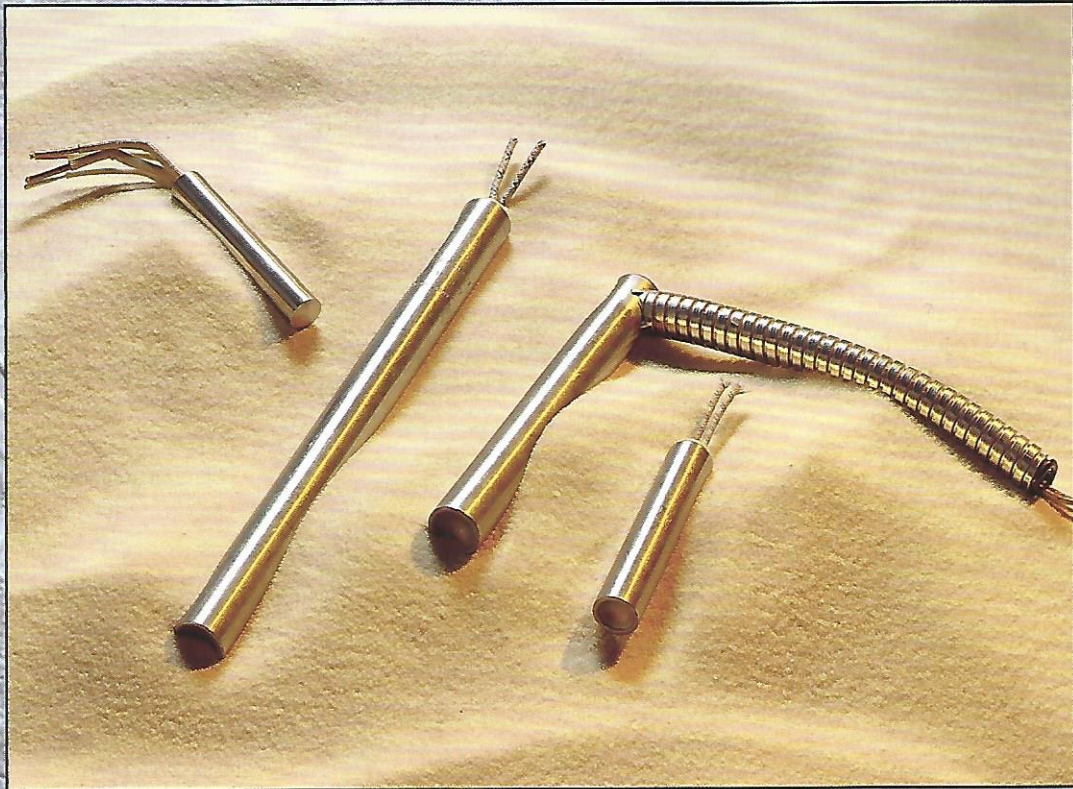


CARTRIDGE HEATERS



Hi-Temp Cartridge heaters are designed for optimum performance above and beyond the norm.

fast  *heat*®



HI-TEMP CARTRIDGE HEATERS

HI-TEMP® CARTRIDGES

Fast Heat's ruggedly constructed, high watt density Hi-Temp Cartridge heaters provide excellent heat transfer efficiency, high operating temperature (typically 90 to 95 watts per square inch, depending on the application) and long life. Hi-Temps can meet U.L./C.S.A. approval, use the chart on page 151 for reference and consult factory.

The Hi-Temp Cartridge is made to withstand internal temperatures of up to 1600° F (871° C). Its swaged construction allows for minimal air gaps, providing superior heat transfer and resistance to impact and vibration. Dual voltage and three phase are available on selected diameters of the Hi-Temp.

If you're in a hurry, Hi-Temps are available through QuickShip and Fast Track. Refer to page 2 for a complete description of these rapid delivery programs.

APPLICATIONS

The Hi-Temp's ability to withstand high heat and excessive vibration makes it ideally suited for many diverse applications, including heating platens, sealing bars, heating fluids, hot stamping and forming.

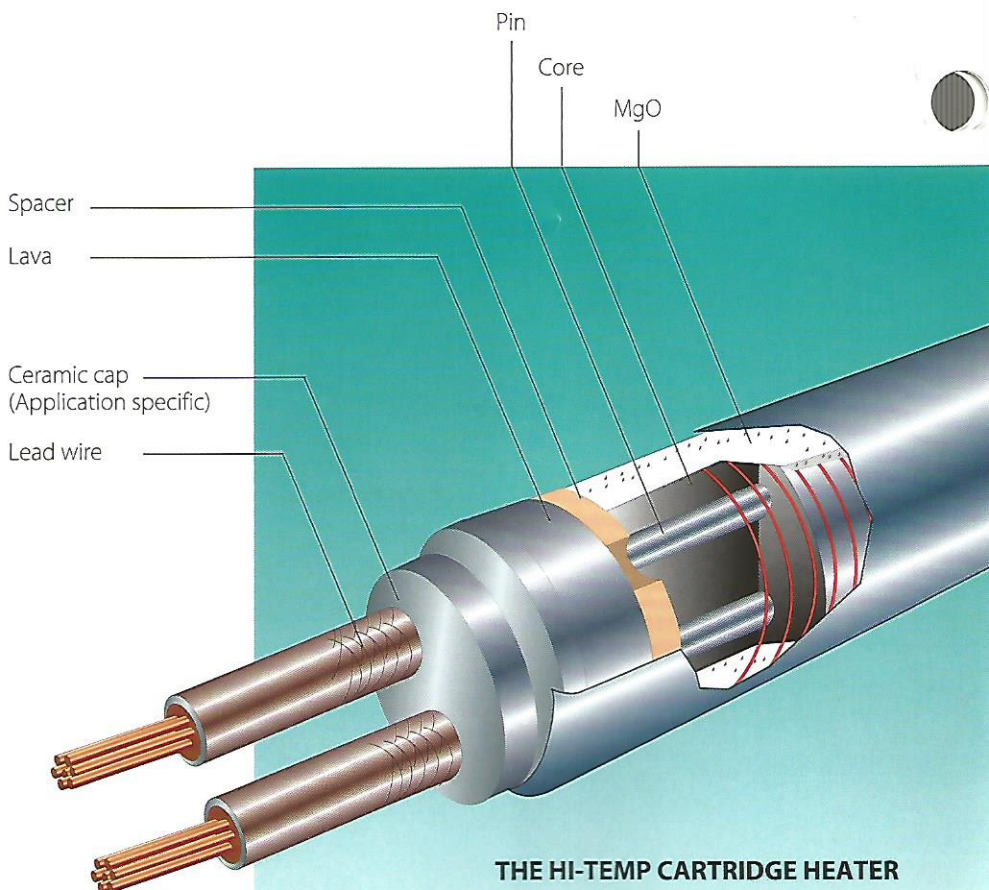
In addition, Hi-Temps can be modified to meet the demands of virtually any special application. Our engineers can utilize a variety of alternative features and options to customize the heater to your specific needs.

FEATURES AND BENEFITS

- High watt density required.
- Efficient dissipation of heat.
- Where space limitations apply.
- Resistant to impact and vibration.
- Dual voltage, selected diameters.
- Three phase, selected diameters.
- Distributed wattage.

MATERIAL AND CONSTRUCTION

- Computer designed specifications.
- High quality resistor wire precisely wound on magnesium oxide cores.
- Resistor core assembly accurately and consistently spaced close to the outer sheath for efficient heat transfer.
- High purity magnesium oxide (MgO) surrounds the resistor core assembly.
- Initial heater diameter is reduced, thus increasing density of the assembly, resulting in a heating source which exhibits exceptional dielectric strength and heat transfer characteristics.
- End disc is always welded in place, preventing contaminants from entering the heater.
- U.L. approved, C.S.A. certified flexible nickel leads attached to nickel pins from within the heater 482° F (250° C), standard. Mica tape insulated 842° F (450° C), available when requested as dictated by the application.
- Incoloy® 800 sheath material.
- Cement is standard; epoxy or RTV seal also available.
- Cold sections vary depending upon heater length and diameter.



THE HI-TEMP CARTRIDGE HEATER

HI-TEMP CARTRIDGE HEATERS



SPECIFICATIONS

Wattage Tolerances: +5% – 10% based on Nema Standards.

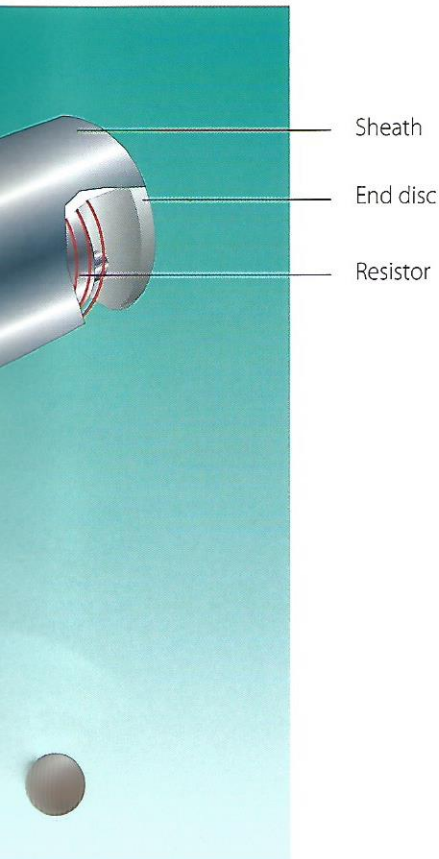
Resistance Tolerances: +10% – 5% to give above power tolerances. Note that above tolerances are based on internal operating temperature, since the room temperature resistance of an element wire is normally 3.3% lower than when operating.

Choice of voltage: 120V or 240V - other voltages on request.

See page 21 to calculate watt density on Hi-Temp heaters.

SPECIAL NOTE ON WARRANTY

Heaters with an operating voltage higher than 250 Volts must be larger than or equal to 5/8" diameter to be eligible for a warranty.



DIAMETER TOLERANCE*

ENGLISH SIZES

1/4" (0.250) = .247 ± .002
5/16" (0.312) = .310 ± .002
3/8" (0.375) = .370 ± .002
7/16" (0.437) = .432 ± .002
1/2" (0.500) = .495 ± .002
9/16" (0.562 - Sleeved) = .560 ± .002
5/8" (0.625) = .620 ± .002
11/16" (0.687) = .682 ± .002
3/4" (0.750) = .745 ± .002
13/16" (0.812 - Sleeved) = .812 ± .003
7/8" (0.875 - Sleeved) = .869 ± .002
15/16" (0.937 - Sleeved) = .932 ± .002
1" (1.000) = .995 ± .003

METRIC SIZES

6.5 mm = 6.4 ± .05	ENGLISH EQUIVALENT
8 mm = 7.9 ± .05	.256" = .253" ± .002
10 mm = 9.9 ± .05	.315" = .312" ± .002
11.9 mm = 11.8 ± .05	.394" = .391" ± .002
12 mm = 11.9 ± .05	.468" = .465" ± .002
12.5 mm = 12.4 ± .05	.472" = .469" ± .002
12.7 mm = 12.6 ± .05	.492" = .489" ± .002
14 mm = 13.9 ± .05 (Sleeved)	.500" = .497" ± .002
15 mm = 14.9 ± .05	.551" = .546" ± .002
16 mm = 15.9 ± .05	.591" = .587" ± .002
17.5 mm = 17.4 ± .05	.630" = .627" ± .002
19.5 mm = 19.4 ± .05	.689" = .687" ± .002
20 mm = 19.9 ± .05	.768" = .768" ± .002
	.787" = .784" ± .002

* Diameter at each end may vary +.002" -.004" (+ .05 mm - .1 mm).

Length Tolerances: ± 2% with ± 1/8" (3.2 mm) min. tolerance, whichever is greater. For closer tolerances contact Fast Heat.

Camber Tolerances: .020" (.05 mm) per foot (1.7 mm per meter) length.

RECOMMENDED MAXIMUM AMPERAGES

ENGLISH SIZES

1/4" = 3.2 Amps	11/16" = 24 Amps
5/16" = 5.8 Amps	3/4" = 24 Amps
3/8" = 7.5 Amps	13/16" = 24 Amps
7/16" = 7.5 Amps	7/8" = 24 Amps
1/2" = 12.5 Amps	15/16" = 24 Amps
9/16" = 12.5 Amps	1" = 24 Amps
5/8" = 24 Amps	

METRIC SIZES

6.5 mm = 3.2 Amps	15 mm = 12.5 Amps
8 mm = 5.8 Amps	16 mm = 24 Amps
10 mm = 7.5 Amps	17.5 mm = 24 Amps
11.9 mm = 12.5 Amps	19.5 mm = 24 Amps
12 mm = 12.5 Amps	20 mm = 24 Amps
12.5 mm = 12.5 Amps	
12.7 mm = 12.5 Amps	
14 mm = 12.5 Amps	

Contact Fast Heat for higher voltage and amperage ratings, and special diameters or tolerances.



AVOIDING COMMON HEATER FAILURE MODES

Use recommended maximum watt density range to avoid excessive watt densities which result in the internal overheating of the heater.

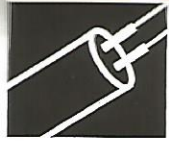
When heater requirements demand excessive watt densities, contact Fast Heat for recommendations. Special heaters can be designed for these applications.

Contamination of heater, both on leads and internally, is serious and results in rapid failure. Care should be taken to keep possible carbonizing agents such as oil and low temperature tapes away from heater. In cases where this is not possible, use catalog recommended seals or contact Fast Heat for assistance.

Lead failure due to excessive flexing can be decreased or halted by utilizing special lead arrangements shown in catalog. For further assistance contact Fast Heat.

Thermal expansion and contraction due to cycling shortens heater life. We recommend reducing watt densities by 20% for those heaters subject to frequent cycling.

Also be sure the full heated length is in contact with metal to avoid burn-out by operating in air.



STANDARD CARTRIDGE HEATERS

STANDARD CARTRIDGES

Our Standard Cartridge heaters are designed as an economical, quality heater for lower temperature use (typically 40 watts per square inch, depending on the application). Standard Cartridges can meet U.L./C.S.A. approval, use the chart on page 151 for reference and consult factory.

The Standard Cartridge Heater is made to withstand internal temperatures of up to 1000° F (538° C) and features a stainless steel sheath for resistance to oxidation. High-purity magnesium oxide (MgO) fills any space around the resistor wire in order to optimize heat transfer and increase the life of the heater.

For faster shipment, Standard Cartridges are available through our Fast Track delivery program. Refer to page 2 for a complete description of these rapid delivery programs.

APPLICATIONS

Standard Cartridge heaters can be used in virtually any application involving lower temperatures and relatively little vibration or impact. Some examples include sealing bars, heating platens, heating fluids and forming.

Standard Cartridges can also be modified to meet the demands of special applications. Our engineers can utilize a variety of alternative features and options to customize the heater to your specific needs.

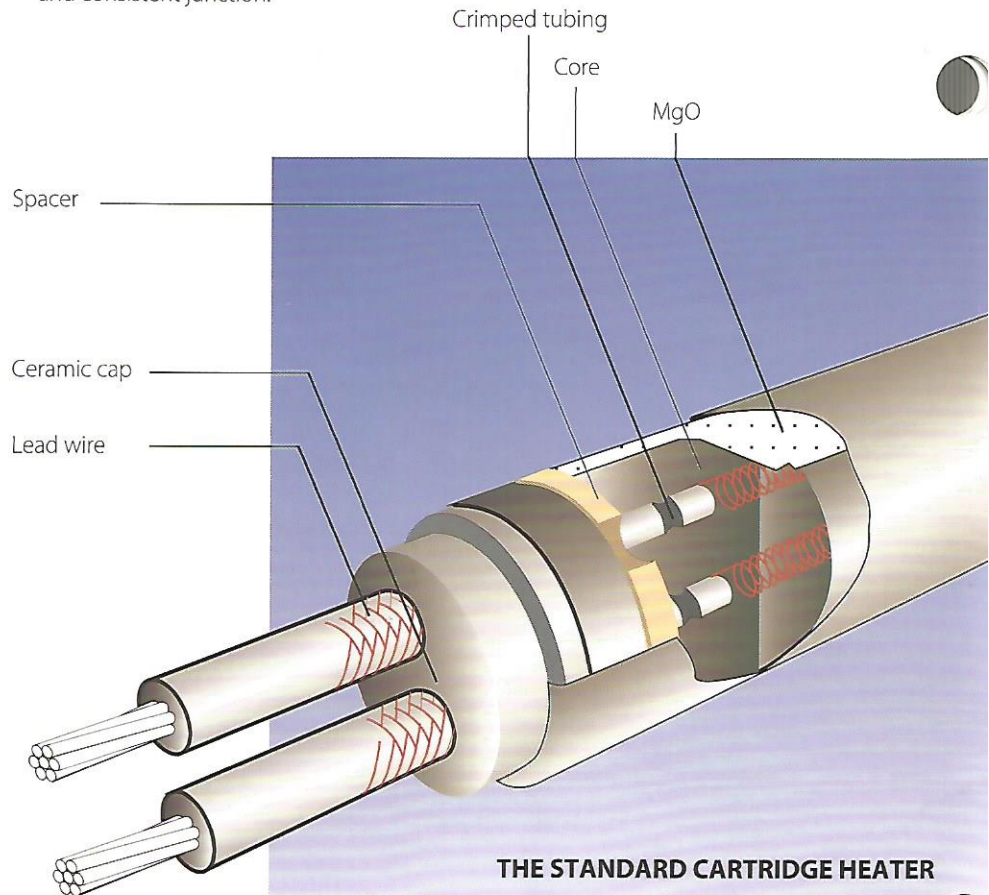
FEATURES AND BENEFITS

- Wide range of diameters.
- Many termination styles.
- Voltage variations.
- U.L. approved and C.S.A. recognized.
- Top quality ceramic element support.
- Unique winding design allows faster heating and longer life.
- High purity MgO packing for even heat distribution.
- Fiberglass insulated lead wire is standard. Other lead wire insulation available upon request.

MATERIAL AND CONSTRUCTION

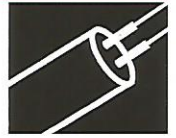
- Computer designed specifications.
- 304 stainless steel sheath for oxidation resistance.
- Ceramic insulator spaces helically wound resistor inside the sheath.
- Helically wound nickel chromium resistor is of a conservative design for each application and evenly stretched through the ceramic insulators.
- Fine grain high purity magnesium oxide (MgO) fills any voids around the resistor wire to optimize heat transfer, dielectric strength and life of the heater.
- Resistor wire is joined to the leads by placing each end into nickel chromium which, upon crimping, affords a positive and consistent junction.

- U.L. approved and C.S.A. certified flexible nickel conductor with fiberglass insulated lead wire 482° F, (250° C) is standard. Mica tape/fiberglass insulated 842° F, (450° C) available when requested as dictated by the application.
- Disc end of the heater rests on a mica insulator and is held in position when the sheath is rolled over onto it. This is a standard assembly procedure unless the application requires moisture or water-proof sealing, at which time the end cap can be sealed by brazing or welding.
- Ceramic cap standard; cement, epoxy or RTV seal also available.



THE STANDARD CARTRIDGE HEATER

STANDARD CARTRIDGE HEATERS



SPECIFICATIONS

Wattage Tolerances: +5% – 10% based on Nema standards.

Resistance Tolerances: +10% – 5% to give above power tolerances. Note that above tolerances are based on internal operating temperature since the room temperature resistance of an element wire is normally 8.5% lower than when operating.

Standard voltages are 120V or 240V. 120V max. for short length units $\frac{3}{16}$ ", $\frac{1}{4}$ ", and $\frac{5}{16}$ " dia. (4.7, 6.3, 7.9 mm).

SPECIAL NOTE ON WARRANTY

Heaters with an operating voltage higher than 250 Volts must be larger than or equal to $\frac{5}{8}$ " diameter to be eligible for a warranty.

DIAMETER TOLERANCE

ENGLISH SIZES	METRIC EQUIVALENT
$\frac{3}{16}$ " (0.1875) = .183 ± .001	4.6 mm ± .02
$\frac{1}{4}$ " (0.250) = .245 ± .002	6.3 mm ± .05
$\frac{5}{16}$ " (0.312) = .308 ± .002	7.8 mm ± .05
$\frac{3}{8}$ " (0.375) = .370 ± .002	9.4 mm ± .05
$\frac{7}{16}$ " (0.437) = .432 ± .002	11.0 mm ± .05
$\frac{1}{2}$ " (0.500) = .494 ± .003	12.6 mm ± .07
$\frac{9}{16}$ " (0.562) = .562 ± .003	14.3 mm ± .07
$\frac{5}{8}$ " (0.625) = .620 ± .003	14.3 mm ± .07
$\frac{11}{16}$ " (0.687) = .681 ± .003	15.8 mm ± .07
$\frac{3}{4}$ " (0.750) = .744 ± .003	17.3 mm ± .07
$\frac{13}{16}$ " (0.812) = .812 ± .003	20.6 mm ± .07
$\frac{7}{8}$ " (0.875) = .869 ± .003	22.2 mm ± .07
$\frac{15}{16}$ " (0.937) = .932 ± .002	23.7 mm ± .07
1" (1.000) = .992 ± .005	25.2 mm ± .12
1 $\frac{1}{4}$ " (1.250) = 1.244 ± .003	31.6 mm ± .12

METRIC SIZES	ENGLISH EQUIVALENT
10 mm = 9.8 ± .05	.394" = .389" ± .003

Length Tolerances: ± .062" (1.6 mm).
For closer tolerances contact Fast Heat.

The Fast Heat Standard Cartridge heater is computer designed and specified to include components that are equal to the wide variety of applications to which this style of heater will be subjected.

As with the Hi-Temp Cartridge heater, a variety of termination styles can be adapted to this style of heater. When there are termination requirements other than the ones illustrated, please contact Fast Heat.

There may be applications where, due to the wattage requirement, it would be appropriate to specify a Standard Cartridge heater but the application dictates that a Hi-Temp be considered. Such applications are where distributed wattage is required or the heater would be subjected to extreme vibration or impact in operation.

Contact Fast Heat for higher voltage and amperage ratings, and special diameters or tolerances.



AVOIDING COMMON HEATER FAILURE MODES

Use recommended maximum watt density range to avoid excessive watt densities which result in the internal overheating of the heater.

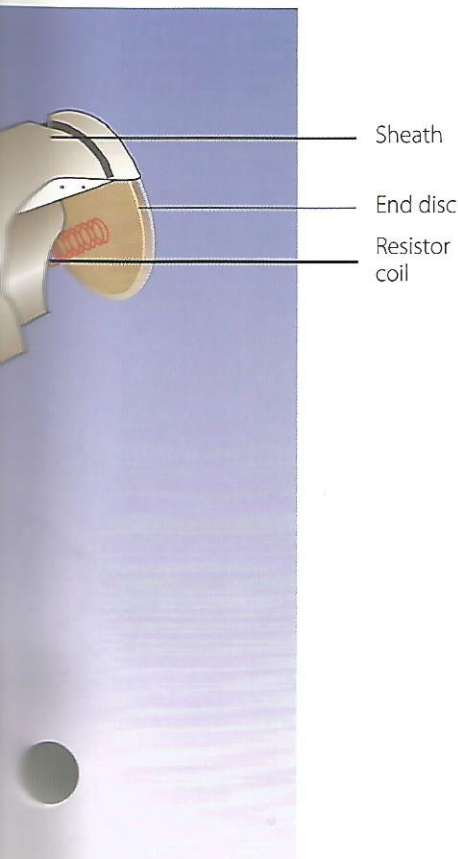
A clean and properly bored hole in relation to heater diameter is required for good heat transfer.

Be aware that moisture/contamination will reduce the life expectancy of a heater. Consider specifying that either the disc or lead end or both be sealed, depending upon the specific conditions to which the heater is being subjected.

Review lead exit variations and select the style that best suits your particular application. Consider such conditions as contamination, abrasion, flexing and sharp bending of the leads as they exit the heater.

It is recommended that watt density be reduced by 20% for those heaters subjected to frequent cycling.

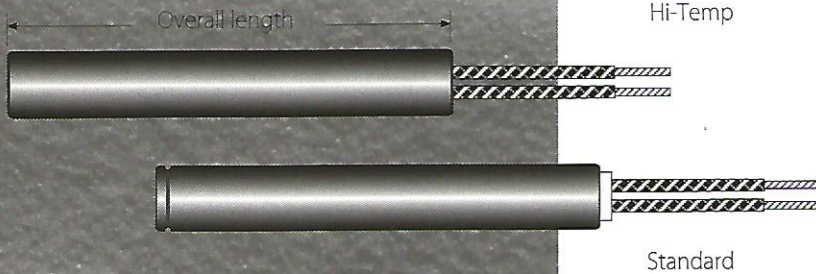
To avoid burn-out by operating in open air, heated length must always be fully inserted. In addition, an exposed heated section of the heater may cause a hazardous condition.





HI-TEMP/STANDARD CARTRIDGE HEATERS

FLEXIBLE LEADS

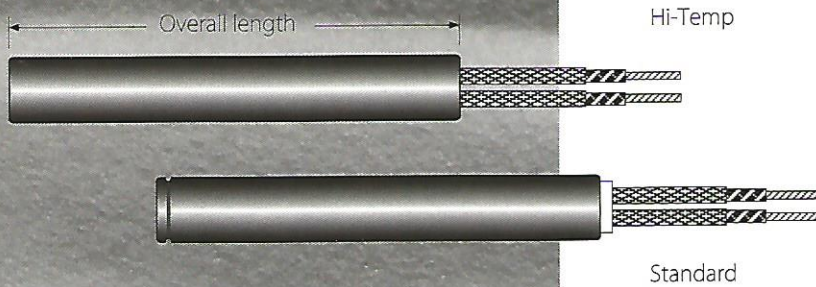


Internally connected leads.

For applications requiring maximum flexibility at lead exit.

10" (25.4 cm) leads standard, other lengths are available.

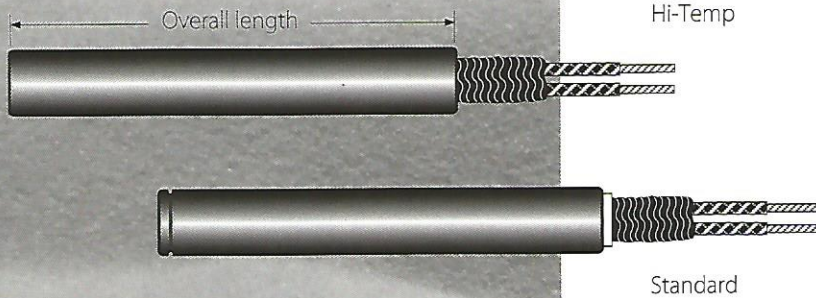
EXTERNALLY CONNECTED LEADS



Hi-Temp Cartridges are provided with approx. 1" (25.4 mm) sleeving over lead junction as standard.

10" (25.4 cm) leads standard, other lengths are available.

STRAIGHT LEADS W/SILK AND PAINT



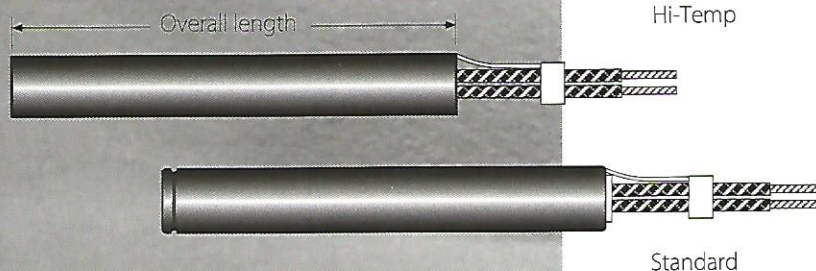
Repairable silk and paint leads for Standard Cartridges.

Hi-Temp Cartridges are provided with approx. 1" (25.4 mm) sleeving as standard.

Silk and paint leads are optional on Hi-Temps.

10" (25.4 cm) leads standard, other lengths are available.

STRAIGHT LEADS W/CLIP SUPPORT



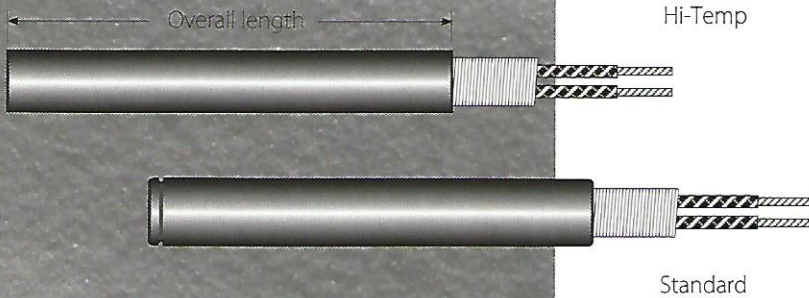
Clip support helps to minimize lead breakage where leads exit heater.

10" (25.4 cm) leads standard, other lengths are available.

HI-TEMP/STANDARD CARTRIDGE HEATERS

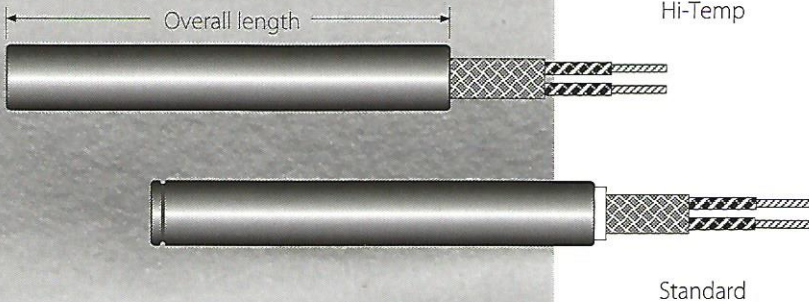


STRAIGHT STRAIN RELIEF SPRING



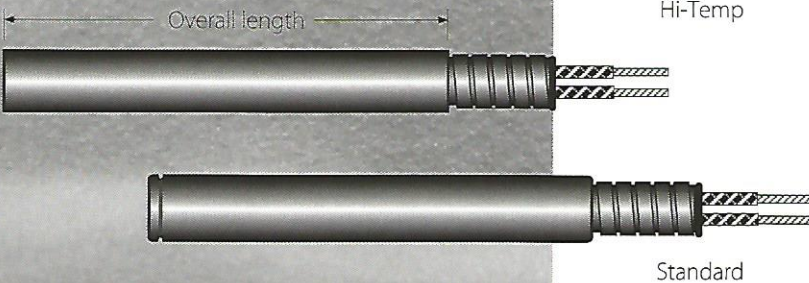
Straight strain relief spring minimizes bending strain on lead wires.
Spring extends approximately 3" (76.2 mm) beyond end of sheath.

BRAID OVER PAIR OF LEADS



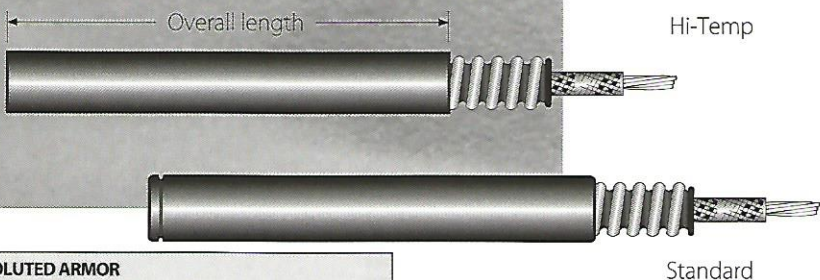
Stainless steel braid over lead wires.
For applications requiring small radius bending and lead wire abrasion protection.
10" (25.4 cm) braid standard, other lengths are available.

SQUARE-LOCK ARMOR STRAIN RELIEF



Straight stainless steel armor cable protects leads from abrasion.
Armor sizes include:
Square-lock - 1/4", 5/16", 1/2", and 5/8".
Convolute - 3/8", and 5/8" only.
(Moisture-resistant)
10" (25.4 cm) standard, other lengths are available.

CONVOLUTED ARMOR STRAIN RELIEF



CONVOLUTED ARMOR

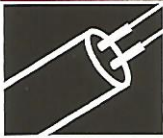
- Used in situations that require moisture resistant armor.
- Available in most instances in which armor is utilized.
- Some size restrictions apply.



POTTING SYSTEMS AVAILABLE

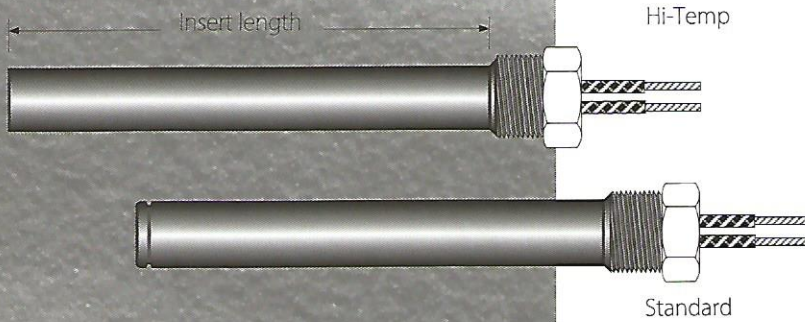
1. Cement 1000° F (538° C)
2. Epoxy 300° F (149° C)
3. RTV® 500° F (260° C)
4. Teflon® Cap 500° F (260° C)

- Cement seal can be wiped with a Silicon® varnish to inhibit moisture penetration.
- Teflon® Cap requires an extended lead time.



HI-TEMP/STANDARD CARTRIDGE HEATERS

N.P.T. BUSHING



Hex head N.P.T. bushing attached.

Must specify insert length and bushing material.

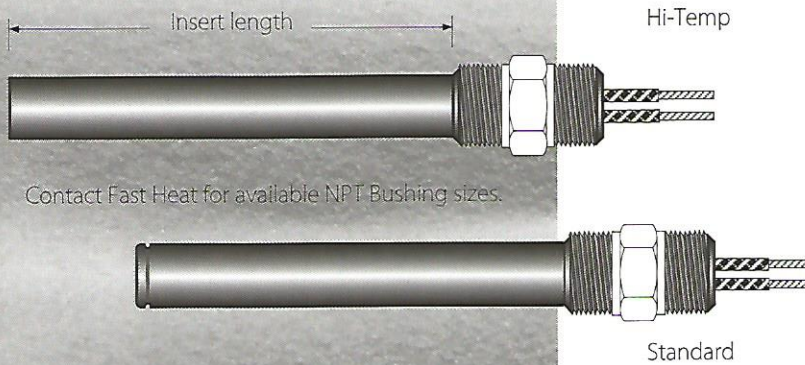
Sheath material types: stainless steel, cold rolled or galvanized.

Bushing material types: brass, stainless steel or steel.

10" (25.4 cm) leads standard, other lengths are available.

For immersion applications, specify sealed end. Up to 3/4" (19 mm) dia. Octagonal box available.

HEX CENTER BUSHING



Contact Fast Heat for available NPT Bushing sizes.

Hex head N.P.T. bushing attached.

Must specify insert length and bushing material.

Sheath material types: stainless steel, steel or brass.

Bushing material types: brass, stainless steel or steel.

10" (25.4 cm) leads standard, other lengths are available.

For immersion applications, specify sealed end.

Octagonal or explosion-proof boxes can be adapted to both Standard and Hi-Temp Cartridge heaters.

Consult Fast Heat for details.

ADAPTERS



Contact Fast Heat for available Adapter sizes.

Must specify insert length and bushing material.

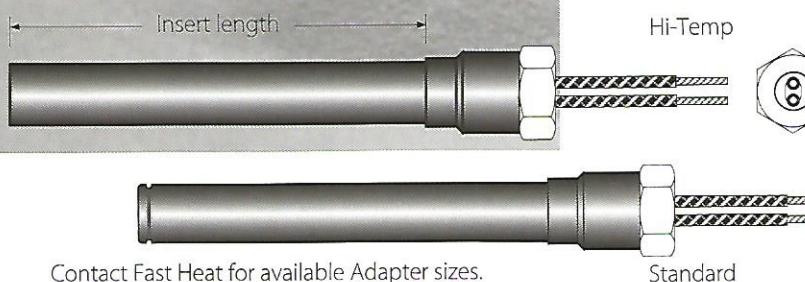
Sheath material types: stainless steel, cold rolled or galvanized.

Bushing material types: brass, stainless steel or steel.

10" (25.4 cm) leads standard, other lengths are available.

For immersion applications, specify sealed end. 5/8" to 1" (15.8 mm to 25.4 mm) dia.

ADAPTERS WITH HEX HEAD



Contact Fast Heat for available Adapter sizes.

Must specify insert length.

Bushing material is copper.

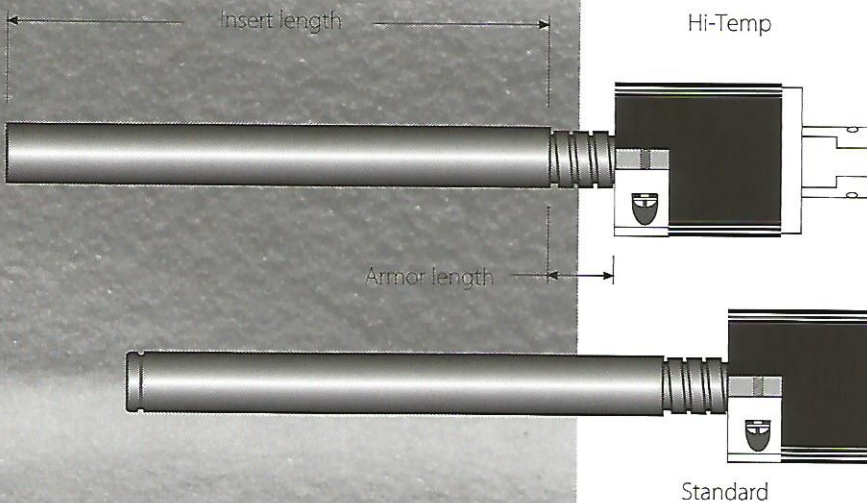
10" (25.4 cm) leads standard, other lengths are available.

For immersion applications, specify sealed end. Up to 3/4" (19 mm) dia.

HI-TEMP/STANDARD CARTRIDGE HEATERS



ARMOR WITH PLUG



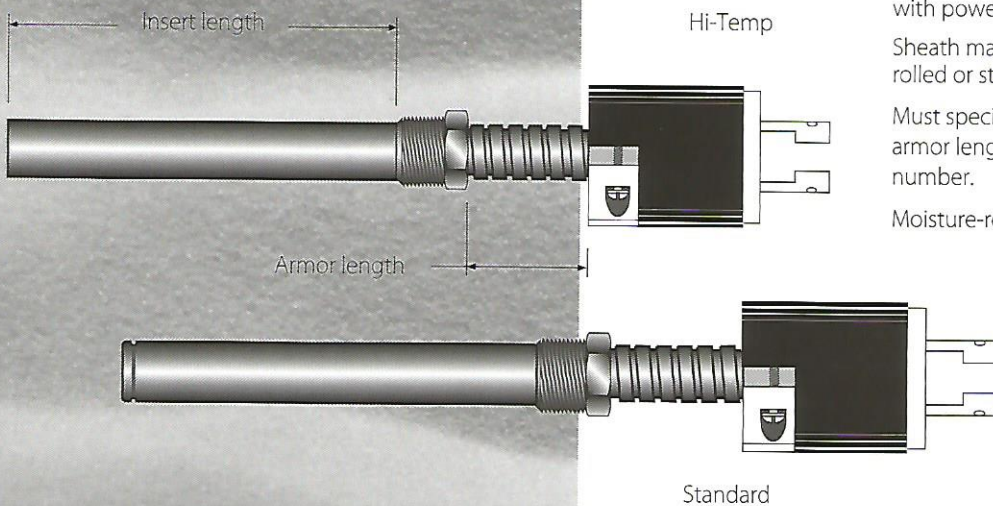
Armor cable with power plug attached.

Must specify armor length and Hubbell® power plug number.

Moisture-resistant armor available.

Other Plugs are available, contact Fast Heat or see page 26 of our QuickShip catalog.

BUSHING, ARMOR AND PLUG



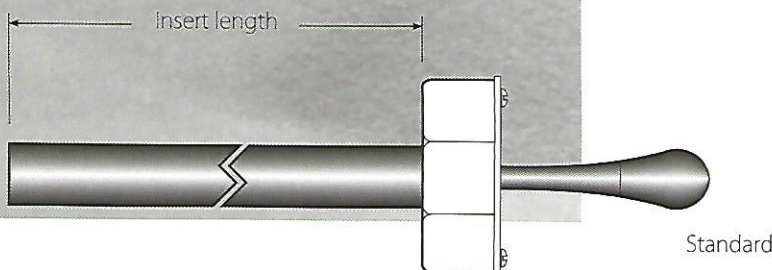
Hex head N.P.T. bushing and armor cable with power plug attached.

Sheath material types: stainless steel, cold rolled or steel.

Must specify insert length, bushing material, armor length and Hubbell® power plug number.

Moisture-resistant armor available.

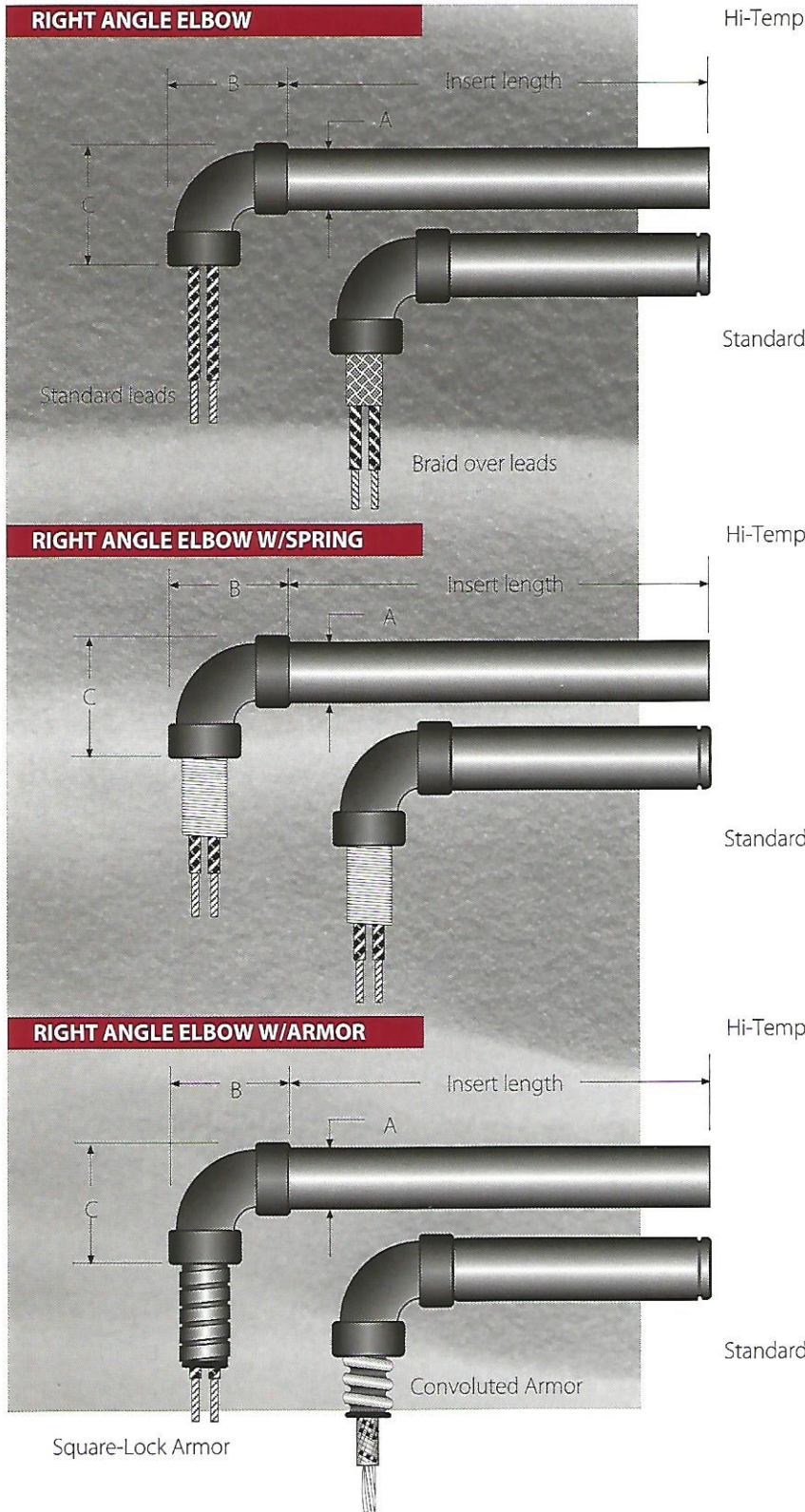
BOLT HEATER



Fast Heat bolt heaters are designed to heat drilled metal surfaces quickly while minimizing heat loss to surrounding areas. Each is designed to expand drilled bolts or studs while maintaining a uniform heat throughout its heated length. Typically, after a bolt is heated (expanded) the holding nut is tightened. The shrink tightness is obtained when the heater is removed and the bolt cools. This process is frequently used in the assembly and/or servicing of heavy duty equipment such as compressors, steam turbines, pressure vessels, etc.



HI-TEMP/STANDARD CARTRIDGE HEATERS



Right angle copper elbow for applications requiring right angle lead exit.

Moisture-resistant seal is optional.

10" (25.4 cm) leads standard, other lengths are available.

Both Hi-Temp and Standard Cartridges are also available with stainless steel braid over the leads (See Standard at left).

Right angle copper elbow with spring for applications requiring right angle lead exit and reduced bending strain on lead wire.

Spring approximately 3" (76.2 mm) long.

10" (25.4 cm) leads standard, other lengths are available.

ELBOW DIMENSIONS

	A		B		C	
	IN	MM	IN	MM	IN	MM
3/8	9.5		1	25.4	1	25.4
1/2	12.8		1 1/4	31.8	1 1/4	31.8
5/8	15.9		1 1/4	31.8	1 1/2	38.1
3/4	19.1		1 5/8	41.3	1 1/2	38.1

Right angle copper elbow with armor cable for applications requiring right angle lead exit and lead wire abrasion protection.

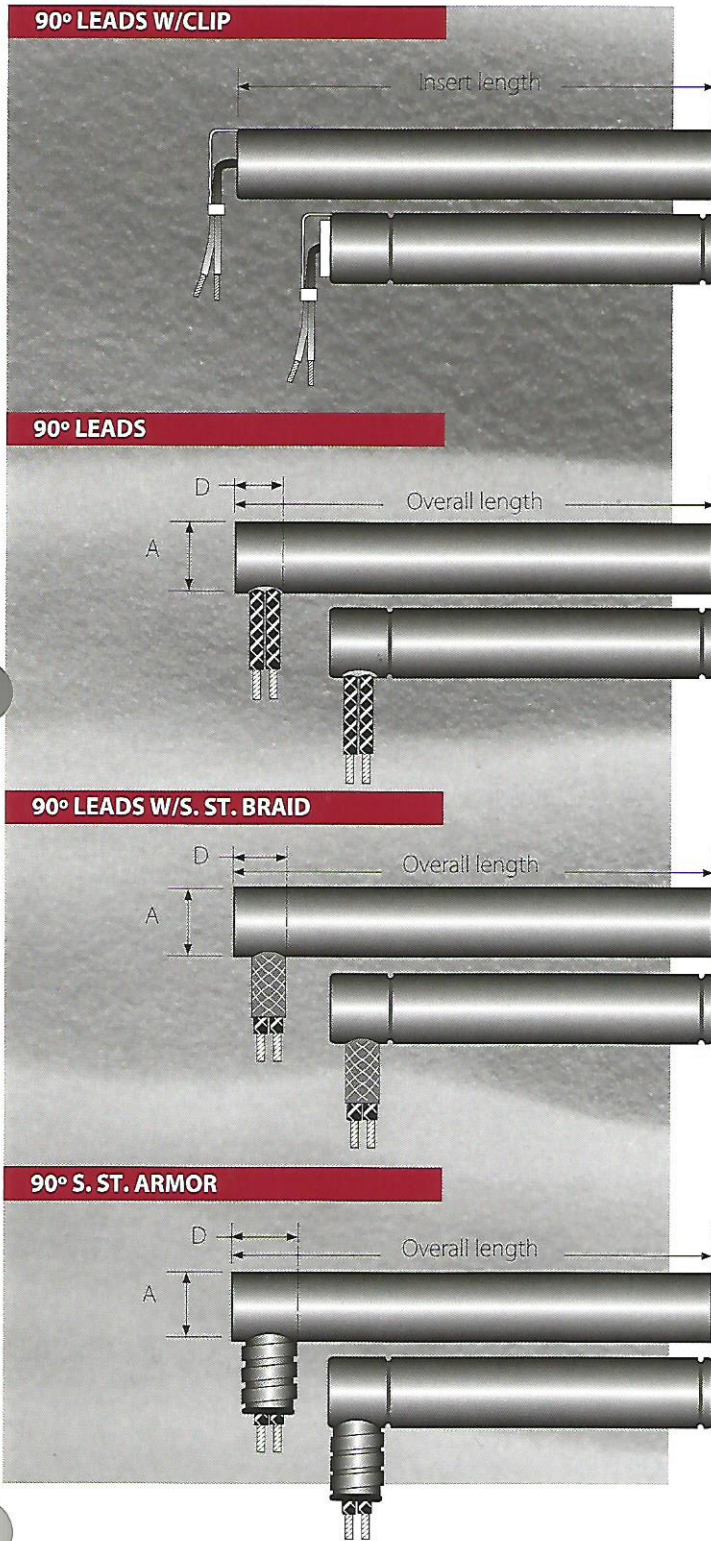
Moisture-resistant armor and seal are optional.

10" (25.4 cm) armor standard, other lengths are available.

Both Hi-Temp and Standard Cartridges are available with either Convuluted or Square-Lock Armor over the leads.

NOTE: Convuluted armor is available in 3/8" and 5/8" diameters.

HI-TEMP/STANDARD CARTRIDGE HEATERS



Hi-Temp

Clip support helps to minimize lead breakage where leads exit heater.

10" (25.4 cm) leads standard, other lengths are available.

Standard

Hi-Temp

Leads exit at 90° angle for applications requiring small radius bends, lead wire protection and where space is limited.

10" (25.4 cm) braid standard, other lengths are available.

Order by overall length.

Standard

Hi-Temp

Braided leads exit at 90° angle for applications requiring small radius bends, lead wire protection and where space is limited.

10" (25.4 cm) braid standard, other lengths are available.

Order by overall length.

Standard

Hi-Temp

Armor cable exit at 90° angle for applications where space is limited and lead wire abrasion protection is required.

10" (25.4 cm) armor standard, other lengths are available.

Order by overall length.

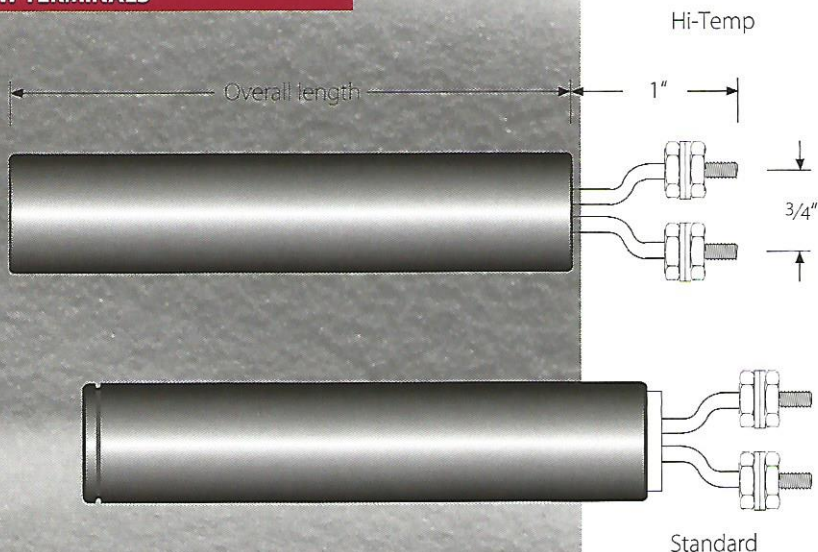
Standard

A		D (min.)	
IN	MM	IN	MM
3/8	9.5	3/8	9.5
1/2	12.7	1/2	12.8
5/8	15.9	5/8	15.9
3/4	19.0	3/4	19.0



HI-TEMP/STANDARD CARTRIDGE HEATERS

SCREW TERMINALS



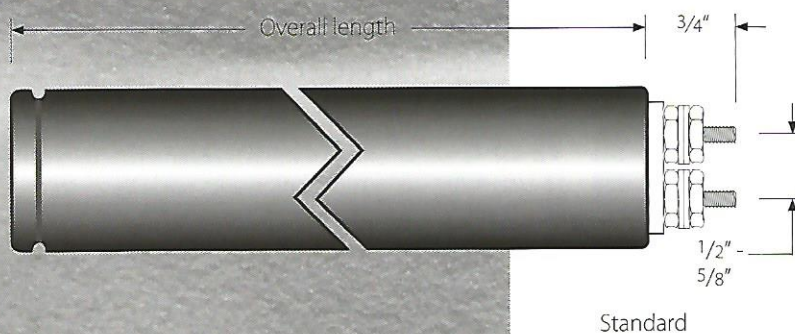
Screw terminals for applications with high amps and requiring universal connection capability. Screw terminals are attached to external pins.

Standard Cartridge 10-32 screw terminal on 3/8" to 15/16" (9.5 mm - 23.8 mm) dia.

Hi-Temp 1/2" to 3/4" (12.7 mm - 19 mm) dia.

NOTE: The Terminal dimensions shown are approximate size.

SCREW TERMINALS

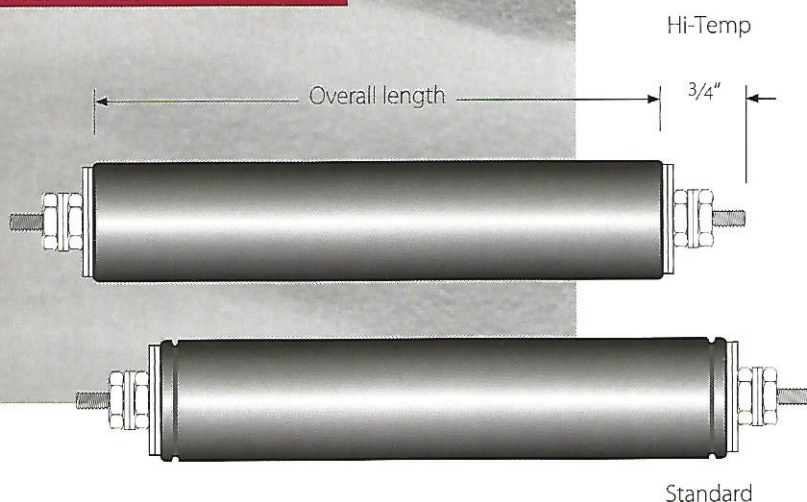


Screw terminals are flush with cap.

Standard Cartridge 10-24 screw terminal 1" to 1 1/4" (25.4 mm - 31.8 mm) dia.

NOTE: The Terminal dimensions shown are approximate size.

SCREW TERMINALS



Screw terminals for applications with high amps and requiring universal connection capability.

Standard Cartridge 10-32 screw terminal 1/2" to 1 1/4" (12.7 mm - 31.7 mm) dia.

Hi-Temp 10-32 screw terminal 1/2" to 3/4" (12.7 mm - 19 mm) dia.

NOTE: The Terminal dimensions shown are approximate size.

THERMOCOUPLE LOCATION CARTRIDGE HEATERS



T/C AT BOTTOM

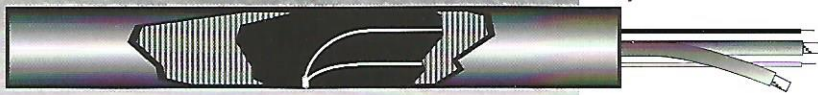


Hi-Temp

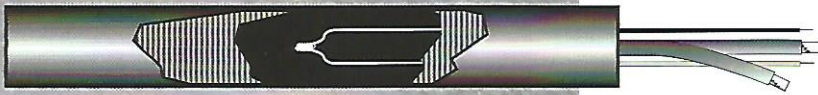


Hi-Temp

T/C AT CENTER



Hi-Temp



Hi-Temp

REMOVEABLE THERMOCOUPLE



Hi-Temp

BOTTOM GROUNDED

For fast response, heater is positioned in a blind hole or where material flows past or encompasses the heater.

The end disk is always welded in place.

Machined flat up to 1/2" (12.7 mm) dia.

BOTTOM UNGROUNDED

Where circumstances are such that an ungrounded thermocouple is required.

CENTER GROUNDED

Selected when a fast response is required.

The thermocouple can be located in any position along the length of the heater. Standard location is midway along the length with approximately 1/4" (6.4 mm) cold section on either side of the junction.

Not available on 1/4" diameter heaters.

CENTER UNGROUNDED

The thermocouple is positioned internally and ungrounded to monitor the heater temperature.

Generally used in research and development applications.

REMOVEABLE THERMOCOUPLE

The thermocouple is inserted down a hypotube for easy removal.

HI-TEMP T/C LOCATION AVAILABILITY

HTR DIA.	GROUNDED		UNGROUNDED	
	BOTTOM	CENTER	BOTTOM	CENTER
1/4" (6.4 mm)	Y	N	Y	Y
5/16" (7.9 mm)	Y	N	Y	Y
3/8" (9.5 mm)	Y	Y	Y	Y
1/2" (12.7 mm)	Y	Y	Y	Y
5/8" (15.9 mm)	Y	Y	Y	Y



T/C AVAILABILITY

All heaters shown are Hi-Temp 10" leads, type "J" T/C standard, type "K" T/C is available.

T/C available in all Standard Cartridge heaters. Located at bottom ungrounded and center ungrounded.