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Tubular Heaters

Tubular Heaters

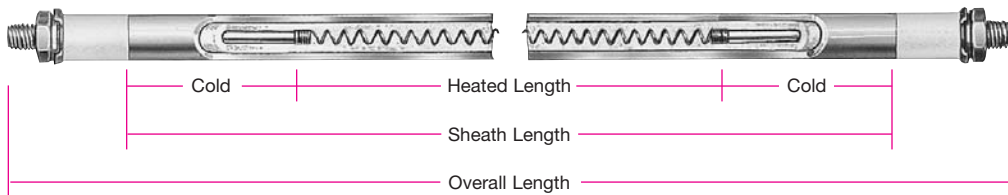


Introduction

Tubular Heater Introduction

Typical Applications

- * Forced air heating
- * Thermal forming machines
- * Direct immersion in liquids
- * Comfort radiant heaters
- * Welded, brazed or clamped to tanks and pipes
- * Hot runner molds
- * Combination radiant and convection heater for ovens and dryers



Design Guidelines

Resistance Tolerance

Tubular heating elements have an Industry Standard Resistance Tolerance of +10%, -5% which translates to a Wattage Tolerance of +5%, -10%. Consult Tempco if tighter tolerances are required for your application.

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 the life expectancy of the heater. The Watt Density is calculated with the following formula:

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

For a particular application element watt density will govern element sheath and internal resistance wire temperature. Factors to consider when choosing a suitable watt density are:

1. Many materials are heat sensitive and can decompose or be damaged if the element is running too hot.
2. Air and other gases that are poor conductors of heat require watt densities matched to the velocity of the gas flow to prevent element overheating.
3. When heating hard water or cleaning solutions mineral deposits can build up on the element sheath, acting as a heat insulator and raising the internal element temperature. If these deposits cannot be periodically removed, use a lower watt density element to increase heater life expectancy.
4. Page 16-12 in the Engineering Data Section of this catalog lists the maximum recommended heater watt density for many materials. For additional information and help please contact Tempco.



Important Note — When heating any substance it is critical to match the heater watt density, operating temperature and sheath material to the specific medium being heated. Failure to do so will result in premature heater failure and/or unsafe conditions.

Construction Characteristics

Tempco Tubular Heaters are the most versatile and widely used source of electric heat for industrial, commercial and scientific applications. They can be designed in a wide range of electrical ratings, diameters, lengths, terminations, and sheath materials. Important and useful characteristics of tubular heaters are that they can be formed into virtually any shape, brazed or welded to any metal surface, and cast into metals. Carefully researched manufacturing methods and quality materials have made Tempco tubular heaters stand apart from other heating elements claiming similar performance.

The cut-away view 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 then filled with Grade "A" Magnesium Oxide powder (MgO). 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.



Agency Approvals



Tempco Tubular Heating Elements have been certified as Recognized Components by Underwriters Laboratories (File Number E90771) under Classification UBJY2 after testing to meet Standard UL1030. Tempco's equivalent CSA File number is LR43099-5.

These files specify the Watt Density limitation per application type and any other limitations imposed by these agencies in the use of this type of heater. For additional information consult Tempco.

If you require UL and/or CSA approval please specify when ordering.





Tubular Heater Standard Specifications

Element Diameter		Maximum Voltage	Maximum Amperage	Resistance in Ohms per Heated Inch		Sheath Length			
in	mm			min	max	min		max	
.260	6.6	250	15	.100	17	11	279	200	5080
.315	8.0	480	30	.060	21	11	279	200	5080
.375	9.5	600	30	.040	21	11	279	200	5080
.430	10.9	600	40	.040	21	11	279	268	6807
.475	12.1	600	40	.040	21	11	279	200	5080
.625	15.9	600	40	.040	17	11	279	255	6477

Table 1 Electrical Limitations and Minimum/Maximum Sheath Lengths

Length		Sheath Length Tolerance (±)		Heated Length Tolerance (±)		Minimum Unheated Length Each End	
in	mm	in	mm	in	mm	in	mm
11-20	279-508	3/32	2.4	1/4	6	1	25
20-50	508-1270	1/8	3.2	1/2	13	1-1/4	32
50-80	1270-2032	5/32	4.0	7/8	22	1-1/2	38
80-110	2032-2794	3/16	4.8	1-1/8	29	1-5/8	42
110-140	2794-3556	7/32	5.6	1-3/8	35	1-3/4	44
140-170	3556-4318	1/4	6.4	1-5/8	41	2	51
170-200	4318-5080	3/8	9.5	1-7/8	48	2-1/4	57
200-up	5080-up	1/2	12.7	2-3/8	60	2-1/2	64

Table 2 Sheath and Heated Length Tolerance (applicable for all diameters)

Tubular Heater Standard Sheath Materials

The selection of a sheath material should be made based on the the chemical composition of the gas or liquid being heated, the characteristics of the materials entering the solution, and the processes controls. A material selection guide can be found on page 16-12.

The best source for chemical/sheath compatibility is the supplier of the gas or liquid to be heated.

The following are the most common tubular element sheath materials. For other materials consult Tempco.

Incoloy® 840: Nickel 18-20%, Chromium 18-22%, Iron balance. Has about 10% less nickel than Incoloy 800. Used in many air heating applications where it has exhibited superior oxidation resistance at less cost than Incoloy 800.
Maximum Sheath Temperature: 1600°F / 871°C

Incoloy® 800: Nickel 30-35%, Chromium 19-23%, Iron balance. The high nickel content of this alloy contributes to its resistance to scaling and corrosion. Used in air heating and immersion heating of potable water and other liquids.
Maximum Sheath Temperature: 1600°F / 871°C

316 Stainless Steel: Chromium 16-18%, Nickel 11-14%, Iron balance. Modified with the addition of Molybdenum (2-3%) to improve corrosion resistance in certain environments, especially those which would tend to cause pitting due to the presence of chlorides. Applications include deionized water.
Maximum Sheath Temperature: 1200°F / 649°C

304 Stainless Steel: Chromium 18-20%, Nickel 8-11%, Iron balance. Used in the food industry, medical, and chemical heating.
Maximum Sheath Temperature: 1200°F / 649°C

321 Stainless Steel: Chromium 17-20%, Nickel 9-13%, Iron balance. Modified with the addition of Titanium to prevent carbide precipitation and resulting intergranular corrosion that can take place in certain mediums when operating in the 800-1200°F (427-649°C) temperature range.
Maximum Sheath Temperature: 1200°F / 649°C

Copper: Standard Copper Alloy
A low temperature, inexpensive material used mainly for clean water heating.
Maximum Sheath Temperature: 350°F / 177°C

Steel: Low Carbon
Used for high to low viscosity oils, asphalt, tar, wax, molten salt, heat transfer liquid media and other compatible solutions.
Maximum Sheath Temperature: 750°F / 399°C

Other Sheath Materials: Available for a limited number of diameters. Consult Tempco for more information.

Inconel® 600: Iron 6-10%, Chromium 14-17%, Nickel balance
Maximum Sheath Temperature: 1800°F / 982°C

Incoloy® 825: Nickel 38-46%, Chromium 19.5-23.5%, Molybdenum 2.5-3.5%, Iron balance
Maximum Sheath Temperature: 1600°F / 871°C



Maximum Sheath Temperature refers to the maximum temperature of the element sheath material. Consideration must be given to the maximum temperature that can be safely applied to the heated material. See **Watt Density** on the previous page for additional information.



Sheath Treatments and Terminations

Incoloy® and Stainless Steel Element Sheath Surface Treatments

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.

Optional Surface Finishes

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 is an electrochemical process that removes surface imperfections and contaminants, enhancing the corrosion 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.

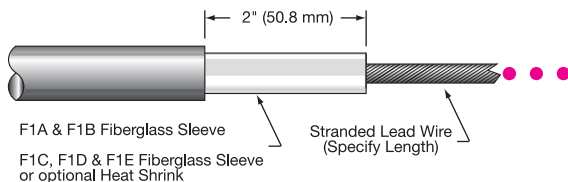
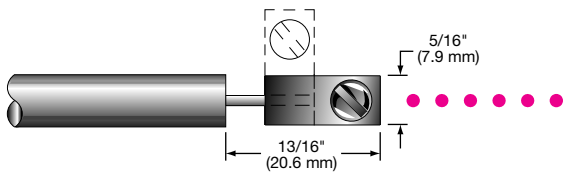
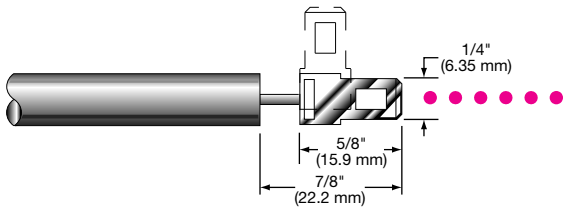
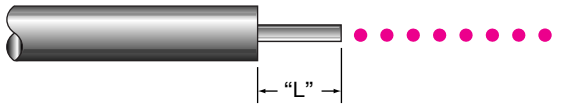
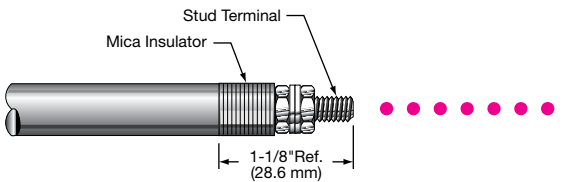
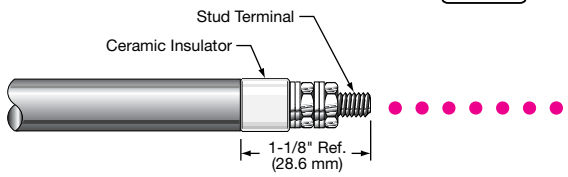
Passivation removes surface contamination, usually iron, so that the optimum corrosion resistance of the stainless steel is maintained. Surface contamination could come from the small amount of steel that may be worn off a tool during the manufacturing process.

Standard Tubular Heater Terminations

Select the termination style that meets your requirements for space, accessibility and reliability.



Note: If the listed terminations do not seem to fit your requirements, call us and let us design one that will.



TYPE T – STANDARD

Threaded stud terminal with ceramic insulator. Standard thread size is 6-32 for .260" (6.6 mm), 8-32 for .315" (8 mm), .335" (8.5 mm) and .375" (9.5 mm), and 10-32 for all other diameters. Other thread sizes and lengths are available to accommodate any electrical requirements and clearance restrictions.

TYPE TM – Stud with Mica Insulator

Stud terminal with mica insulator. Standard thread size is 6-32 for .260" (6.6 mm), 8-32 for .315" (8 mm), .335" (8.5 mm) and .375" (9.5 mm), and 10-32 for all other diameters. Other thread sizes and lengths are available to accommodate any electrical requirements and clearance restrictions.

TYPE P – Plain Pin

Plain terminal pin. Specify Length "L." Standard 1/2" (12.7 mm) pin length.

Element Diameter		Nominal Pin Diameter	
in	mm	in	mm
.260	6.6	.091	2.3
.315	8.0	.105	2.7
.375	9.5	.105	2.7
.430	10.9	.125	3.2
.475	12.0	.125	3.2
.625	15.9	.160	4.1

TYPE SF & SF9 (90°) – Quick Connect

1/4" male quick connect (slip-on) terminals are welded to the element terminal pin. They provide quick and easy installation of lead wire with excellent holding force. Material: Nickel-Plated Steel.

TYPE L_ & L9_ (90°) – Terminal Lug

A nickel-plated steel lug is projection welded to the terminal pin straight (Type "L_") or at 90° to the sheath (Type "L9_").

Standard LA, L9A 10-32 screw Optional LB, L9B 8-32 screw

TYPE F1_ – Lead Wire

Type F1A 250°C (482°F) TGGT insulation

Type F1B 450°C (842°F) MGT insulation

Type F1C 200°C (392°F) Teflon® insulation

Type F1D 150°C (302°F) Silicone Rubber insulation

Type F1E 105°C (221°F) Thermoplastic (PVC) insulation
Standard 10" (254 mm) leads. Specify longer leads if required.

Fiberglass Sleeve Standard

F1C, F1D & F1E available with optional Heat Shrink. Specify when ordering.



Lead wire gauge is determined by the ampacity of the heater with the lead wires in an ambient temperature of 40°C (104°F). Higher ambients may require heavier gauge lead wires.

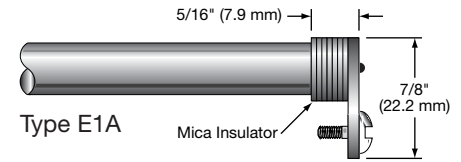
Product Inventory Available for Viewing and Selection @ www.tempco.com



Tubular Heater Standard Terminations

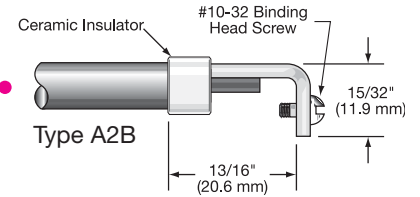
TYPE E__ – Right-Angle Lug Terminal

- Type E1A** 8-32 screw with mica insulator (Standard)
- Type E1B** 8-32 screw with ceramic insulator
- Type E2A** 10-32 screw with mica insulator
- Type E2B** 10-32 screw with ceramic insulator



TYPE A__ – Right-Angle Terminal (for use when space is tight)

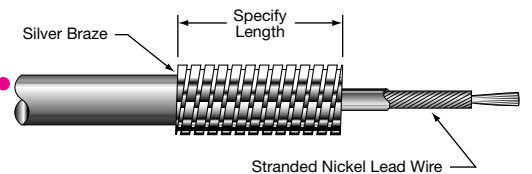
- Type A1A** 8-32 screw with mica insulator
- Type A1B** 8-32 screw with ceramic insulator
- Type A2A** 10-32 screw with mica insulator
- Type A2B** 10-32 screw with ceramic insulator (Standard)



TYPE R1__ – Flexible Armor Cable

- Type R1A** Galvanized cable
- Type R1B** Stainless steel cable

Provides excellent protection to lead wires in abrasive environments. Specify cable length and lead wire length.
Standard 10" (254 mm) armor cable over 12" (305 mm) leads. Specify longer leads or cable, if required.

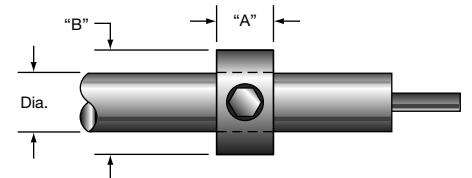


Tubular Heater Standard Mounting Methods

Part Number	For Element Diameter		"A" THK		"B" OD	
	in	mm	in	mm	in	mm
FAS-108-102	.260	6.6	5/16	7.9	5/8	15.9
FAS-108-102	.315	8.0	5/16	7.9	5/8	15.9
FAS-108-103	.375	9.5	3/8	9.5	3/4	19.1
FAS-108-104	.430	10.9	7/16	11.1	7/8	22.2
FAS-108-106	.475	12.0	7/16	11.1	1	25.4

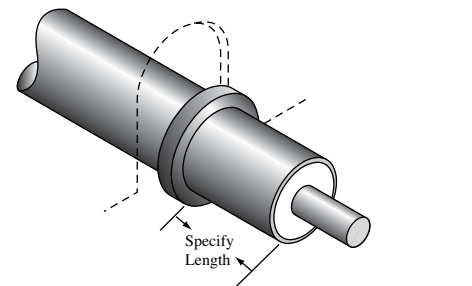
TYPE MC – Mounting Collar

Plated steel mounting collars are locked in place with a set-screw and serve as an adjustable stop for through-the-wall mounting. Collars are shipped in bulk unless otherwise specified. Mounting collars can be ordered with the heater or purchased separately.



TYPE LR – Locator Washer

Locator washers are permanently attached to the heater sheath by staking/crimping and are used to limit the movement of the heater while allowing for expansion and contraction of the heater sheath. When ordering, specify location from end of sheath.

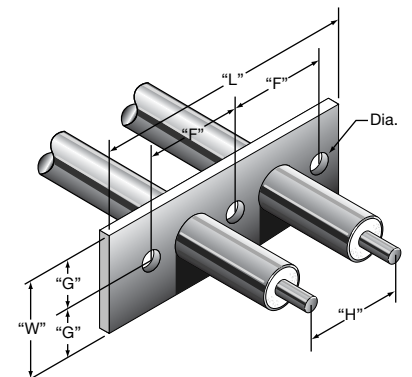


TYPE MF – Mounting Bracket

Tempco's made-to-order mounting brackets are made from 18 gauge stainless steel for strength and stiffness. It is an economical way to mount the heater in non-pressurizing, non-liquid applications. Unless otherwise specified, the bracket will be located 1/2" from the edge of the heater sheath. OEM quantity brackets are manufactured by Tempco on our own high speed precision N/C Turret Press. The standard method of attaching the tubular element to the bracket is staking or crimping.

The rectangular mounting bracket shown at right is a popular, made-to-order design. Specify all dimensions shown when requesting a quote.

Custom brackets of any size, thickness or material can be supplied to meet your requirements.



Multiple element heater assembly with a custom mounting bracket.



CONTINUED →



Mounting Methods

Tubular Heater Standard Mounting Methods

Continued from previous page...

TYPE B – Bulkhead Fittings

Bulkhead fittings provide a leak-proof method for mounting tubular heating elements through tank walls. Brass crimped fittings are used for low pressure water (up to 80 psig) or non-pressure air. Specify if stainless steel jam nut and washer are required when ordering stainless steel fittings. Brass hex nut, plated steel washer and gasket are standard.

Fittings for vacuum or high pressure gas and liquid use are silver brazed or TIG welded. Method will vary by material and application. Fittings in table are most commonly used. Special fittings can be made to meet your application requirements.

Standard fitting location is with threads flush at the end of the element sheath as shown below. For other locations specify distance from end of sheath.

CAUTION Do not locate the fitting over the heated section of the element.

Specify: Material; Round or Hex Flange; Thread Type and Length; Location on Sheath; Crimped, Brazed, or Welded Construction.

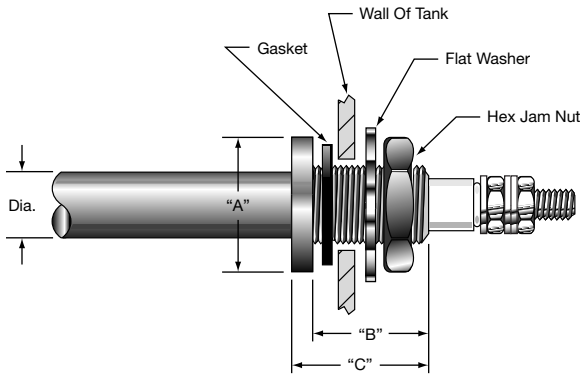
Fitting Attachment Method — General Guidelines

These are guidelines only. Consult Tempco if you require assistance in determining the method best suited for your application.

Fittings Crimped: Low pressure water (up to 80 psig) and non-pressure air applications

Fittings Brazed: Non-ferrous alloys (copper) and dissimilar non-weldable metals

Fittings Welded: High pressure liquids and gases, and high temperature applications



Standard Bulkhead Fittings For Tubular Heaters — Round Flanged Standard

Tubular Diameter	in mm	Fitting Material	Flange Type	"A"		"B"		"C"		Thread Size (UNF)
				in	mm	in	mm	in	mm	
.260	6.6	Brass	Round	3/4	19	1/2	12.7	5/8	16	1/2-20
.260	6.6	Stn. Stl.	Round	3/4	19	1/2	12.7	5/8	16	1/2-20
.315	8.0	Brass	Round	3/4	19	1/2	12.7	5/8	16	1/2-20
.315	8.0	Stn. Stl.	Round	3/4	19	1/2	12.7	5/8	16	1/2-20
.375	9.5	Brass	Round	3/4	19	1/2	12.7	5/8	16	1/2-20
.375	9.5	Stn. Stl.	Round	3/4	19	1/2	12.7	5/8	16	1/2-20
.430	10.9	Brass	Round or Hex	7/8	22	3/4	19.0	7/8	22	5/8-18
.430	10.9	Stn. Stl.	Round or Hex	7/8	22	3/4	19.0	7/8	22	5/8-18
.430	10.9	Steel	Round	7/8	22	3/4	19.0	7/8	22	5/8-18
.475	12.1	Brass	Round	7/8	22	3/4	19.0	7/8	22	5/8-18
.475	12.1	Stn. Stl.	Round	7/8	22	3/4	19.0	7/8	22	5/8-18
.475	12.1	Steel	Round	7/8	22	3/4	19.0	7/8	22	5/8-18
.475	12.1	Brass	Round	1	25	3/4	19.0	7/8	22	3/4-16
.475	12.1	Stn. Stl.	Round	1	25	3/4	19.0	7/8	22	3/4-16
.625	15.9	Stn. Stl.	Round	1-1/8	29	3/4	19.0	1	25	7/8-14



Optional: Larger Thread Sizes and Hex Flanged Bulkhead Fittings are available. Consult Tempco with your requirements.



Tubular Heater Standard Moisture Seals

Magnesium Oxide (MgO) is used as the insulating material in Tempco tubular heaters because of its excellent thermal conductivity and dielectric strength. However, MgO is hygroscopic and can absorb moisture from the atmosphere. This absorption of moisture may be detected when an Insulation Resistance (IR) test is done with a megohmmeter prior to energizing the heater circuit. In very humid environments, circuits utilizing a GFI (ground fault interrupter) for safety may experience nuisance tripping when energizing the heater.

The Tempco manufacturing process produces a dry element with an IR of several thousand megohms minimum. However, after shipment and depending on humidity levels and storage time, a heater can absorb moisture and show a decrease in IR. In many cases, depending on the supply voltage and the application, the heater can be safely energized and will dry itself out.

If a heater has absorbed moisture, a safe and effective method of drying it out prior to installation is to bake it in an oven at 300°F (149°C) until an acceptable IR reading is obtained. When possible, removing the terminal hardware will expedite this process. If this method is not practical consult factory for other recommendations.

For applications where moisture absorption would be unacceptable Tempco has several optional element end seals to retard absorption of moisture in the MgO. If a true hermetic seal is required, ceramic to metal end seals (Type H) are available. With any of these seals, the maximum recommended operating temperature must not be exceeded.

Style SS—Silicone Resin Seal

A brushed-on coating that penetrates the MgO, offering economical moisture protection under humid storage conditions.

Maximum Usable Termination Temperature: 390°F (200°C)
UL Rated Maximum Termination Temperature: 221°F (105°C)

Type V2A: conformal coating
Type V2B: silicone oil

Style SEH—Epoxy Resin Seal

Epoxy resin provides a moisture resisting barrier.

UL Rated – Maximum Termination Temperature:

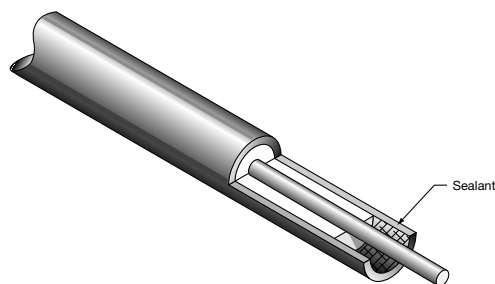
Type V: 194°F (90°C)
Type V1: 266°F (130°C)
Type V4: 392°F (200°C)

Style SER—RTV Seal

RTV (room temperature vulcanizing) silicone rubber adhesive sealant provides a good moisture seal.

UL Rated – Maximum Termination Temperature:

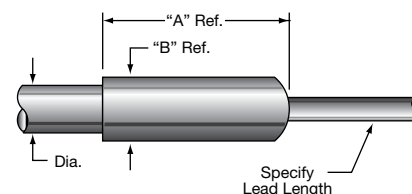
Type R: 302°F (150°C)
Type R1: 392°F (200°C)



TYPE M—Self Sealing Heat Shrinkable Boot with Lead Wire

This type seal is used primarily for defrost heaters. Temperature range -67 to 300°F (-55 to 149°C). Standard 10" (254 mm) leads; specify longer leads if required.

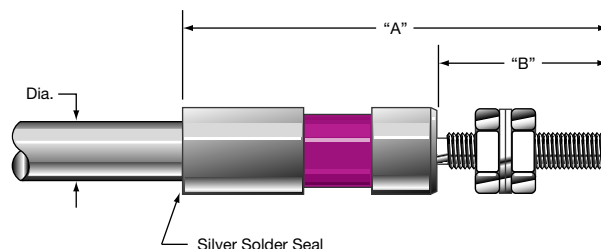
Heater Diameter		"A"		"B"	
in	mm	in	mm	in	mm
.260	6.6	2-1/8	54	7/16	11
.315	8.0	2-1/8	54	7/16	11
.430	10.9	2-1/8	54	9/16	14



TYPE H—Hermetic Seal

Ceramic to metal seals provide an airtight seal for temperatures to 500°F (260°C) in the seal area.

Heater Diameter		"A"		"B"		Thread Size
in	mm	in	mm	in	mm	
.260	6.6	1-11/16	43	13/32	10	8-32
.315	8.0	1-11/16	43	13/32	10	10-32
.430	10.9	2-1/8	54	21/32	17	1/4-28
.475	12.1	2-1/8	54	21/32	17	1/4-28





Bend Formations

Tubular Heater Standard Bend Formations

Forming Tubular Elements

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 furnace 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. However, since forming also work hardens the metal, some precautions must be observed in order to prevent the sheath from breaking during bending or developing stress cracking marks.



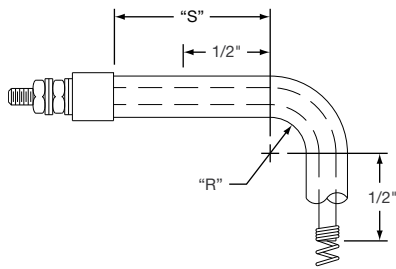
Note: Elements with tight bends and some applications require the bends to be recompact in special dies to restore the integrity of the insulation density and maintain dielectric strength. Large bends do not need to be recompact.



Note: Smaller inside bending radius than listed in the table can be factory accomplished. It requires special forming techniques to prevent damage to the tubular heater. Consult Tempco with your requirements.

Tubular Element Minimum Bending Radius

Element Diameter		Factory Bend Minimum R		Field Bend Minimum R		Minimum S	
in	mm	in	mm	in	mm	in	mm
.260	6.6	3/8	9.5	3/4	19.1	1/2	12.7
.315	8.0	1/2	12.7	1	25.4	1/2	12.7
.375	9.5	9/16	14.3	2	50.8	5/8	15.9
.430	10.9	3/4	19.1	2-1/2	63.5	3/4	19.1
.475	12.0	7/8	22.2	2-1/2	63.5	1	25.4

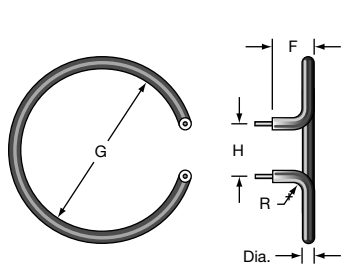


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Avoid bends within a minimum of 1/2" of the terminal pin and resistance wire junctions unless the bending radius is a minimum 3" (75 mm).

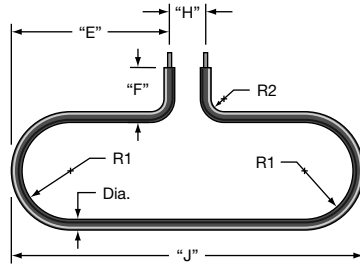
Elements are being fed into a roll reducing mill to compact the MgO insulating powder. After rolling, the elements are annealed in the conveyor belt furnace seen in the background.



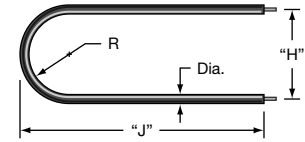
TYPICAL Bend Formations



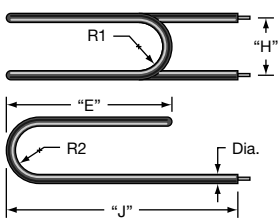
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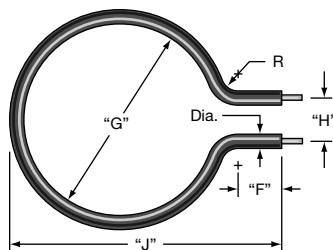
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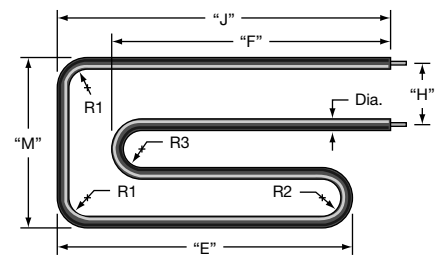
FT3



FT4



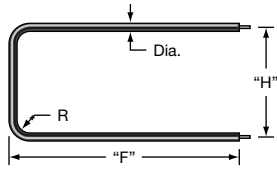
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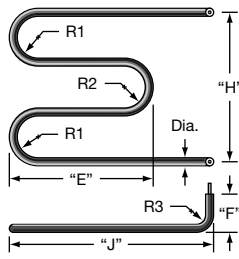
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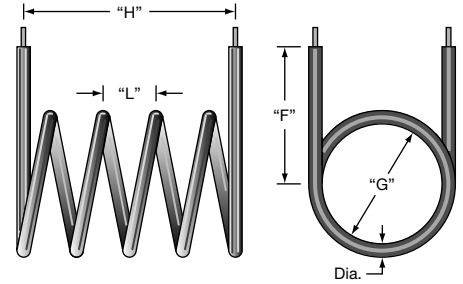
Tubular Heater Standard Bend Formations



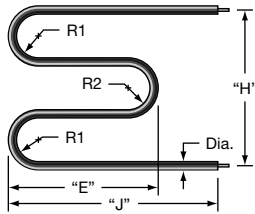
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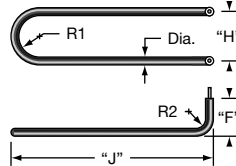
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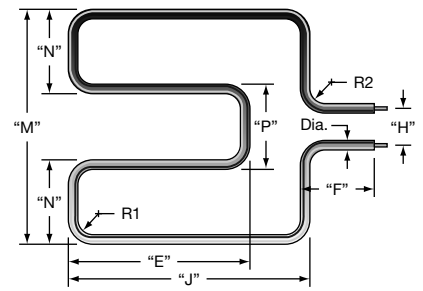
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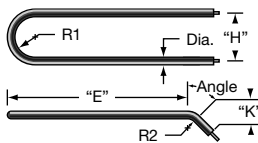
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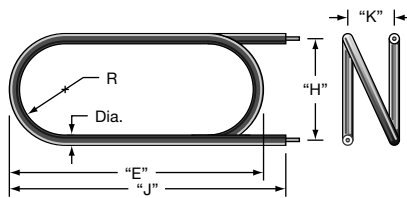
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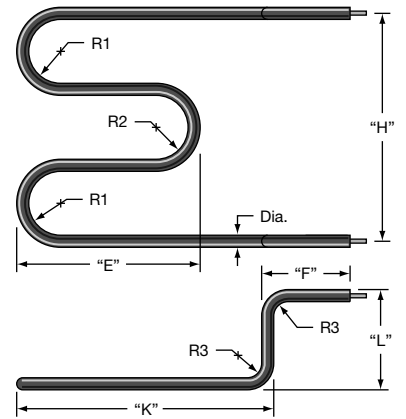
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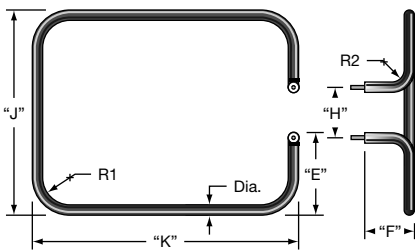
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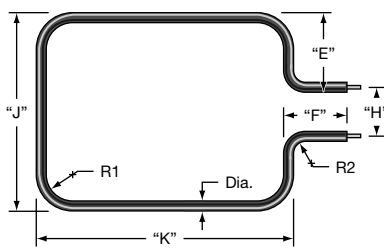
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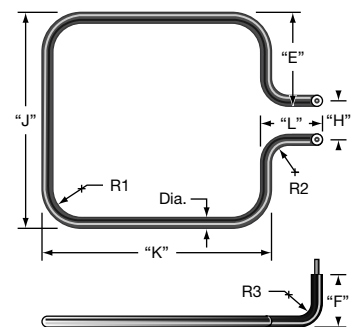
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FT16



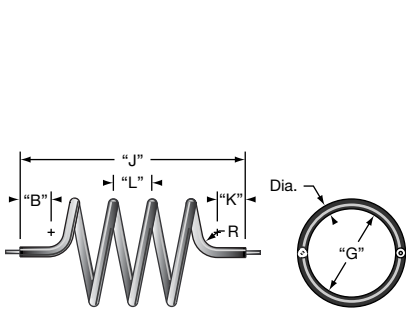
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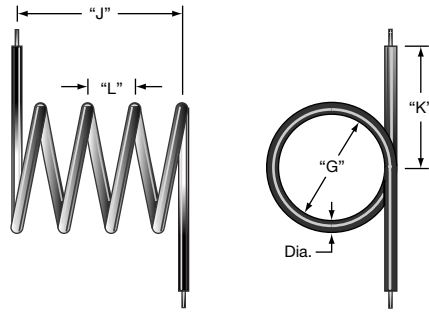
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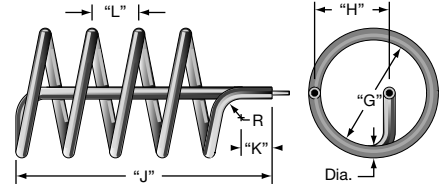
Tubular Heater Standard Bend Formations



FT19

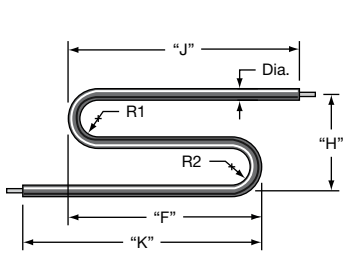


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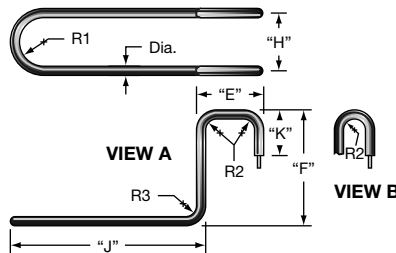


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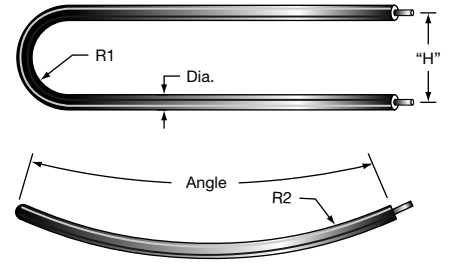
TYPICAL Bend Formations



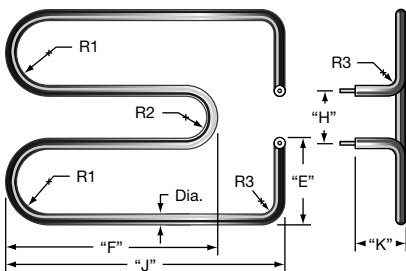
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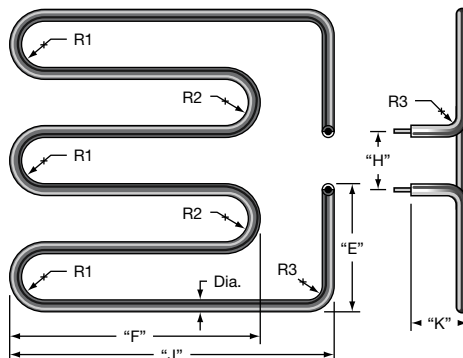
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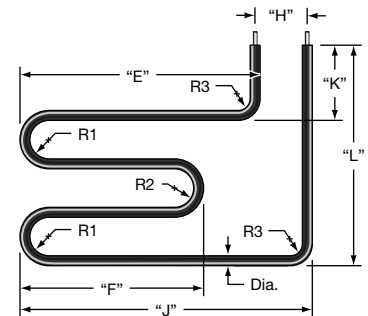
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FT25



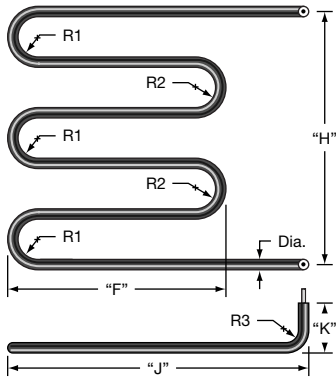
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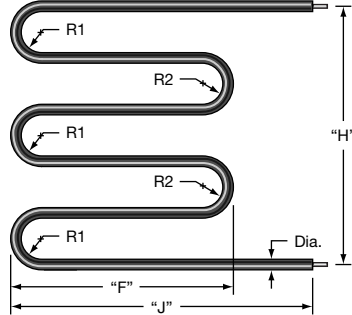
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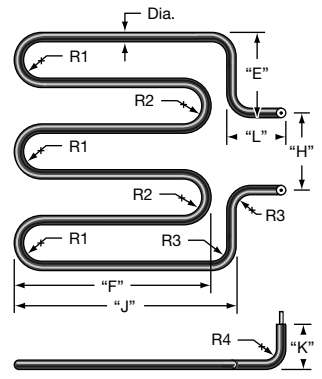
Tubular Heater Standard Bend Formations



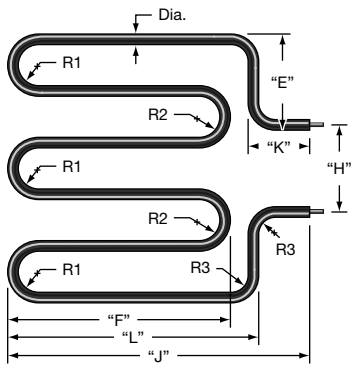
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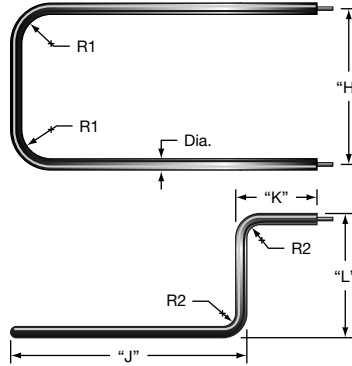
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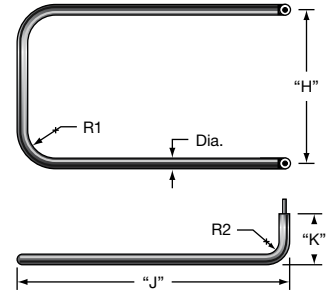
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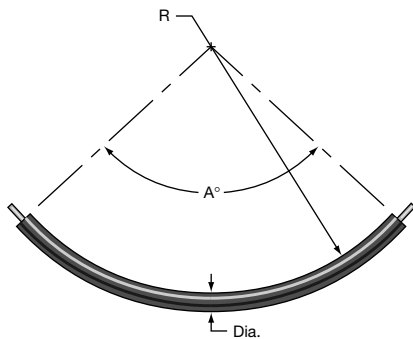
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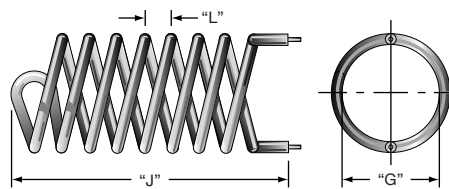
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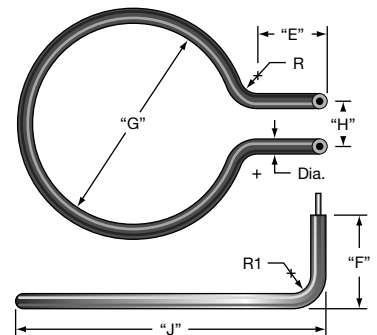
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FT34



FT35



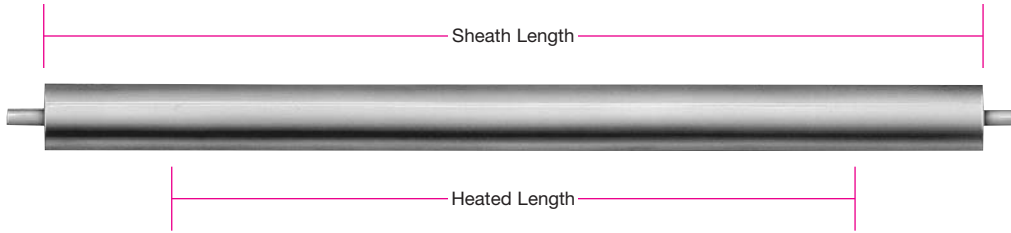
FT36

Tubular Heaters



Standard Sizes and Ratings

Tubular Heater Standard (Non-Stock) and Stock Sizes and Ratings



Standard tubular heaters are fully annealed for field or factory bending. They are inventoried with plain pin extensions that allow quick installation of Termination Types T, TM, F1, A, E, SF, SF9, L and L9. Part Numbers listed are for heaters with Type “T” termination. For other terminations a Part Number will be issued at time of order.

Standard (Non-Stock) and Stock Sizes and Ratings with Type T Termination

Element Description	Sheath Length		Heated Length		Watts	Part Number 240V	Approximate Net Weight	
	in	mm	in	mm			lbs	kgs
23 W/in² .475 Dia. Incoloy® 840 12 mm (3.6 W/cm ²)	39	991	27	686	1000	*THE04000	1.0	.5
	54	1372	42	1067	1500	*THE04001	1.1	.5
	69	1753	57	1448	2000	THE04002	1.3	.6
	84	2134	72	1829	2500	*THE04003	1.4	.6
	99	2515	87	2210	3000	THE04004	1.6	.7
	132	3353	120	3048	4175	THE04005	1.7	.8
30 W/in² .260 Dia. Incoloy® 840 6.6 mm (4.7 W/cm ²)	157	3988	145	3683	5000	THE04006	1.8	.8
	20	508	15	381	400	THE04007	.2	.1
	25	635	20	508	500	THE04008	.2	.1
	30	762	25	635	600	THE04009	.2	.1
	35	889	30	762	800	*THE03384	.3	.1
	40	1016	35	889	900	*THE04010	.3	.1
	45	1143	40	1016	1000	*THE04011	.4	.2
	50	1270	45	1143	1200	THE04012	.4	.2
	55	1397	50	1270	1200	THE03383	.4	.2
	60	1524	55	1397	1400	*THE03373	.5	.2
	65	1651	60	1524	1600	THE02648	.5	.2
	70	1778	65	1651	1800	THE04013	.6	.3
75	1905	70	1778	1800	THE04014	.6	.3	
80	2032	75	1905	2000	THE04015	.6	.3	
30 W/in² .315 Dia. Incoloy® 840 8.0 mm (4.7 W/cm ²)	15	381	10	254	300	THE04016	.2	.1
	20	508	15	381	400	THE04017	.3	.1
	25	635	20	508	600	THE04018	.3	.1
	30	762	25	635	800	THE04019	.4	.2
	35	889	30	762	900	THE03328	.5	.2
	40	1016	35	889	1000	*THE04020	.5	.2
	45	1143	40	1016	1200	THE04021	.6	.3
	50	1270	45	1143	1400	THE04022	.7	.3
	55	1397	50	1270	1600	*THE04023	.7	.3
	60	1524	55	1397	1800	*THE03134	.8	.4
	65	1651	60	1524	1800	THE04024	.9	.4
	70	1778	65	1651	2000	*THE03380	1.0	.5
	75	1905	70	1778	2200	THE04025	1.0	.5
	80	2032	75	1905	2400	THE04026	1.1	.5
90	2286	85	2159	2600	THE04027	1.2	.5	
100	2504	95	2413	3000	THE04028	1.3	.6	

An asterisk (*) next to the Part Number guarantees *in-stock* availability for same-day shipping when **ORDERED BY 2^{PM} CST**



Product Inventory Available for Viewing and Selection @ www.tempco.com



Tubular Heater Standard (Non-Stock) and Stock Sizes and Ratings

Standard (Non-Stock) and Stock Sizes and Ratings with Type T Termination

Element Description	Sheath Length		Heated Length		Watts	Part Number 240V	Approximate Net Weight	
	in	mm	in	mm			lbs	kgs
30 W/in² .430 Dia. Incoloy[®] 840 10.9 mm (4.7 W/cm²)	15	381	10	254	400	THE04029	.3	.1
	20	508	15	381	600	THE04030	.5	.2
	25	635	20	508	800	THE04031	.6	.3
	30	762	25	635	1000	THE04032	.7	.3
	35	889	30	762	1200	THE04033	.8	.4
	40	1016	35	889	1400	THE04034	.9	.4
	45	1143	40	1016	1600	THE04035	1.0	.5
	50	1270	45	1143	1800	THE04036	1.1	.5
	55	1397	50	1270	2000	THE03415	1.3	.6
	60	1524	55	1397	2200	THE03376	1.4	.6
	65	1651	60	1524	2400	THE04037	1.5	.7
	70	1778	65	1651	2600	*THE04038	1.6	.7
	75	1905	70	1778	2800	*THE04039	1.7	.8
	80	2032	75	1905	3000	*THE04040	1.8	.8
	90	2286	85	2159	3500	THE04041	2.0	.9
	100	2540	95	2413	4000	*THE03593	2.3	1.0
110	2794	105	2667	4500	*THE03067	2.5	1.1	
120	3048	115	2921	5000	THE04042	2.7	1.2	
40 W/in² .375 Dia. Incoloy[®] 840 9.5 mm (6.2 W/cm²)	21 ¹ / ₁₆	535	16 ¹³ / ₁₆	427	800	THE04043	.4	.2
	27 ¹ / ₈	689	22 ¹ / ₈	581	1100	THE04044	.5	.2
	32 ¹ / ₈	816	27 ¹ / ₈	708	1300	THE04045	.6	.3
	42 ¹ / ₈	1089	38 ¹ / ₈	981	1800	*THE04046	.8	.4
	57 ¹ / ₂	1461	53 ¹ / ₄	1353	2500	THE04047	1.1	.5
	69 ¹ / ₄	1759	65	1651	3000	THE04048	1.3	.6
	81 ¹ / ₄	2064	77	1956	3600	THE04049	1.5	.7
	109 ¹ / ₄	2775	105	2667	4000	THE04050	2.1	1.0
	134 ¹ / ₂	3416	127 ³ / ₄	3245	5000	THE04051	2.5	1.1
153 ³ / ₈	3896	145 ¹ / ₈	3705	5500	THE04052	2.9	1.3	
179 ¹ / ₄	4553	171 ¹ / ₄	4350	6500	THE04053	3.4	1.5	
48 W/in² .475 Dia. Incoloy[®] 840 12 mm (7.4 W/cm²)	23	584	14	356	1000	THE04054	.6	.3
	30	762	21	533	1500	THE04055	.9	.4
	39	991	27	686	2000	THE04056	1.1	.5
	44	1118	35	889	2500	THE04057	1.3	.6
	54	1372	42	1067	3000	THE04058	1.6	.7
	69	1753	57	1448	4000	THE04059	2.0	.9
	84	2134	72	1829	5000	THE04060	2.2	1.0
	99	2515	87	2210	6000	THE04061	2.8	1.3
	149	3785	133	3378	9720	THE04062	4.0	1.8

Ordering Information

Catalog Heaters

Part Numbers preceded by an asterisk (*) are in stock for immediate delivery with Type T termination.

Termination Types TM, F1, A, E, SF, SF9, L, and L9 can be applied to stock heaters. For these terminations the Heater Part Number will be issued at time of order.

Part Numbers with no asterisk are standard designs that are available straight in 2 weeks and formed in 4 weeks.

Custom Engineered/Manufactured Heaters

Understanding that an electric heater can be very application specific, for sizes and ratings not listed, **TEMPCO** will design and manufacture a tubular heater to meet your requirements. **Standard lead time is 4 weeks.**

Please Specify the following:

- | | |
|--|---|
| <input type="checkbox"/> Type of Application | <input type="checkbox"/> Sheath Material |
| <input type="checkbox"/> Wattage and Voltage | <input type="checkbox"/> Termination Type |
| <input type="checkbox"/> Diameter | <input type="checkbox"/> Type of Mounting, if Required |
| <input type="checkbox"/> Heated Length | <input type="checkbox"/> Type of Moisture Seal, if Required |
| <input type="checkbox"/> Unheated Length at Each End | <input type="checkbox"/> Bending Configuration (supply Drawing and/or Sample) |

Tubular Heaters



Hot Runner Manifold Heaters

Tubular Heaters for Hot Runner Manifolds

Construction

Hot Runner Manifold Heaters are made to order using .260", .315" or .375" diameter Incoloy® tubular heating elements. Commonly specified terminations include threaded stud or wire leads.

Important Information on Forming

Precise forming of the tubular heater is required for it to seat properly into the milled slot in the manifold. To ensure this fit, we use a physical template as an inspection tool in the forming process to verify bending accuracy.

The template is a reproduction of the milled slot in the form of a plastic or aluminum plate. It can be customer supplied or manufactured by Tempco. Only through the use of a forming template is bending accuracy guaranteed.

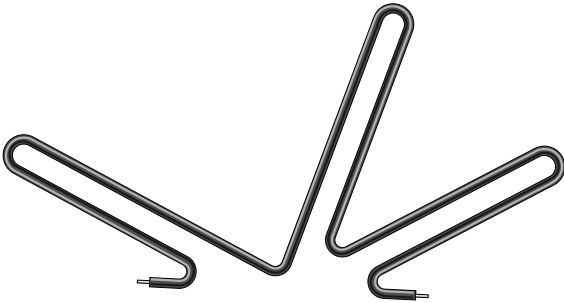
When ordering for new applications:

Supply a drawing or forming template if available.

When ordering for replacement:

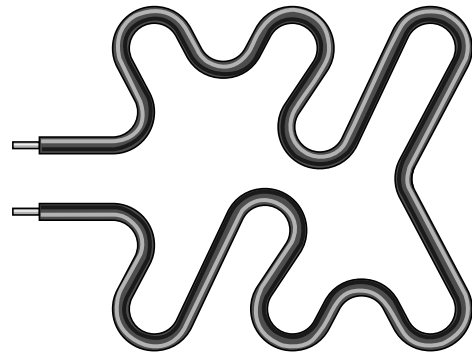
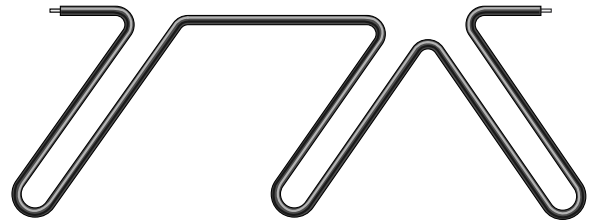
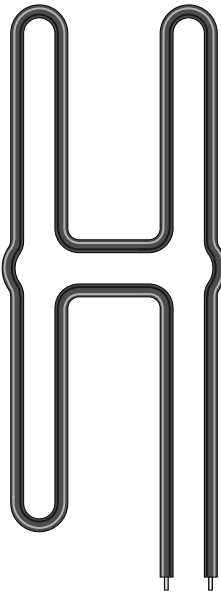
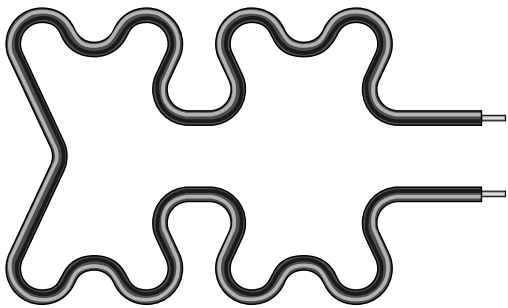
Supply a sample heater and/or a drawing of the manifold indicating the milled heater slot.

Note: For heaters originally manufactured by Tempco only the Tempco Part Number is required.



Examples of Mold Heater Formations

Consult Tempco With Your Requirements.
We Welcome Your Inquiries.



Heat Transfer Cement

When tubular heating elements are used in a milled slot any air gaps between the element and the plate can cause hot spots on the element. Heat transfer cement is used to fill these air gaps, permitting the heater to run cooler, thus maximizing its life expectancy. Cement is water soluble and can be applied with a putty knife or trowel and can be used in temperatures up to 1250°F (675°C).

Part Number SEA-108-101 (1 Gallon)
SEA-108-102 (1 Quart)

Ordering Information

TEMPCO will design and manufacture a Tubular Hot Runner Manifold Heater to meet your requirements.

Please Specify the following:

- Wattage and Voltage
- Diameter
- Heated Length
- Unheated Length at each end
- Termination Type (see pages 10-4 and 10-5)



Finned and Single Ended Elements

Finned Tubular Heaters

Tempco finned tubular heaters provide rapid heat transfer for natural convection or forced air space heating in industrial process air heating systems.

Finned tubular heaters start out as a standard tubular heater with the fins being attached on a custom built finning machine.

Standard Sizes and Materials

304 Stainless Steel .475" diameter tubular element with 1.12" diameter fin.

Copper Clad Steel .430" diameter tubular element with 1.31" diameter fin.

Other materials available for the element sheath and fins include Monel, 316 Stainless Steel and Steel with high temperature aluminum paint.

Specifications

Diameter: .315", .430", .475"

Material: 304SS, 316SS, Steel Copper Clad, Monel, Steel

Min. Sheath Length: 11"

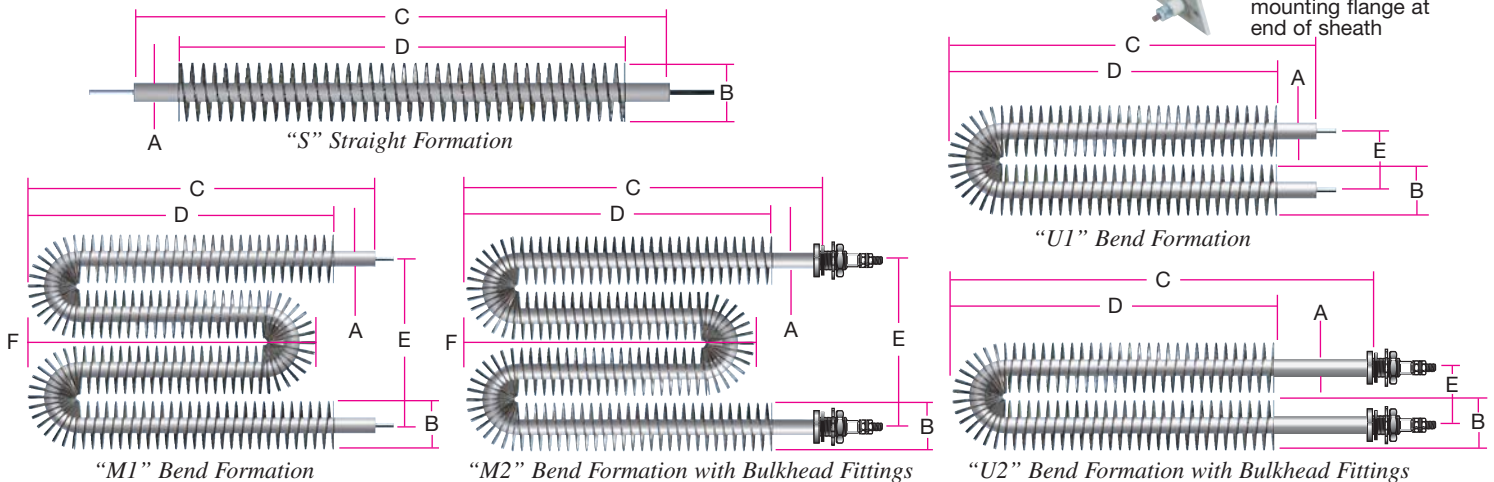
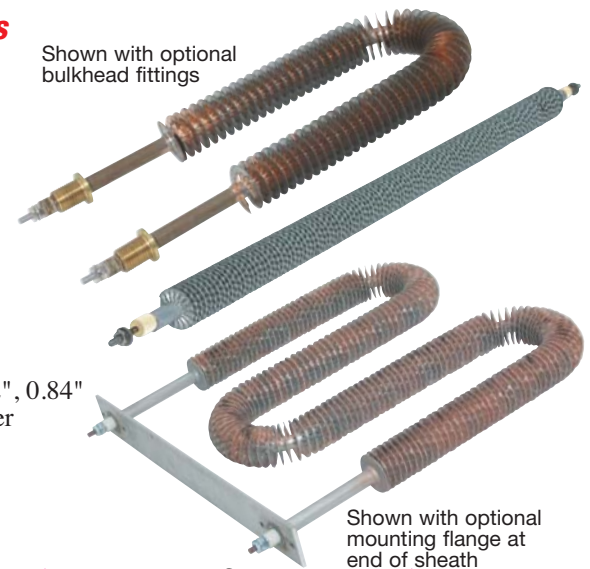
Max Sheath Length: 256"

Fin Diameter: 1.31", 1.14", 1.12", 0.84"

Terminations: All Tubular Heater

Max. Volts: 480 Vac

Max. Amperage: 40 Amp



Ordering Information, Finned Tubular Heaters

- Please Specify** the following:
- Sheath/Fin Material
 - Bulkhead Fittings
 - Terminations and Seals
 - Bend Formations and Dimensions
 - Mounting Flange
 - Sheath Diameter
 - Wattage and Voltage

Single-Ended Tubular Heaters



The **Single-Ended Tubular Heater** manufacturing and design process is similar to that of the double ended tubular heater. Single ended tubular heaters are made strictly per customer request, providing an economical alternative to cartridge heater applications, simplifying wiring and installation for applications requiring localized heat. Flanges, bulkhead and NPT fittings can be attached to the sheath for mounting or immersion heating applications.

Specifications

Diameters: .315" .430" .475" .490", .625"

Material: 304SS, 316SS, Steel Copper Clad, Monel, Steel

Min. Sheath Length: 11"

Max. Sheath Length: 96"

Termination: Lead Wires

Max. Volts: 277 Vac

Max. Amperage: 30 Amp

Ordering Information Single-Ended Tubular Heaters

- Please Specify** the following:
- Sheath Material and Diameter
 - Heater Length and Cold Ends
 - Bulkhead Fittings
 - Wattage and Voltage
 - Terminations and Seals
 - Mounting Flange

Tubular Heaters



Quote Request

Tubular Heater, Finned Tubular Heater and Single Ended Tubular Heater Quote Request

Made-To-Order Quote Request Form – Copy and Fax us your requirements.

Customer Drawing

Name _____
 Company _____
 Address _____

 Phone _____ Fax _____
 E-Mail _____

Moisture Seals

Moisture Seals: None _____
Optional: Style SS: Type V2A _____ Type V2B _____
 Style SER: Type R _____ Type R1 _____
 Style SEH: Type V _____ Type V1 _____
 Type M _____ Type H _____
 Describe if Custom _____

Application Information

Describe in Detail _____

 Air or Immersion _____
 Maximum Load Temperature _____
 Quantity _____

Optional Sheath Surface Treatments

(For Incoloy® and Stainless Steel Sheath Elements only)
Passivation _____ **Bright Annealing** _____
Electro-Polishing _____
 Other _____

Specifications

Type: Standard _____ Finned _____ Single Ended _____
 Sheath Material _____
 Diameter _____ Fin Dia. if applies _____
 Overall Sheath Length _____
 Cold Section: 1st end _____ 2nd end _____
 Watts _____ Volts _____
 UL _____ cUL _____ CSA _____ CE _____
 Termination Type _____ (Type T – standard screw)
 Standard Options _____

Bends and Shapes

Standard Formation Code _____
 Specify Letters and Corresponding Dimensions Below:

 Number of Bends if known _____
 Single/Multiple _____ Plane _____
 Coils/Turns _____ Dia. _____
Circle: Full _____ Dia. _____ Partial _____ Degree _____

Mounting: MC ___ LR ___ Location: _____ MF ___
 Bulkhead Fittings ___ Material ___ Flange Type ___
 Describe if Custom _____

Describe if Custom: _____

