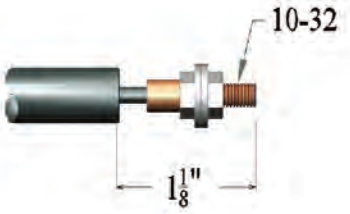
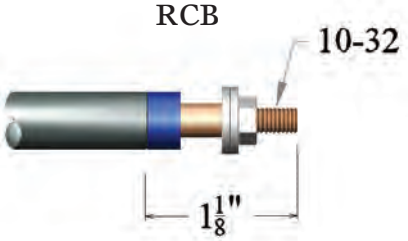
Terminal Options

CB



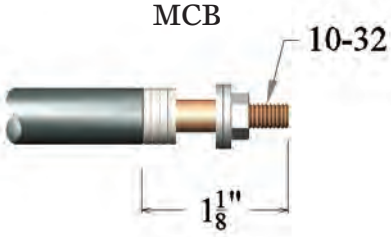
600V, 400°C

RCB



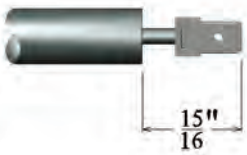
600V, 200°C

MCB



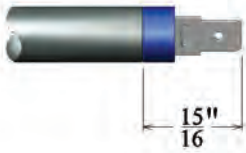
600V, 400°C

PT



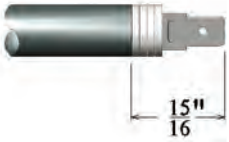
250V, 250°C

RPT



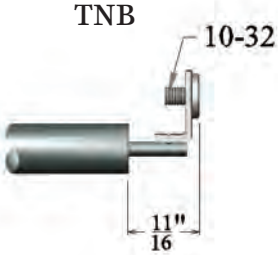
250V, 200°C

MPT



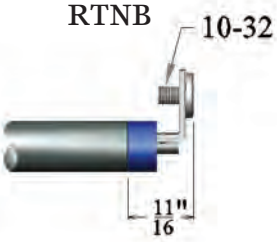
250V, 250°C

TNB



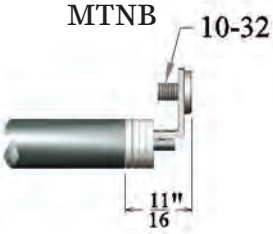
250V, 400°C

RTNB



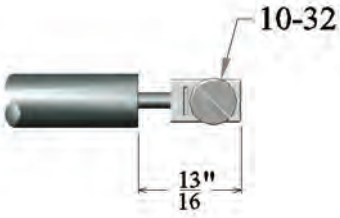
250V, 200°C

MTNB



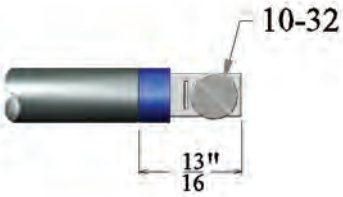
250V, 400°C

TSB



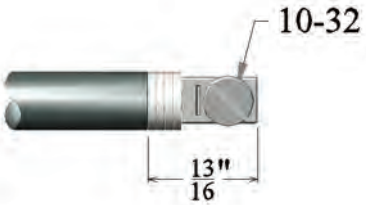
250V, 400°C

RTSB



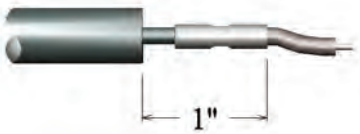
250V, 200°C

MTSB



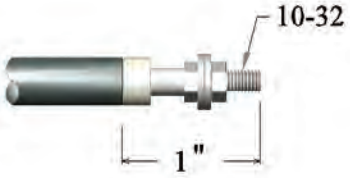
250V, 400°C

WT



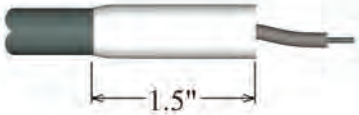
300V, 200°C

CSB



250V, 400°C

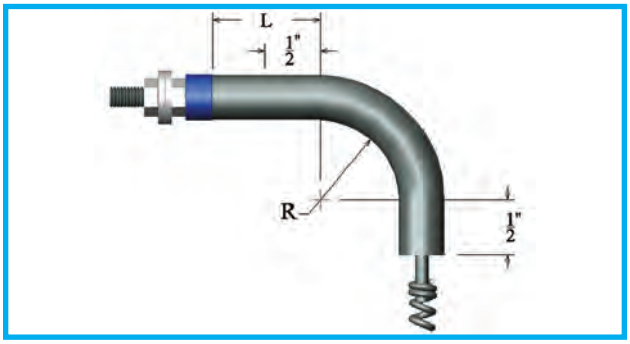
TH
(WATERPROOF)



600V, 150°C

Bending

Annealed tubular heaters can be bent. The inside radius of the bend should not be less than the recommended radii shown in the table below. For optimum results, bending should start from the center of a tubular heater and gradually move towards the ends. Care should be taken to insure that the connection between the cold pin and the coil does not fall in the bent area. A minimum of 1/2" clearance should seperate this connection from the bend. The following sketch provides the necessary guidelines.



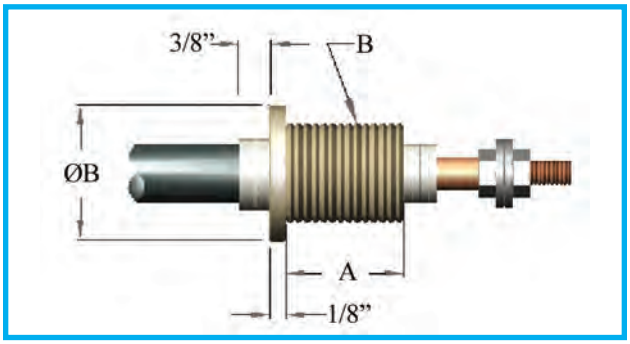
Sheath Diameter (in)	Min Factory Bend Radius (in)	Min Field Bend Radius (in)
0.260	5/16	3/4
0.315	5/16	1
0.375	3/8	1 5/8
0.430	1/2	1 5/8
0.475	5/8	2
For smaller bending radii please consult our factory.		

Re-compaction

During the process of bending tubular heaters, the rock-hard MgO insulating material forms cracks, specially on sharp bends. These cracks and fractures are weak points that lead to overheating and failure in dielectric strength. This problem becomes more emphasized in high-watt or high-temperature conditions. In order to re-establish compactness and prevent failure, recompressing elements at bent locations becomes necessary.

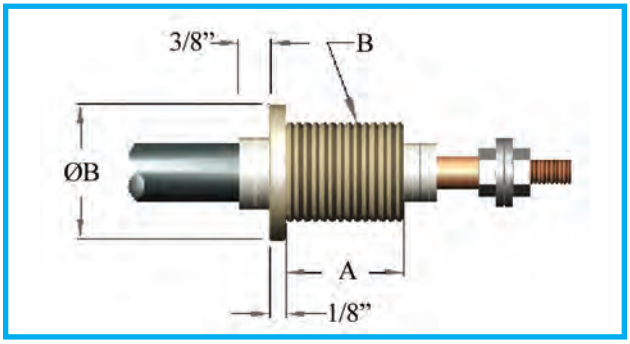
Mounting Accessories

Crimped Fitting



Part #	*Material	Used On	Thread Size	Dim. A	Dim. B
THF26C-B53	Brass	0.260"	1/2-20	17/32"	3/4"
THF31C-B53	Brass	0.315"	1/2-20	17/32"	3/4"
THF31C-B75	Brass	0.315"	5/8-18	3/4"	1"
THF37C-B75	Brass	0.375"	5/8-18	3/4"	1"
THF43C-B75	Brass	0.430"	5/8-18	3/4"	1"
THF43C-B87	Brass	0.430"	5/8-18	7/8"	1"

Welded Fitting



Part #	*Material	Used On	Thread Size	Dim. A	Dim. B
THF26W-S53	SS304	0.260"	1/2-20	17/32"	3/4"
THF31W-SB53	SS304	0.315"	1/2-20	17/32"	3/4"
THF31W-S75	SS304	0.315"	5/8-18	3/4"	1"
THF37W-S75	SS304	0.375"	5/8-18	3/4"	1"
THF43W-S75	SS304	0.430"	5/8-18	3/4"	1"
THF43W-S87	SS304	0.430"	5/8-18	7/8"	1"

* Fittings with different materials are available

BUCAN STRAIGHT & FORMED TUBULAR HEATERS

Standard Bending Formations

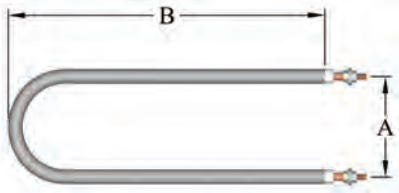


Figure 1

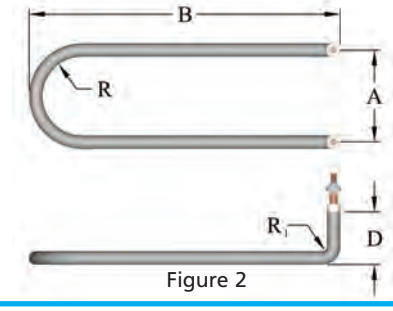
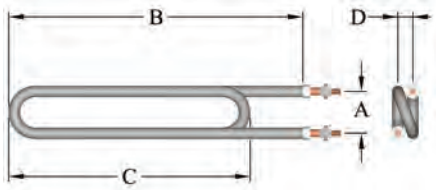


Figure 2



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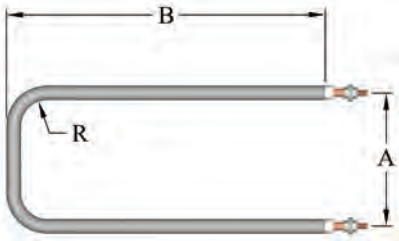


Figure 4

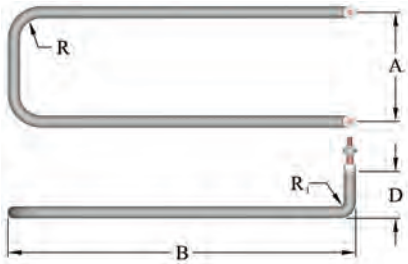


Figure 5

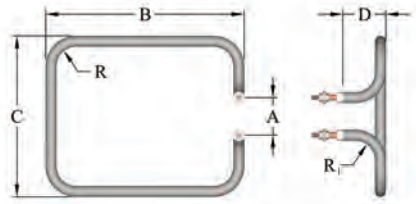


Figure 6

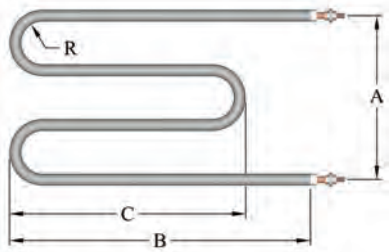


Figure 7

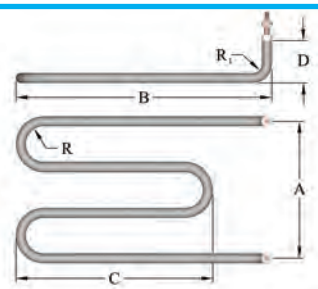


Figure 8

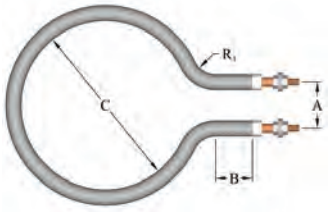


Figure 9

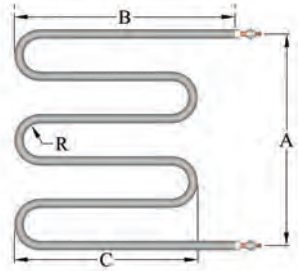


Figure 10

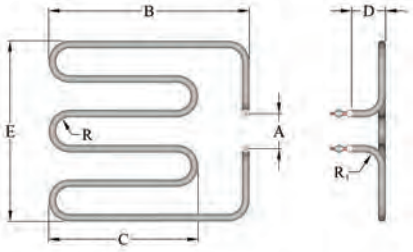


Figure 11

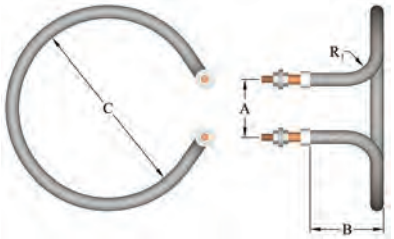


Figure 12

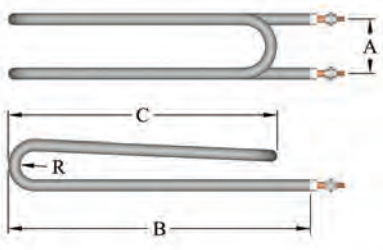


Figure 13

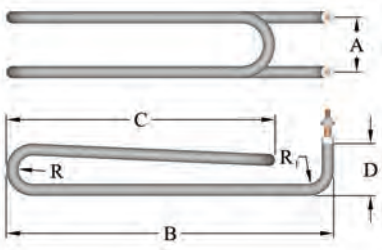


Figure 14

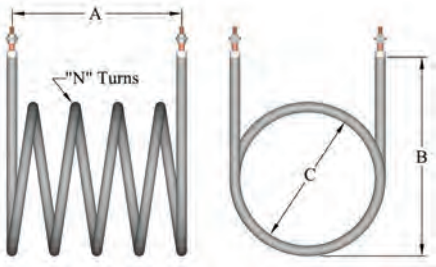
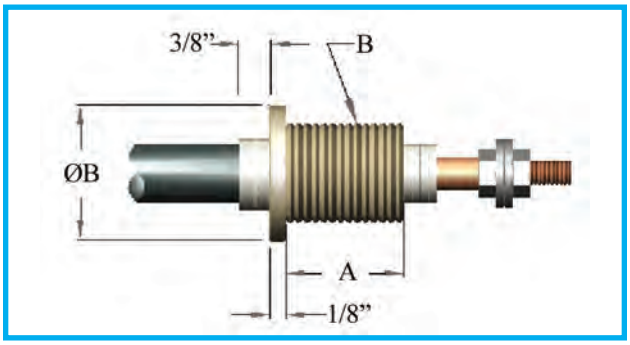


Figure 15

Mounting Accessories (Cont.)

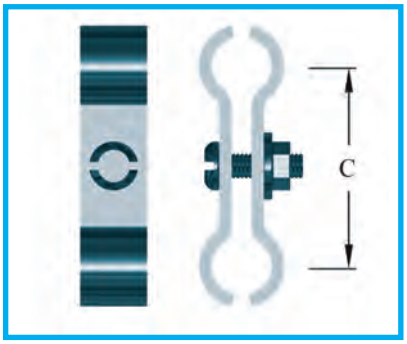
Brazed Fitting



Part #	*Material	Used On	Thread Size	Dim. A	Dim. B
THF26B-B53	Brass	0.260"	1/2-20	17/32"	3/4"
THF31B-B53	Brass	0.315"	1/2-20	17/32"	3/4"
THF31B-B75	Brass	0.315"	5/8-18	3/4"	1"
THF37B-B75	Brass	0.375"	5/8-18	3/4"	1"
THF43B-B75	Brass	0.430"	5/8-18	3/4"	1"
THF43B-B87	Brass	0.430"	5/8-18	7/8"	1"

* Fittings with different materials are available

"C" Clamp



Part #	Material	"C"
C15	SS304	1.5"
C20	SS304	2"

Mounting Bracket

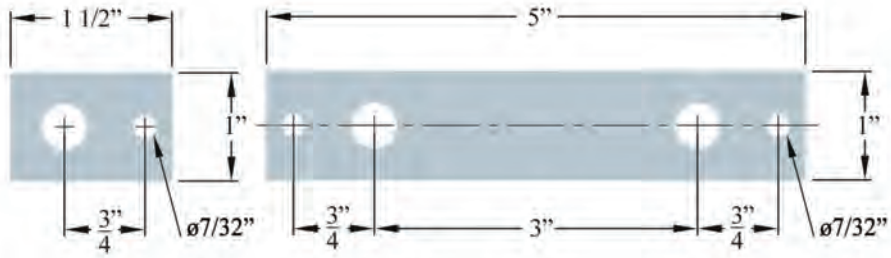


Figure 1 Figure 2

Part #	Material	Fig. #
MB1000	Steel	1
MB2000	Steel	2

Mounting Tips

- Tubular heaters expand when heated. At least 1% of element length should be considered as expansion and adequate clearance included in total design.
- When a tubular heater is attached to a surface, the middle clamp screws should be tightened completely. However, the end clamp screws should be tightened enough to hold the heater down and allow for expansion at the same time. This procedure will prevent the tubular heater from getting detached from the surface during the heating cycle.
- When tubular heaters are placed in grooves, the groove depth should be less than the heater diameter by 0.008"- 0.010", in order to insure proper clamping.
- Insulating materials (if used) should never be in direct contact with heaters. An air gap should separate the heater sheath from the insulating material.
- Tubular heater electric terminals should not be placed in vacuum or heated zones.