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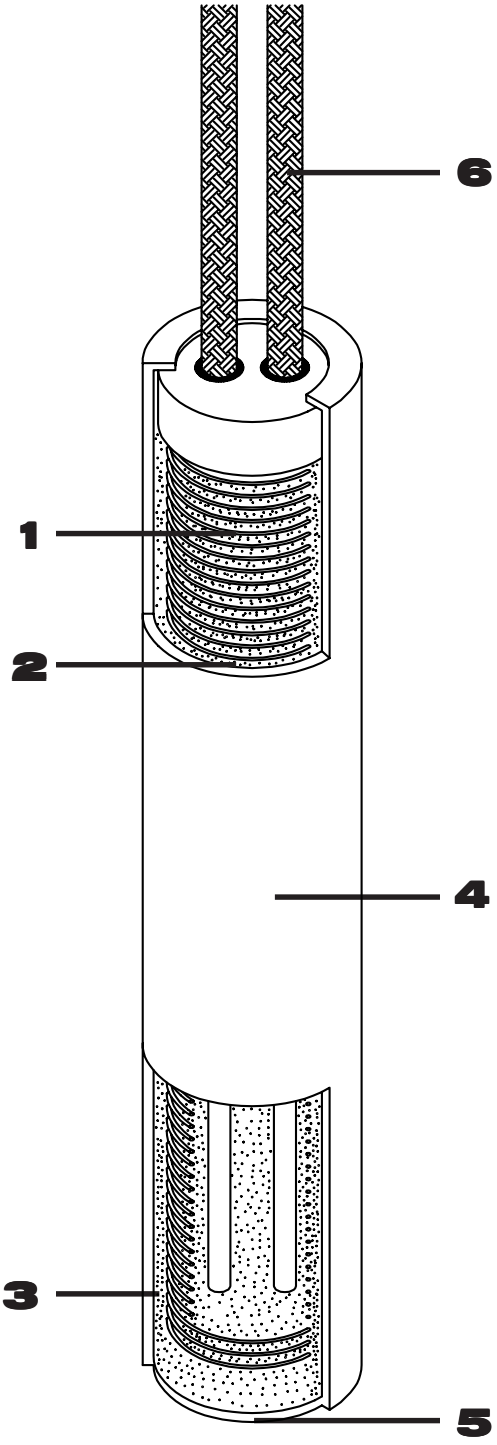
CARTRIDGE HEATING ELEMENTS

Cartridge Heaters.....premium performance, affordable price.

In the years since it's introduction, the ITP high watt density, swaged cartridge heater has attained a standard of quality second to none.

Our total commitment to engineering excellence is reflected in our successful efforts to improve heater performance and production efficiency. The results obtained clearly establishas the most consistent, reliable and economical cartridge heater on the market.



Quality Design And Construction.....

1

Premium Quality Element Wire. Nickel-chromium resistance wire is precision wound on a high purity ceramic core to optimum computer generated gauge and pitch specifications. Element wires overlap the internal pins and are swaged into a metallurgical bond for optimum connection life.

2

Superior Element Positioning. Precision centering of the element assembly insures optimum heat uniformity around the circumference of the cartridge. The element winding is in close proximity to the cartridge sheath providing rapid and efficient transfer of heat to the application.

3

Densely Compacted Ceramic Insulation. The magnesium oxide ceramic insulation is compressed to near theoretical density in order to provide the best combination of heat transfer and dielectric strength. This dense mass of compacted ceramic also provides maximum resistance to shock and vibration.

4

High Temperature Alloy Sheath. Available sheath materials include various stainless steel and incoloy compositions. Additional metal sheath compositions can also be supplied as applications dictate.

5

Welded End Seal. A metal end disc of the same alloy as the sheath is heli-arc welded into the end of the cartridge. This seal weld offers the total seal required for liquid heating applications as well as eliminating the possibility of contaminants entering the disc end of the cartridge.

6

Durable, Heat Resistant Lead Systems. The standard high temperature leads exit from the cartridge through a protective ceramic end cap. The lead insulation is recessed well into the cap to eliminate any possibility of exposing bare wire when bending the leads sharply at the lead end. Standard leads consist of ten inches of UL approved stranded wire. The lead wire insulation is UL rated for 492◦F/250◦C continuous operating temperature.

A wide variety of other standard and special purpose lead styles are also available.

Cartridge Heaters.....standard, special purpose and custom.

The ITP swaged cartridge design and manufacturing process is geared to provide quick delivery on both standard and application oriented versions of the "MAXPAK cartridge heater.

Standard Swaged Cartridge Heaters

Our extended range of imperial and metric cartridge diameters was established to provide our customers with a full service source for virtually any standard cartridge diameter required. A wide assortment of lead and seal options, construction variations and mounting options ensures compatibility with both new and existing heating applications.

***** Extended Imperial And Metric Diameter Range**
***** All Combinations Of Sizes And Ratings Available**
***** Many Popular Lead And Seal Options**
***** Standard Integral Sensor Styles**
***** Wide Range Of Standard Mounting Options**
***** Many Standard Construction Options**

Special Purpose Swaged Cartridge Heaters

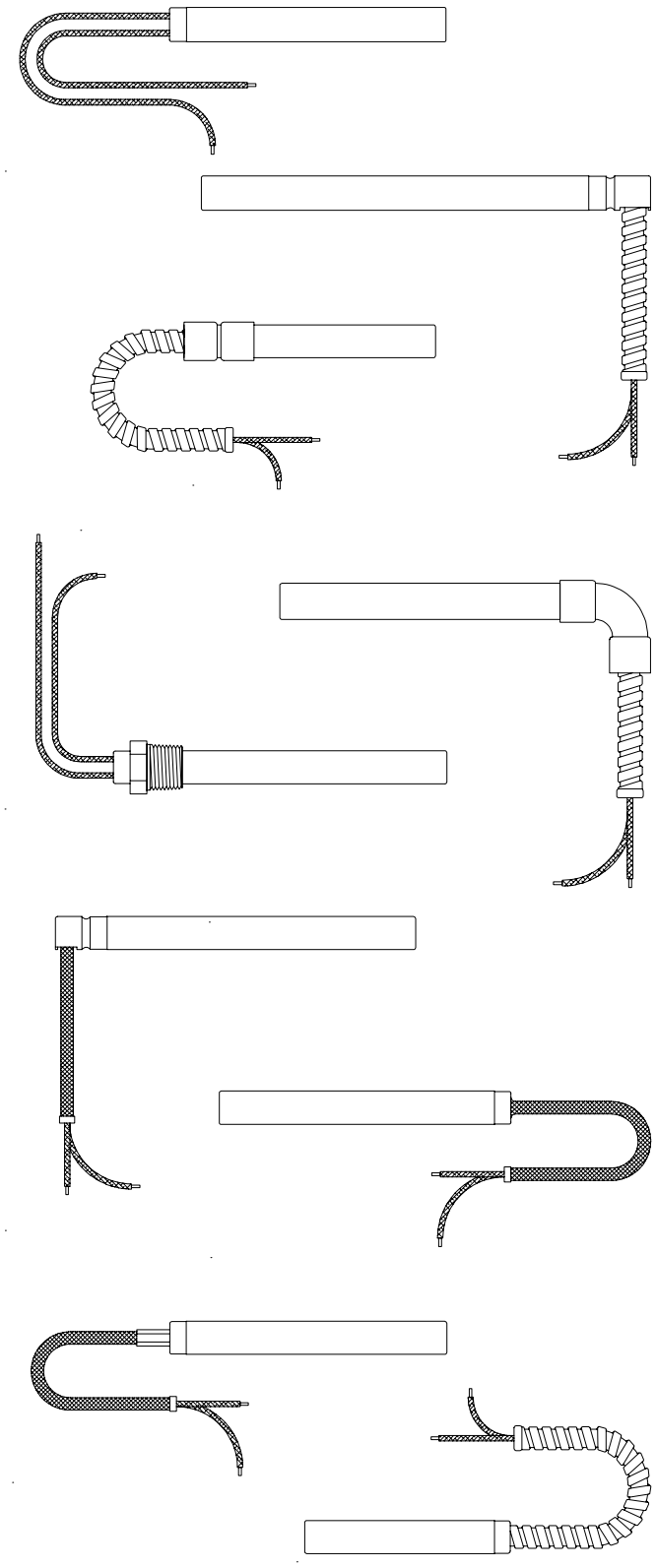
ITP manufactures a variety of special purpose cartridge heaters for many common specialized heating applications. These special purpose cartridges are designed to provide the optimum physical, thermal and electrical characteristics for the precise application for which they were designed.

***** Runnerless Injection Mold Heaters**
***** Thermoset Mold Platen Heaters**
***** High Performance Heaters**
***** Bolt Expansion Heaters**
***** High Wattage Immersion Heaters**

Custom Swaged Cartridge Heaters

Custom cartridge heaters can be manufactured to customer specifications or can be engineered to satisfy the specific requirements of special applications. Custom cartridges often consist of standard units with relatively minor design modifications but may include a variety of the special features noted below.

***** Unique Application Oriented Lead Configurations**
***** Special Non-Standard Diameters**
***** Extended Temperature And Wattage Performance**
***** Corrosion Resistant And Exotic Sheath Materials**
***** Low voltage Element Designs**
***** Special Multiple Sensor Options**
***** Unique Custom Engineered Construction Options**
***** Special Purpose Mounting Fittings**



Dimensional Specifications

Dimensional Tolerances

Standard dimensional tolerances are shown in the right hand column. High precision tolerances can be maintained if required. All standard imperial and metric diameters and their related length limits are outlined in the tables shown below. Diameters and lengths not shown can be produced as a specialty item if required.

Diameter - See diameter tolerances in the tables below.
Length - All units < 4 1/2" long +/- 3/32"
- 1/8" & 3/16" dia. units > 4 1/2" long +/- 3% of length
- All other units > 4 1/2" long +/- 2% of length
Camber - .015 inches per foot. Slight camber does not normally present a problem since the heater will flex sufficiently to enter a straight, clean hole.

Imperial Diameter Specifications			Standard Length Limits			
Nominal Dia. (Inches)	Actual Dia. (Inches)	Actual Diameter (Millimeters)	Minimum Length (Inches)	Minimum Length (Millimeters)	Maximum Length (Inches)	Maximum Length (Millimeters)
1/8	.122 +/-.002	3.11	1 1/4	31.8	12	304.8
3/16	.184 +/-.002	4.67	1 1/4	31.8	12	304.8
1/4	.246 +/-.002	6.25	7/8	22.2	36	914.4
5/16	.308 +/-.002	7.82	7/8	22.2	36	914.4
3/8	.371 +/-.002	9.42	7/8	22.2	48	1219.2
7/16	.433 +/-.002	11.00	7/8	22.2	48	1219.2
1/2	.496 +/-.002	12.60	7/8	22.2	60	1524.0
9/16	.558 +/-.002	14.15	1	25.4	60	1524.0
5/8	.621 +/-.002	15.77	1	25.4	72	1828.8
3/4	.746 +/-.002	18.95	1	25.4	72	1828.8
7/8	.871 +/-.003	22.12	1 1/4	31.8	72	1828.8
1	.996 +/-.003	25.30	1 1/4	31.8	72	1828.8

Metric Diameter Specifications			Standard Length Limits			
Nominal Dia. (Millimeters)	Actual Dia. (Millimeters)	Actual Diameter (Inches)	Minimum Length (Millimeters)	Minimum Length (Inches)	Maximum Length (Millimeters)	Maximum Length (Inches)
6	5.90 +/-.05	.232	22.2	7/8	914.4	36
6.5	6.40 +/-.05	.252	22.2	7/8	914.4	36
8	7.90 +/-.05	.311	22.2	7/8	1219.2	48
10	9.90 +/-.05	.390	22.2	7/8	1219.2	48
12	11.90 +/-.05	.469	22.2	7/8	1524	60
12.5	12.40 +/-.05	.488	22.2	7/8	1524	60
15	14.90 +/-.05	.587	25.4	1	1828.8	72
16	15.90 +/-.05	.626	25.4	1	1828.8	72
20	19.90 +/-.05	.783	25.4	1	1828.8	72

Electrical Specifications

Electrical Tolerances

Standard electrical tolerances are shown in the right hand column. High precision tolerances can be held if required. Cartridge heater electrical limits for a standard, two lead construction are listed in the tables shown below. Special units with multiple leads are available in single phase and three phase wiring systems, permitting the use of higher ratings than those shown.

Power (Watts) - 1/8" & 3/16" diameter units +10%, -15%
- All other units +5%, -10%

Resistance (Ohms) - 1/8" & 3/16" diameter units +15%, -10%
- All other units +10%, -5%
- Resistance increases with temperature. All cartridges are designed to a resistance value 5% lower than the calculated resistance.

Imperial Electrical Limits			Minimum Watts/Heater Length @ 120 V.			Max. Watts @ 120V/240V/480V		
Nominal Diameter	Maximum Volts	Maximum Amperes	1" Length	1 1/2" Length	2" Length	120 Volts Single Phase	240 Volts Single Phase	480 Volts Single Phase
1/8	240	3.0	-	10	10	360	720	-
3/16	240	3	-	10	10	360	720	-
1/4	240	4.4	100	55	40	525	1050	-
5/16	240	4.4	100	55	40	525	1050	-
3/8	240	6.7	65	35	25	800	1600	-
7/16	240	6.7	65	35	25	800	1600	-
1/2	240	9.7	40	25	20	1160	2320	-
9/16	240	9.7	40	25	20	1160	2320	-
5/8	480	23.0	35	20	15	2760	5520	10000
3/4	480	23.0	35	15	10	2760	5520	10000
7/8	480	23.0	-	15	10	2760	5520	10000
1	480	23.0	-	15	10	2760	5520	10000

Metric Electrical Limits			Minimum Watts/Heater Length @ 120 V.			Max. Watts @ 120V/240V/480V		
Nominal Diameter	Maximum Volts	Maximum Amperes	1" Length	1 1/2" Length	2" Length	120 Volts Single Phase	240 Volts Single Phase	480 Volts Single Phase
6	240	4.4	100	55	40	525	1050	-
6.5	240	4.4	100	55	40	525	1050	-
8	240	4.4	65	35	25	800	1600	-
10	240	6.7	65	35	25	800	1600	-
12	240	9.7	40	25	20	1160	2320	-
12.5	240	9.7	40	25	20	1160	2320	-
15	480	23.0	35	20	15	2760	5520	10000
16	480	23.0	30	15	10	2760	5520	10000
20	480	23.0	-	10	10	2760	5520	10000

Watt Density Ratings And Calculations

Heater Wattage Determination

The procedures used to establish cartridge wattage are outlined below. Please note that the required equations, as well as typical application examples, are detailed in the catalog section "Application Data".

1 Establish an acceptable heat up time and desired operating temperature.

2 Calculate the total wattage required to meet the application requirements.

3 Determine the cartridge diameter and length most suitable to the dimensions of your application.

4 Establish the quantity of heaters required to maintain temperature uniformity.

5 Calculate heater wattage by dividing total wattage required by heater quantity.

6 Calculate cartridge heater watt density. (See column "Watt Density Calculations".)

7 Select the graph or table appropriate to your application and insure that the calculated watt density of the cartridge does not exceed the recommended maximum watt density. Additional graphs are contained in the catalog section titled "Application Data".

8 If the calculated watt density is found to be excessive, implement a correction method from the list below and repeat the calculation process.

* Increase either the cartridge heater diameter or length, or both.
* Increase the quantity of cartridge heaters used in the application.
* Increase the heat up time allowed to lower the total wattage required.

Watt Density Calculations

The calculation of heater watt density consists of a simple, three step procedure.

1 Determine actual heated length by subtracting all cold lengths from the cartridge overall length. Minimum cold lengths include 1/4" at both disc and lead end with additional cold length required for certain lead and construction options.

2 Calculate heated area.

Cartridge Heated Area = Cartridge Heated Length x Actual Cartridge Diameter x 3.14

3 Calculate Watt Density

Cartridge Watt Density = Total Cartridge Watts ÷ Cartridge Heated Area

Watt Density Recommendations For Heating Solids

Using The Graph To Establish Appropriate Watt Density Based On Cartridge Fit.

Heater to hole fit is critical. Subtract minimum diameter of the heater (actual diameter minus tolerance) from maximum hole diameter to determine fit.

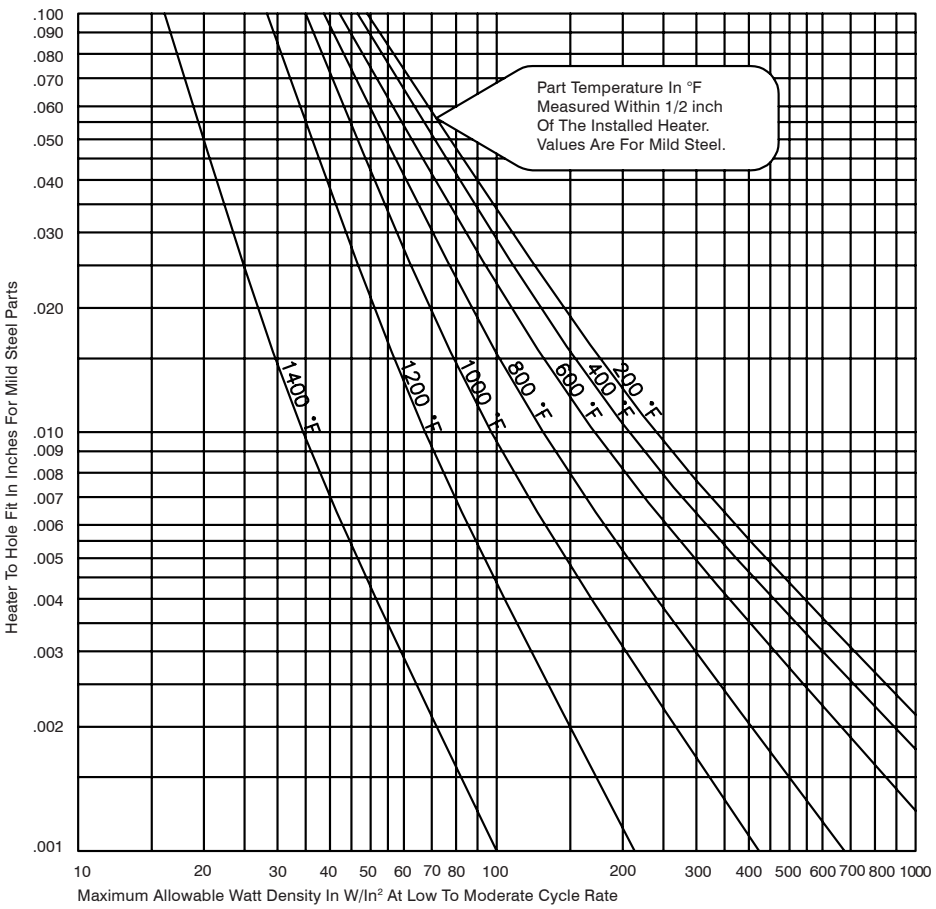
To determine maximum watt density when operating temperature and fit are known:

* Locate the intersection point of operating temperature curve and planned scale fit value. Read recommended watt density on scale directly below this point.

To determine maximum fit value when part temperature and watt density are known:

* Locate the intersection point of operating temperature curve and known watt density scale value. Read maximum fit value on scale directly across from this point.

Adjustment Factors:
* For stainless steel parts enter graph with a .002 greater than actual fit value.
* For brass and aluminum enter graph with 100 °F greater part temperature.
* For on-off cycles more frequent than once an hour multiply maximum recommended watt density by .8.
* For on-off cycles more frequent than once a minute multiply maximum recommended watt density by .7.



Watt Density Recommendations For Heating Liquids

Immersion Application Notes

Swaged cartridges satisfy the need for compact, high capacity heat sources in the heating of liquids. Watt density ratings as high as 150-300 watts per square inch are available for water applications. Refer to the table for watt density recommendations for various liquids.

For best performance in liquid heating applications:

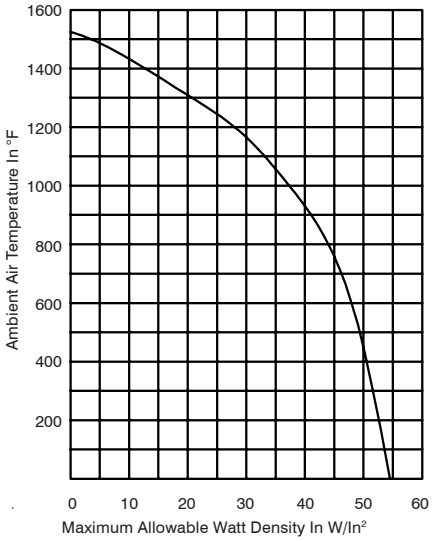
* Insure that the cartridge is in the main body of the liquid.
* Keep the cartridge totally immersed in liquid at all times.
* Prevent mineral deposits and scale from forming on the heater surface.
* Avoid frequent on and off cycling of the heater cartridge.
* Do not allow viscous, organic materials to carbonize on the heater sheath.
* Insure that sludge at the bottom of the tank is removed at periodic intervals.
* Sheath must be compatible with liquid to minimize corrosion.

Material Or Liquid Being Heated	Temperature	Max. Watt Density
Water and minimum 80% water solutions including acid and alkali cleaning baths.	210 °F	150-300 watts/sq. in.
Liquid metals including lead, solder, sodium and potassium.	500 °F 700 °F 900 °F 1100 °F 1300 °F	600 watts/sq. in. 500 watts/sq. in. 400 watts/sq. in. 300 watts/sq. in. 200 watts/sq. in.
Vegetable Oil @ Velocity of 1 fps.	400 °F	30 watts/sq. in.
Dowtherm A @ Velocity of 1 fps.	500 °F	20 watts/sq. in.
Machine Oil @ Velocity of 1 fps.	250 °F	18 watts/sq. in.
Therminol FR-2 @ Velocity of 1 fps.	500 °F	12 watts/sq. in.
Bunker C Fuel Oil @ Velocity of 1 fps.	160 °F	10 watts/sq. in.
Asphalt @ Velocity of 1 fps.	300 °F	8 watts/sq. in.
Molasses @ Velocity of 1 fps.	100 °F	5 watts/sq. in.

Watt Density Recommendations For Heating Gases

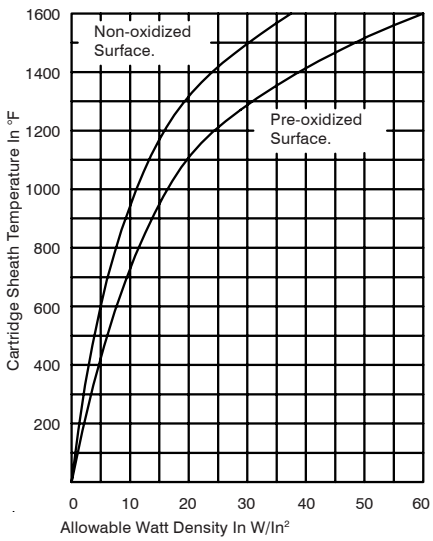
Maximum Watt Density Versus Ambient Air Temperature
(Natural Convection)

The graph values below are for one cartridge in air or similar gas environment. When using multiple cartridges and spacing between heaters is less than one diameter multiply .95 times graph value. If a reflector is placed behind the cartridge multiply .85 times the graph value.



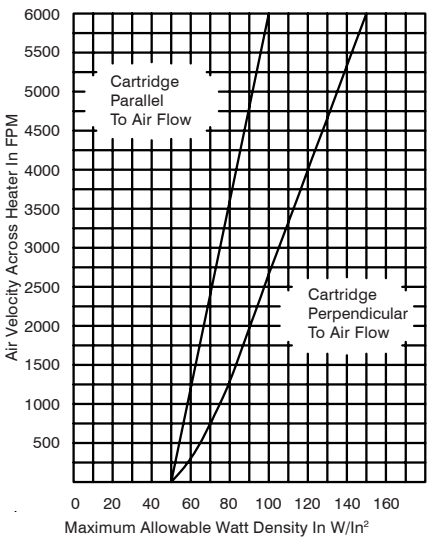
Cartridge Sheath Temperature Versus Watt Density
(70 °F Ambient Air With Natural Convection)

The watt density required to obtain various cartridge sheath temperatures is shown in the graph below. Note that the values given are for typical pre-oxidized and non-oxidized sheath surfaces. A sheath temperature of 1450 °F with infrequent cycling would give approximately one year heater life.



Maximum Watt Density Versus Forced Convection Air Velocity
(Entering Air Between 0 °F and 200 °F)

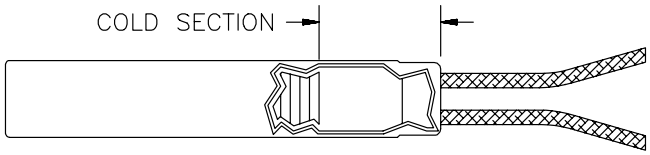
The maximum watt density values in the graph below are based on air movement expressed in feet per minute (FPM). If air quantity is known in cubic feet per minute (CFM) divide the CFM value by the total free area around the heater. Total free area is container area minus the heater area.



Thermal And Electrical Construction Options

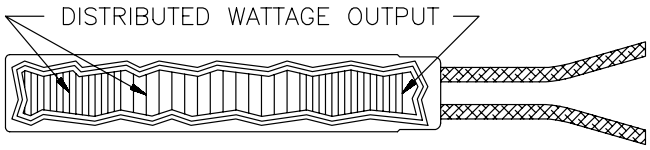
Special Cold Sections

One or more cold sections can be placed at any desired position along the heater length. Cold sections are often used in applications where a portion of the heater may not be totally enclosed within the object or liquid being heated. Additional uses include reducing heat output in key locations of applications and isolating lower temperature rated leads and seals from the higher operating temperature of the heated application. When ordering, specify length and location.



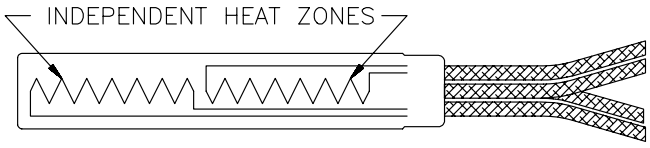
Distributed Wattage

Special heat profiles are readily produced by varying the coil pitch along the length of the heater. These distributed wattage element designs are useful in adjusting application temperature uniformity and modifying process conditions. Typical applications which benefit from the use of distributed wattage include heated plattens, sealing bars, extrusion dies and various components of runnerless systems for injection molding. To order, specify desired wattage distribution.



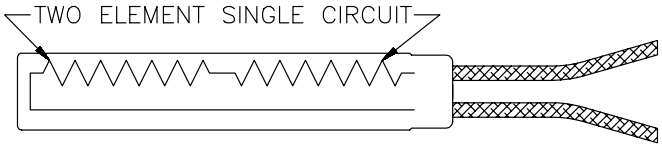
Independent Heat Zones

Independently controlled heat zones permit individual adjustment of specific areas of an application where temperatures vary due to transient process conditions. This option is particularly useful in applications which require a high level of temperature uniformity and are limited to a single cartridge heater such as a sealing bar or a runnerless mold component. Please provide complete details of your application requirements when ordering.



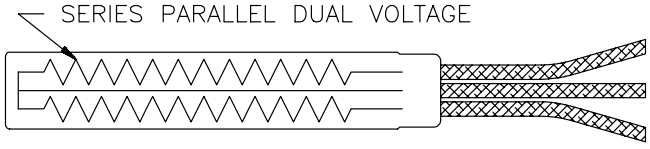
Single Circuit Element

The element of long conventional swaged cartridges is normally composed of a number of individual elements wired in parallel. The use of a series circuit design in longer cartridge heaters insures that any element failure within the cartridge results in a totally open circuit condition. This feature has proven valuable in applications where the undetected failure of a single element of the cartridge can create an unacceptable reduction in process quality.



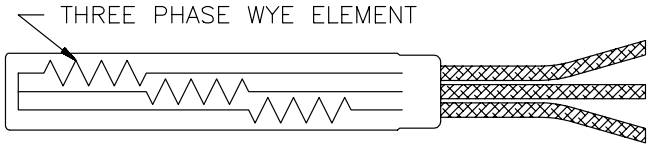
Dual Voltage Designs

Swaged cartridge heaters can be designed to operate on two different voltages through the addition of additional element and circuit leads. Leads can be wired through a switching device to select the desired operating voltage and element circuit. Dual voltage designs are commonly used when a heater must operate on two different voltages, such as in recreational vehicle equipment. Indicate the desired operating voltages when ordering.



Three Phase Element

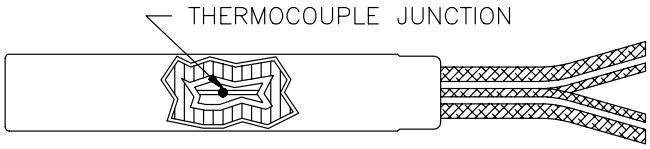
Any cartridge, 3/8" or more in diameter, can be designed with a three phase element provided that voltage limits are observed. The vast majority, however, are 5/8" or larger in diameter. Three phase design benefits include maintaining voltage supply balance and providing higher heater power ratings without exceeding the amperage capacity of the pins and leads. Please specify three phase delta or three phase wye connection when ordering.



Internal Temperature Sensor Options

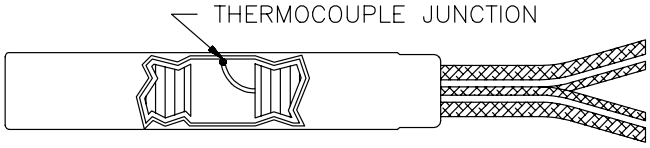
Thermocouple Style 1

The “Style 1” thermocouple is located within the element core and is used to determine actual element temperature during operation. It is useful in the development of new applications where it is necessary to insure that internal temperatures do not exceed the 1600 °F maximum recommended limit of the cartridge. Specify the style number, calibration and desired location when ordering.



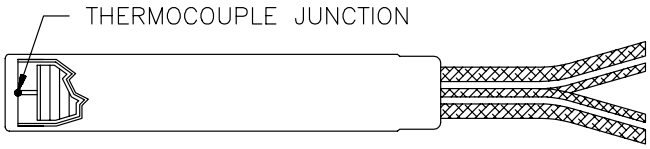
Thermocouple Style 2

The “Style 2” thermocouple junction is grounded against the inside diameter of the heater sheath and is located within a 1/2" cold length. The thermocouple junction may be located anywhere along the heater sheath. This thermocouple style will give a good approximation of the application temperature at that location and can be used for control. Specify style number, calibration and desired location when ordering.



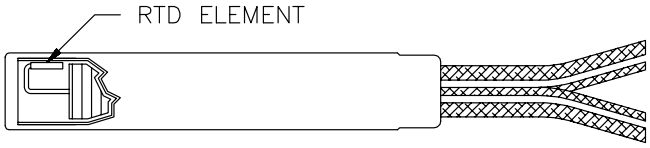
Thermocouple Style 3

The “Style 3” thermocouple junction is internally grounded to the end disc of the cartridge. This style of thermocouple will give a good approximation of part temperature in the heater end disc area. It is most useful in applications requiring close control at the end of the component, such as gating probes for runnerless molding systems. Specify style number and calibration when ordering.



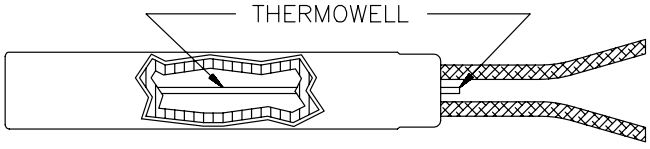
RTD Elements

Various styles of RTD elements, including platinum 100 ohm thin film and wire wound styles, can be located within cold sections of a cartridge 1/4" or more in diameter. Unless otherwise specified, the RTD will be located in the end disc area, providing a good approximation of heated part temperature. A 100 ohm thin film RTD rated at -30 °F to 900 °F is standard. Please specify if a higher temperature rating or an optional sensing location is required.



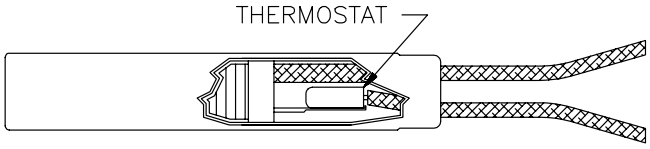
Thermowells

Small diameter, stainless steel thermowells can be swaged into 1/4" diameter and larger cartridge heaters. These thermowells permit the insertion of mineral insulated thermocouples for temperature measurement along the length of the cartridge. Thermowells can be located within the element or adjacent the inside diameter of the sheath. Specify thermowell location. Please indicate quantity and calibration of optional thermocouples if required.



Thermostats

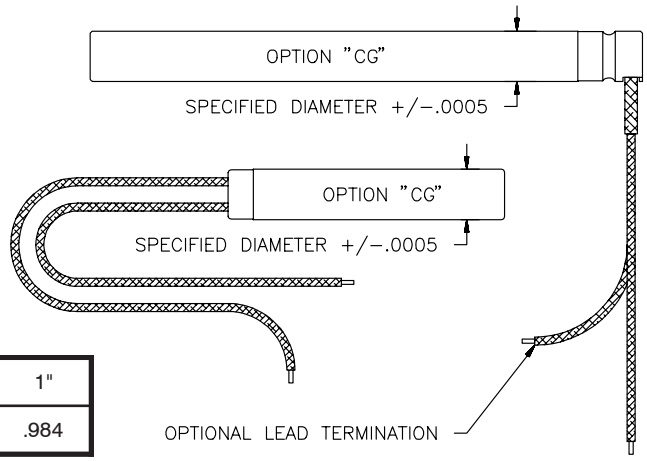
Fixed set point thermostats located within a cold zone are primarily intended for immersion applications and are available only in 1/2" diameter cartridges and larger. These devices can be used to prevent overheating of the liquid or the cartridge. Successful control of liquid temperatures usually requires pre-production prototypes and testing. Please supply complete description of application when ordering.



Mechanical Construction Options

Option “CG” Centerless Grinding

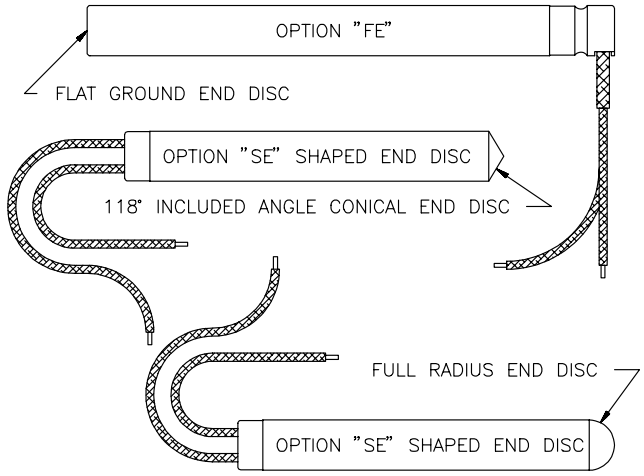
Cartridges can be centerless ground to precision diameter tolerances for improved cartridge to hole fit. This option is particularly useful in metal block heating applications where the cartridge is required to operate at the upper limits of its watt density capabilities. Please note that standard units are ground to a smaller than standard actual diameter. Diameter tolerances are held to +/- .0005 on centerless ground cartridge heaters. When ordering, specify Option “CG”. Cartridge heaters with finished diameters not shown in the table or with special diameter tolerances can be supplied. Please note any special requirements on your order.



Cartridge Dia.	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
Precision Dia.	.241	.302	.363	.488	.613	.738	.984

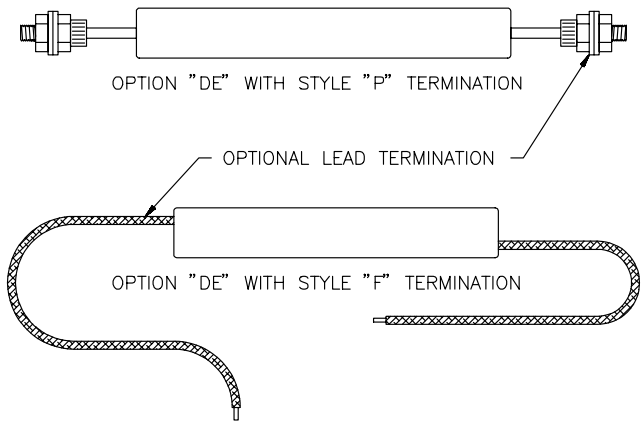
Option “FE” And “SE” Flat And Shaped End Disc

A flat or shaped end disc configuration can be substituted for the normally concave end disc sealing the end of the cartridge. The flat and shaped end discs are commonly used to increase heat transfer into the extremities of an application by using a matching, flat bottomed or shaped hole. These options are useful in applications where process temperature at the end of the heated component is critical. These special end discs are often used in conjunction with distributed wattage to insure heat uniformity. Common shape variations include a 118 degree included angle cone designed to match the standard angle at the bottom of a drilled hole. When ordering please specify option “FE” or “SE”. When option “SE” is selected, please enclose a sketch or clear description of the required shaped end disc configuration.



Option “DE” Double End Termination

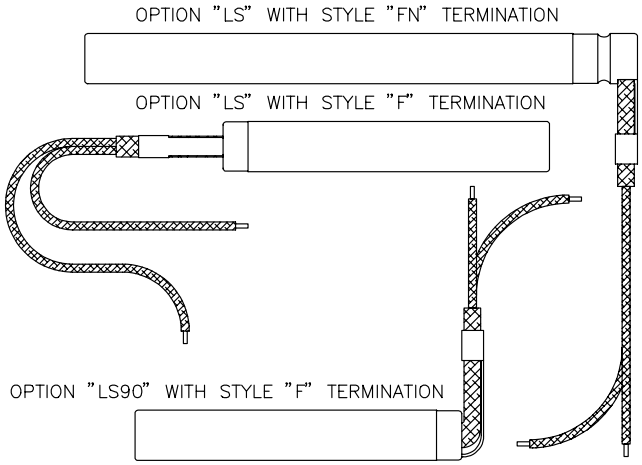
The double end lead termination provides an alternative lead connection system for heating applications with special wiring requirements. Common applications for the double end lead system include the retrofit of tubular elements utilizing existing wiring and multiple heater assemblies requiring combinations of series and parallel wiring to bus bar systems in applications where space is limited. The double end termination system is typically supplied with post terminals but can be equipped with any desired lead configuration and protection system. The full range of electrical and thermal construction options can be supplied in the double end termination configuration. Please specify option “DE” and include the desired lead style and lead length in your order.



Mechanical Construction Options

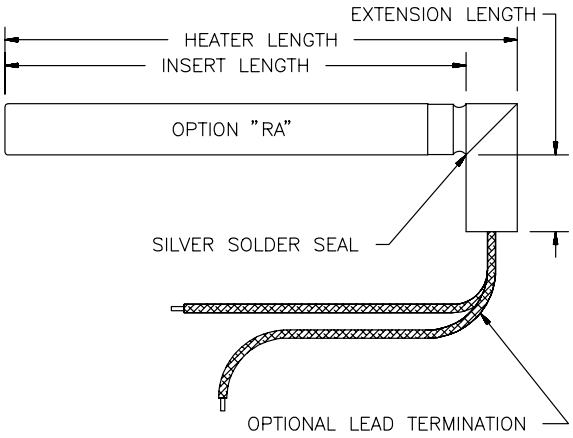
Option “LS” Lead Support Clip

The lead support clip provides a simple and secure restraint system for the cartridge heater leads. A 3/4 inch long support clip is standard on heaters less than 1/2 inch in diameter. A 1 1/4 inch long clip is used on heaters 1/2 inch and larger in diameter. Support clips normally exit at the same angle as the lead style selected. Other exit angles can be supplied on request. Support clips can be used with all plain, sleeved and wire braid protected lead styles. Lead support clips are useful in protecting leads from external stress and can be utilized as pull tabs to simplify heater removal for maintenance. Clip supports in special configurations or with mounting holes can be supplied if required. To order, specify “LS” option and include any special requirements. Please include lead configuration in your order.



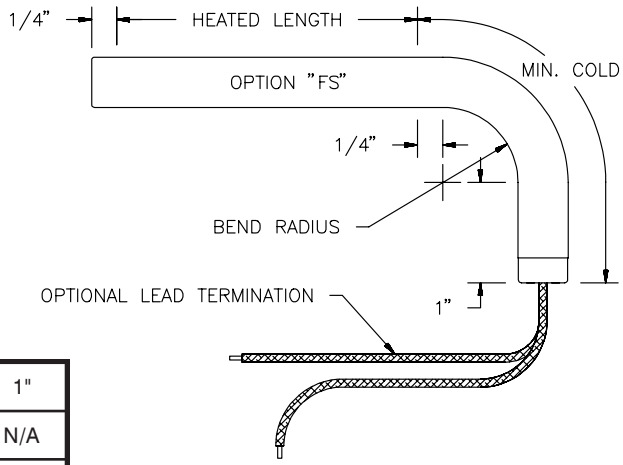
Option “RA” Right Angle Sheath Extension

The “RA” construction option features a 90 degree tube extension securely brazed to the main sheath of the heater. This protective extension provides extra durability in applications where the lead exit area of the cartridge may be subject to extreme abuse. While the diameter of the tube extension is normally the same as that of the cartridge, it can also be supplied in customer specified alternate diameters. The extension is constructed of the same alloy as that used for the cartridge sheath. All standard lead constructions can be fitted to the right angle extension. To order, specify “RA” option and note your desired extension length as well as any special features you require. Include the desired lead configuration in your order.



Option “FS” Formed Sheath

The “FS” formed sheath construction option provides a one piece 90 degree exit formed in a cold zone of the cartridge. The formed sheath construction is useful in liquid heating applications where the heater must make a 90 degree bend inside an enclosure and a fully sealed one piece sheath design is preferred. The formed end can also provide a self supported reorientation of the cartridge leads. The minimum radius of the bend varies in relation to the cartridge diameter. Minimum allowable bend radius for the various common cartridge diameters is indicated in the chart below. To order, specify “FS” option noting any special radius, bend angle and cold length requirements. Insure that your order includes the desired lead style.

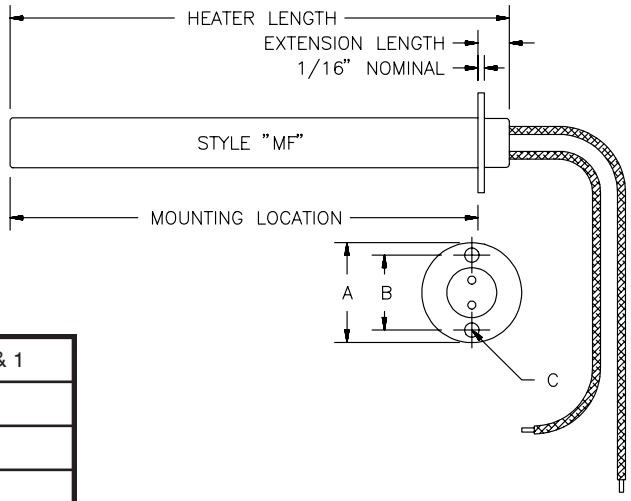


Cartridge Dia.	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
Min. Bend Radius	1/2	1/2	1/2	3/4	1	1 1/4	N/A
Min. Cold Length	2 1/4	2 1/4	2 3/8	2 7/8	3 3/8	3 7/8	N/A

Cartridge Mounting Options

Option "MF" Mounting Flanges

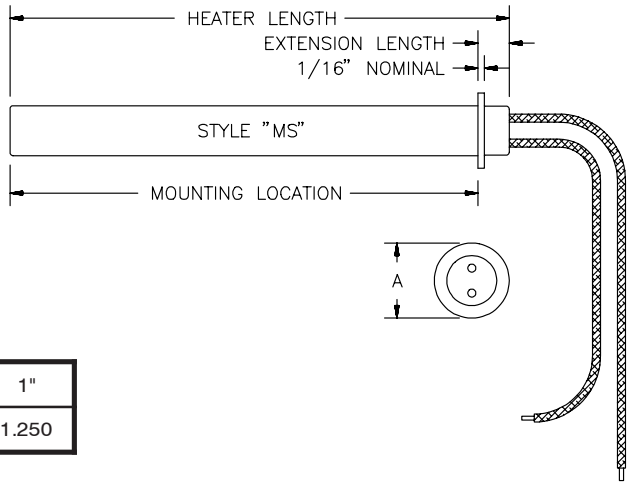
These industry standard mounting flanges provide a means of securing the cartridge in a fixed position to prevent movement and creep due to conditions of mild vibration and thermal cycling. Standard flanges are often used to mount various external wiring devices including electrical boxes and plugs. Nonstandard flanges featuring special shapes, sizes and mounting hole configurations can be supplied when required. Standard flanges are manufactured from 300 series stainless steel and conform to the dimensions shown in the table below. Flanges must be located over an unheated area. To order, specify "MF" option and note the desired mounting location.



Cartridge Dia.	1/4, 5/16, 3/8 & 1/2	3/8, 1/2, 5/8 & 3/4	5/8, 3/4 & 1
Flange Dia.	1	1 1/2	2
Hole Bolt Circle	.750	1.125	1.500
Hole Dia.	.144	.156	.201

Option "MS" Stop Rings

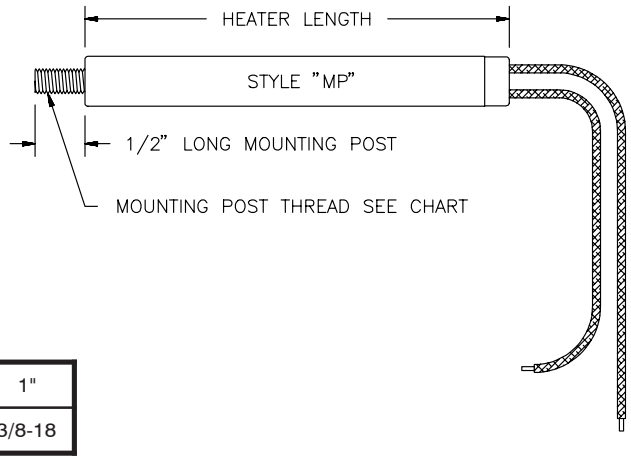
The standard stainless steel stop ring provides a means of locating a cartridge at a specific and consistent location within a through drilled hole. By adding a drilled and tapped hole in close proximity to the heater, an appropriate screw can be used to capture the stop ring edge and secure the cartridge in position. Stop rings are manufactured from 300 series stainless steel and conform to the dimensions listed in the below table. Stop rings in special shapes and sizes can be supplied when required. Stop rings can be located at any position along the length of the cartridge, but must always be placed over a cold area. To order, specify "MS" option and include the desired mounting location in your order.



Cartridge Dia.	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
Stop Ring Dia.	.500	.562	.625	.750	.875	1.000	1.250

Option "MP" Disc End Mounting Posts

The threaded disc end mounting post provides an alternative method of securing a cartridge heater in place in a heated block. The addition of an appropriate size washer with a nut to secure it in place will prevent the cartridge from backing out of the hole. This mounting method is often used in conjunction with a stop ring to secure a heater in position in applications where space restrictions prohibit the use of a mounting flange. The 1/2 inch long threaded post is securely attached to the heater and can also be used to assist in the removal of the cartridge for system maintenance. Standard mounting post thread specifications for various heater diameters are listed in the below table. To order, specify option "MP".

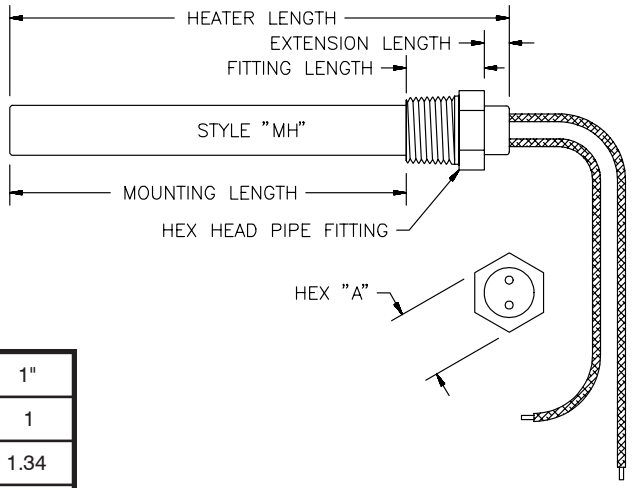


Cartridge Dia.	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
Mtg. Post Thread	8-32	8-32	10-24	1/4-20	1/4-20	3/8-18	3/8-18

Cartridge Mounting Options

Option “MH” Hex Head Pipe Fittings

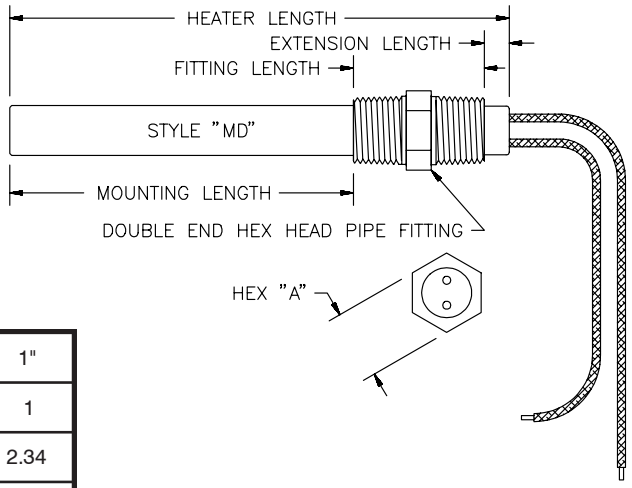
Standard hex head pipe fittings provide a leak resistant, cartridge mounting system for liquid filled container systems and piping. These fittings are also useful in securing heaters into non-immersion applications such as plattens and molds. Fittings can be located at any desired location but must always be located over unheated areas. Standard fitting location for straight lead styles is flush with the lead end of the heater, leaving no extension. Fitting location for 90 degree lead styles corresponds to the start of the standard lead extension. Fittings are available in brass, steel and stainless steel. Special fitting sizes and materials can be supplied when required. Please specify desired material and location when ordering.



Cartridge Dia.	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
Fitting NPT Thread	1/8	1/4	1/4	3/8	1/2	3/4	1
Fitting Length	.56	.75	.75	.78	.97	1.15	1.34
Hex "A"	7/16	9/16	9/16	11/16	7/8	1 1/16	1 5/16

Option “MD” Double End Hex Head Pipe Fittings

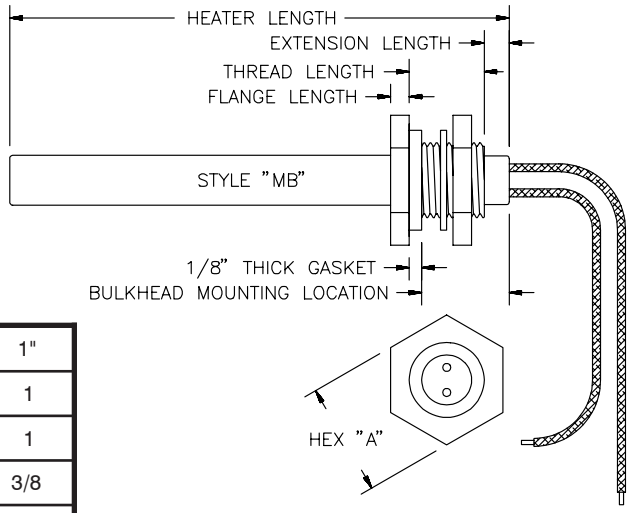
The double end pipe nipples provide a leak resistant, cartridge mounting system for liquid applications and provides for mounting of boxes for lead protection. Fittings can be located at any desired location but must always be located over unheated areas. Standard fitting location for straight lead styles is flush with the lead end of the heater, leaving no extension. In the case of 90 degree leads the standard fitting location corresponds to the start of the standard lead extension. Fittings are available in brass, steel and stainless steel. Special fitting sizes and materials can also be supplied when required. Please specify desired material and mounting location when ordering.



Cartridge Dia.	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
Fitting NPT Thread	1/8	1/4	1/4	3/8	1/2	3/4	1
Fitting Length	1.06	1.45	1.45	1.45	1.89	1.97	2.34
Hex "A"	7/16	9/16	9/16	11/16	7/8	1 1/16	1 5/16

Option “MB” Bulkhead Fittings

The bulkhead style fittings are useful in air and gas heating applications involving thin wall containers and can also be used to attach protective electrical boxes to the heater. Fittings can be positioned at any location but must be over an unheated zone. The standard fitting location for straight lead styles is flush with the lead end of the heater, leaving no extension. The 90 degree lead styles are not recommended due to difficulty of installation. Fittings are available in brass, steel and stainless steel and are supplied complete with gasket, washer and nut. Special fitting sizes and materials can also be supplied if required. Please specify desired material and bulkhead mounting location when ordering.

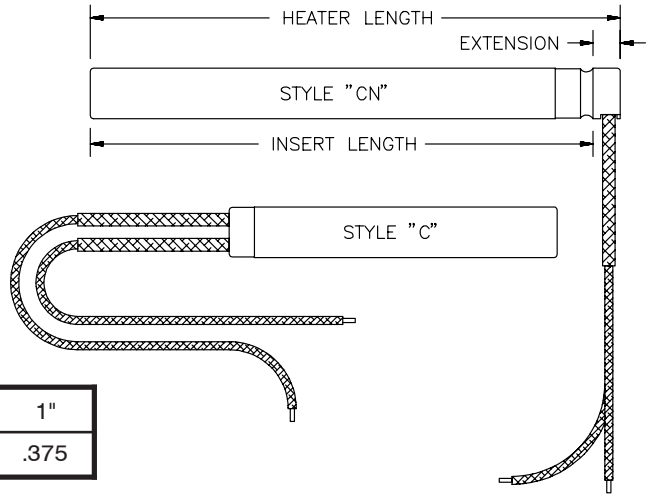


Cartridge Dia.	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
Fitting Thread Size	1/2-20	1/4	1/4	3/8	1/2	3/4	1
Thread Length	3/4	3/4	3/4	3/4	3/4	1	1
Flange Length	3/16	3/16	3/16	3/16	3/8	3/8	3/8
Hex "A"	3/4	3/4	15/16	1 1/8	1 5/16	1 1/2	1 7/8

Cartridge Lead Options

Style “C” And “CN” Crimp Connected Leads

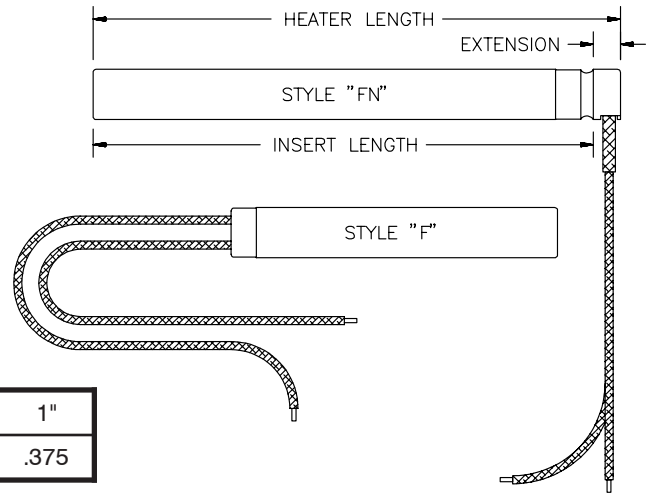
The “C” and “CN lead configurations consist of stranded lead wire externally crimp connected to the solid pins exiting the heater. Style “C” leads exit straight out the end of the cartridge while the leads of the style “CN” exit out the side of the sheath at 90 degrees. The lead end of the style “CN” is covered by a welded in end cap. The pin and connection area of both styles are sheathed in an insulating layer of silicone rubber coated fiberglass sleeving. Standard lead insulation is rated at 492 °F/250 °C continuous wire temperature. Both “C” and “CN” lead styles are best suited to applications where lead flexing is minimal. A lead length of 10 inches, including the solid pin extension, is standard. When ordering, specify “C” or “CN” leads and the desired lead length.



Cartridge Dia.	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
Extension	.250	.250	.250	.250	.312	.312	.375

Style “F” And “FN” Full Flexible Leads

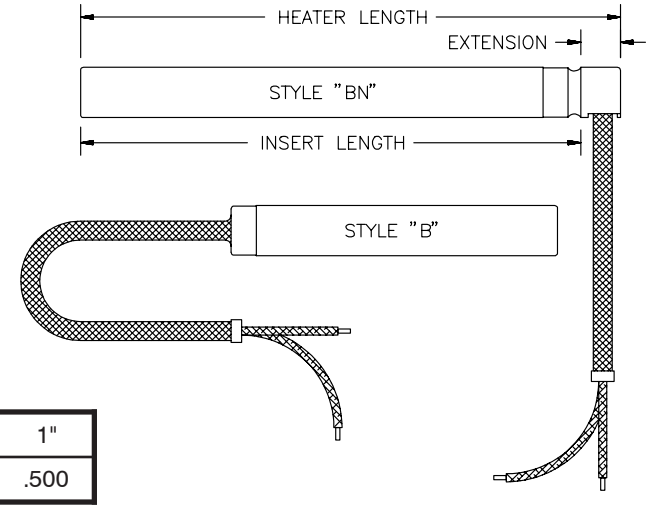
The “F” and “FN” style leads are internally connected to provide a fully flexible lead exit from the ceramic end cap. Style “F” leads exit straight out the lead end of the cartridge while the leads of the style “FN” exit out the side of the sheath at 90 degrees. The lead end of the style “FN” is covered by a welded in end cap. Standard lead insulation is rated at 492 °F/250 °C continuous wire temperature. Style “F” and “FN” leads can be bent sharply at the ceramic end cap without exposing or breaking the conductor and are popular in applications where the lead exit area is restricted. Depending on heater length, a 1 inch minimum cold section may be required. A lead length of 10 inches is standard. When ordering, specify “F” or “FN” leads and the desired lead length.



Cartridge Dia.	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
Extension	.250	.250	.250	.250	.312	.312	.375

Style “B” And “BN” Braid Protected Leads

The “B” and “BN” style leads feature full flexible leads with protective stainless steel overbraid. Style “B” leads exit straight out the lead end of the cartridge while the style “BN” leads exit out the side of the sheath at 90 degrees. The lead end of the style “BN” is covered by a welded in end cap. Standard lead insulation is rated at 492 °F/250 °C continuous wire temperature. Style “B” and “BN” leads are popular in applications where external wiring is required and where some additional protection is necessary. Depending on cartridge length, a 1 1/4 inch minimum cold section may be required. A lead length of 12 inches with 10 inches of braid is standard. Unless otherwise specified, leads are 2 inches longer than the requested braid length. When ordering, specify “B” or “BN” leads and desired lead and braid length.

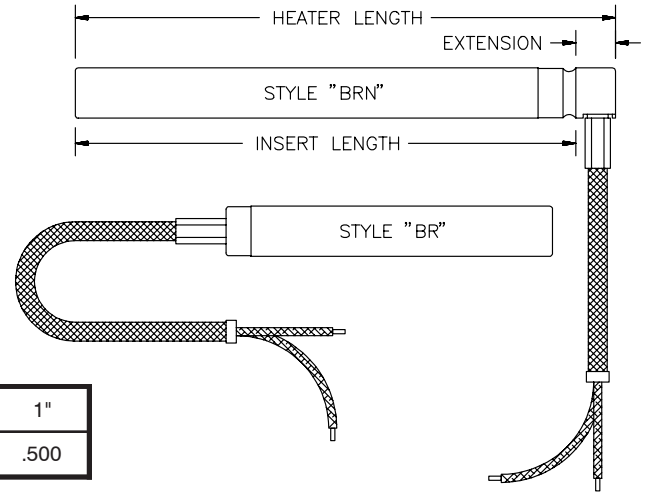


Cartridge Dia.	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
Extension	.375	.375	.375	.375	.437	.437	.500

Cartridge Lead Options

Style "BR" And "BRN" Braid Protected Leads

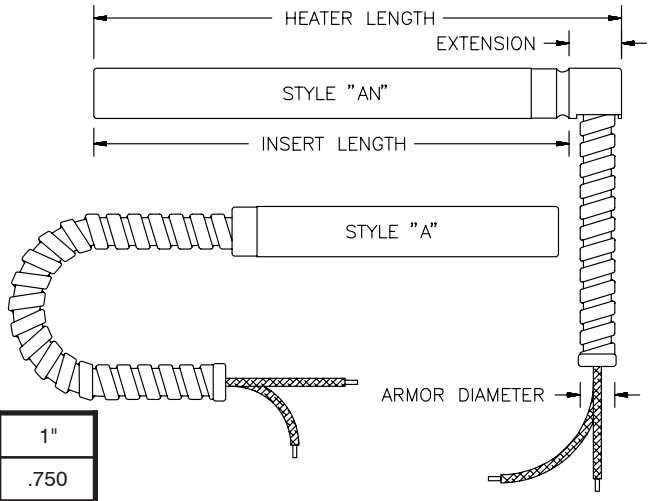
The "BR" and "BRN" style leads feature flexible leads with protective stainless steel overbraid externally crimped to the heater. Style "BR" leads exit straight out the lead end of the cartridge while the style "BRN" leads exit out the side of the sheath at 90 degrees. The lead end of the style "BRN" is covered by a welded in end cap. Standard lead insulation is rated at 492 °F/250 °C continuous wire temperature. Style "BR" and "BRN" leads are useful where protection is required and a rigid lead exit is preferred. Depending on heater length, a 1 1/4 inch minimum cold section may be required. A lead length of 12 inches with 10 inches of braid is standard. Unless otherwise specified, leads are 2 inches longer than the braid length. When ordering, specify "BR" or "BRN" leads and desired lead and braid length.



Cartridge Size	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
Extension	.375	.375	.375	.375	.437	.437	.500

Style "A" And "AN" Armor Protected Leads

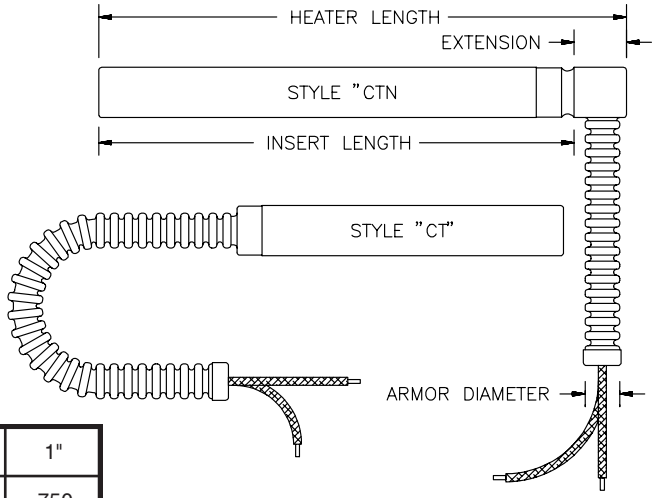
The "A" and "AN" style leads feature full flexible leads with protective stainless steel armor. Style "A" leads exit straight out the lead end of the cartridge while the style "AN" leads exit out the side of the sheath at 90 degrees. The lead end of the style "AN" is covered by a welded in end cap. Standard lead insulation is rated at 492 °F/250 °C continuous wire temperature. Style "A" and "AN" leads are popular in applications where external wiring is required and additional protection is necessary. Depending on heater length, a 1 1/4 inch minimum cold section may be required. A lead length of 13 inches with 10 inches of armor is standard. Unless otherwise specified, leads are 3 inches longer than the armor length. When ordering, specify "A" or "AN" leads and desired lead and armor length.



Cartridge Dia.	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
Extension	.375	.375	.500	.500	.625	.625	.750
Armor O.D. (Max.)	.207	.244	.275	.345	.437	.493	.623

Style "CT" And "CTN" Convoluted Tubing Protected Leads

The "CT" and "CTN" style leads feature flexible leads and a totally sealed stainless steel convoluted tubing style armor silver solder sealed to the heater. Style "CT" leads exit straight out the lead end of the cartridge while the style "CTN" leads exit out the side of the sheath at 90 degrees. The lead end of the style "CT" is covered by a welded in end cap. Standard lead insulation is rated at 492 °F/250 °C continuous wire temperature. Style "CT" and "CTN" leads are popular in applications where the heaters are constantly exposed to contaminants. Depending on heater length, a 1 1/4 inch minimum cold section may be required. A lead length of 13 inches with 10 inches of armor is standard. Unless other wise specified, leads are 3 inches longer than the armor length. When ordering, specify "CT" or "CTN" leads and desired lead and armor length.

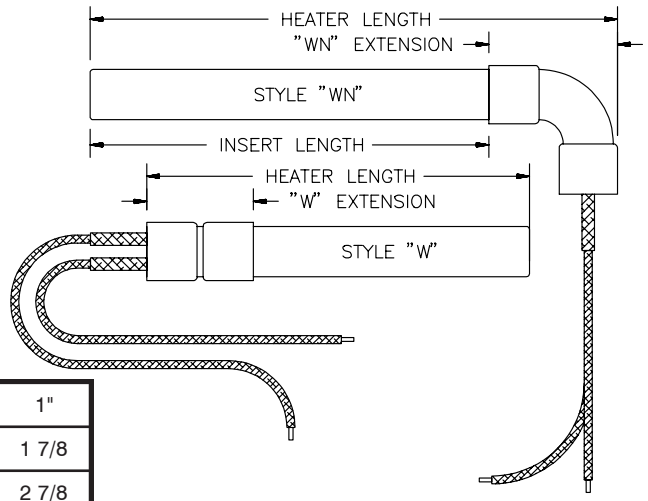


Cartridge Dia.	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
Extension	N/A	N/A	N/A	.500	.625	.625	.750
Armor O.D. (Max.)	N/A	N/A	N/A	.426	.426	.570	.570

Cartridge Lead Options

Style “W” and “WN” Wrot Copper Protective Lead Fittings

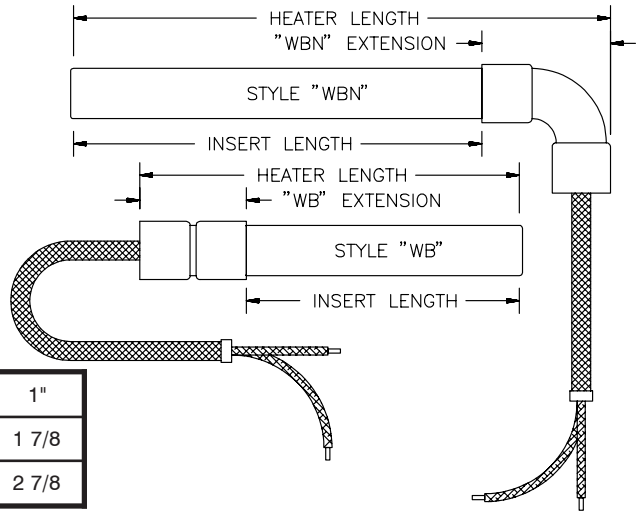
The “W” And “WN” lead configurations feature flexible leads exiting the cartridge through a protective wrot copper fitting. The style “W” leads exit the cartridge through a straight coupling while the style “WN” leads exit through a wrot copper elbow to provide a 90 degree lead exit. Standard lead insulation is rated at 492 °F/250 °C continuous wire temperature. The style “W” and “WN” leads provide lead protection and a positive stop to control heater insertion depth. The wrot copper fittings are also useful in applications where a silicone or epoxy potted seal is required. Lead length, measured from the fitting lead exit, is supplied as 10 inches standard. When ordering specify “W” or “WN” and desired lead length.



Cartridge Dia.	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
"W" Extension	7/8	7/8	1	1 3/16	1 1/4	1 1/2	1 7/8
"WN" Extension	1 1/16	1 1/16	1 3/8	1 5/8	2 1/16	2 1/8	2 7/8

Style “WB” and “WBN” Wrot Copper Fittings With Braid

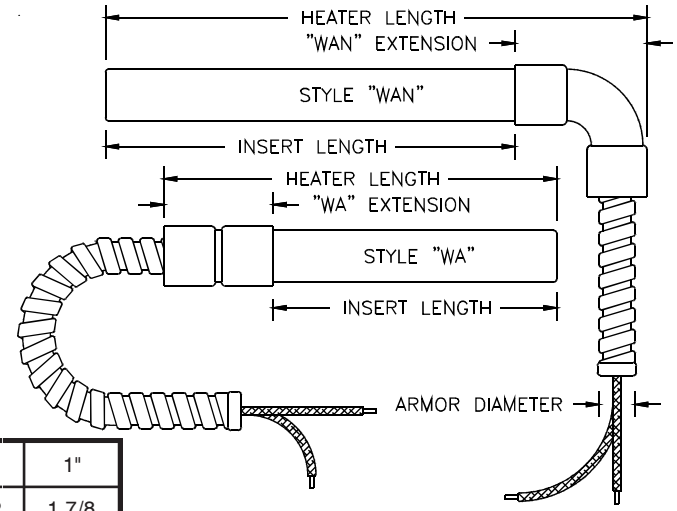
The “WB” and “WBN” lead styles are stainless steel wire braid protected and exit from a protective wrot copper fitting. The style “WB” leads exit the cartridge from a straight coupling while the style “WBN” leads exit through a copper elbow to provide a 90 degree lead exit. Standard lead insulation is rated at 492 °F/250 °C continuous wire temperature. “WB” and “WBN” lead systems provide substantial lead protection and a positive stop to control heater insertion depth. The fitting is also useful in applications where a silicone or epoxy seal is required. Standard leads are 13 inches with 10 inches of wire braid, as measured from the fitting lead exit. Unless otherwise specified, leads are 3 inches longer than the braid length. When ordering, specify “WB” or “WBN” and the desired lead length and braid length.



Cartridge Dia.	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
"WB" Extension	7/8	7/8	1	1 3/16	1 1/4	1 1/2	1 7/8
"WBN" Extension	1 1/16	1 1/16	1 3/8	1 5/8	2 1/16	2 1/8	2 7/8

Style “WA” and “WAN” Wrot Copper Fittings with Armor

The “WA” and “WAN” lead styles are stainless steel armor protected and exit from a protective wrot copper fitting. The style “WA” leads exit the cartridge through a straight coupling, while the style “WAN” armor protected leads exit through a copper elbow to provide a 90 degree lead exit. Standard lead insulation is rated at 492 °F/250 °C continuous wire temperature. “WA” and “WAN” lead systems provide substantial lead protection and a positive stop to control heater insertion depth. The fitting also accommodates silicone and epoxy potting when required. Standard leads are 13 inches with 10 inches of armor, as measured from the fitting lead exit. Unless otherwise specified, leads are 3 inches longer than the armor length. When ordering, specify “WA” or “WAN” leads and the desired lead and armor length.

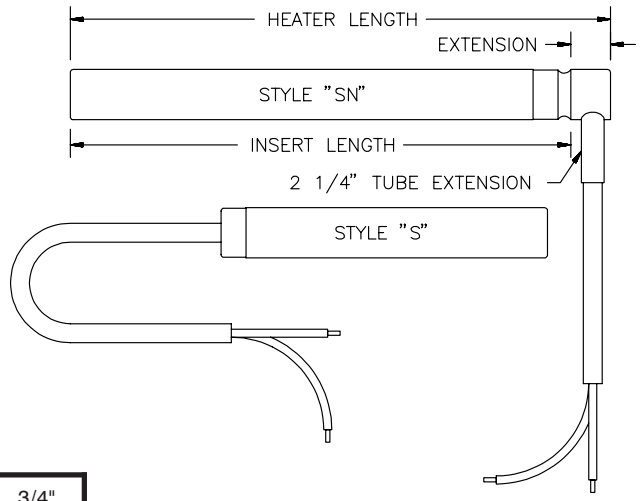


Cartridge Dia.	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
"WA" Extension	7/8	7/8	1	1 3/16	1 1/4	1 1/2	1 7/8
"WAN" Extension	1 1/16	1 1/16	1 3/8	1 5/8	2 1/16	2 1/8	2 7/8
Armor O.D. (Max.)	1/4	5/16	3/8	1/2	5/8	5/8	1

Cartridge Lead Options

Style “S”, “SN” "SP" And "SNP" SJO Cord Style Leads

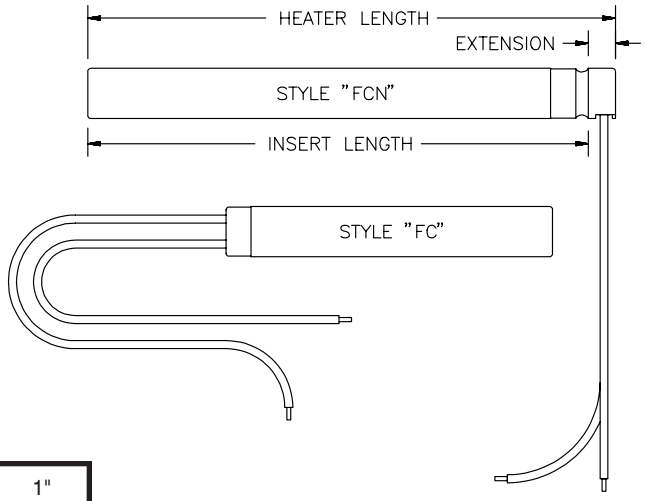
The “S” and “SN” SJO electrical cord style leads provide additional lead protection and moisture resistance in applications where leads are exposed to temperatures below 150 °F. Depending on the application a 2 to 3 inch cold section may be required to insure that the SJO cable is operating below the maximum temperature limit. Style “S” leads exit straight out the lead end of the cartridge while the leads of the style “SN” exit out the side of the sheath at 90 degrees through a protective extension tube. The lead end of the style “SN” is covered by a welded in cap. Style "SP" and "SNP" are similar but include a molded plug. The SJO cable lead styles are particularly useful in applications such as crankcase heating and food processing equipment, where the heater leads may be exposed to liquid contamination. Standard leads include consist of 36 inches of SJO cable. When ordering, specify “S” or “SN” leads and required cable length. If a molded on plug is required, specify "SP" or "SNP" and the required cable length.



Cartridge Size	3/16"	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"
Cold Extension	.250	.375	.375	.375	.375	.437	.437

Style “FC” And “FCN” Flexible Stainless Steel Cable Leads

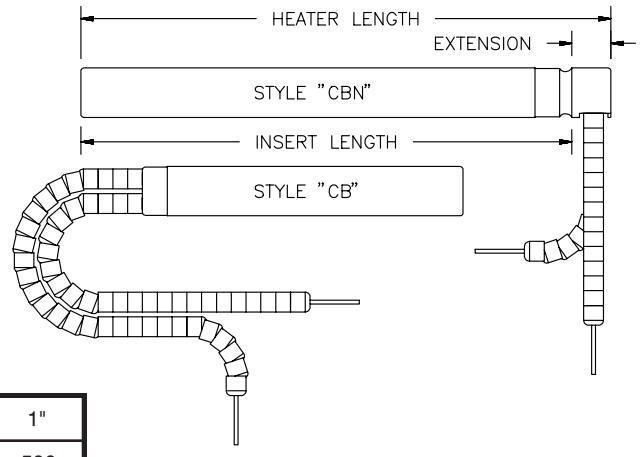
The “FC” and “FCN” style leads provide extended life in applications where severe flexing of leads is unavoidable. The lead conductors consist of flexible stainless steel stranded cable. Style “FC” leads exit straight out the lead end of the cartridge while the leads of the style “FCN” exit out the side of the sheath at 90 degrees. The lead end of the style “FCN” is covered by a welded in cap. The lead styles “FC” and “FCN” are particularly useful in applications such as sealing bars, where the heater leads must withstand constant flexing. “FC” and “FCN” leads can be combined with wire braid or armor for additional lead protection. Standard leads are teflon insulated but can also be supplied with fiberglass insulation or mica tape insulation. When ordering, specify “FC” or “FCN” leads and note any special insulation or lead protection. The stainless steel lead conductor reduces the total current capacity of the leads and can make this lead style impractical on larger high wattage heaters.



Cartridge Dia.	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
Extension	.250	.250	.250	.250	.312	.312	.375

Style “CB” And “CBN” Ceramic Bead Insulated Leads

The “CB” and “CBN” style leads provide a customer specified length of solid pin leads with high temperature ceramic bead insulation. Style “CB” leads exit straight out the lead end of the cartridge while the leads of the style “CBN” exit out the side of the sheath at 90 degrees. The lead end of the style “CBN” is covered by a welded in cap. The lead styles “CB” and “CBN” are intended for applications where the heater leads are exposed to temperatures exceeding the rating of the standard lead insulation. “CB” and “CBN” leads are often combined with an additional length of crimped on conventional leads. Standard leads include 6 inches of beads on 8 inch pins. When ordering, specify “CB” or “CBN” leads, ceramic bead length and required pin length. Include any crimp connected lead length desired.

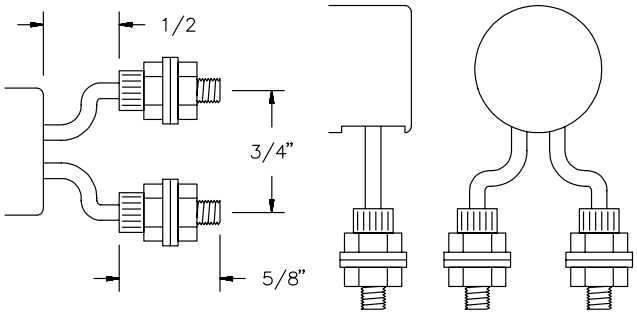


Cartridge Dia.	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
Extension	.375	.375	.375	.375	.437	.437	.500

Cartridge Lead Termination Options

Style “PT” And “PTN” Post Terminals

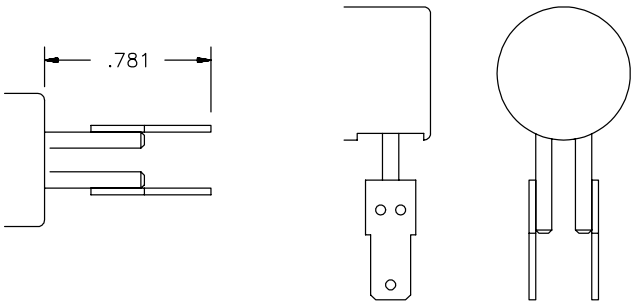
The “PT” and “PTN” post terminal lead connection option consists of a stainless steel 8-32 terminal securely welded to the #10 pins exiting the heater. This termination is available on standard heaters 5/8 inch in diameter and larger. Two standard terminal orientations are provided to accommodate various lead clearance requirements. The post terminal lead system provides a secure external termination for heaters installed in hard wired electrical systems where replacement of individual heaters without disturbing the wiring of the remaining heaters is essential The post terminal configurations shown at the right will be supplied unless otherwise specified. When ordering, specify “PT” or “PTN” termination and include any special terminal dimensions and thread specifications.



STYLE "PT" STYLE "PTN"

Style “ST” And "STN" Spade Termination

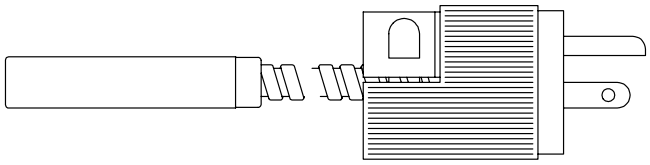
The “ST” and "STN" style terminations feature attached male spade connectors. The quick connect spade connectors are available in a range of standard sizes and configurations. The style “ST” and "STN" terminations provide convenience in applications where the frequent connection and disconnection of the heater is required. When ordering, specify style “ST” or "STN" termination and note any special spade terminal design required. Leads with matching female connectors can also be supplied. If required, please include the required lead type and lead length when placing your order.



STYLE "ST" STYLE "STN"

Style “PL” Plug Termination

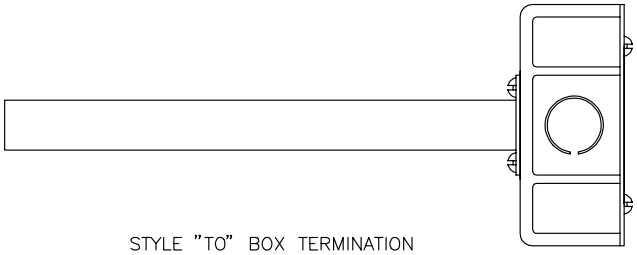
The “PL” style lead termination features an attached male plug with a nylon dead front design and a molded-in cord grip. Available plugs include straight and twist-lock blade types in both grounded and ungrounded versions. The style “PL” plug termination can be attached to any of the protected lead configurations. The style “PL” termination is primarily intended for those applications where the frequent connection and disconnection of the heater is required. When ordering, specify style “PL” termination and provide a complete description of the plug or the manufacturers plug catalog number desired. Please also include the required lead style and lead lengths when placing your order.



STYLE "PL" TERMINATION WITH STYLE "A" ARMOR

Style “TO”, “TM” And “TE” Box Termination

The “TO”, “TM” and “TE” electrical box terminations feature electrical box enclosures mounted to the lead end of the heater. Box style terminations enclose the heater lead connections and provide application environmental protection. Style “TO” features a standard NEMA 1 octagonal box, style “TM” a NEMA 4 moisture-proof box and style “TE” a NEMA 7 explosion proof box. Style “TO”, “TM” and “TE” terminations are useful in applications where external wiring must conform to specific wiring codes or in applications where additional protection of electrical connections is necessary. When ordering, specify “TO”, “TE” or “TE” box termination and desired terminal or lead style. If a specific box is required, please provide a complete description or manufacturers box catalog number.

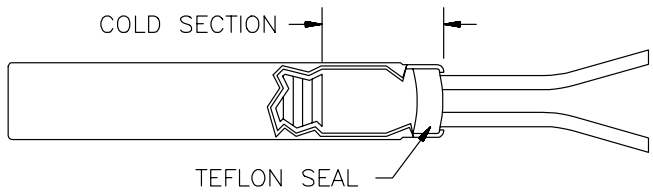


STYLE "TO" BOX TERMINATION

Cartridge Lead Seal Options

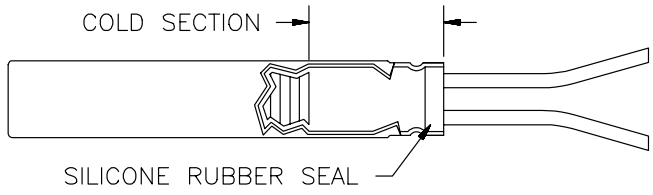
Style “TS" Compressed Teflon Plug Lead Seals

The style “TS” lead seals feature a swaged in teflon seal plug and teflon leads. The resulting lead construction provides a contamination resistant seal which reduces the possibility of contamination from liquids such as water and oil. The teflon seal is most effective in applications where the seal is exposed to temperatures below 275 °F. Depending on the application a 1 inch or longer cold section may be required to insure that the teflon seal and leads are maintained below recommended temperature limits. Teflon seals can be combined with most standard lead styles. When ordering specify seal option “TS". Please include desired lead style and length.



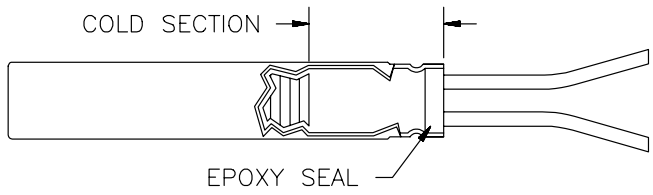
Style “SS” Silicone Rubber Potted Lead Seals

The style “SS” lead seals consist of silicone rubber sealant potted into a cavity at the lead end of the cartridge. The resulting seal construction reduces the possibility of contamination from liquids such as water and oil. The silicone rubber potted lead seal is most effective in applications where the seal is exposed to temperatures below 450 °F. Depending on the application a 1 inch or longer cold section may be required to insure that the silicone rubber seal and leads are maintained below recommended temperature limits. Silicone rubber seals can be combined with most standard lead styles. When ordering specify seal option “SS". Please include desired lead style and length.



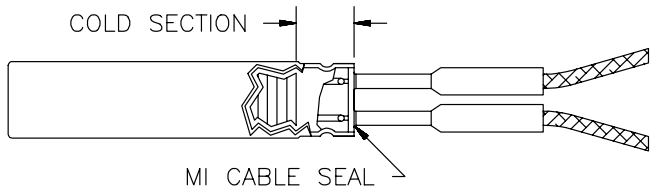
Style “ES” Epoxy Potted Lead Seals

The style “ES” lead seals consist of high temperature epoxy potted into a cavity at the lead end of the cartridge. The epoxy sealed lead construction provides both contamination and abuse resistance. The seal reduces the possibility of contamination from liquids such as water and oil. The epoxy seal is most effective in applications where the seal is exposed to temperatures below 350 °F. Depending on the application a 1 inch or longer cold section may be required to insure that the epoxy seal is maintained below recommended temperature limits. Epoxy seals can be combined with most standard lead styles. When ordering specify seal option “ES". Please include desired lead style and length.



Style “CS” MI Cable Lead Seals

The style “CS” lead seals consist of two high temperature, single conductor, mineral insulated cables, braze sealed to the cartridge. Leads are terminated into sealed transition fitting on each cable. The mineral insulated cable provides both contamination and physical abuse resistance. The seal reduces the possibility of contamination from liquids such as water and oil. The sealed cable area at the end of the cartridge can withstand temperatures up to 1200 °F. This construction requires a 1/2 inch cold section, in which to terminate the cable. Style "CS" seals can be combined with most standard lead styles. When ordering specify seal option “CS". Please include cable length, desired lead insulation and lead length.



Order Information

Ordering Standard Sizes And Ratings

The standard size and rating tables on the following pages list the diameter, length and electrical ratings normally available for same or next day shipment. The cartridges listed are stocked in the popular type "F" flexible lead configuration but are also available in many of the other optional lead constructions. Stop rings, flanges and threaded fittings, can be added to the stock units.

To Order Stock Cartridges From The Standard Size And Rating Tables Specify:

*** Product Number**
*** Watts**
*** Volts**
*** Lead Styles And Dimensions**
*** Mounting Features**

Ordering Non-Standard Cartridge Heaters

The cartridge is available in a virtually unlimited number of design variations. Diameter and length options include imperial and metric dimensions. Lead systems and mounting features can be tailored to the application. A wide range of thermal, electrical and temperature sensing options can be implemented if required. Any combination of voltage and wattage within the specified limits of the cartridge can be supplied.

To Order Non-Standard Cartridges Specify:

*** Diameter**
*** Length**
*** Voltage**
*** Wattage**
*** Special Construction Features**
*** Lead Styles And Dimensions**

Imperial Cartridge Product Number Definition

H 5 H 15 A 12 T1J

Cartridge Diameter Code
See Fractional Code Chart
For Appropriate Letter Code

Cartridge Length Dimension
Length Dimension Specified In
Whole Inches

Cartridge Fractional Length Code
See Fractional Letter Code Chart
For Appropriate Letter Code

Cartridge Lead Length
Specified In Whole Inches
Or Millimeters

Cartridge Lead Style Code
See Cartridge Lead Options
For Appropriate Letter Codes

Cartridge Lead Protection Length
Specified In Whole Inches Or
Millimeters

Cartridge Option Codes
Options Are Specified By Selecting
Codes For The Desired
Construction, Installation And
Mounting Options

Fractional Letter Codes Z=0

A = 1/16	F = 3/8	K = 11/16
B = 1/8	G = 7/16	L = 3/4
C= 3/16	H = 1/2	M = 13/16
D= 1/4	I = 9/16	N = 7/8
E= 5/16	J = 5/8	O = 15/16

Metric Cartridge Product Number Definition

10 Z 200 Z 300 A 500 T1J

Cartridge Diameter Code
Diameter Specified In Millimeters

Fractional Diameter Code
Z = 0 For Even Millimeter Dimensions
H = 1/2 For 1/2 Millimeter Dimensions

Cartridge Length Dimension
Specified In Millimeters

Fractional Length Code
Z = 0 For Even Millimeter Dimensions
H = 1/2 For 1/2 Millimeter Dimensions

Cartridge Lead Length
Specified In Millimeters

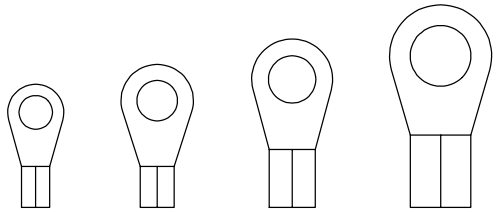
Cartridge Lead Style Code
See Cartridge Lead Options
For Appropriate Letter Codes

Cartridge Lead Protection Length
Specified In Millimeters

Cartridge Option Codes
One Or More Cartridge Options
Can Be Specified By Selecting
Appropriate Codes For Various
Construction, Installation And
Mounting Options

Style “HTL” Terminal Lugs

High temperature terminal lugs provide a heat resistant termination for high temperature applications. These lugs are offered in a range of sizes and temperature ratings suitable for most heating element wiring applications.



Style “HTL" Terminal Lug Prod. No. Definition

HTL 10 18 NS

Style Code
Heater Accessory
Terminal Lug

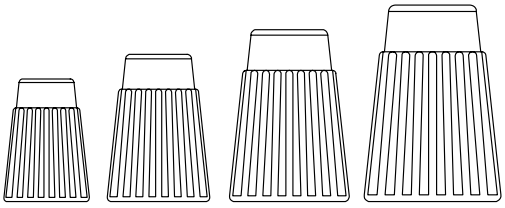
Lug Size
#6
#8
#10
1/4
5/16
3/8

Wire Range Code
18 - #22 - #18
14 - #16 - #14
10 - #12 - #10

Material Code
NS - Nickel Plated Steel (900 °F)
NC - Nickel Plated Copper (650 °F)
NP - Pure Nickel (1200 °F)

Style “HWN” Ceramic Wire Nuts

High temperature ceramic wire nuts allow convenient wire connection in high temperature operating environments. The ceramic wire nuts are offered in four standard sizes suitable for most element wiring applications.



Style “HWN" Ceramic Wire Nut Prod. No. Definition

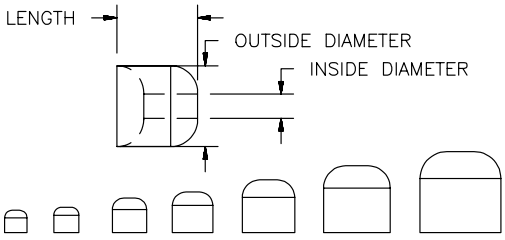
HWN 18-22

Style Code
Heater Accessory
Wire Nut

Wire Nut Size Code
18-22 - Fits Maximum Of Two 18 Gauge Stranded Wires
16-18 - Fits Maximum Of Two 16 Gauge Stranded Wires
14-16 - Fits Maximum Of Two 14 Gauge Stranded Wires
10-12 - Fits Maximum Of Two 10 Gauge Stranded Wires

Style “HCB” Ceramic Bead Insulators

Ceramic bead insulators are useful insulating and spacing wires in very high temperature wiring applications. The ceramic beads are offered in a range of inside and outside diameters suitable for a variety of element wiring applications.



Style “HCB" Ceramic Bead Prod. No. Definition

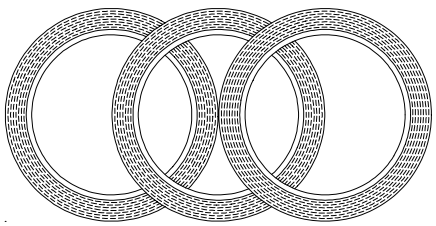
HCB 1B

Style Code
Heater Accessory
Ceramic Bead Insulators

Bead Size Code - 0.D. X I.D. X Lgth.
1B - .110 X .056 X .110
1C - .125 X .056 X .125
2B - .170 X .068 X .170
3B - .200 X .092 X .200
4B - .260 X .116 X .260
4C - .260 X .152 X .110
5B - .330 X .124 X .125
6B - .400 X .156 X .170
6C - .400 X .180 X .400
7A - .440 X .180 X .440

Style “HFT” Fiberglass Tape

Fiberglass tape is high temperature resistant and is useful in securing wire bundles in high heat areas of applications. Tape is stocked in standard rolls containing 36 yards of tape per roll.



Style “HFT" Fiberglass Tape Prod. No. Definition

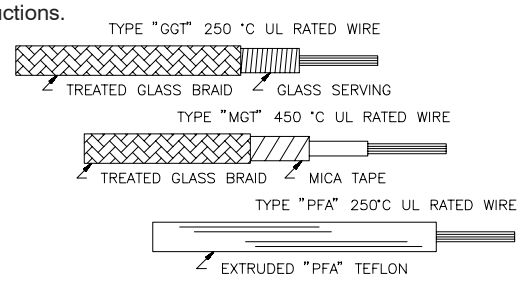
HFT 1/2

Style Code
Heater Accessory
Fiberglass Tape

Tape Width
1/2"
3/4"
1"

Style “HIW” Insulated Wire

High temperature insulated wire is suitable for connection of heating elements in high temperature environments. Standard wire styles include UL rated fiberglass, mica tape and teflon insulated constructions.



Style “HIW" Insulated Wire Prod. No. Definition

HIW 1 18 N

Style Code
Heater Accessory
Terminal Lug

Insulation Code
1 - "GGT"
2 - "MGT"
3 - "PFA"

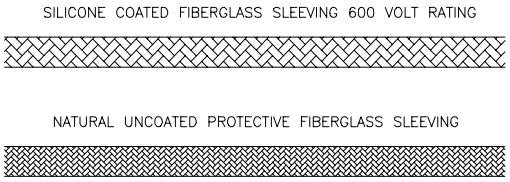
Wire Gauge

#24	#16
#22	#14
#20	#12
#18	#10

Conductor Code
N - Nickel
P - Nickel Plated Copper

Style “HFS” Fiberglass Sleeving

Heat resistant fiberglass sleeving is useful in further protecting wiring from physical abuse. The sleeving is offered in a silicone coated version rated at 600 volts and in a natural finish intended only for wire protection.



Style “HFS" Fiberglass Sleeving Prod. No. Definition

HFS 8 S

Style Code
Heater Accessory
Fiberglass Sleeving

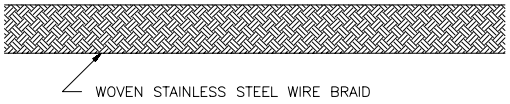
Sleeving Size And Nom. I.D.

24 - .022	14 - .066	4 - .208	7/16 - .43
22 - .027	12 - .085	2 - .263	1/2 - .50
20 - .034	10 - .112	0 - .330	9/16 - .56
18 - .042	8 - .133	5/16 - .31	5/8 - .62
16 - .053	6 - .166	3/8 - .37	3/4 - .75

Sleeve Style Code
S - Silicone Coated
(Electrical 600 Volt)
N - Natural Uncoated
(Protective Only)

Style “HWB” Wire Braid

Stainless steel wire braid is useful in protecting heater leads and wire bundles from abrasion. Flexible stainless steel braid will expand to fit wire bundles substantially larger than its' specified inside diameter.



Style “HWB" Wire Braid Prod. No. Definition

HWB 1/8

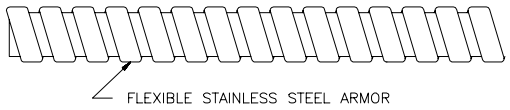
Style Code
Heater Accessory
Wire Braid

Braid Nominal Inside Diameter

1/8"	3/8"	3/4"
3/16"	7/16"	7/8"
1/4"	1/2"	1"
5/16"	5/8"	1 1/4"

Style “HFA” Flexible Armor

Stainless steel armor assists in protecting heating element leads and wiring from mechanical damage. Armor is offered in a range of sizes suitable for wide range of applications.



Style “HFA" Flexible Armor Prod. No. Definition

HFA 3/8

Style Code
Heater Accessory
Flexible Armor

Armor Size

1/8 - .125 Min. I.D. - .207 Max. O.D.	9/32 - .271 Min. I.D. - .376 Max. O.D.
5/32 - .152 Min. I.D. - 232 Max. O.D.	5/16 - .302 Min. I.D. - .437 Max. O.D.
3/16 - .183 Min. I.D. - .275 Max. O.D.	3/8 - .363 Min. I.D. - .493 Max. O.D.
7/32 - .206 Min. I.D. - .306 Max. O.D.	1/2 - .493 Min. I.D. - .623 Max. O.D.
1/4 - .245 Min. I.D. - .345 Max. O.D.	5/8 - .605 Min. I.D. - .755 Max. O.D.