

Cast-In Heaters - Large Thermo-Platens

Engineered Solutions With Advanced Technology in Cast-In Thermo-Platens

Tempco specializes in innovative engineering and manufacturing of thermal components. Coupled with our diverse foundry and machine shop capabilities, this expertise provides the know-how behind our product line offering of large electrically heated platens that are manufactured by using our cast-in heater technology.

This casting process incorporates the heat source (tubular heating element) as an integral component of the platen. This process provides a more cost-effective and reliable approach than drilling holes for cartridge heaters or clamping inefficient and cumbersome-to-use strip heaters to the back surface of a platen.

Tempco's thermo-platens are made from aluminum, bronze and brass alloys. These materials provide excellent thermal conductivity for rapid heat transfer with uniform temperature gradients. To further enhance heat profiles, the formation and the location of the tubular heaters within the casting are precisely engineered using the latest computer design techniques.

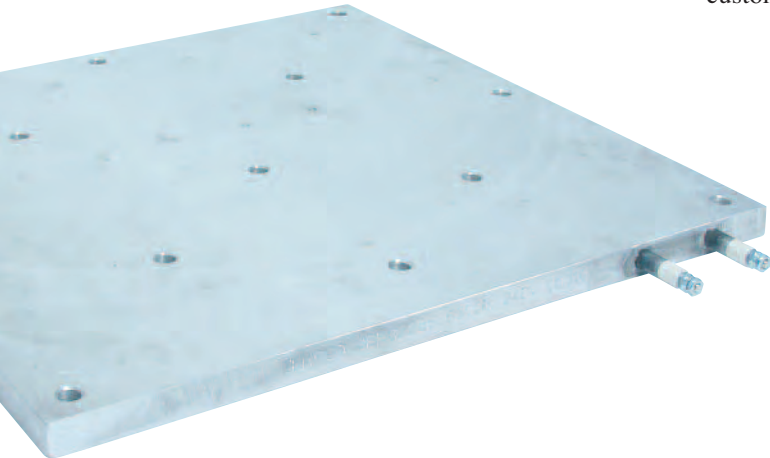
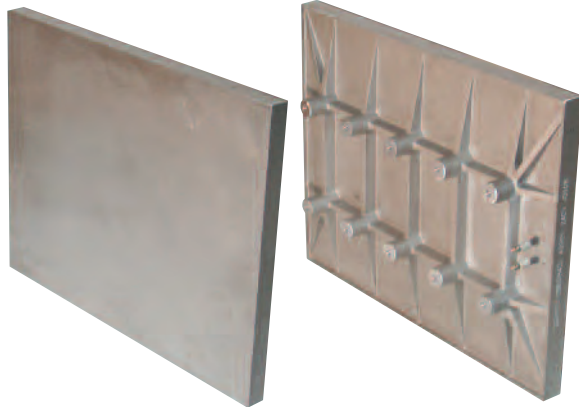
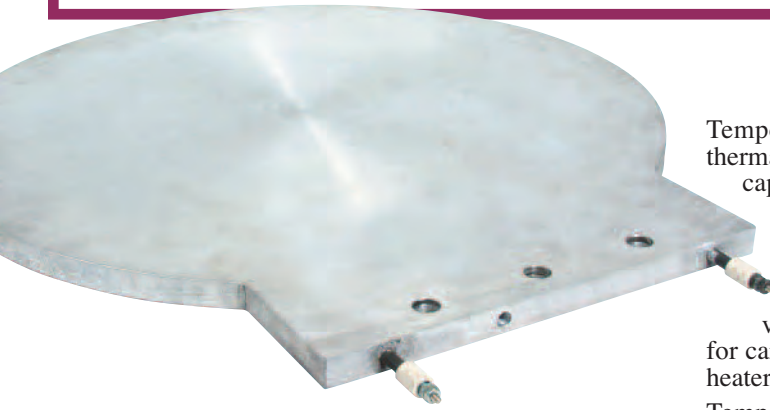
When the process requires heating and cooling cycles, thermo-platens can be manufactured with the addition of stainless steel tubing to provide liquid cooling capabilities.

The working surfaces and/or contours of the thermo-platen can be machined to your specifications up to and including blanchard ground for extremely flat surface requirements.

Our capabilities for manufacturing large thermo-platens offer you the freedom to think big in your design requirements.

We offer complete engineering services and support, working with you every step of the way from prototype to production to ensure customer satisfaction.

There is no substitute for our acquired knowledge.



Cast-In Heaters – Large Thermo-Platens

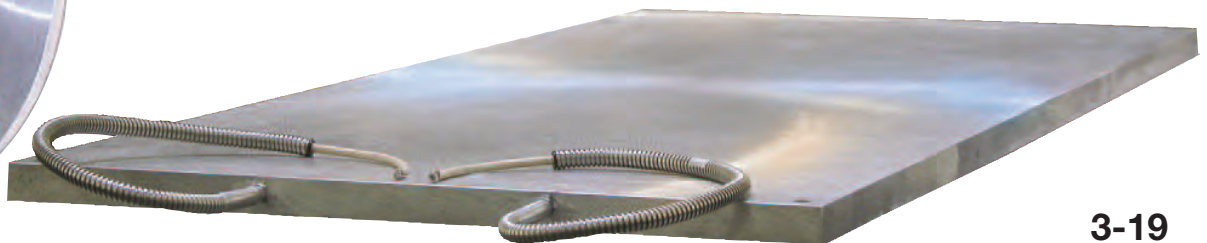
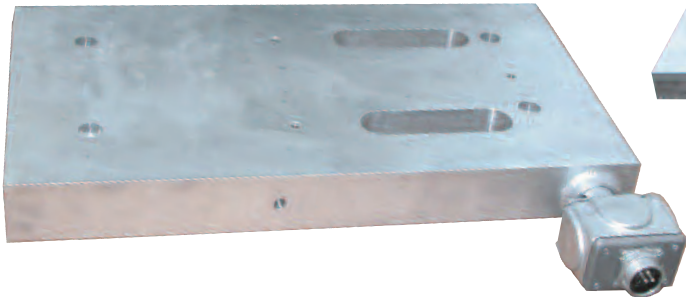
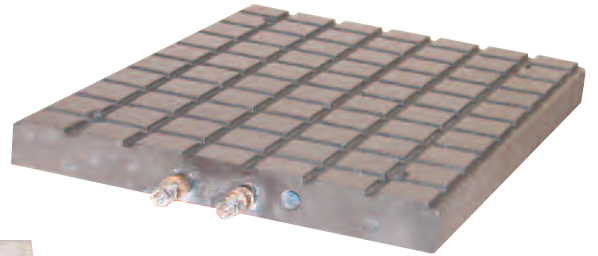
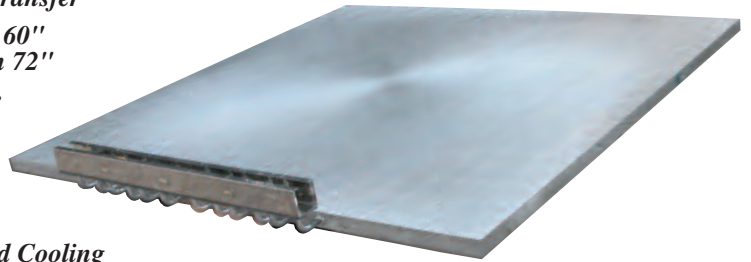
Design Features & Options

- * **Castings:**
 - Aluminum up to 600 lbs.
 - Bronze & Brass up to 300 lbs.
(Recommended for high operating pressures and temperatures)
- * **Exceptionally Long Operating Life**
- * **Single- or Three-Phase Circuit**
- * **Surface Finishes: Electroless Nickel-Plated, Teflon®, Hard-Coat Anodizing, Magnaplate**
- * **Thermowells for Temperature Sensors**
- * **Excellent Heat Transfer**
- * **Maximum width 60"**
Maximum length 72"
- * **Uniform Surface Temperatures**
- * **Machined to Customer Specifications**
- * **Heating & Liquid Cooling Functions**
- * **Various Heater & Cooling Tube Terminations**



Note: Cast-In Thermo-Platens are made to customer specifications. For technical assistance, engineering data and available options please refer

to pages 3-4 & 3-5. When ordering please provide detailed design drawings, including dimensions, critical tolerances, electrical ratings, watts, volts, single- or three-phase, and any other feature or special requirements.



When Your Needs Call for **LARGER Than **BIG** Cast-In Thermal Platens & You Need Them NOW – Look No Further Than Tempco!**

We Can Do It – We Have the Technology!

Cast-In Thermal Components – Liquid Cool



Cast Aluminum Motor Housing & Base with Integral Liquid Cool Capabilities
U.S. Patents: # 6222289 & #5939808

Engineered Solutions With State-Of-The-Art Technology in Liquid Cool Aluminum Cast-In Thermal Components

You can count on Tempco to continue our tradition of leadership by providing cutting edge solutions as we address the needs and challenges of specialized segments of industries that depend on cooling for the operating efficiency and performance of their equipment.

As a result of market demand for such products, Tempco introduces our capabilities of producing a complete selection of made-to-order liquid cool aluminum cast-in thermal components, available in both complex geometrics or simple platens.

The thermodynamic relationship between the liquid heat transfer media circulating through the precisely formed and configured stainless steel cooling tube and the aluminum alloy casting maximizes heat removal efficiency. Tempco's liquid cool cast-in thermal component technology is a novel approach to clean, efficient and reliable process cooling of difficult and complex applications.

Consult Tempco with your challenging applications. Our capabilities for manufacturing these complex liquid cool thermal components offer you the advantage to think outside the box. Let the endless possibilities spark your imagination, allowing you the freedom to customize your design.



Let Tempco's Creative Team of Professionals Tackle Your Next Cast-In Liquid Cool Thermal Component Project. We Have the Technology, Infrastructure & Commitment to Exceed Our Customers' Expectations.

Thermo-Platens for Liquid Cooling of High Density Electronic Systems & Other Applications Requiring Flat Surface Cooling

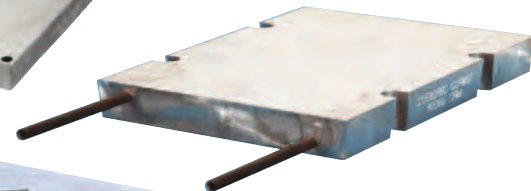
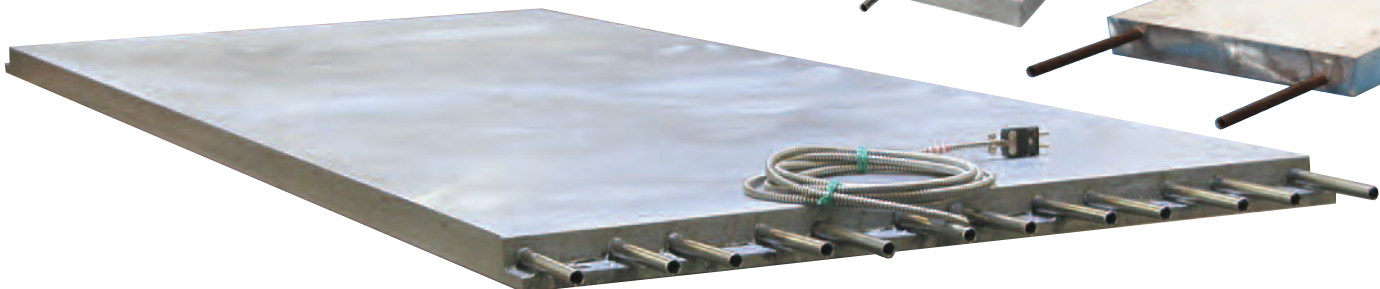
In a world of compact designs with increased power densities, more heat is being generated than can be properly dissipated by conventional air blowers. For applications that have high-watt densities such as lasers, high-powered electronics, telecommunications, and semiconductor processing, liquid-cooled cold plates are the ideal high-performance heat transfer solution.

Mounting the components on an aluminum platen with internal liquid cooling tubes replaces forced air cooling to achieve and maintain lower electronic cabinet temperatures, thus increasing the operating service life of the individual components and the system.

When drilling and/or tapping is required for the cold plate application, Tempco will perform the machining to ensure that the product's integrity is not compromised.

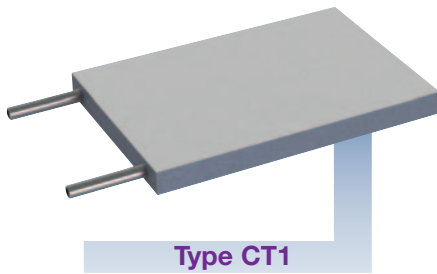


Now You Can Give Your Electronics a Chill!

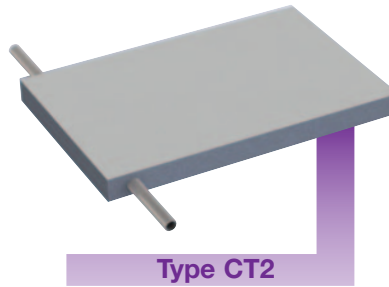


Thermo-Platen Specifications

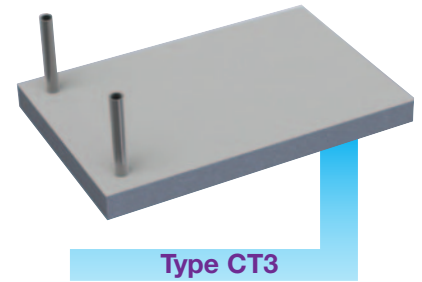
Typical Cooling Tube Exit Locations For Cast-In Thermo-Platens



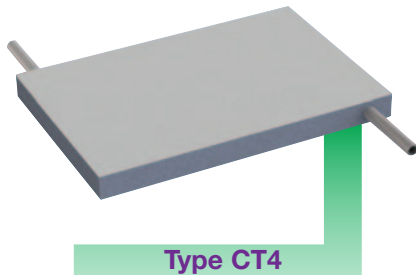
Cooling tubes exiting through the thickness toward the ends of the width or length.



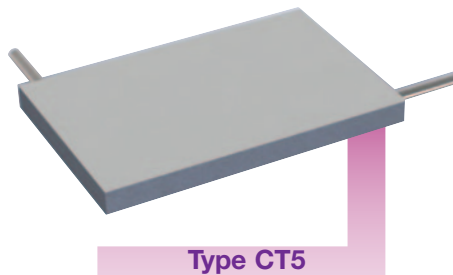
Cooling tubes exiting through the thickness opposite of each other toward the ends of the width or length.



Cooling tubes exiting at the ends of the width or length through the top surface.



Cooling tubes exiting through the thickness at opposite ends of each other toward the ends of the width or length.



Cooling tubes exiting through the thickness at opposite ends of each other with one in the width and one in the length.

Complex Geometrics



Note: Cooling Tube Exit Locations for Complex Geometric Liquid Cool Thermal Components can be at any practical location for the shape and size of the individual thermal component.

For Cooling Tube Termination Optional Fittings and Accessories See pages 3-52 and 3-53.

Standard Cooling Tube Fittings For Cast-In Thermo-Platens



Type FF Flared Seal Fittings

Brass flared seal fittings are well adapted for low to medium pressure and resistant to mechanical pullout. Available for 3/8" and 1/2" diameter tubing with SAE 45° flare.

Diameter Tubing	Thread	Part Number
3/8"	5/8"-18	FTG-124-101
1/2"	3/4"-16	FTG-124-104



Type HS Hi-Seal Fittings

Hi-seal brass fittings are highly dependable under the most adverse conditions. For reliable and trouble-free service with ease of installation, we strongly recommend hi-seal fittings. Available for 3/8" and 1/2" diameter tubing. Male thread is 1/2" NPT for 1/2" tube and 3/8" tube.

Diameter Tubing	Part Number
3/8"	FTG-118-124
1/2"	FTG-118-116

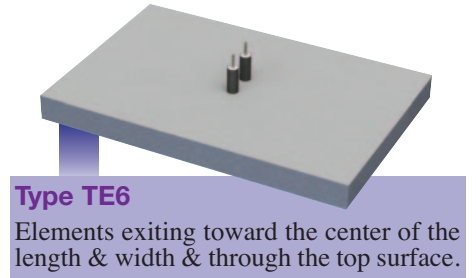
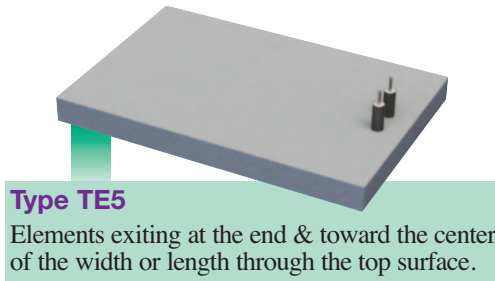
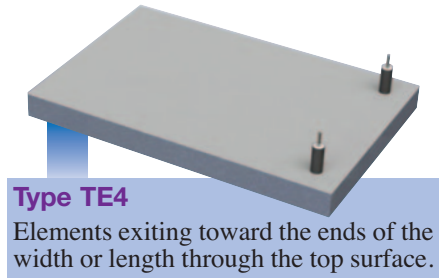
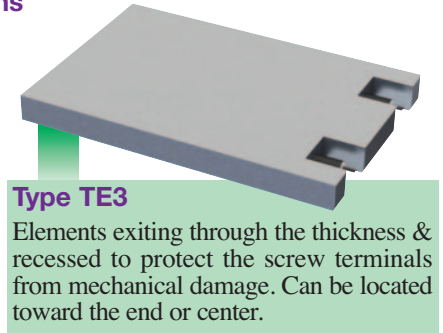
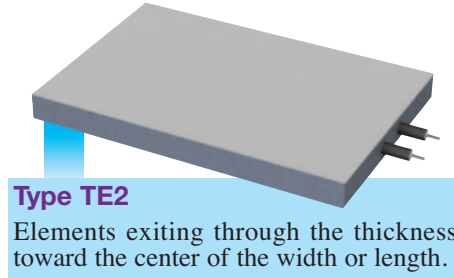
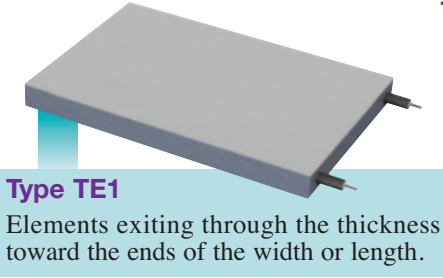
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Heating Element Specifications

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Thermo-Platen Specifications

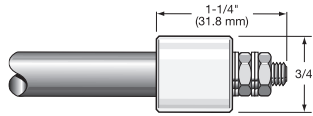
Typical Tubular Heating Element Exit Locations



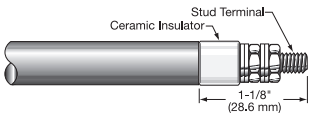
Most common thermo-platen terminations listed below;
for additional terminations and complete details, see pages 3-54 and 3-55.

Standard Tubular Heater Terminations for Thermo-Platens

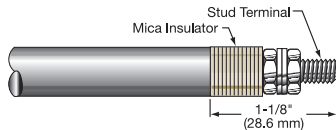
Type S – Heavy Duty Ceramic Insulators (Standard Unless Otherwise Specified)



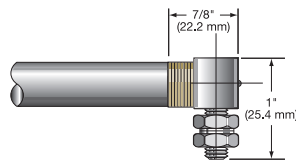
Type T7– Ceramic Insulator: same diameter as heating element



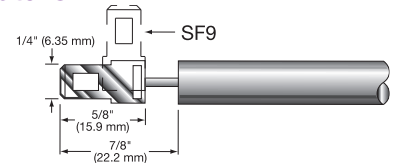
Type T – Mica Insulator: same diameter as heating element



Type R – Mica Washers with 90° Blockhead Screw Terminal



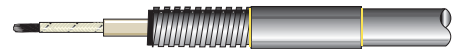
Type SF & SF9 – Quick-disconnect Spade Tabs



Type F – Flexible Leads with Fiberglass Sleeve



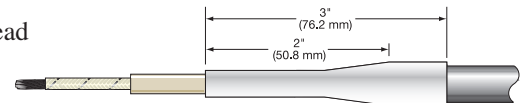
Type R1 – Flexible Stainless Steel Armor Cable



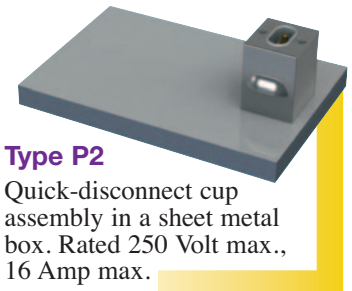
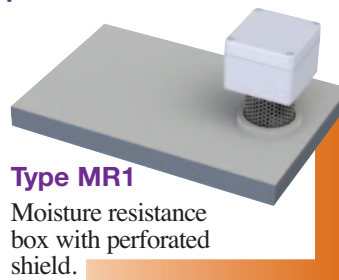
Type R1A – Stainless Steel Wire Overbraid



Type TS – Flexible Lead with Shrink-Down Teflon® Sleeve



Typical Terminal Box Options and Locations



Thermo-Platen Quote Request Form

Ordering Information

To process your order or quotation, please specify the following information.

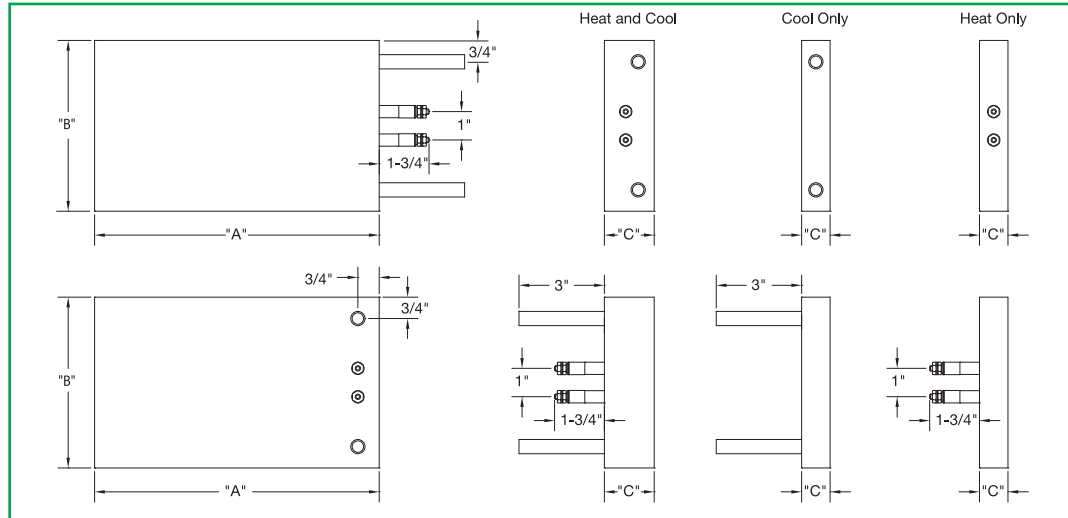


Note: Cast-In Thermo-Platens are made to customer specifications.

For technical assistance and engineering data, please refer to pages 3-4 & 3-5.

For available options, please refer to pages 3-21 & 3-22.

When ordering, please provide detailed drawings including dimensions, critical tolerances and any other feature or special requirements.



Thermo-Platen Type

- Heat Only Cool Only Heat and Cool

Dimensions

Length "A" _____ Width "B" _____ Thickness "C" _____

Material Specifications

- Aluminum Bronze Brass

Electrical Specifications

Watts each element _____ Volts each element _____ Phase _____

Element Exit Location

- "TE1" "TE2" "TE3" "TE4" "TE5" "TE6" (see page 3-22)
 Other, Specify _____ (provide detailed drawing)

Termination Style

- "S" Post Terminals "T7" Post Terminals "T" Post Terminals
 "R" 90° Blockhead "SF" Quick-disconnect Spade Tab
 "SF9" 90° Quick-disconnect Spade Tab "F" Plain Leads
 "R1" Armor Cable Leads "R1A" SS Wire Overbraid "TS" Leads and Shrink Sleeve
 "P1" Quick-Disconnect Cup assembly Other, Specify _____ (See page 3-22)

Terminal Protection Box

- None "C2" Standard "EP" Explosion Resistant "MR1" Moisture Resistant
 "P2" Quick-Disconnect Cup assembly

Cooling Tube Exit Locations

- Type CT1 Type CT2 Type CT3 Type CT4 Type CT5
(See page 3-21 for details)

Cooling Tube Specifications

- 1/4" O.D. SS 3/8" O.D. SS 1/2" O.D. SS
 3/8" O.D. Incoloy® 1/2" O.D. Incoloy® Dual Cooling Tubes
 Standard Wall Thickness Other Wall Thickness, Specify _____
(See page 3-5 for Standard Wall Thickness Information)

Cooling Tube Fittings

- "FF" Flared Seal "HS" Hi-Seal Fittings
 Other, Specify _____ (See page 3-52)

Surface Finish

Machined or As-Cast. *Indicate surfaces to be machined.*

Special Cast-In Features

Holes, Cutouts, Slots, Bevels, Mounting Studs, Stand-Offs and Taper Angles.
For special features, a detailed drawing is required.

⚠ WARNING: Cancer and Reproductive Harm - www.P65Warnings.ca.gov.

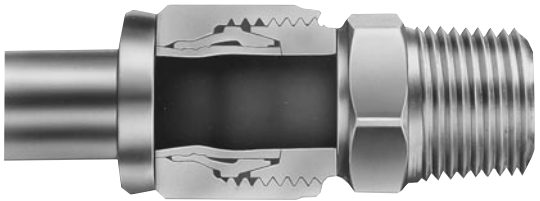
Cooling Tube Termination Options for Liquid-Cooled Cast-In Band Heaters



Type FF Flared Seal Fittings

Brass flared seal fittings are well adapted for low to medium pressure and resistant to mechanical pullout. Available for 3/8" and 1/2" diameter tubing with SAE 45° flare.

Diameter Tubing	Thread	Part Number
3/8"	5/8"-18	FTG-124-101
1/2"	3/4"-16	FTG-124-104



Type HS Hi-Seal Fittings

Hi-seal brass fittings are highly dependable under the most adverse conditions. For reliable and trouble-free service with ease of installation, we strongly recommend hi-seal fittings. Available for 3/8" and 1/2" diameter tubing. Male thread is 1/2" NPT for 1/2" tube and 3/8" tube.

Diameter Tubing	Part Number
3/8"	FTG-118-124
1/2"	FTG-118-116



Type RA 90° Copper Elbow

90° copper elbow is brazed to the Cast-In Heater cooling tube extension with additional tube extension for connecting cooling lines with compression and/or flared fittings. Available for 3/8" and 1/2" diameter tubing. If required, specify.

Diameter Tubing	Part Number
3/8"	FTG-127-102
1/2"	FTG-127-103



Type RT Cast Brass 90° Threaded Elbow

90° threaded elbow is brazed to the cooling tube extension, providing an easy and quick method for connecting cooling lines. Recommended to be factory installed to assure good braze seals. Available for 3/8" and 1/2" NPT internal threads. If required, specify.

Diameter Tubing	NPT	Part Number
1/2"	3/8"	FTG-125-101
1/2"	1/2"	FTG-125-102



Type R3 Straight Threaded Copper Fitting

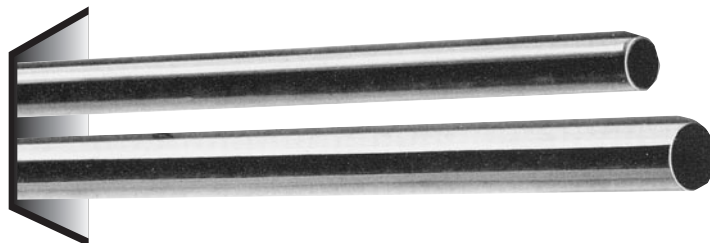
Straight threaded fitting is brazed to the cooling tube extensions, providing an easy and quick method for connecting cooling lines. Recommended to be factory installed to assure good braze seals. Available for 3/8" and 1/2" diameter tubing with internal threads. If required, specify.

Diameter Tubing	NPT	Part Number
3/8"	3/8"	FTG-131-103
1/2"	3/8"	FTG-131-102
1/2"	1/2"	FTG-131-101

Installation Accessories for Liquid-Cooled Cast-In Band Heaters

Stock Tubing for Cooling Lines

Cooling Line Tubing can be used to connect the Tempco Cast-In heat/cool bands to the plumbing system of your extruder. Tubing is available in 6'8" lengths for U.P.S. shipments and up to 20' lengths for truck shipments. Barlow's formula below was used to calculate Working Pressure in the table.



$$\text{Maximum Working Pressure (PSIG)} = \frac{2 \times \text{Material Strength (PSI at Room Temperature)} \times \text{Wall Thickness of Tube (in)}}{\text{OD of Tube (in)} \times \text{SF (Safety Factor of 1.5 to 10 depending on application)}}$$

Tubing Diameter (in)	Material	Wall Thickness (in)	Burst Pressure (PSI)	Working Pressure (Safety Factor 4) (PSI)	Material Strength (PSI)	Volume (in ³ /ft)	Part Number
1/4	304 SS	0.028	11200	2800	75000	0.3547	TUB-101-130
3/8	304 SS	0.035	14000	3500	75000	0.8767	TUB-101-108
1/2	304 SS	0.049	14700	3675	75000	1.5231	TUB-101-110
1/2	304 SS	0.065	19500	4875	75000	1.2903	TUB-101-122
1/2	Incoloy	0.049	17052	4263	87000	1.5231	TUB-111-108

Flexible Teflon® Wire Braided Hose

Flexible Teflon® Wire Braided Hose provides an excellent means of connecting Cast-In Heaters to the extruder plumbing system. This style of hose meets the demands of medium to tight bending radius requirements. The stainless steel braid protects the Teflon® hose from any harsh mechanical conditions that may be present.

A variety of brass male and female threaded fittings can be incorporated onto the hose, making it a practical choice for use in conjunction with Tempco's Style RC Non-Exposed Fittings and other available fittings.

Rigid brass adapter fittings as listed below are used to mate the base hose assembly to your existing installation. This allows for the installation of the rigid NPT coupling into the plumbing system and then attaching the swivel fitting on the hose, making assembly relatively easy. Remember to use Teflon® tape or equivalent.

Standard Hose: Size 8 (1/2") .405" I.D., .549" O.D.

Operating Pressure: 2000 PSI

Burst Pressure: 8000 PSI



Ordering Information

The standard hose assemblies are supplied with 1/2" female 37° SAE flare swivel style crimped-on fittings. The hose assemblies can be ordered in 6" increments starting at 18" minimum. Fitting material is Brass.

Part Number*

WHT05

*Complete the Part Number with length of hose in 6" increments starting at 18" (018).

Standard lead time is 2 weeks or less.

Adapter Fittings for Flexible Teflon® Wire Braid Hose

Rigid brass adapter fittings are used to mate the base hose assembly to your existing installation.

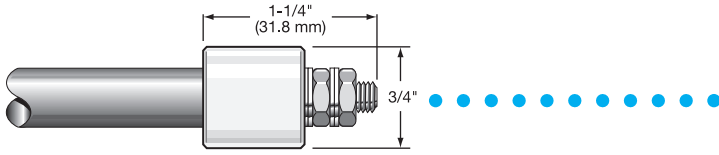
T1	T2	Part Number
1/2" male 37° SAE flare	1/2"-14 NPT male	FTG-161-103
1/2" male 37° SAE flare	1/2"-14 NPT female	FTG-161-102
1/2" male 37° SAE flare	3/8"-18 NPT male	FTG-161-104
1/2" male 37° SAE flare	3/8"-18 NPT female	FTG-161-105



⚠ WARNING: Cancer and Reproductive Harm - www.P65Warnings.ca.gov.

Standard Tubular Heater Terminations for Cast-In Heaters

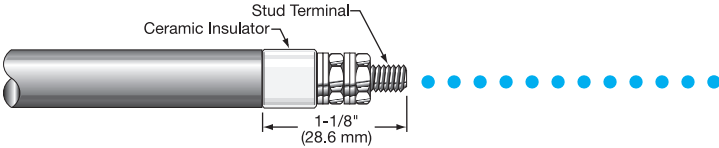
Select the termination style that meets your requirements for space, accessibility and reliability.



Type S Standard Unless Otherwise Specified

Heavy Duty Ceramic Insulators.

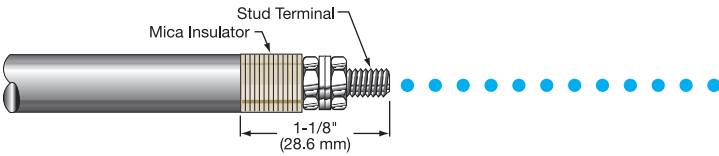
- .315" diameter heater has 8-32 screw terminals.
- .430" diameter heater has 10-32 screw terminals.



Type T7

Ceramic insulator is the same diameter as the heating element.

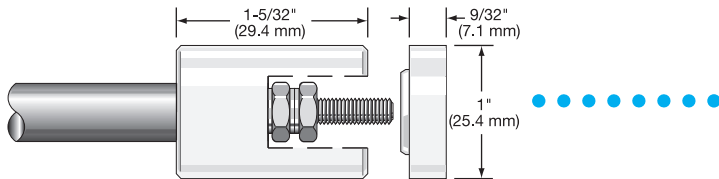
- .260" diameter heater has 6-32 screw terminals.
- .315" diameter heater has 8-32 screw terminals.
- .430" diameter heater has 10-32 screw terminals.



Type T

Mica insulator is the same diameter as the heating element.

- .260" diameter heater has 6-32 screw terminals.
- .315" diameter heater has 8-32 screw terminals.
- .430" diameter heater has 10-32 screw terminals.



Type C4

Heavy duty ceramic insulator with terminal cover.

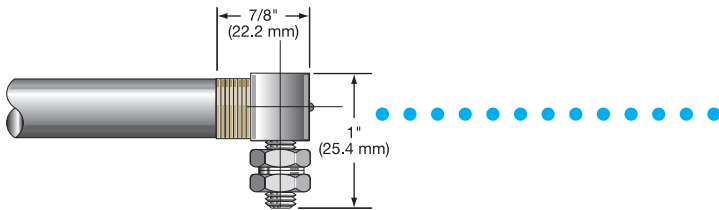
- .315" diameter heater has 10-32 screw terminals.
- .430" diameter heater has 10-32 screw terminals.



TYPE P—Plain Pin

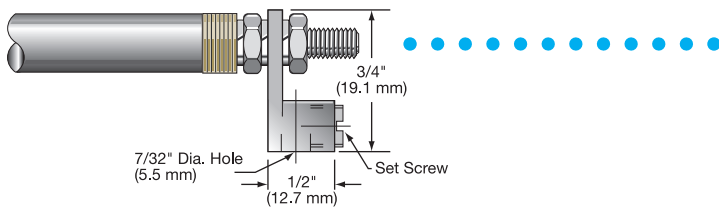
Plain terminal pin. Specify Length "L." Standard 1/2" (12.7 mm) pin length.

Element Diameter		Nominal Pin Diameter	
in	mm	in	mm
.260	6.6	.091	2.3
.315	8.0	.100	2.5
.430	10.9	.120	3.0



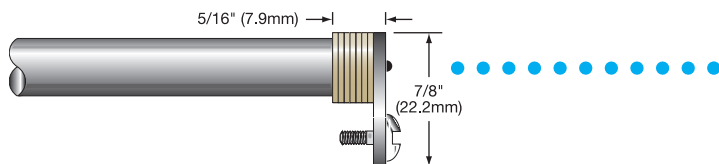
Type R

Mica washers with 90° blockhead screw terminal with 10-32 screw threads. Available for .315" and .430" diameter heaters.



Type R2

Mica washers with blockhead and through hole for lead wire connection. Eliminates the use of ring terminals. Available for .315" and .430" diameter heaters. Accepts 6-14 gauge wire.



Type E

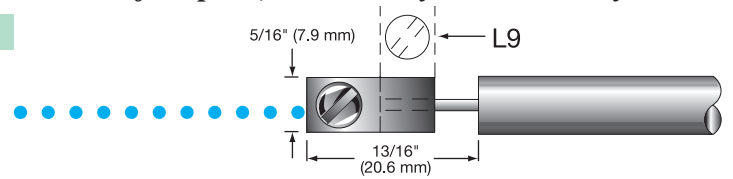
Right-angle lug welded to pin with mica washer insulators and 10-32 binding head screw. Available for .260", .315" and .430" diameter heaters.

Standard Tubular Heater Terminations for Cast-In Heaters

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

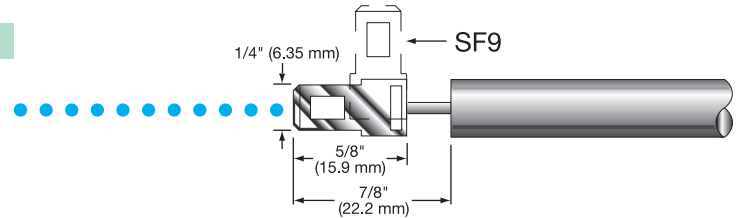
Type L & L9

Terminal lug spot welded to pin with 10-32 binding head screw. Available for .260", .315" and .430" diameter heaters. Type L represents straight; Type L9 represents 90° to pin. Specify lug orientation.



Type SF & SF9

Quick-disconnect spade tabs spot welded to pin. Available for .260", .315" and .430" diameter heaters. Type SF represents straight. Type SF9 represents 90° to pin. Specify tab orientation.



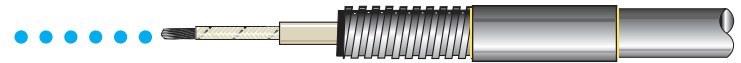
Type F

Flexible lead: insulated stranded wire crimped to cold pin. Crimp connection is insulated with fiberglass sleeving. Available for .260", .315" and .430" diameter heaters. Wire insulation rated to 250°C, 450°C optional. Specify lead length.



Type R1

Flexible Armor Cable provides excellent protection to lead wires against abrasion and contaminants. Available for .260", .315" and .430" diameter heaters. Specify cable length and lead length. Style may vary from depiction depending on heater diameter and cable diameter used.



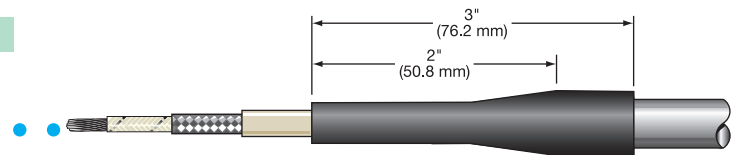
Type R1A

Stainless Steel Wire Overbraid provides flexibility and excellent protection to lead wires against abrasion. Available for .260", .315" and .430" diameter heaters. Specify stainless steel wire overbraid length and lead length. Style may vary from depiction depending on heater diameter and braid diameter used.



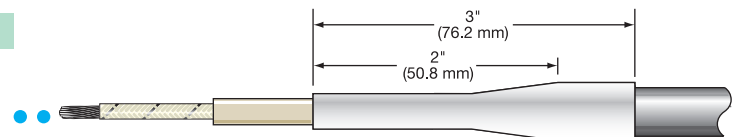
Type MR

Moisture resistant shrink strain relief and lead wire with or without stainless steel overbraid. Available for .260", .315" and .430" diameter heaters. Specify lead wire and overbraid length. Maximum operating temperature is 350°F (177°C).



Type TS

Contamination seal shrink-down Teflon® sleeving over the heater and lead wire splice. Provides a good moisture resistant seal. Maximum operating temperature 500°F (260°C). Available for .260", .315" and .430" diameter heaters. Specify lead length.



Type P1

Quick -disconnect plug, either mounted directly on casting or on elements ends offset a specified distance from casting. Rating: 16A-250VAC.



General Purpose Terminal Protection Boxes For Cast-In Heaters

Standard Box Type C2

Terminal Boxes provide a simple and economical means to eliminate exposed heater terminals and live electrical wiring, protecting employees from potential electrical shock. They also eliminate electrical shorts that can result from exposed wiring on Cast-In Heater installations.

Type C2 is an individual terminal box for protecting the terminals on each Cast-In Band Heater half. It is also used on many other Cast-In Heater designs with one set of heater terminals. The C2 box design requires a flat pad on half-round castings or a flat surface on other casting designs for mounting. It is made from heavy gauge, rust-resistant sheet metal. The cover is removable for easy access to terminals. The box has two 7/8" diameter knockouts opposite each other for standard 1/2" BX connectors.

To simplify installation, Cast-In Heaters fitted with boxes can be factory pre-wired with high temperature lead wire that can be protected with armor cable. If one of these options is required, **specify terminal box type, lead wire and cable length**. Satisfies NEMA 1 requirements.

Standard C2 box size: L = 4" W = 2-1/2" H = 2-1/8"



Terminal Protection for Both Heater Halves Type C7

Type C7 terminal boxes are made from rust-resistant sheet metal. The C7 base is fixed to the clamping straps. The box has two 7/8" diameter knockouts opposite each other for standard 1/2" BX connectors. The cover is removable, providing easy access to the screw terminals for electrical wiring.

To simplify installation, Cast-In Heaters fitted with boxes can be factory pre-wired with high temperature lead wire, protected with armor cable. If either one of these options is required, **specify terminal box type, lead wire and cable length**. Satisfies NEMA 1 requirements.

C7 Terminal Box Size varies with dimensions of casting.



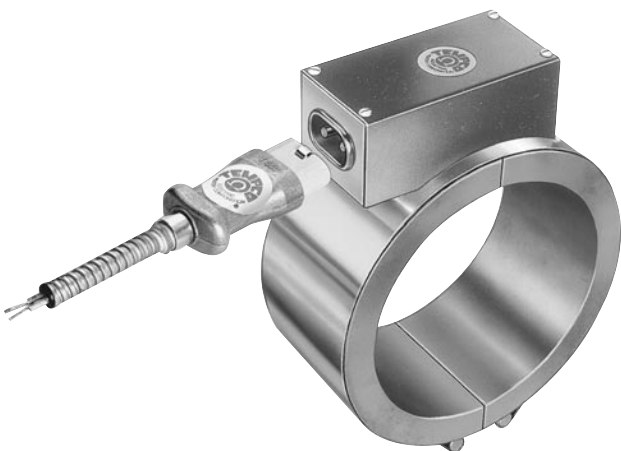
Quick-Disconnect High Temperature Cup and Box Assembly Type P2

Quick-Disconnect Cup assemblies provide the simplest and safest means for applying power to any type of Cast-In Heater installation. The box extends over the screw terminals on both Cast-In Band Heater halves. The combination of prewired cup and box assembly, along with factory prewired high temperature lead wire protected with armor cable, eliminates live exposed heater terminals and electrical wiring, protecting employees from electrical shock and the possibility of electrical shorts due to exposed wiring.

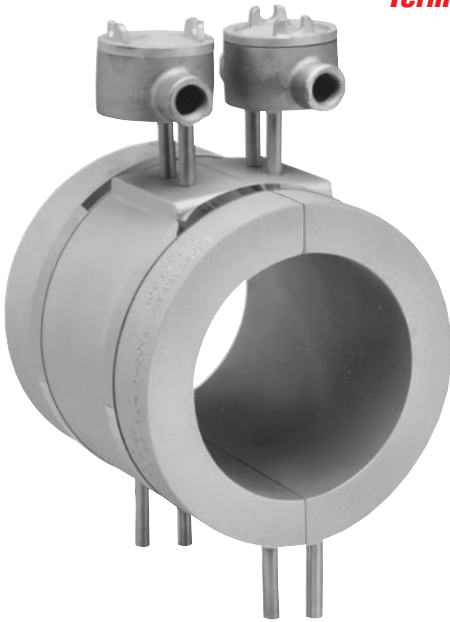
If prewired plugs are required, **specify length of lead wire and cable**.

Rated 250V maximum, 15 Amp maximum

Terminal Box Size varies with dimensions of casting.



Terminal Protection Boxes for Cast-In Heaters



Type EP Explosion and Moisture Resistant Box

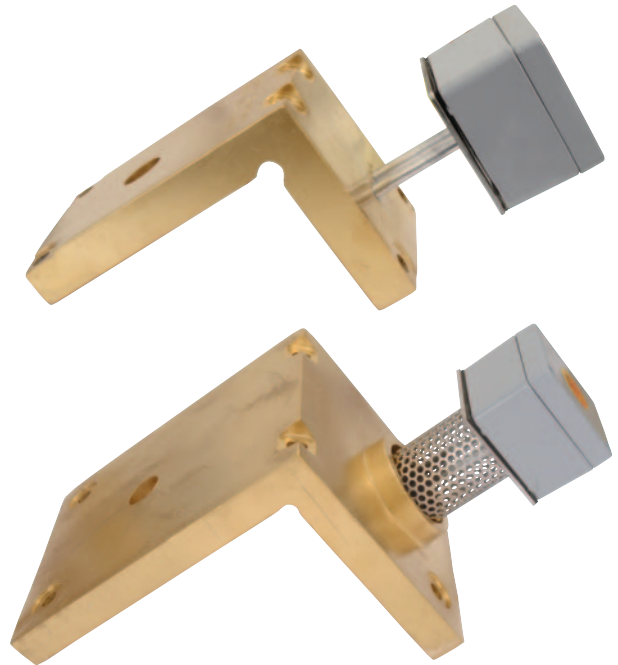
Cast iron explosion and moisture resistant boxes should be used in areas where the surrounding air may become contaminated with combustible gases or a high humidity level may exist. Installation requires one box per Cast-In Heater half and they are brazed to the tubular heater. The standard box has one 1/2" NPT hub.

Optional: Two hubs per box available. Cast-In Heater fitted with boxes can be factory prewired with high temperature lead wire, protected with special armor cable. If either of these options is required, please specify the following:

- Number of hubs
- Cable type
- Lead wire length
- Cable length

Type MPR Moisture Resistant Box

This design has a moisture resistant die cast aluminum box with a non-removable polyurethane gasket in the lid. Lid is secured with captive stainless steel screws. Body and lid are painted in basic industrial gray; interior contains copper ground screw. Box is mounted to a plate that is brazed to the element. Available in a wide variety of sizes.



Type MR1 Moisture Resistant Box with Perforated Shield

This design incorporates the MPR housing style along with a perforated tube shielding unheated extensions of the tubular heating elements. This feature provides mechanical strength to the element extension and prevents overheating of the terminals, reducing possible premature failure from corrosion and oxidation.



Type CB

A cast box mounted directly on the casting is used to protect the termination.

Exposed electrical wiring on cast-in heater installations is a violation of Electrical Safety Codes including O.S.H.A.

Experience Our Value-Added Services that are Second to None

Casting Alloys

Casting Alloy	Aluminum	Copper	Silicone	Zinc	Lead	Maximum Iron	Tin	Other
Aluminum 319	85.8 - 91.58%	3.0 - 4.0%	5.50 - 6.50%	≤ 1.0%	—	≤ 1.0%	—	≤ 1.7%
Aluminum 356	90.1 - 93.3 %	≤ 0.25%	6.50 - 7.50%	≤ 0.35%	—	≤ 0.60%	—	≤ 1.125%
Bronze	9.0 - 11.0%	≥ 86.0%	—	—	—	0.80 - 1.50%	—	≤ 1%
Yellow Brass	≤ 0.55%	58.0 - 64.0%	≤ 0.05%	32.0 - 40.0%	0.80 - 1.50%	≤ 0.70%	0.50 - 1.50%	≤ 1%

Material Properties

Material	Classification	Max. Surface Temperature °F (°C)	Density (lb/in ³)	Coefficient of Linear Thermal Expansion (in/in/°F × 10 ⁻⁶)	Specific Heat Capacity (BTU/lb-°F)	Thermal Conductivity (BTU-in/hr-ft ² -°F)	Melting Point (°F)
Aluminum 319	Aluminum 319.0	700 (371)	0.101	12.7 @ 68° - 572°F	0.23	754	960 - 1120
Aluminum 356	Aluminum 356.0	750 (399)	0.0968	12.9 @ 68° - 572°F	0.23	1160	1030 - 1140
Bronze	UNS C95300	1350 (732)	0.272	9 @ 68° - 572°F	0.0896	437	1900 - 1913
Yellow Brass	UNS C85700	1200 (649)	0.304	12.2 @ 68° - 500°F	0.0899	582	1660 - 1690

Linear Thermal Expansion Formula: $\Delta L = L_i \times \alpha \times (T_f - T_i) \times 10^{-6}$

ΔL = Change in Length

L_i = Initial Length

T_f = Final Temperature

α = Coefficient of Linear Thermal Expansion

T_i = Initial Temperature

Minimum Casting Thickness vs. Heating Element and/or Cooling Tube Diameters

Casting Thickness	Maximum Available Element Diameter Heat Only	Maximum Available Cooling Tube Diameter Cool Only	Maximum Element and Cooling Tube Combination Heat and Cool
5/8" (15.9 mm)	.260	1/4	—
3/4" (19.1 mm)	.375	3/8	—
1" (25.4 mm)	.430	1/2	—
1-1/4" (31.8 mm)	.430	1/2	.260 and 3/8
1-3/8" (34.9 mm)	.430	1/2	.315 and 1/2
1-1/2" (38.1 mm)	.430	1/2	.430 and 1/2
1-5/8" (41.3 mm)	.430	1/2	.430 and 1/2
1-3/4" (44.5 mm)	.430	1/2	.430 and 1/2
Finned Casting			
3/4" (19.1 mm)	.375	—	—
7/8" (22.2 mm)	.430	—	—
1" (25.4 mm)	.430	—	—
1-3/4" (44.5 mm)	.430	—	—

Casting Size & Weight Limitations

	Cylindrical	Platen
Minimum Inside Diameter:	1" (25.4 mm)	—
Maximum Inside Diameter:	48" (1219 mm)	—
Minimum Width:	—	1-1/2" (38.1 mm)
Maximum Width:	—	60" (1524 mm)
Minimum Length:	1-3/4" (44.5 mm)	4" (102 mm)
Maximum Length:	40" (1016 mm)	72" (1829 mm)
Finish:	125 RMS Standard or to customer spec.	
Gap (two-piece cylindrical cast-in band heaters):	1/4" (6.4 mm) top and bottom or to customer specification	
Maximum Weight:	Aluminum— 600 pounds Bronze & Brass— 300 pounds	

NOTES: Cylindrical heaters are made with two half-round heaters. Cast-In thermal components can be made in any practical size, weight and geometric shape.

Heating Element Electrical Specifications

Tubular Heater Diameter	.260"	.315"	.375"	.430"
Maximum Volts	240	277	480	600
Maximum Amps Per Element	15	30	40	40
Maximum Watt Density:	Aluminum Alloy—35 W/in ² on the element Bronze or Brass—45 W/in ² on the element			
Resistance Tolerance:	+10%, -5%			
Wattage Tolerance:	+5%, -10%			
Three Phase available depending on casting size. Ground Studs can be added to most cast-ins.				



Note: Tempco-Pak mineral insulated cable heaters can be used in place of tubular heating elements to fit physical constraints not possible with conventional heating elements. See catalog Section 5 for more details.

Cooling Tube Materials for Castings with Liquid Cooling

Tube Material	Tube OD and Wall Thickness
Stainless Steel (Standard)	1/4" O.D. × .028 wall
Stainless Steel (Standard)	3/8" O.D. × .035 wall
Stainless Steel (Standard)	1/2" O.D. × .049 wall
Stainless Steel (Optional)	5/8" O.D. × .049 wall
Incoloy® 840 (Optional)	1/2" O.D. × .049 wall
Tubing with heavier wall thickness is available upon request.	

Options for Cast-In Thermal Components

Casting Surface Treatments

Special surface finishes are required in some applications:

- Electroless Nickel Plating
- Anodizing
- Teflon®
- Hard-Coat Anodizing
- Magnaplate

Lab Services

- Computerized Infrared Heating Profiles
- Life Cycle Testing
- X-Rays to confirm heating element location and casting density
- Heating Ramp Rate Testing

Agency  US Approvals

Cast-In Heater Elements are UL recognized under UL File Number E90771.

If you require UL Agency Approval, please specify when ordering.

Installation Recommendations

Installation Recommendations for Cast-In Thermal Components

Tempco Cast-In Heaters will provide long life and dependable, trouble-free service if properly installed, operated, and maintained as per the following recommendations:

Installation

1. Allow sufficient space for thermal expansion. The amount of space required depends upon the Cast-In Heater size, operating temperature and alloy.
2. Surface being heated must be free of any foreign materials and have a smooth finish.
3. Make sure that the casting is properly seated. The clamping devices used should be tightened down to the correct recommended torque. After initial heat-up, retighten fasteners to the correct recommended torque.

Recommended Torque:

10 ft-lb for 1/4–5/16 bolts, 20 ft-lb for 7/16–5/8 bolts

5. Thermal insulation can be used to reduce heat losses.
6. Avoid mounting heaters in an atmosphere containing combustible gases and vapors unless specifically manufactured for use in such conditions.
7. Liquid Cooled Cast-In Heater fittings must be securely tightened to prevent leaks.
8. To prevent overheating and heater failure, adequate temperature controls should be installed. For assistance in selecting temperature controls and thermocouples, see Tempco's (in-stock) complete line of Plug-In type Proportional Temperature Controls for heating and cooling applications in Section 13. Also see the listing on standard and hot melt thermocouples in Section 14.

Wiring

1. For connections at the heater terminals, use high temperature nickel conductor or nickel clad copper lead wire or alloy bus bar. Keep all electrical connections properly protected to eliminate electric shock to machine operators.
2. Heaters of equal wattage and voltage can be connected in series for higher voltage.
3. Heater installations must be properly grounded to eliminate electric shock hazard, and wiring must comply with electrical codes.
4. Always have a qualified electrician perform all wiring and connection of heaters and control components. Terminals must be tightened to the correct torque (2.5 ft/lb for terminal connections).

CAUTION: Castings are not designed to be lifted or carried by the terminations or leads.

Exposed electrical wiring on cast-in heater installations is a violation of Electrical Safety Codes including O.S.H.A.



Note: See page 16-11 for Wiring Diagrams and page 15-2 for lead wire selection

Operation

1. It is recommended to slow start the process during first use.
2. Do not operate above rated voltage. Excess voltage will result in heater failure.
3. Do not operate Cast-In Heaters above recommended temperatures. Heater temperature must be monitored and controlled. Use of over-temperature T/C is strongly recommended for higher temperature applications. Excess temperatures will result in heater failure and/or melting.
4. Electrical terminals must be kept free of contaminants, as spillage of plastic, water, oils, and their vapors can cause electric shorts, resulting in heater failure.
5. Liquid Cooled Cast-In Heaters must not be cycled to operate simultaneously. Thermal stresses may result in shorter heater life.
6. The water used on Liquid Cooled Cast-In Heaters must be properly treated. Hard water contains corrosive media that will contaminate the tubing, producing stress corrosion cracks and resulting in shorter heater life. Presence of minerals in water can cause clogged tubes that can result in poor heat transfer and eventually heater failure.

Maintenance

1. Never perform any type of service on heaters prior to disconnecting all electrical power.
2. To ensure good surface contact, periodically check clamping. Retighten clamping to the correct torque when required.
3. Repeat cycling of temperature controls can indicate poor surface contact or a burned-out heater.
4. Heater terminals must be kept free of plastics, oil, water, and any other foreign matter. As these materials carbonize, they create electrical shorts.
5. Heater terminal electrical connections must be kept tight. Loose connections can overheat and eventual destroy the connection or the heater terminal.
6. Water lines must be periodically checked for leaks. Water on heater terminals can be detrimental to the entire heating system.
7. Thermocouples must be kept free of contaminants and be checked for good response to temperature changes. Our recommendation is to change them periodically, as a bad thermocouple can be the cause of destroying an entire heating zone.

●●●●●●●● **Complete Your Installation With** ●●●●●●●●
▼▼▼▼▼▼▼▼ **Accessories Available From Stock** ▼▼▼▼▼▼▼▼

Accessory	Catalog Section
* Stainless Steel Tubing and Fittings For Cooling Lines	3
* Pressure Transducers and Rupture Disks	12
* Temperature Controllers	13
* Temperature Sensors, Thermocouple Wire, Jacks & Plugs	14
* High Temperature Lead Wire & Fiberglass Tape, Ceramic Terminal Covers and Electric Plugs	15

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