

CAST-IN HEATERS

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% | 6.50 - 7.50% | 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 C9530 | 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 |

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 |
| 1-5/8" (41.3 mm) | 4.30 | 1/2 | .430 and 1/2 |
| 1-3/4" (44.5 mm) | 4.30 | 1/2 | .430 and 1/2 |

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/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.

CASTING SIZE AND 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 | 1/4" (6.4 mm) top and bottom or to customer specification | |
| MAXIMUM WEIGHT | Aluminum— 600 pounds Bronze & Brass— 300 pounds | |

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 wal |
| Stainless Steel (Standard) | 1/2" O.D. × .049 wall |
| Stainless Steel (Optional) | 5/8" O.D. × .049 wall |
| Stainless Steel (Optional) | 1/2" O.D. × .049 wall |

Tubing with heavier wall thickness is available upon request.

OPTIONS FOR THERMAL COMPONENTS

Castig 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
- cXa-sRtianygs dteon csoitnyfirm heating element location and
- Heating Ramp Rate Testing



Cast-In Heater Elements are UL recognized under UL File Number E90771. Please specify if you require UL Agency Approval when ordering.

CAST-IN HEATERS

FINNED AIR-COOLED

Aluminum Finned Cast-In Band Heaters are used as an alternative to Liquid Cooled Cast-In Band Heaters for heating and cooling the barrels of plastic extruders. Finned Cast-In Band Heaters are manufactured in aluminum alloys because this material provides very good thermal conductive properties. For applications requiring higher operating temperatures and/or higher watt densities, bronze or brass alloys can be used.

Precision machining of the inside diameter yields superior heat transfer between the heater and the machine barrel, thereby ensuring uniform heating and cooling of the extrusion process. The heaters are secured to the barrel either by Stainless Steel Clamp Bands or by means of Bolt Clamping the heater halves together.

Finned Cast-In Band Heaters can be designed to meet the mechanical and physical constraints of existing extruder shroud systems. They are manufactured for Original Equipment Manufacturers (OEM) and maintenance (MRO) applications to customer specifications.

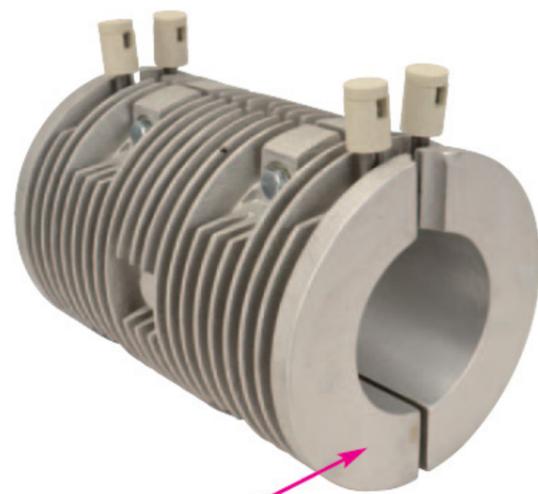
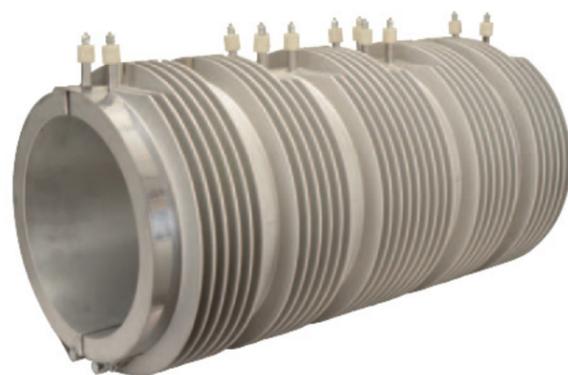


END TYPES

TYPE FS1 - HEATER WITHOUT SIDE FLANGES

These cast-in band heaters are normally made to be used in conjunction with the Cool to the Touch and Multi-Versal Shroud Systems. They can also be used as stand alone replacements or other heating and cooling extrusion systems.

The standard mounting method for these designs is bolt clamping. An alternative mounting method is to use stainless steel straps. Type "T" screw terminals are the standard termination.



Side Flange

TYPE FS2 - HEATER WITH SIDE FLANGES

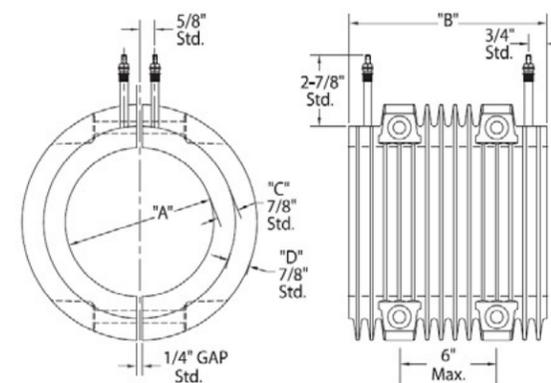
These cast-in band heaters are normally made to be used in conjunction with the Arctic Cast Shroud System. They can also be used as stand alone replacements for other heating and air cooling extrusion systems.

The standard mounting method for these designs is bolt clamping. An alternative mounting method is to use stainless steel straps. Type "E" screw terminals are the standard termination.

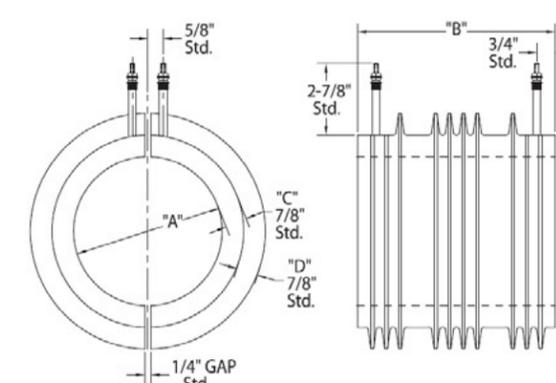
CAST-IN HEATERS

ORDERING INFORMATION

Finned Cast-In Band Heater Bolt Clamping



Finned Cast-In Band Heater Strap Clamping



Recommended Dimesions Shown.

DIMENSIONS

Inside Dia. "A" _____ Length "B" _____
Thickness "C" _____ Fin Height "D" _____

MATERIAL SPECIFICATIONS

Aluminum Bronze Brass

HEATER END TYPE

Type FS1 Type FS2

CLAMPING STYLE

Straps Bolt Clamp

ELECTRICAL SPECIFICATIONS

Watts each half _____ Volts each half _____ Phase _____

TERMINAL STYLE

"S" Post Terminals "T" Mica Washers "T7" Post Terminals
 "F" Plain Leads "TS" Leads and Shrink Sleeve
 "C4" Ceramic Cover "R1" Armor Cable Leads
 "E" Right-Angle Lugs Other: See pages for additional terminations

SURFACE FINISH

125 RMS Standard or to Customer Specifications

SPECIAL CAST-IN FEATURES

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

Cancer and Reproductive Harm - www.P65Warnings.ca.gov.

MPI Morheat Inc

SALES & SERVICE

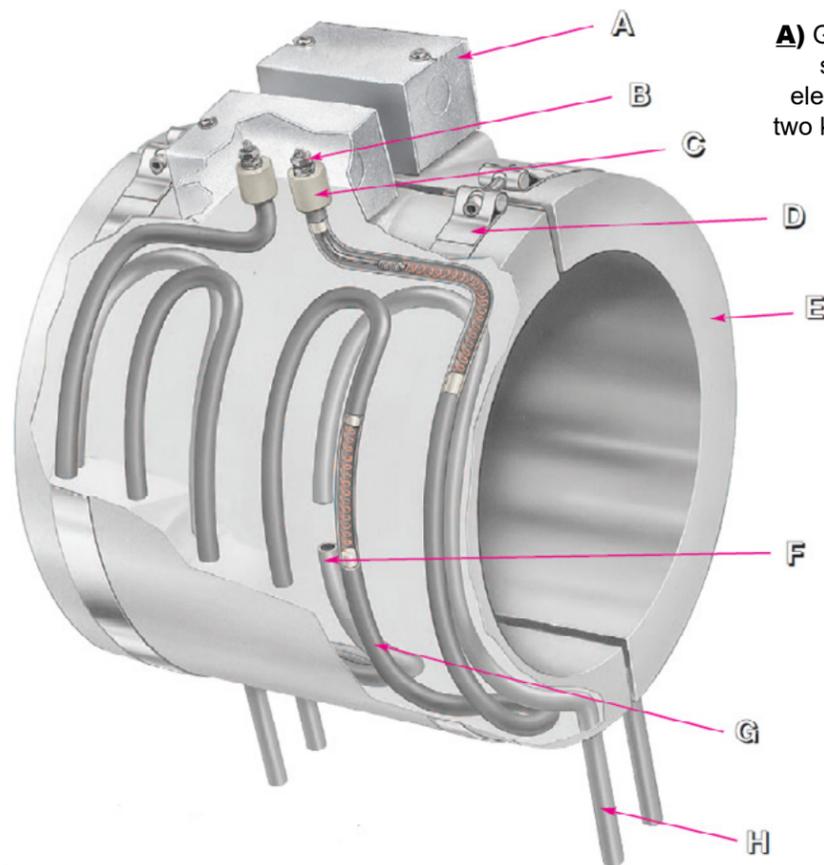
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CAST-IN HEATERS

LIQUID COOLED

The liquid cooling function of the Cast-In Heater is of primary importance in maintaining the proper temperature of the barrel in the extrusion process. Tempco offers many different liquid cooling variations, styles and terminations. The following pages will assist you in selecting the liquid cooling system best suited to your application.



A) General purpose stainless steel terminal boxes provide a simple and economical way to eliminate exposure to live electrical terminals. To simplify electrical wiring, the box has two knockouts for standard 1/2" BX cable connectors. Boxes can be supplied factory prewired with high temperature lead wire protected with armor cable or wire braid.

B) Threaded post terminals with 10-32 threads are securely fastened to the tubular heating element cold pin, assuring positive electrical contact for maximum amperage carrying capacity.

C) The standard Type "S" terminal has specially designed ceramic insulators that provide support to the screw terminals. The tubular heater is recessed into the insulator to help prevent the screw terminals from bending or breaking from mechanical abuse.

D) Specially designed, low expansion 430 stainless steel clamping straps with 1/4"-20 socket head cap screws and barrel nuts, in either 3/4" or 1-1/4" widths, are supplied as our standard method for securing the casting to the barrel. The number and width of the straps is determined by the length and weight of the heater.

E) Having an in-house foundry gives us the flexibility to apply sound foundry techniques to control the quality of each casting. Specially designed steel and cast iron molds are used in our Permanent Mold Casting Process, producing a dense casting, free of internal voids with smoother as-cast surfaces. When casting small quantities, the No-Bake Sand Mold process is used. This process produces a better quality casting than other sand processes. The inside diameter of all Cast-In Band Heaters is machine finished to customer specifications.

F) A critical consideration in the design of a heat and liquid cooled Cast-In Heater is the cooling tube itself, since cooling tube failures usually occur before heating element failures. MPI Morheat has devoted many years of research and testing to select alloy tubes that are resistant to corrosion, and that will also withstand the continuous stress that is placed on the cooling tube. Our testing also included developing the proper tube forming techniques to limit the effects of thermal shock from repetitive heat/cool cycling that can produce stress cracking, especially at the point the cooling tube exits the casting.

H) Cooling tube extensions can be cut to your specified length, with various types of tube fittings factory installed. The casting can also be supplied with non-exposed cooling tube fittings, which reduce cooling tube failure due to stress corrosion cracking.

G) To maintain lower watt densities important for good heater life, the largest possible diameter steel sheath tubular heater is used. MPI Morheat most commonly uses a .430 diameter element with 1/8" diameter cold pins. This pin size allows installation of larger and stronger screw terminal connections, providing additional strength to prevent broken terminals due to mechanical abuse.

CAST-IN HEATERS

LIQUID-COOLED CLAMPING METHODS

SINGLE SET OF COOLING TUBES - INDUSTRY STANDARD

The single set cooling tube design features 1/4", 3/8" or 1/2" diameter tubing precisely formed into a serpentine or any other suitable shape and cast into the body of the Cast-In Heater. This is the most widely used method for providing a means of cooling in liquidcooled Cast-In Heaters. From this basic design, the user can choose to factory equip the cooling tubes with any of the cooling tube termination options shown on the next page. Electrical termination options are shown on the following pages. The two most common clamping variations are shown below.

TYPE CW - SINGLE COOLING TUBE WITH STRAP CLAMPING



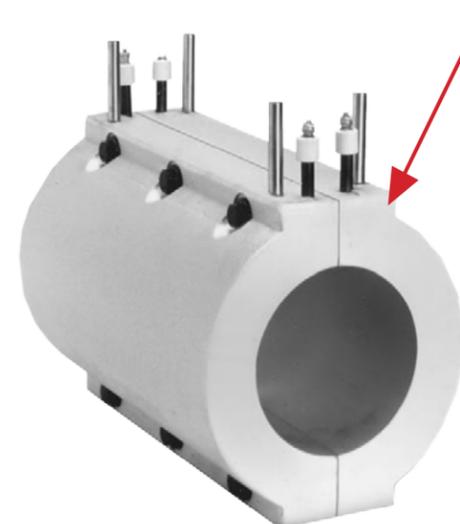
Type CW Cast-In Band Heaters consist of liquid cooled and/or heating functions, and are secured to the extruder barrel with 3/4" or 1-1/4" wide low expansion stainless steel clamping straps with 1/4"-20 socket head cap screws and barrel nuts.

If not otherwise specified, supplied with Type S electrical screw termination, 3" long cooling tube extensions and straps for clamping.

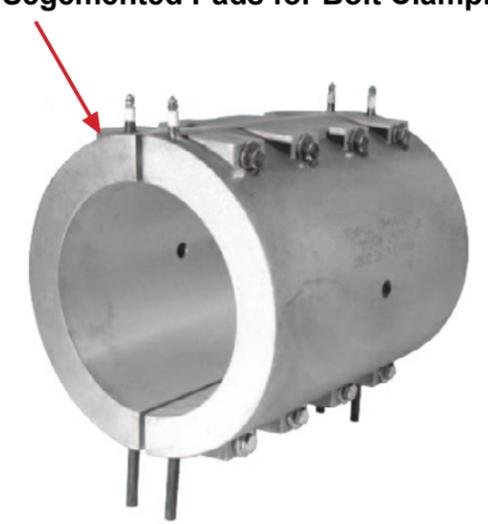
TYPE CWB - SINGLE COOLING TUBE WITH BOLT CLAMPING

Type CWB Cast-In Band Heaters consist of liquid cooled and/or heating functions, and are secured to the barrel by bolts clamping the two halves together around the barrel. A variety of bolt clamping designs and hardware is available. If not otherwise specified, cast-in band heaters are supplied with Type S electrical screw termination and 3" long cooling tube extensions.

Style 1 - Continuous Flange for Bolt Clamping



Style 2 - Segemented Pads for Bolt Clamping



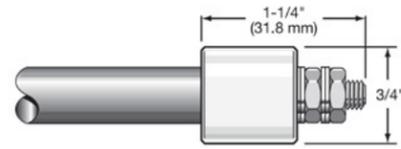
CAST-IN HEATERS

ELECTRICAL TERMINATION OPTIONS

STANDARD TUBULAR HEATER TERMINATIONS FOR CAST-IN HEATERS

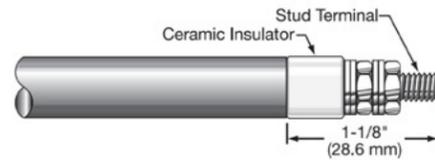
Type S Standard Unless Otherwise Specified

- Heavy Duty Ceramic Insulators.
- 0.315" diameter heater has 8-32 screw terminals.
- 0.430" diameter heater has 10-32 screw terminals.



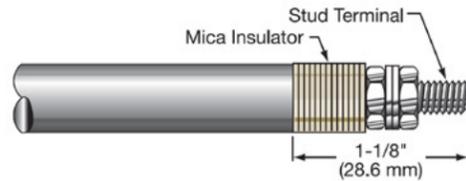
Type T7

- Ceramic insulator is the same diameter as the heating element.
- 0.260" diameter heater has 6-32 screw terminals.
- 0.315" diameter heater has 8-32 screw terminals.
- 0.430" diameter heater has 10-32 screw terminals.



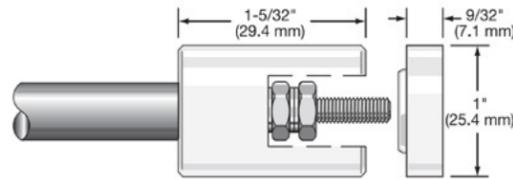
Type T

- Mica insulator is the same diameter as the heating element.
- 0.260" diameter heater has 6-32 screw terminals.
- 0.315" diameter heater has 8-32 screw terminals.
- 0.430" diameter heater has 10-32 screw terminals.



Type C4

- Heavy duty ceramic insulator with terminal cover.
- 0.315" diameter heater has 10-32 screw terminals.
- 0.430" diameter heater has 10-32 screw terminals.



Type P - Plain Pin

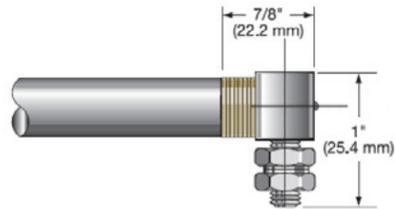
- Plain terminal pin. Specify Length "L." Standard 1/2" (12.7 mm) pin length.

| Element Diameter | Nominal Pin Diameter |
|------------------|----------------------|
| 0.260 | 0.091 |
| 0.315 | 0.100 |
| 0.430 | 0.120 |



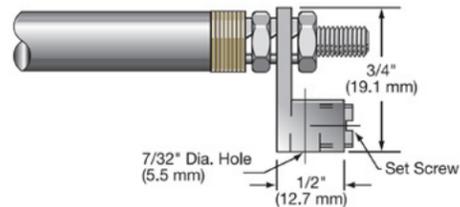
Type R

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



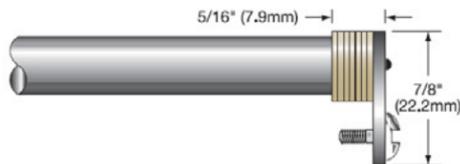
Type R2

- Mica washers with blockhead and through hole for lead wire connection.
- Eliminates the use of ring terminals.
- Available for 0.315" and 0.430" 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 0.260", 0.315" and 0.430" diameter heaters.



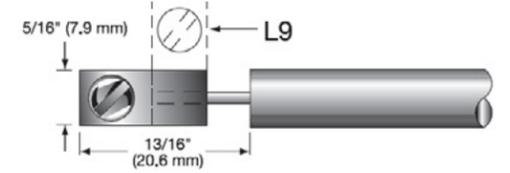
CAST-IN HEATERS

ELECTRICAL TERMINATION OPTIONS

STANDARD TUBULAR HEATER TERMINATIONS FOR CAST-IN HEATERS

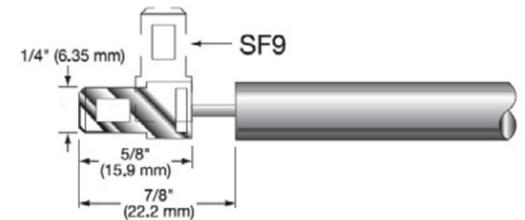
Type L & L9

- Terminal lug spot welded to pin with 10-32 binding head screw.
- Available for 0.260", 0.315" and 0.430" 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 0.260", 0.315" and 0.430" 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.



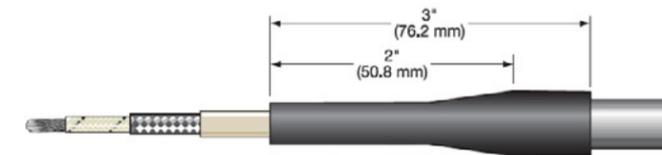
Type R1A

- 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 depending on heater diameter and braid diameter used.



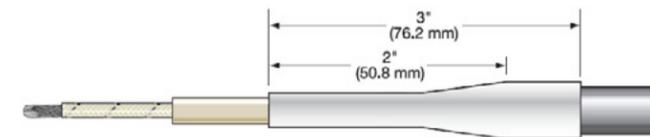
Type MR

- 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 0.260", 0.315" and 0.430" and 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.



CAST-IN HEATERS

ELECTRICAL TERMINATION HOUSINGS

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 prewired

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 prewired 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.

CAST-IN HEATERS

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.

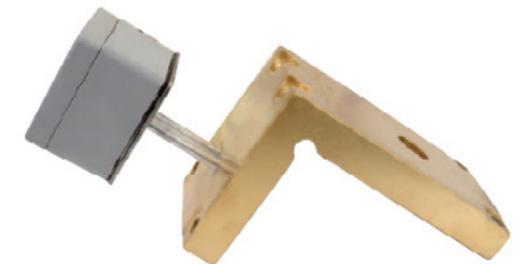
Optional: Two hubs per box available. Cast-In Heater fitted with boxes can be factory prewired with high temperature lead wire, protected with special armor cable.

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.

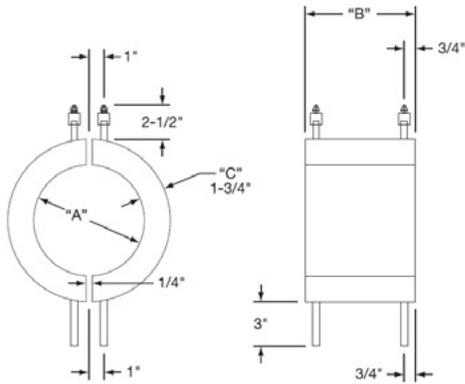


Exposed electrical wiring on cast-in heater installations is a violation of Electrical Safety Codes including O.S.H.A.

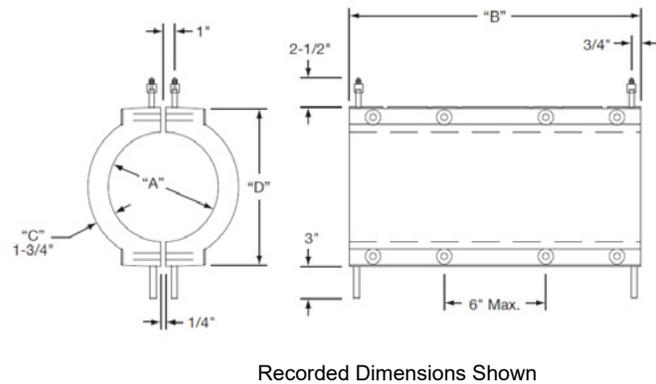
CAST-IN HEATERS

TERMINAL PROTECTION BOXES FOR CAST-IN HEATERS

CAST-IN BAND HEATER STRAP CLAMPING



CAST-IN BAND HEATER BOLT CLAMPING



VARIABLE DIMENSIONS

Inside Dia. "A" _____ Length "B" _____ Thickness "C" _____ "D" _____

MATERIAL SPECIFICATIONS

Aluminum Bronze Brass

ELECTRICAL SPECIFICATIONS

Watts each half _____ Volts each half _____ Phase _____

TERMINAL STYLE

"S" Post Terminals "C4" Ceramic Cover "F" Plain Leads
 "R" 90° Blockhead "T7" Post Terminals "MR" Moisture Resistant
 "E" Right-Angle Lugs "T" Post Terminals "TS" Leads and Shrink Sleeve
 "R1" Armor Cable Leads "R1A" SS Wire Overbraid
 "R2" Blockhead and Through Hole See Other Pages for additional Terminations

TERMINAL PROTECTION BOX

None "C2" Standard "C7" 1 Box for both halves "EP" Explosion Resistant
 "P2" High Temperature Quick-Disconnect "MPR" Moisture Resistant Box
 "MR1" Rigid Moisture Resistant Box "CB1" Cast Aluminum Box

CLAMPING STYLE

Straps Bolt Clamp

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 _____

COOLING TUBE FITTINGS

Non-exposed 3/8" NPTF "HS" Hi-Seal Fitting "RA" 90° Copper Elbow
 Non-exposed 1/2" NPTF "RT" 90° Threaded Elbow
 "FF" Flared Seal "R3" Straight Threaded

SURFACE FINISH

125 RMS Standard or to Customer Specifications

SPECIAL CAST-IN FEATURES

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

MPI Morheat Inc

SALES & SERVICE

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