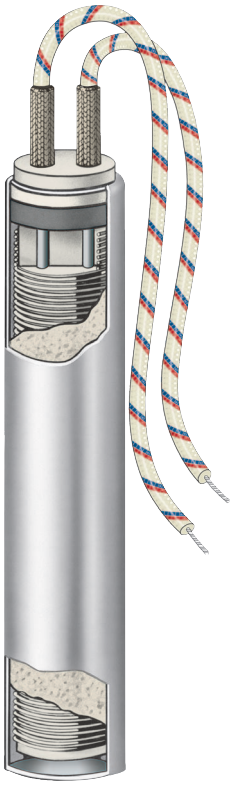
Made in USA



METRIC SIZES

Hi-Density CARTRIDGE HEATERS

Standard Specifications and Tolerances of Hi-Density Cartridge Heaters in ***Metric*** sizes. If tighter tolerances are required consult Tempco.

LEAD LENGTH TOLERANCE

Up to 1000 mm: -15/+40 mm
1000 mm to 2000 mm: -25/+50 mm
Above 2000 mm: ±100 mm

DIMENSIONAL SPECIFICATIONS

Nominal Diameter	6.5		8		10		12.5		16		20	
	mm	(in)	mm	(in)	mm	(in)	mm	(in)	mm	(in)	mm	(in)
Actual Diameter	6.43	(.253)	7.92	(.312)	9.93	(.391)	12.42	(.489)	15.93	(.627)	19.91	(.784)
Actual Diameter Tolerance	±.05 mm (±.002")											
Minimum Length	25.4	(1)	25.4	(1)	25.4	(1)	25.4	(1)	25.4	(1)	31.75	(1-1/4)
Maximum Length	914	(36)	914	(36)	1219	(48)	1524	(60)	1829	(72)	1829	(72)
Length Tolerance Heaters up to 127 mm (5") long	±2.4	(3/32)	±2.4	(3/32)	±2.4	(3/32)	±2.4	(3/32)	±2.4	(3/32)	±3.2	(1/8)
Length Tolerance Heaters over 127 mm (5") long	±2% of Sheath Length											
Camber Tolerance Heaters up to 152 mm (6") long	0.13 mm (0.005")											
Camber Tolerance Heaters over 152 mm (6") long	0.50 mm (0.020") per 305 mm (12") of length (0.5 x (length in mm/305)^2)											

With some force, Tempco Hi-Density Cartridge Heaters will normally flex enough to fit into a straight reamed hole.

ELECTRICAL SPECIFICATIONS

Nominal Diameter	6.5	8	10	12.5	16	20
Maximum Voltage	260	260	260	380	480*	480*
Maximum Amperage (see next line for exceptions)	4.4	4.4	6.7	10.5	23	23
†Maximum Amperage for Types C1C, C1D, C2C, C2D, CS, F, M3, R1B, S1B, S2B, SA, W, & W3 & Terminations	3.0	3.0	5.5	7.6	9.7	9.7
Maximum Wattage at 260V	1140	1150	1740	2730	5980	5980
Maximum Wattage at 380V	—	—	—	3990	8740	8740
Maximum Wattage at 480V	—	—	—	—	10,580	10,580
Wattage Tolerance	Plus 5%, Minus 10%					
Resistance Tolerance	Plus 10%, Minus 5%					

*480V when applicable. Consult Tempco.

†Current carrying capacities are for ambient temperatures up to 482°F (250°C) with mica insulated lead wires.

Recommendations for Improving the Life of Tempco Hi-Density Metric Cartridge Heaters

Tempco Hi-Density Metric Cartridge Heaters have been widely used in many demanding and diverse applications since 1972. The commonly used basic applications are platen, plastic mold and die heating, liquid immersion and air heating.

Note: Selection of the wrong termination for the particular application is the major reason for all heater failures. However, failure to consider other important criteria can also have a negative effect on the life of the heater. To get the best performance and assure long life, it is important to carefully evaluate the following factors.

Operating Temperature

Operating temperature of a heater is a major factor in determining the life expectancy of a heating element. The heater life depends on the actual temperature of the resistance wire within the heater and not on the process operating temperature. The graph in Fig. 1 demonstrates the proper relationship between operating temperature and watt density; the higher the operating temperature, the lower the maximum recommended watt density.

Heater Watt Density

Cartridge heater watt density is defined as the wattage dissipated per square centimeter of the heated sheath surface. For a particular application a heater's watt density governs internal resistance wire temperature, which determines the outer sheath temperature. These factors are critical to the proper heating of the application and to the life expectancy of the heater. Special construction features that promote excellent heat transfer permit Hi-Density cartridge heaters to operate at higher watt densities while maintaining the lowest possible resistance wire temperatures of any style cartridge heater.

Heater watt density (w/cm^2) is calculated using the following formula:

$$\text{Watt Density} = \frac{\text{Heater wattage}}{\text{Heated length} \times \text{Heater diameter} \times 3.1416}$$

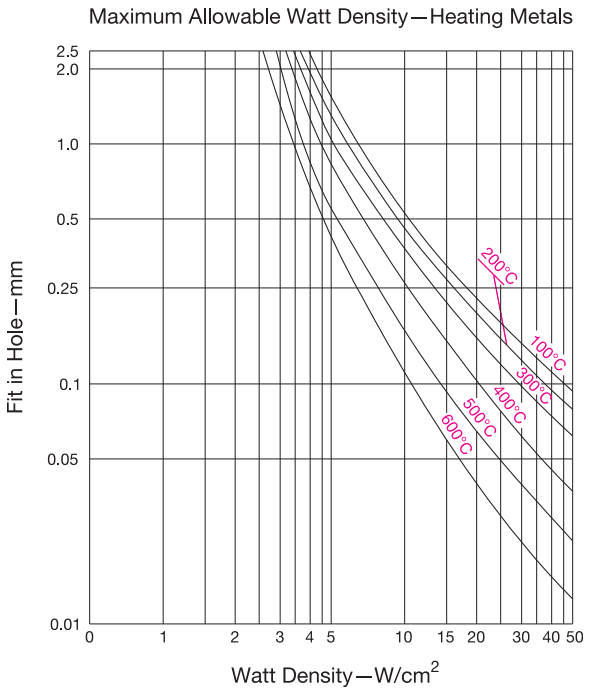
Heated length is the overall length of the heater minus any unheated (cold) sections. Standard Type N, Hi-Density Metric Cartridge Heaters have 9.5 mm at the lead end and 6.4 mm at the disc end unheated. This would mean a 100 mm long heater would have 84.1 mm effective heated length. Unheated sections vary with type of heater termination. For descriptions of terminations and options, see pages 2-39 through 2-60.

The graph in Fig. 1 shows the maximum recommended watt density for Hi-Density Metric Cartridge Heaters when used in a steel platen. Watt density limitations for various materials are given in the engineering section of this catalog. For liquid immersion heaters the maximum watt density depends on the type of liquid being heated. The more viscous, or thicker the liquid, the lower the maximum watt density. Higher watt density can cause the liquid to carbonize and accumulate on the heater sheath, which will cause premature heater failure. It is advisable to use heaters that have watt densities below the maximum recommended watt density to get the longest heater life. If the actual heater watt density is close to the maximum recommended watt density, you can correct the problem by:

1. Increasing the number, diameter and length of heaters.
2. Lowering the total wattage; however, this may increase the heat-up time.
3. Obtaining tighter fit (see Fig. 2 — Determining Fit).

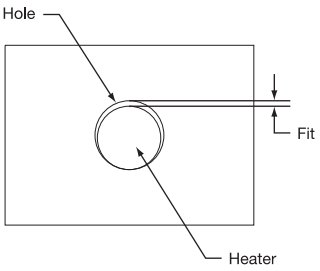
A Hi-Density cartridge heater designed at the maximum recommended watt density allows the smallest heater to be used to obtain the required wattage with good service life. All things being equal, using a lower watt density heater will typically provide optimized service life.

Fig. 1 Recommended Watt Density for Heating Metal Parts



The graph shows the recommended maximum watt density for Tempco Hi-Density Metric Cartridge Heaters at different operating temperatures and fit, when the heater is installed in an oxidized mild steel block. The thermocouple is located 12.5 mm from the heater. When heating other materials, the data needs to be extrapolated based on the thermal conductivity of the material. Consult Tempco with your requirements.

Fig. 2 Determining Fit



CONTINUED

Recommendations for Improving the Life of Tempco Hi-Density Metric Cartridge Heaters

Continued from previous page...

Determining Fit

When heating a platen, mold, die or hot runner probe with Hi-Density Metric Cartridge Heaters inserted into drilled holes, fit is an important factor in determining the life expectancy of the heater. Fit is the difference between the minimum diameter of the cartridge heater and the maximum diameter of the hole. Unheated sections on a Hi-Density cartridge may be smaller in diameter due to swaging. To determine fit, use the smallest diameter on the heated length only.

Example: A 10 mm nominal OD Hi-Density cartridge heater has an actual diameter of 9.95 ±.03 mm, which translates to a minimum diameter of 9.92 mm. If used in a 10.01 mm ±.02 mm hole, the fit would be .11 mm (10.03 mm – 9.92 mm = 0.11 mm).

When medium watt density heaters (less than 9.30 watts per square centimeter) are used in low temperature applications (less than 600°F [315°C]) general purpose drills are commonly used to drill holes. The typical hole size may be 0.07 mm to 0.20 mm over the drill size. For higher watt density and/or higher temperature applications, we recommend that the holes are drilled and reamed for the tightest possible fit. In applications where precise temperature control and heat transfer properties are required, Hi-Density cartridge heaters can be centerless ground to ±0.01 mm.

Although a tighter fit is desirable to efficiently transfer heat and to get long heater life, a looser fit will aid in installing and removing heaters, especially long heaters. We recommend that you apply Tempco's BNS anti-seize cartridge heater coating as it will improve heat transfer and will make the removal of heaters easier.

The graph in Fig 1. (page 2-29) shows the effect of fit in determining the maximum recommended watt density on a steel platen. As it is indicated in the graph, the tighter the fit, the higher the maximum recommended watt density.

Temperature Control and Location of Temperature Sensing Device

In order to better control the heater temperature and hence the resistance wire temperature, use of an appropriate temperature control and the proximity of the heater to the sensor is very important. The graph in Fig 1. (page 2-29) shows the effect of operating temperature in determining the maximum recommended watt density on a steel platen where the sensor is located 12.5 mm from the heater. Higher watt density heaters can generate heat faster than the surrounding area's ability to dissipate heat. This creates a thermal lag between the heater and the sensor. The closer the sensor to the heater, the better you can control the heater temperature. By keeping the sensor further from the heater, temperature gradients of several hundred degrees can be observed in many applications, especially during initial start-up and heavy thermal cycling. Although the set operating temperature may be low, the heater may be running at a very high temperature. This is a common cause of heater failure. This can be minimized using time proportional and PID functions of the temperature controllers. See Section 13 for temperature controllers and Section 14 for thermocouples and sensors.

Power Control

Power control methods affect the life expectancy of heating elements. In general, although economical, on-off controls increase thermal fatigue and oxidation rate on heating elements by causing wide temperature swings of the internal heating element. Silicon Controlled Rectifiers (SCRs), Mercury Relays and Solid State Power Controls can increase the life expectancy of heating elements by reducing the temperature swings of the internal heating element. See Section 13 for power controls.

Important Installation Considerations

1. For closest fit and best heat transfer, use reamed holes.
2. When possible, drill holes through the object being heated. This will make heater removal easier.
3. When using an anti-seize coating like Tempco's BNS spray or paste, **do not apply** over lead wires or any other current carrying conductors.
4. When using insulated tape or sleeving, check to make sure it is rated for the temperature of the application. Lower temperature rated materials can contain an adhesive or binder that can carbonize and become electrically conductive.
5. When using heaters near their maximum recommended watt density, it is recommended that the temperature sensing probes be located approximately 12.5 mm from the heater sheath.
6. Lead wires should not be located in the hole containing the cartridge heater during operation. This may cause the lead wires to be exposed to temperatures above their rated temperature.
7. When used in a vacuum application, make sure the lead end of the heater is outside the vacuum. If the lead has to be in the vacuum, consult Tempco for specific recommendations.
8. Many applications will subject a heater's electrical terminations to one or more of the following potentially damaging conditions:
   - Moisture
   - Oil and other contaminants
   - Flexing
   - Abrasion
   - High temperature

Note: To protect the heater from damage in these harsh environments, Tempco has a wide selection of terminations and options available. See pages 2-39 through 2-60 for details.

CALCULATING WATTAGE REQUIREMENTS

Formulas and related data to calculate wattage requirements are detailed in the Engineering Section located at the back of this catalog. For new applications it is recommended that testing under actual operating conditions be performed to confirm wattage and watt density calculations.

An excellent evaluation method is to power up a heater with the calculated wattage and watt density through a variable voltage transformer. By changing the voltage and therefore the heater output, thermocouples sensing heater and process temperature can verify the design.

Standard (Non-Stock) Hi-Density Metric Cartridge Heaters

6.5 mm Diameter Actual 6.45 mm (.253")

Sheath Length (mm)	Watts	Watt Density (W/cm²)	Part Number 220V
40	50	9	HDM00001
40	75	13	HDM00002
40	100	18	HDM00003
40	125	22	HDM00004
40	150	27	HDM00005
60	50	5	HDM00006
60	100	10	HDM00007
60	150	15	HDM00008
60	200	21	HDM00009
60	250	26	HDM00010

Sheath Length (mm)	Watts	Watt Density (W/cm²)	Part Number 220V
80	100	7	HDM00011
80	150	11	HDM00012
80	200	15	HDM00013
80	300	22	HDM00014
80	400	29	HDM00015
100	100	6	HDM00016
100	200	11	HDM00017
100	300	17	HDM00018
100	400	22	HDM00019
100	500	28	HDM00020
130	100	4	HDM00021
130	250	10	HDM00022
130	400	17	HDM00023
130	500	21	HDM00024
130	600	25	HDM00025

8 mm Diameter Actual 7.95 mm (.312")

Sheath Length (mm)	Watts	Watt Density (W/cm²)	Part Number 220V
40	50	7	HDM00026
40	75	11	HDM00027
40	100	14	HDM00028
40	150	22	HDM00029
40	200	29	HDM00030
60	75	6	HDM00031
60	150	13	HDM00032
60	200	17	HDM00033
60	250	21	HDM00034
60	300	25	HDM00035
80	100	6	HDM00036
80	200	12	HDM00037
80	300	18	HDM00038
80	400	24	HDM00039
80	500	29	HDM00040
100	100	5	HDM00041
100	250	11	HDM00042
100	400	18	HDM00043
100	500	23	HDM00044
100	600	27	HDM00045

Sheath Length (mm)	Watts	Watt Density (W/cm²)	Part Number 220V
130	200	7	HDM00046
130	350	12	HDM00047
130	500	17	HDM00048
130	600	20	HDM00049
130	700	24	HDM00050
160	200	5	HDM00051
160	400	11	HDM00052
160	600	16	HDM00053
160	700	19	HDM00054
160	900	24	HDM00055
200	300	6	HDM00056
200	500	11	HDM00057
200	700	15	HDM00058
200	900	19	HDM00059

Note: Part Numbers above are for Hi-Density Cartridge Heaters terminated with Type N leads, 250 mm (10") long. See pages 2-39 through 2-57 for other terminations.

Metric Size Cartridge Heaters are made-to-order only. *Standard lead time is 3 weeks.*

Custom Engineered/Manufactured Hi-Density Metric Cartridge Heaters
Refer to ordering information on page 2-33.

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Standard (Non-Stock) Hi-Density Metric Cartridge Heaters

10 mm Diameter Actual 9.95 mm (.391")

Sheath Length (mm)	Watts	Watt Density (W/cm²)	Part Number 220V
40	50	6	HDM00060
40	100	12	HDM00061
40	150	17	HDM00062
40	200	23	HDM00063
40	250	29	HDM00064
60	100	7	HDM00065
60	150	10	HDM00066
60	200	13	HDM00067
60	300	20	HDM00068
60	400	27	HDM00069
80	100	5	HDM00070
80	200	9	HDM00071
80	300	14	HDM00072
80	400	19	HDM00073
80	600	28	HDM00074
100	200	7	HDM00075
100	300	11	HDM00076
100	400	15	HDM00077
100	500	18	HDM00078
100	700	25	HDM00079
130	200	5	HDM00080
130	400	11	HDM00081
130	600	16	HDM00082

Sheath Length (mm)	Watts	Watt Density (W/cm²)	Part Number 220V
130	800	22	HDM00083
130	1000	27	HDM00084
160	200	4	HDM00085
160	500	11	HDM00086
160	800	17	HDM00087
160	1000	22	HDM00088
160	1200	26	HDM00089
200	300	5	HDM00090
200	600	10	HDM00091
200	1000	17	HDM00092
200	1200	20	HDM00093
200	1400	24	HDM00094
250	400	5	HDM00095
250	700	9	HDM00096
250	1000	13	HDM00097
250	1400	20	HDM00098
300	500	6	HDM00099
300	1000	11	HDM00100
300	1500	17	HDM00101

12.5 mm Diameter Actual 12.45 mm (.489")

Sheath Length (mm)	Watts	Watt Density (W/cm²)	Part Number 220V
60	100	6	HDM00102
60	200	12	HDM00103
60	300	17	HDM00104
60	400	23	HDM00105
60	500	29	HDM00106
80	150	6	HDM00107
80	300	12	HDM00108
80	400	16	HDM00109
80	500	20	HDM00110
80	700	28	HDM00111
100	200	6	HDM00112
100	400	12	HDM00113
100	600	18	HDM00114
100	800	24	HDM00115
100	1000	30	HDM00116
130	250	6	HDM00117

Sheath Length (mm)	Watts	Watt Density (W/cm²)	Part Number 220V
130	500	11	HDM00118
130	800	18	HDM00119
130	1000	22	HDM00120
130	1400	31	HDM00121
160	300	5	HDM00122
160	600	11	HDM00123
160	1000	18	HDM00124
160	1400	25	HDM00125
160	1700	30	HDM00126
200	400	6	HDM00127
200	700	10	HDM00128
200	1000	14	HDM00129
200	1500	21	HDM00130
200	2000	28	HDM00131
250	500	5	HDM00132
250	1000	11	HDM00133
250	1500	16	HDM00134
250	2000	22	HDM00135
300	600	5	HDM00136
300	1500	13	HDM00137
300	2000	18	HDM00138

Note: Part Numbers above are for Hi-Density Cartridge Heaters terminated with Type N leads, 250 mm (10") long. See pages 2-39 through 2-57 for other terminations.

Metric Size Cartridge Heaters are made-to-order only. *Standard lead time is 3 weeks.*

Custom Engineered/Manufactured Hi-Density Metric Cartridge Heaters
Refer to ordering information on page 2-33.

Standard (Non-Stock) Hi-Density Metric Cartridge Heaters

16 mm Diameter Actual 15.95 mm (.627")

Sheath Length (mm)	Watts	Watt Density (W/cm²)	Part Number 220V
60	100	5	HDM00139
60	300	14	HDM00140
60	400	18	HDM00141
60	500	23	HDM00142
60	700	32	HDM00143
80	200	6	HDM00144
80	400	12	HDM00145
80	600	19	HDM00146
80	800	25	HDM00147
80	1000	31	HDM00148
100	300	7	HDM00149
100	500	12	HDM00150
100	700	17	HDM00151
100	1000	24	HDM00152
100	1300	31	HDM00153
130	400	7	HDM00154

Sheath Length (mm)	Watts	Watt Density (W/cm²)	Part Number 220V
130	600	10	HDM00155
130	800	14	HDM00156
130	1200	21	HDM00157
130	1600	28	HDM00158
160	500	7	HDM00159
160	700	10	HDM00160
160	1000	14	HDM00161
160	1500	21	HDM00162
160	2000	28	HDM00163
200	600	6	HDM00164
200	1000	11	HDM00165
200	1500	16	HDM00166
200	2000	22	HDM00167
250	700	6	HDM00168
250	1500	13	HDM00169
250	2000	17	HDM00170
300	1000	7	HDM00171
300	1500	11	HDM00172
300	2000	14	HDM00173

20 mm Diameter Actual 19.95 mm (.784")

Sheath Length (mm)	Watts	Watt Density (W/cm²)	Part Number 220V
60	250	8	HDM00174
60	400	13	HDM00175
60	300	10	HDM00176
60	500	17	HDM00177
80	500	12	HDM00178
80	800	19	HDM00179
100	650	12	HDM00180
100	1000	18	HDM00181
130	300	4	HDM00182
130	800	11	HDM00183
130	1250	17	HDM00184
160	800	9	HDM00185

Sheath Length (mm)	Watts	Watt Density (W/cm²)	Part Number 220V
160	1000	11	HDM00186
160	1250	13	HDM00187
200	1000	8	HDM00188
200	1200	10	HDM00189
200	1600	14	HDM00190
250	1250	8	HDM00191
250	1750	12	HDM00192
250	2000	13	HDM00193
300	1600	9	HDM00194
300	2200	12	HDM00195

Note: Part Numbers above are for Hi-Density Cartridge Heaters terminated with Type N leads, 250 mm (10") long. See pages 2-39 through 2-57 for other terminations.

Ordering Information

Catalog Heaters

Order by Catalog Part Number from the Standard Sizes and Ratings List on the preceding pages. Note that Part Numbers shown are for heaters with Type N Termination (250 mm leads).

Available Terminations and Optional Features can be found on pages 2-39 through 2-60.

Custom Engineered/Manufactured Heaters

Because an electric heater can be very application specific, for sizes and ratings not listed, **TEMPCO** will design and manufacture a Hi-Density Metric Cartridge Heater to meet your requirements. ***Standard lead time is 3 weeks.***

Please Specify the following:

- ❑ Diameter
- ❑ Length
- ❑ Wattage
- ❑ Voltage
- ❑ Termination types (see pages 2-39 through 2-51)
- ❑ Options/Special Features (see pages 2-52 through 2-60)
- ❑ Lead Length
- ❑ Cable/Braid length
- ❑ Application Type
- ❑ Operating Temperature

Tempco Offers Innovative Cartridge Heater Terminations Focused on Providing Maximum Performance Under a Diverse Segment of Demanding Applications

Cartridge Heater Terminations Can be Elusive to Define and Are Often Overlooked

To ensure maximum efficiency and reliable cartridge heater service, evaluate your existing operating conditions and proceed to select the best suited termination(s) for your application.

Failure to evaluate the operating conditions and the environment of a cartridge heater application and/or improper termination selection will compromise the operating reliability and functional life of the cartridge heater, resulting in costly machine downtime and loss of revenue due to lack of productivity.

The synergy between the cartridge heater termination and the application will result in reduced operating cost, increased productivity, optimized performance and improved customer satisfaction.

Take Advantage of Tempco's Innovative Cartridge Heater Terminations.

We offer a selection of over 40 standard terminations specifically designed to address the operating requirements of a multitude of diverse applications requiring protection against the following conditions:

- ***Abrasion***
- ***Contamination***
- ***Flexing***
- ***Moisture Resistance***
- ***High Temperatures***

In addition, there are many cartridge heater adaptations to facilitate their use:

- ***Double-End Powerleads***
- ***Mounting Flanges***
- ***Locating Ring or Bushings***
- ***Pull Straps***
- ***NPT or Bulkhead Fittings***
- ***Built-In Thermocouples & Thermostats***
- ***Electrical Boxes***

Refer to pages 2-39 through 2-60 for complete specifications and details on all available terminations and options.

A Wise Man Once Said . . .
"A Cartridge Heater is Only As Good as the Termination that Powers It."

Standard Termination — HDC and HDM Hi-Density Cartridge Heaters

Available through the Hi-Density Cartridge Heater Terminator Program for Same or Next Day Shipping

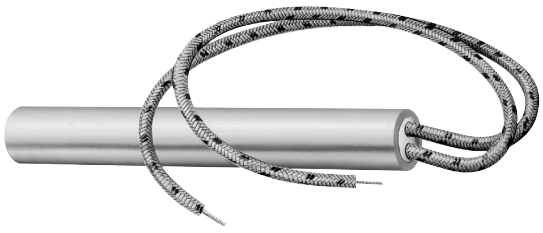
Type N External Pins with Leads

Available on HDC and HDM cartridge heaters

Flexible stranded lead wires have fiberglass insulation and are connected to 1-1/4" (32 mm) long solid conductors. Silicone rubber coated fiberglass sleeving insulates the pin/lead wire connection.

- Nominal 3/8" unheated section at the lead end is required.
- Standard lead wire temperature rating: 482°F (250°C)
- Silicone rubber coated fiberglass sleeving temperature rating: 392°F (200°C)
- **Standard** 10" (254 mm) leads. Specify longer leads.

Standard Termination — LDC Low-Density Cartridge Heaters



Type F Internally Connected Flexible Leads

Available on HDC, HDM and LDC Cartridge Heaters

The fiberglass lead wires are internally connected to the terminal pins. This lead termination provides flexibility, permitting the lead wires to be sharply bent as they exit the heater.

- Minimum 3/8" up to 1" unheated section at the lead end is required.
- Standard lead wire temperature rating for HDC and HDM cartridge heaters is 842°F (450°C)
- Standard lead wire temperature rating for LDC cartridge heaters is 482°F (250°C)
- **Standard** 10" (254 mm) leads. Specify longer leads. For HDC & HDM heaters, leads longer than 60" require a splice.

Note: The standard termination for Tempco's line of Miniature Hi-Density Cartridge Heaters is Type M3 - Teflon® End Plug Seal. See pages 2-10 and 2-11 for complete Minature Cartridge heater details.

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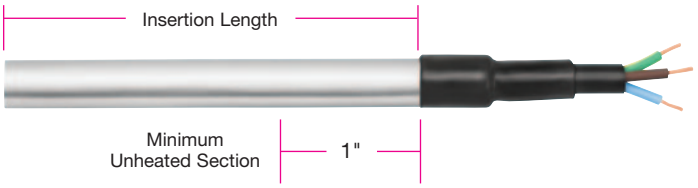
Cartridge Heater — Moisture Resistant Terminations



Type M1 Polyolefin Liquid Barrier

Available on HDC, HDM, and LDC cartridge heaters

A liquid barrier used for low temperature applications primarily in refrigeration or food service applications. The seal bonds to both the heater and the leads.

- Minimum 1" unheated section at the lead end is required.
- Three conductor SJO type cord.
- Available only in certain diameters. Heaters smaller than 1/2" diameter require an adapter.
- **Standard** 10" (254 mm) leads. Specify longer leads.

Type M2 ☐ Potted End Seal

Available on HDC, HDM and LDC cartridge heaters

Potted end seals help to protect the heater from moisture or contamination from plastic material, cleaning solvents, or oils. The bottom end disc seal is welded in.

M2A Cement potting with silicone varnish. Fiberglass lead wires externally connected.
- Cement potting temperature rating: 1000°F (538°C)
- Standard lead wire temperature rating: 482°F (250°C)

M2B Silicone rubber potting. Silicone rubber lead wires internally connected.
- Silicone rubber potting temperature rating: 392°F (200°C)
- Standard lead wire temperature rating: 392°F (200°C)

M2C High temperature epoxy potting. Teflon® lead wires internally connected.
- High temp. epoxy potting temp. rating: 450°F (232°C)
- Standard lead wire temperature rating: 392°F (200°C)

M2D Low temperature epoxy potting. Teflon® lead wires internally connected.
- Low temp. epoxy potting temp. rating: 266°F (130°C), UL rated to 194°F (90°C)
- Standard lead wire temperature rating: 392°F (200°C)

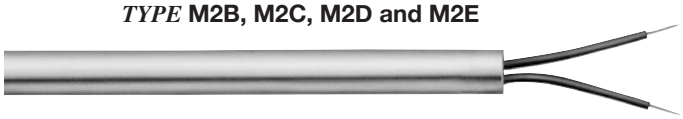
M2E Cement potting with silicone varnish. Fiberglass lead wires internally connected.
- Cement potting temperature rating: 1000°F (538°C)
- Standard lead wire temperature rating: 482°F (250°C)

- Minimum of 3/8" up to 1" unheated section at the lead end is required.
- **Standard** 10" (254 mm) leads. Specify longer leads.

***TYPE* M2A**

M2A and M2E are available through the Hi-Density Cartridge Heater Terminator Program for 2nd or 3rd Day Shipping

***TYPE* M2B, M2C, M2D and M2E**



Note: Type M3 is the Standard Termination for Tempco's Miniature Hi-Density Cartridge Heaters. See pages 2-10 and 2-11 for complete details.

Type M3 Teflon® End Plug Seal

Available on HDC and HDM cartridge heaters

A moisture resistant Teflon® seal that is swaged in during the manufacturing process with Teflon® insulated lead wire.

- Minimum 3/8" up to 1" unheated section at the lead end is required.
- Teflon® seal temperature rating: 392°F (200°C)
- Standard lead wire temperature rating: 392°F (200°C)
- **Standard** 10" (254 mm) leads. Specify longer leads. Leads longer than 60" require a splice.

View Product Inventory @ www.tempco.com

Cartridge Heater — Moisture Resistant Terminations

Type SA Sealed Corrugated Armor Cable

Available on 1/2" Diameter and Larger HDC, HDM and LDC cartridge heaters

A liquid-proof stainless steel corrugated metal hose is silver brazed to the end of the cartridge heater. The end disc of the heater is also welded or brazed. This termination provides a positive seal against moisture and contamination entering the heater.

- Minimum 3/8" up to 1" unheated section at the lead end is required.
- Standard fiberglass lead wire temperature rating HDC and HDM: 842°F (450°C), LDC: 482°F (250°C)
- **Standard** 10" (254 mm) cable over 12" (305 mm) leads. Specify longer leads or cable.

Cartridge Heater — Flexible Spring Abrasion Resistant Terminations

Type S1 ☐ Flexible Spring

Available on HDC, HDM, and LDC cartridge heaters.

The leads are reinforced with a steel spring for applications with extreme flexing. The spring is mechanically fastened or silver brazed.

S1A Mechanically fastened spring.

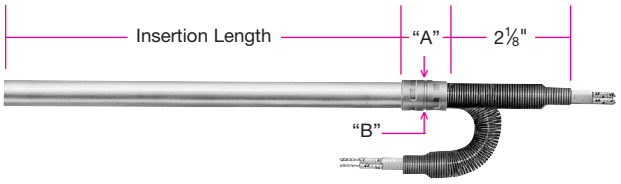
S1B Silver brazed spring.

- Minimum 3/8" up to 1" unheated section at the lead end is required.
- Standard fiberglass lead wire temperature rating HDC and HDM: 842°F (450°C), LDC: 482°F (250°C)
- **Standard** 10" (254 mm) leads. Specify longer leads.

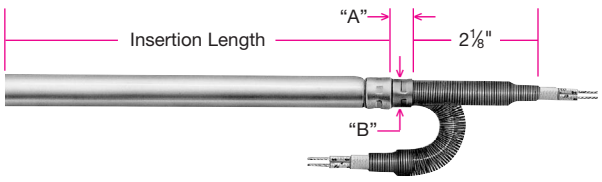
Dimensions for Type S1

	Diameter in	Diameter mm	Fig.	"A" Dim. in	"A" Dim. mm	"B" Dim. in	"B" Dim. mm
Hi-Density Cartridge Heaters	1/4	6.35	1	11/16	17.46	5/16	7.94
	5/16	7.94	1	11/16	17.46	7/16	11.11
	3/8	9.53	1	11/16	17.46	7/16	11.11
	1/2	12.70	1	13/16	20.64	9/16	14.29
	5/8	15.88	1	1	25.40	3/4	19.05
	3/4	19.05	1	1-1/4	31.75	7/8	22.23
	1	25.40	2	5/8	15.88	5/8	15.88
Low-Density Cartridge Heaters	3/16	4.76	—	—	—	—	—
	1/4	6.35	1	11/16	17.46	5/16	7.94
	3/8	9.53	1	11/16	17.46	7/16	11.11
	1/2	12.70	1	13/16	20.64	9/16	14.29
	5/8	15.88	2	7/16	11.11	9/16	14.29
	3/4	19.05	2	1/2	12.70	9/16	14.29
	7/8	22.23	2	5/8	15.88	9/16	14.29
	15/16	22.81	2	5/8	15.88	5/8	15.88
	1	25.40	2	5/8	15.88	5/8	15.88
	1-1/4	31.75	2	5/8	15.88	5/8	15.88

TYPE **S1** Fig. 1



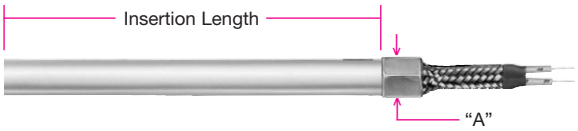
TYPE **S1** Fig. 2



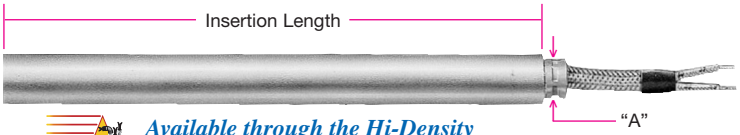
Made in USA

Cartridge Heater — Flexible Braid Abrasion Resistant Terminations

***TYPE* W** Fig. 1



***TYPE* W** Fig. 2



Available through the Hi-Density Cartridge Heater Terminator Program for 2nd or 3rd Day Shipping

Type W Wire Braided Leads

Available on HDC, HDM, and LDC cartridge heaters

Stainless steel braid over fiberglass leads offers sharp bending not possible with armor cable, as well as abrasion protection.

- Minimum 3/8" up to 1" unheated section at the lead end is required.
- Standard lead wire temperature rating HDC and HDM: 842°F (450°C), LDC: 482°F (250°C)
- **Standard** 10" (254 mm) braid over 12" (305 mm) leads. Specify longer braid/leads.

Diameter in	Diameter mm	Fig.	"A" Dim./HD in	"A" Dim./HD mm	"A" Dim./LD in	"A" Dim./LD mm
3/16	4.76	1	—	—	1/4	6.35
1/4	6.35	1	5/16	7.94	5/16	7.94
5/16	7.94	1	3/8	9.53	—	—
3/8	9.53	2	3/8	9.53	3/8	9.53
1/2	12.70	2	7/16	11.11	7/16	11.11
5/8	15.88	2	9/16	14.29	9/16	14.29
3/4	19.05	2	9/16	14.29	9/16	14.29
7/8	22.23	2	—	—	9/16	14.29
15/16	23.81	2	—	—	9/16	14.29
1	25.40	2	9/16	14.29	9/16	14.29
1-1/4	31.75	2	—	—	9/16	14.29

Type W3 Swaged-In Wire Braided Leads

Available on HDC and HDM cartridge heaters

Stainless steel braid over fiberglass leads offers sharp bending not possible with armor cable, as well as abrasion protection. In addition, Type W3 offers contamination resistance due to the Teflon® seal required for holding the wire braid.

- Minimum 3/8" up to 1" unheated section at the lead end is required.
- Teflon® Seal temperature rating: 392°F (200°C)
- Standard lead wire temperature rating: 842°F (450°C)
- **Standard** 10" (254 mm) braid over 12" (305 mm) leads. Specify longer braid/leads.

Cartridge Heater — Armor Cable Abrasion Resistant Terminations

Type CS ☐ Straight Armor Cable Directly Attached to Sheath

Available on HDC, HDM, and LDC cartridge heaters

The armor cable is directly attached to the cartridge heater, eliminating the coupling, to maintain an overall diameter equal to or smaller than the cartridge diameter.

CSA Galvanized armor cable – minimum diameter: 5/16"

CSB Stainless steel armor cable – minimum diameter: 5/16"

- Minimum 3/8" up to 1" unheated section at the lead end is required.
- Heaters with an OD of 3/4" or larger require reducing diameter washer
- Standard fiberglass lead wire temperature rating HDC and HDM: 842°F (450°C), LDC: 482°F (250°C)
- **Standard** 10" (254 mm) cable over 12" (305 mm) leads. Specify longer leads or cable.

Type C1 ☐ Straight Armor Cable with Coupling

Available on HDC, HDM, or LDC cartridge heaters

Armor cable provides the maximum in protection for abrasive, jagged environments. The coupling between the cartridge and the armor cable is mechanically fastened or silver brazed.

C1A Galvanized armor cable, mechanically fastened

C1B Stainless steel armor cable, mechanically fastened

- Standard fiberglass lead wire temperature rating 482°F (250°C)

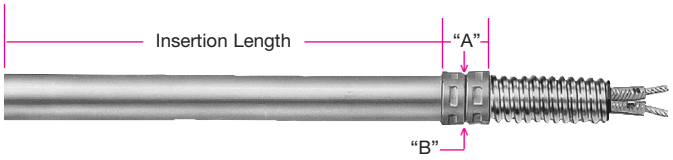
C1C Galvanized armor cable, silver brazed

C1D Stainless steel armor cable, silver brazed

- Standard fiberglass lead wire temperature rating HDC and HDM: 842°F (450°C), LDC: 482°F (250°C)

- Minimum 3/8" up to 1" unheated section at the lead end is required.
- **Standard** 10" (254 mm) cable over 12" (305 mm) leads. Specify longer leads or cable.

***TYPE* C1** Fig. 1

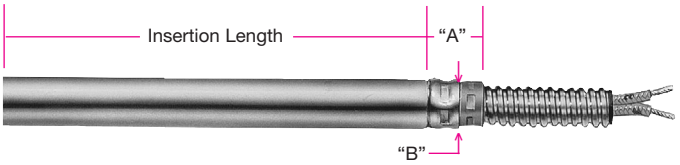


C1A and C1B are available through the Hi-Density Cartridge Heater Terminator Program for Same or Next Day Shipping

Dimensions for Type C1

	Diameter in	Diameter mm	Fig.	"A" Dim. in	"A" Dim. mm	"B" Dim. in	"B" Dim. mm	Cable Dia.
Hi-Density Cartridge Heaters	1/4	6.35	1	11/16	17.46	5/16	7.94	1/4
	5/16	7.94	1	11/16	17.46	7/16	11.11	1/4
	3/8	9.53	1	11/16	17.46	7/16	11.11	3/8
	1/2	12.70	1	13/16	20.64	9/16	14.29	1/2
	5/8	15.88	1	1	25.40	3/4	19.05	1/2
	3/4	19.05	1	1-1/4	31.75	7/8	22.23	1/2
	1	25.40	2	5/8	15.88	5/8	15.88	1/2
Low-Density Cartridge Heaters	3/16	4.76	—	—	—	—	—	—
	1/4	6.35	1	11/16	17.46	5/16	7.94	1/4
	3/8	9.53	1	11/16	17.46	7/16	11.11	3/8
	1/2	12.70	1	13/16	20.64	9/16	14.29	1/2
	5/8	15.88	2	7/16	11.11	9/16	14.29	1/2
	3/4	19.05	2	1/2	12.70	9/16	14.29	1/2
	7/8	22.23	2	5/8	15.88	9/16	14.29	1/2
	15/16	23.81	2	5/8	15.88	5/8	15.88	1/2
	1	25.40	2	5/8	15.88	5/8	15.88	1/2

***TYPE* C1** Fig. 2



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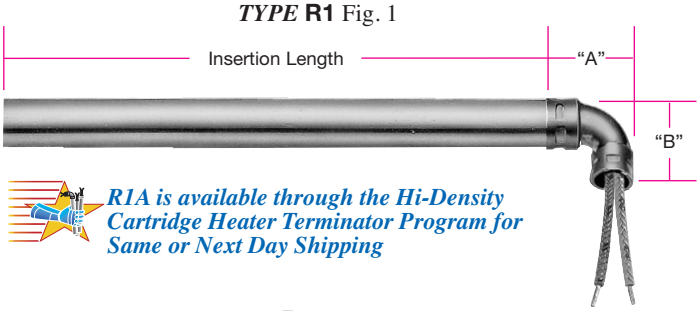
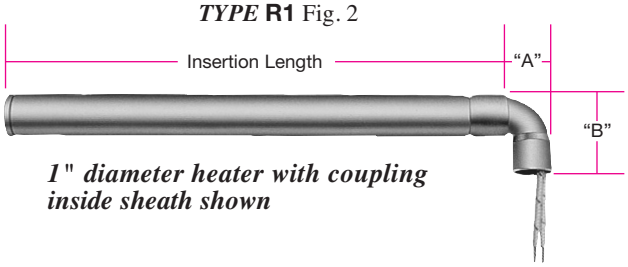
Cartridge Heater — Plain Leads Right-Angle Terminations

TYPE **R1** Fig. 1



R1A is available through the Hi-Density Cartridge Heater Terminator Program for Same or Next Day Shipping

TYPE **R1** Fig. 2



1" diameter heater with coupling inside sheath shown

Dimensions for Type R1

	Diameter in	Diameter mm	Fig.	"A" Dim. in	"A" Dim. mm	"B" Dim. in	"B" Dim. mm
Hi-Density Cartridge Heater	1/4	6.35	1	3/4	19.05	3/4	19.05
	5/16	7.94	1	15/16	23.81	15/16	23.81
	3/8	9.53	1	15/16	23.81	15/16	23.81
	1/2	12.70	1	1-1/4	31.75	1-1/4	31.75
	5/8	15.88	1	1-1/4	31.75	1-1/4	31.75
	3/4	19.05	1	1-3/4	44.45	1-1/4	31.75
	1	25.40	2	1-1/8	28.58	1-3/8	34.93

Type R1 ☐ Right-Angle Leads with Copper Elbow

Available on HDC, HDM, and LDC cartridge heaters

This termination is used when space is limited. The copper elbow is mechanically fastened or silver brazed.

R1A Mechanically fastened

R1B Silver brazed

- Minimum 3/8" up to 1" unheated section at the lead end is required.
- Standard fiberglass lead wire temperature rating HDC and HDM: 842°F (450°C), LDC: 482°F (250°C)
- **Standard** 10" (254 mm) leads. Specify longer leads.

Dimensions for Type R1

	Diameter in	Diameter mm	Fig.	"A" Dim. in	"A" Dim. mm	"B" Dim. in	"B" Dim. mm
Low Density Cartridge Heater	3/16	4.76	—	—	—	—	—
	1/4	6.35	1	3/4	19.05	3/4	19.05
	3/8	9.53	1	15/16	23.81	15/16	23.81
	1/2	12.70	1	1-1/4	31.75	1-1/4	31.75
	5/8	15.88	2	11/16	17.46	1-1/4	31.75
	3/4	19.05	2	3/4	19.05	1-1/4	31.75
	7/8	22.23	2	3/4	19.05	1-3/8	34.93
	15/16	23.81	2	1-1/8	28.58	1-3/8	34.93
	1	25.40	2	1-1/8	28.58	1-3/8	34.93
	1-1/4	31.75	2	1-1/8	28.58	1-3/8	34.93

R2A and R2B are available through the Hi-Density Cartridge Heater Terminator Program for 2nd or 3rd Day Shipping

Type R2 ☐ Right-Angle Leads

Available on HDC, HDM, and LDC cartridge heaters

This termination is used when space is limited. Not suitable for abrasive environments. The plain leads are internally connected and offer flexibility. Various lead end finishes are available as listed below:

R2A Cement potting, no lead end disc
- Cement potting temperature rating: 1000°F (538°C)
- Standard fiberglass lead wire temperature rating: 482°F (250°C)

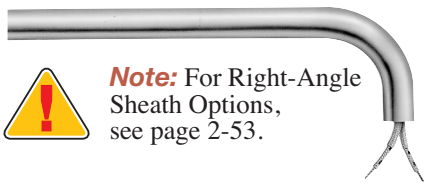
R2B Cement potting, welded lead end disc
- Cement potting temperature rating: 1000°F (538°C)
- Standard fiberglass lead wire temperature rating: 482°F (250°C)

R2C Silicone rubber potting, welded lead end disc
- Silicone Rubber potting temperature rating: 392°F (200°C)
- Standard silicone rubber lead wire temperature rating: 392°F (200°C)

R2D High temperature epoxy potting, welded lead end disc
- High Temperature epoxy potting temperature rating: 450°F (232°C)
- Standard Teflon® lead wire temperature rating: 392°F (200°C)

R2E Low temperature epoxy potting, welded lead end disc
- Low Temperature epoxy potting temperature rating: 266°F (130°C)
- Standard Teflon® lead wire temperature rating: 392°F (200°C)

- Minimum 3/8" up to 1" unheated section at the lead end is required.
- **Standard** 10" (254 mm) leads. Specify other lead lengths.



Note: For Right-Angle Sheath Options, see page 2-53.

CONTINUED

Cartridge Heater — Plain Leads Right-Angle Terminations

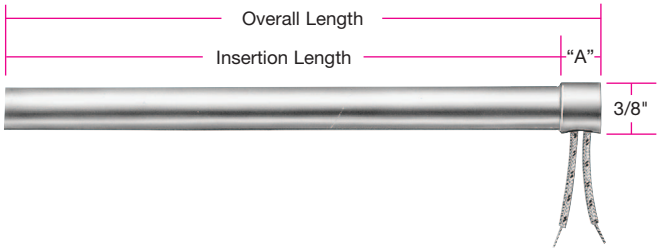
Continued from previous page…

Type R2 ☐ Right-Angle Leads

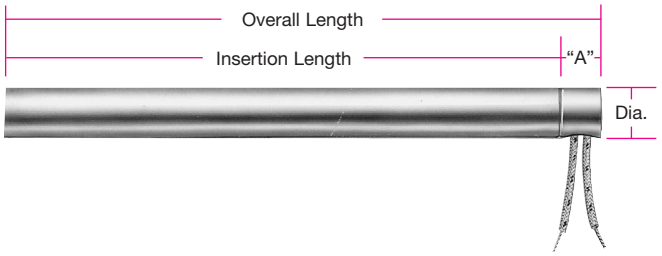
Dimensions for Type R2

	Diameter in	Diameter mm	Fig.	"A" Dim. in	"A" Dim. mm
Hi-Density Cartridge Heaters	1/4	6.35	1	7/16	11.11
	5/16	7.94	1	7/16	11.11
	3/8	9.53	2	7/16	11.11
	1/2	12.70	2	9/16	14.29
	5/8	15.88	2	9/16	14.29
	3/4	19.05	2	9/16	14.29
	1	25.40	2	5/8	15.88
Low-Density Cartridge Heaters	1/4	6.35	1	7/16	11.11
	3/8	9.53	2	7/16	11.11
	1/2	12.70	2	9/16	14.29
	5/8	15.88	2	9/16	14.29
	3/4	19.05	2	9/16	14.29
	7/8	22.23	2	5/8	15.88
	15/16	23.81	2	5/8	15.88
	1	25.40	2	5/8	15.88
	1-1/4	31.75	2	5/8	15.88

TYPE **R2** Fig. 1



TYPE **R2** Fig. 2



Cartridge Heater — Flexible Spring Abrasion Resistant Right-Angle Terminations

Type S2 ☐ Right-Angle Spring

Available on HDC, HDM, and LDC cartridge heaters

The leads are reinforced with a steel spring for applications with extreme flexing. The spring is mechanically fastened or silver brazed.

S2A Mechanically fastened spring

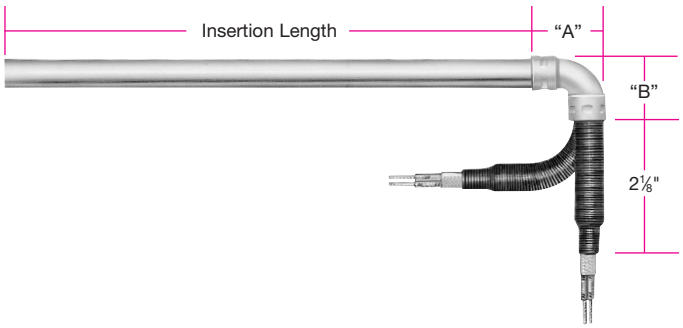
S2B Silver brazed spring

- Minimum 3/8" up to 1" unheated section at the lead end is required.
- Standard fiberglass lead wire temperature rating HDC and HDM: 842°F (450°C), LDC: 482°F (250°C)
- **Standard** 10" (254 mm) leads. Specify longer leads.

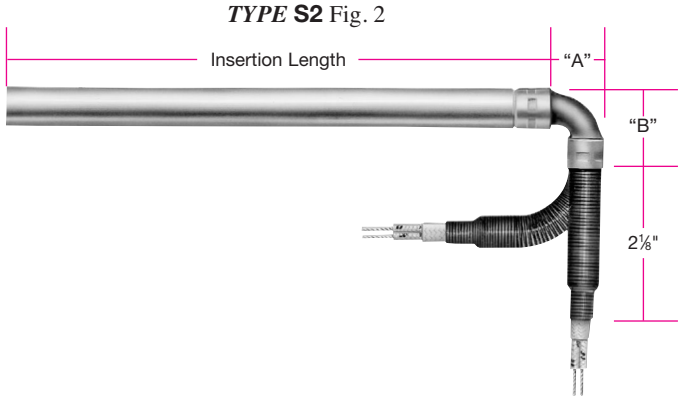
Dimensions for Type S2

	Diameter in	Diameter mm	Fig.	"A" Dim. in	"A" Dim. mm	"B" Dim. in	"B" Dim. mm
Hi-Density Cartridge Heaters	1/4	6.35	1	3/4	19.05	3/4	19.05
	5/16	7.94	1	15/16	23.81	15/16	23.81
	3/8	9.53	1	15/16	23.81	15/16	23.81
	1/2	12.70	1	1-1/4	31.75	1-1/4	31.75
	5/8	15.88	1	1-1/4	31.75	1-1/4	31.75
	3/4	19.05	1	1-3/4	44.45	1-1/4	31.75
	1	25.40	2	1-1/8	28.58	1-3/8	34.93
Low-Density Cartridge Heaters	3/16	4.76	—	—	—	—	—
	1/4	6.35	1	3/4	19.05	3/4	19.05
	3/8	9.53	1	15/16	23.81	15/16	23.81
	1/2	12.70	1	1-1/4	31.75	1-1/4	31.75
	5/8	15.88	2	11/16	17.46	1-1/4	31.75
	3/4	19.05	2	3/4	19.05	1-1/4	31.75
	7/8	22.23	2	3/4	19.05	1-3/8	34.93
	15/16	23.81	2	1-1/8	28.58	1-3/8	34.93
	1	25.40	2	1-1/8	28.58	1-3/8	34.93
	1-1/4	31.75	2	1-1/8	28.58	1-3/8	34.93

TYPE **S2** Fig. 1



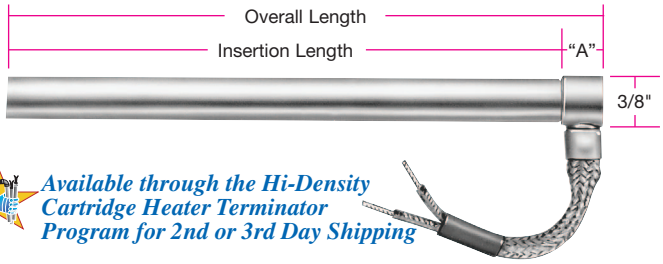
TYPE **S2** Fig. 2



Made in USA

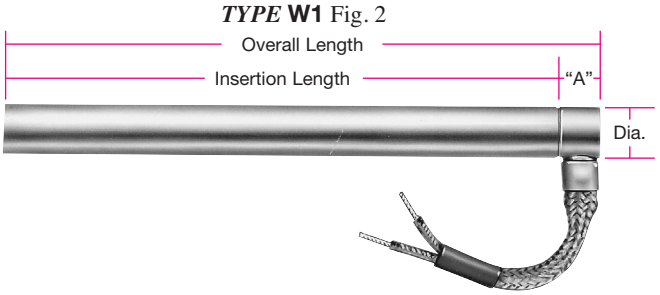
Cartridge Heater — Flexible Braid Abrasion Resistant Right-Angle Terminations

TYPE **W1** Fig. 1



Available through the Hi-Density Cartridge Heater Terminator Program for 2nd or 3rd Day Shipping

TYPE **W1** Fig. 2



Type W1 ☐ Right-Angle Wire Braided Leads

Available on HDC, HDM, and LDC cartridge heaters

Stainless steel braid over fiberglass leads for abrasion protection, mechanically crimped to the cartridge sheath at 90°. Wire braid offers extreme flexibility not possible with armor cable. Various lead end finishes are available as listed below.

W1A Cement potting and silicone varnish, no lead end disc.
- ➤ Cement potting temperature rating: 1000°F (538°C)
- ➤ Standard lead wire temperature rating: 482°F (250°C)

W1B Welded lead end disc.
- ➤ Cement potting temperature rating: 1000°F (538°C)
- ➤ Standard lead wire temperature rating: 482°F (250°C)

➤ Minimum 3/8" up to 1" unheated section at the lead end is required.

➤ **Standard** 10" (254 mm) braid over 12" (305 mm) leads. Specify longer braid or leads.

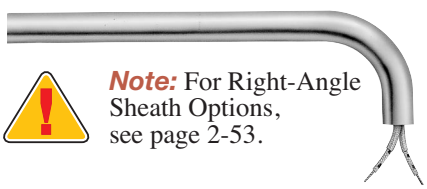
Dimensions for Type W1

	Diameter in	Diameter mm	Fig.	"A" Dim. in	"A" Dim. mm
Hi-Density Cartridge Heaters	1/4	6.35	1	7/16	11.11
	5/16	7.94	1	7/16	11.11
	3/8	9.53	2	7/16	11.11
	1/2	12.70	2	9/16	14.29
	5/8	15.88	2	9/16	14.29
	3/4	19.05	2	9/16	14.29
	1	25.40	2	5/8	15.88

Dimensions for Type W1

	Diameter in	Diameter mm	Fig.	"A" Dim. in	"A" Dim. mm
Low-Density Cartridge Heaters	1/4	6.35	1	7/16	11.11
	3/8	9.53	2	7/16	11.11
	1/2	12.70	2	9/16	14.29
	5/8	15.88	2	9/16	14.29
	3/4	19.05	2	9/16	14.29
	7/8	22.23	2	5/8	15.88
	15/16	23.81	2	5/8	15.88
	1	25.40	2	5/8	15.88
	1-1/4	31.75	2	5/8	15.88

Cartridge Heater — Armor Cable Abrasion Resistant Right-Angle Terminations



Note: For Right-Angle Sheath Options, see page 2-53.

Type C2 ☐ Right-Angle Armor Cable with Copper Elbow

Available on HDC, HDM, and LDC cartridge heaters

Armor cable provides the maximum in protection for abrasive, jagged environments. The copper elbow between the cartridge and the armor cable is mechanically fastened or silver brazed.

C2A Galvanized armor cable, mechanically fastened

C2B Stainless steel armor cable, mechanically fastened

C2C Galvanized armor cable, silver brazed

C2D Stainless steel armor cable, silver brazed

➤ Minimum 3/8" up to 1" unheated section at the lead end is required.

➤ Standard fiberglass lead wire temperature rating HDC and HDM: 842°F (450°C), LDC: 482°F (250°C)

➤ **Standard** 10" (254 mm) cable over 12" (305 mm) leads. Specify longer cable or leads.

CONTINUED

Cartridge Heater — Armor Cable Abrasion Resistant Right-Angle Terminations

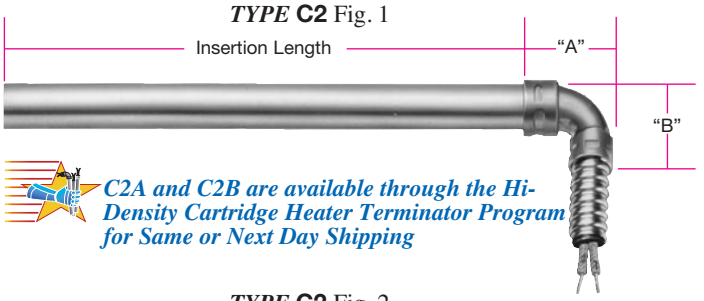
Continued from previous page…

Type C2 ☐ Right-Angle Armor Cable with Copper Elbow

Dimensions for Type C2

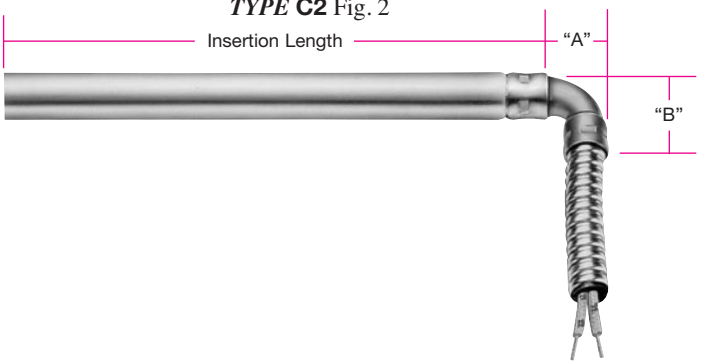
	Diameter in	Diameter mm	Fig.	"A" Dim. in	"A" Dim. mm	"B" Dim. in	"B" Dim. mm	Cable Dia.
Hi-Density Cartridge Heaters	1/4	6.35	1	3/4	19.05	3/4	19.05	1/4
	5/16	7.94	1	15/16	23.81	15/16	23.81	1/4
	3/8	9.53	1	15/16	23.81	15/16	23.81	3/8
	1/2	12.70	1	1-1/4	31.75	1-1/4	31.75	1/2
	5/8	15.88	1	1-1/4	31.75	1-1/4	31.75	1/2
	3/4	19.05	1	1-3/4	44.45	1-1/4	31.75	1/2
	1	25.40	2	1-1/8	28.58	1-3/8	34.93	1/2
Low-Density Cartridge Heaters	1/4	6.35	1	3/4	19.05	3/4	19.05	1/4
	3/8	9.53	1	15/16	23.81	15/16	23.81	3/8
	1/2	12.70	1	1-1/4	31.75	1-1/4	31.75	1/2
	5/8	15.88	2	11/16	17.46	1-1/4	31.75	1/2
	3/4	19.05	2	3/4	19.05	1-1/4	31.75	1/2
	7/8	22.23	2	3/4	19.05	1-3/8	34.93	1/2
	15/16	23.81	2	1-1/8	28.58	1-3/8	34.93	1/2
	1	25.40	2	1-1/8	28.58	1-3/8	34.93	1/2
	1-1/4	31.75	2	1-1/8	28.58	1-3/8	34.93	1/2

TYPE **C2** Fig. 1



C2A and C2B are available through the Hi-Density Cartridge Heater Terminator Program for Same or Next Day Shipping

TYPE **C2** Fig. 2



Type C3 ☐ Right-Angle Armor Cable

Available on HDC, HDM, and LDC cartridge heaters

Use this termination when space is limited and maximum protection is required. The armor cable is tack welded or silver brazed to the cartridge sheath at 90°. The sheath extension is potted with cement. Various lead end finishes are available as listed below.

C3A Cement potting and silicone varnish with no lead end disc, galvanized cable

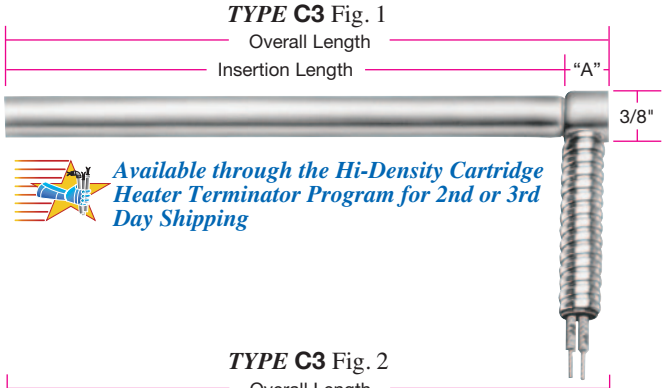
C3B Cement potting and silicone varnish with no lead end disc, stainless steel cable

C3C Welded lead end disc, with galvanized cable

C3D Welded lead end disc, with stainless steel cable

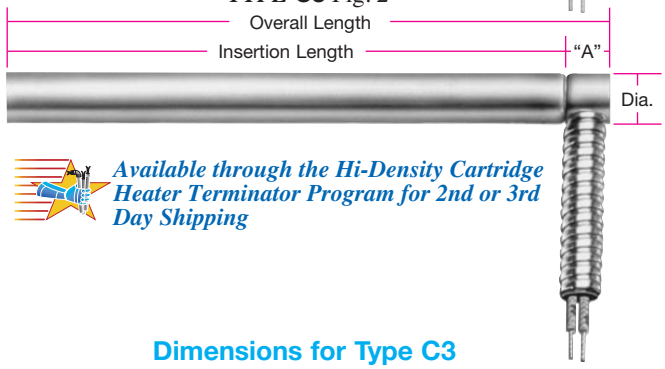
- Minimum 3/8" up to 1" unheated section at the lead end is required.
- Cement potting temperature rating: 1000°F (538°C)
  Standard fiberglass lead wire temperature rating: 482°F (250°C)
- **Standard** 10" (254 mm) armor cable over 12" (305 mm) leads. Specify longer cable or leads.

TYPE **C3** Fig. 1



Available through the Hi-Density Cartridge Heater Terminator Program for 2nd or 3rd Day Shipping

TYPE **C3** Fig. 2



Available through the Hi-Density Cartridge Heater Terminator Program for 2nd or 3rd Day Shipping

Dimensions for Type C3

	Diameter in	Diameter mm	Fig.	"A" Dim. in	"A" Dim. mm	Armor Cable in	Armor Cable mm
Hi-Density Cartridge Heaters	1/4	6.35	1	7/16	11.11	1/4	6.35
	5/16	7.94	1	7/16	11.11	1/4	6.35
	3/8	9.53	2	7/16	11.11	3/8	9.53
	1/2	12.70	2	9/16	14.29	3/8	9.53
	5/8	15.88	2	9/16	14.29	1/2	12.70
	3/4	19.05	2	9/16	14.29	1/2	12.70
	1	25.40	2	5/8	15.88	1/2	12.70

Dimensions for Type C3

	Diameter in	Diameter mm	Fig.	"A" Dim. in	"A" Dim. mm	Armor Cable in	Armor Cable mm
Low-Density Cartridge Heaters	1/4	6.35	1	7/16	11.11	1/4	6.35
	3/8	9.53	2	7/16	11.11	3/8	9.53
	1/2	12.70	2	9/16	14.29	3/8	9.53
	5/8	15.88	2	9/16	14.29	1/2	12.70
	3/4	19.05	2	9/16	14.29	1/2	12.70
	7/8	22.23	2	5/8	15.88	1/2	12.70
	1	25.40	2	5/8	15.88	1/2	12.70
	1-1/4	31.75	2	5/8	15.88	1/2	12.70

Cartridge Heater — Screw Terminations

Type T1 Screw Terminals

Available on LDC type cartridge heaters only

For use with leads, crimp terminals, or bus bars. Includes washers and nuts.

- Minimum 1/2" unheated section at the lead end is required.
- Diameters available: 3/4", 7/8", 15/16", 1", and 1-1/4".
- **Standard:** screw #6-32 × 3/4" long

Diameter	in	3/4	7/8	15/16	1	1-1/4
	mm	19.05	22.23	23.81	25.40	31.75
"A" Dimension	in	3/8	7/16	7/16	1/2	1/2
	mm	9.53	11.11	11.11	12.70	12.70

Type T2 Screw Terminals

Available on HDC and HDM type cartridge heaters only

For use with leads, crimp terminals, or bus bars. Includes washers and nuts.

- Minimum 1/2" unheated section at the lead end is required.
- Diameters available: HD — 5/8", 3/4", 1"
  HDM — 16 mm and 20 mm
- **Standard:** screw #8-32

Cartridge Heater — High Temperature Termination

Available through the Hi-Density Cartridge Heater Terminator Program for Same or Next Day Shipping

Type B Heat Resistant Ceramic Bead Insulation

Available on HDC, HDM, and LDC cartridge heaters.

The ultimate in high temperature lead protection. Allows for the attachment of flexible leads to the heater away from the high heat area. Used when the ambient temperature exceeds 842°F (450°C).

- **Standard** 10" (254 mm) solid nickel pins insulated with ball and socket construction type ceramic beads

Available through the Hi-Density Cartridge Heater Terminator Program for Same or Next Day Shipping

Type BL Heat Resistant Ceramic Bead Insulation with Leads

Available on HDC, HDM, and LDC cartridge heaters.

High temperature flexible leads are connected away from the high heat area.

- **Standard** 6" (254 mm) solid nickel pins insulated with ball and socket construction type ceramic beads and 10" (254 mm) fiberglass leads rated at 842°F (450°C). Specify longer leads.

Cartridge Heater — Double End Terminations

Type T4 ☐ Double End Terminal Pin

Available on HDC, HDM, and LDC cartridge heaters

For those applications in which wiring from both ends is an advantage. Various seals are available:

T4A Cement potting seal with silicone varnish
- ➤ Cement potting temperature rating: 1000°F (538°C)

T4B High temp. moisture resistant epoxy seal
- ➤ High temp. epoxy temp. rating: 450°F (232°C)

T4C Low temp. moisture resistant epoxy seal
- ➤ Low temp. epoxy temp. rating: 266°F (130°C)

➤ Minimum 1" unheated section at each end is required.

➤ **Standard** terminal pin length is 2".

Type F1 ☐ Double End Flexible Leads

Available on HDC, HDM, and LDC cartridge heaters

For applications in which it is an advantage to wire from both ends. The leads are internally connected and can be bent sharply as they exit the potted ends. Various seals are available:

F1A Fiberglass leads with cement potting seal and silicone varnish
- ➤ Cement potting temperature rating: 1000°F (532°C)
- ➤ Standard lead wire temperature rating: 482°F (250°C)

F1B Teflon® leads with high temp. moisture resistant epoxy seal
- ➤ High temp. epoxy temperature rating: 450°F (232°C)
- ➤ Standard lead wire temperature rating: 392°F (200°C)

F1C Teflon® leads with low temp. moisture resistant epoxy seal
- ➤ Low temp. epoxy temperature rating: 266°F (130°C)
- ➤ Standard lead wire temperature rating: 392°F (200°C)

➤ Minimum 1" unheated section at each end is required.

➤ **Standard** 10" leads. Specify longer leads. Leads longer than 60" require a splice.

Type T3 Double End Screw Terminals

Available on HDC, HDM, and LDC cartridge heaters from 1/2" to 1-1/4" diameter

A double ended heater with quick change wiring screw terminals. Includes zinc plated washers and nuts.

➤ Minimum 1/2" unheated section at each end is required.

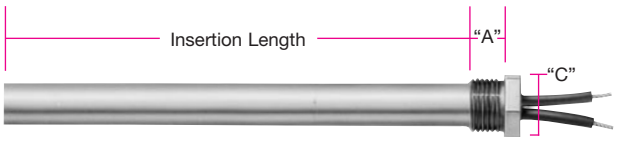
Standard screw sizes:

➤ 1/2" diameter — #8-32 × 3/4" screws

➤ 5/8" to 1-1/4" diameter — #10-32 × 3/4" screws

Cartridge Heater Termination — Single Ended National Pipe Thread (NPT) Fitting

TYPE **CM** Fig. 1 – Fitting Flush with Lead End of Sheath



CMB & CMP are available through the Hi-Density Cartridge Heater Terminator Program for 2nd or 3rd Day Shipping

NOTE: Stainless steel fittings are available through the Terminator program for heaters 1/2" diameter and larger.

Note: Fitting can be offset from end of sheath. See Figure 2, Single Threaded Mounting Options CMV and CMW below.

Standard NPT Bushing Dimensions (Fig. 1 & Fig. 2)

Heater Diameter (in)	NPT Size	"A"	"B"	"C"
1/4	⅛-27	3/8	3/16	7/16
3/8	¼-18	1/2	3/16	9/16
1/2	⅜-18	9/16	1/4	11/16
5/8	½-14	5/8	1/4	7/8
3/4	¾-14	3/4	1/4	1-1/8
7/8	1-11½	3/4	1/4	1-3/8
1	1-11½	7/8	3/8	1-3/8
1-1/4	1¼-11½	15/16	3/8	1-3/4

Type CM ☐ Single Threaded Fitting Mounting Termination Fitting Flush with Lead End of Sheath

Available on HDC, HDM, and LDC cartridge heaters

A single threaded pipe fitting is attached to the end of a cartridge heater to allow for installation into a threaded hole. Brass fittings are silver brazed and stainless steel fittings are heli-arc welded. Available with the potting seals listed in the table.

Potted end seals help to protect the heater from moisture or contamination from plastic material, cleaning solvents, or oils. The bushing cavity can be sealed with various materials such as:

CMA/CMN **Low temperature epoxy potting** — 266°F (130°C), UL rated to 194°F (90°C)
Teflon® leads internally connected, rated 392°F (200°C).

CMB/CMP **Hi-temp cement potting with silicone varnish** — 1000°F (538°C)
Fiberglass leads internally connected, rated 482°F (250°C).

CMC/CMQ **Silicone rubber potting** — 392°F (200°C)
Silicone rubber leads internally connected, rated 392°F (200°C).

CMD/CMR **High temperature epoxy potting** — 450°F (232°C)
Teflon® leads internally connected, rated 392°F (200°C).

➤ A minimum of 1/4" unheated section below the bushing is required.

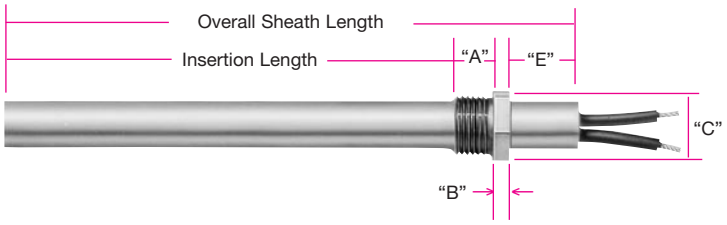
➤ **Standard** 10" (254 mm) leads. Specify longer leads.

Type Codes for Single Threaded Fittings

Potting Seal Type	Fitting Material: Brass	Fitting Material: Stainless Steel
Low Temp Epoxy	CMA	CMN
Hi-Temp Cement	CMB	CMP
Silicone Rubber	CMC	CMQ
Hi-Temp Epoxy	CMD	CMR

Single Ended National Pipe Thread (NPT) Fitting Option

TYPE **CM** Fig. 2 – Fitting Offset from Lead End of Sheath



Type CM ☐ Single Threaded Fitting Mounting Option Fitting Offset from Lead End of Sheath

Available on HDC, HDM, and LDC cartridge heaters

This mounting option available with many terminations attaches a fitting offset from the lead end of the sheath. This option is useful when the lead wires need to be kept away from the heated area. Brass fittings are silver brazed and stainless steel fittings are offset heli-arc welded.

CMV Brass Fitting

CMW Stainless Steel Fitting

➤ Specify offset dimension "E" when ordering.

➤ A termination must be specified separately.

Hi-Density Cartridge Immersion Heater Specifically Designed for Heating Water & Other Liquids

See Page 2-23.

Cartridge Heater — Double Ended National Pipe Thread (NPT)

Type CN ☐ Double Threaded Fitting Mounting Termination
Fitting Flush with Lead End of Sheath

Available on HDC, HDM, and LDC cartridge heaters

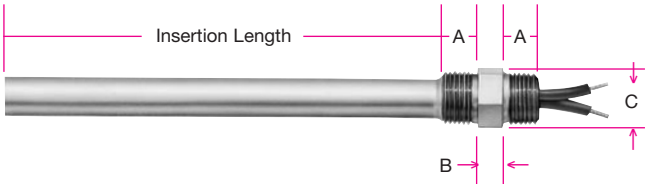
A double threaded pipe fitting is attached to the end of a cartridge heater to allow for installation into a threaded hole. Brass fittings are silver brazed and stainless steel fittings are heli-arc welded.

Standard NPT Bushing Dimensions

Heater Diameter (in)	NPT Size	"A"	"B"	"C"
1/4	⅛-27	3/8	1/4	7/16
3/8	¼-18	1/2	1/4	9/16
1/2	⅜-18	9/16	1/4	11/16
5/8	½-14	5/8	5/16	7/8
3/4	¾-14	3/4	3/8	1-1/8
7/8	1-11½	3/4	3/8	1-3/8
1	1-11½	7/8	3/8	1-3/8
1-1/4	1¼-11½	7/8	1/2	1-3/4

Type Codes for Double Threaded Fittings

Potting Seal Type	Fitting Material: Brass	Fitting Material: Stainless Steel
Low Temp Epoxy	CNA	CNN
Hi-Temp Cement	CNB	CNP
Silicone Rubber	CNC	CNQ



Potted end seals help to protect the heater from moisture or contamination from plastic material, cleaning solvents, or oils. The bushing cavity can be sealed with various materials such as:

CNA/CNN **Low temperature epoxy potting** — 266°F (130°C), UL rated to 194°F (90°C)
Teflon® leads internally connected, rated 392°F (200°C).

CNB/CNP **Hi-temp cement potting w/ silicone varnish** — 1000°F (538°C)
Fiberglass leads internally connected, rated 482°F (250°C).

CNC/CNQ **Silicone rubber potting** — 392°F (200°C)
Silicone rubber leads internally connected, rated 392°F (200°C).

CND/CNR **High temperature epoxy potting** — 450°F (232°C)
Teflon® leads internally connected, rated 392°F (200°C).

➤ A minimum of 1/4" unheated section below the bushing is required.

➤ **Standard** 10" (254 mm) leads. Specify longer leads.

Cartridge Heater Immersion Heater Top Hat Screw Plug Termination

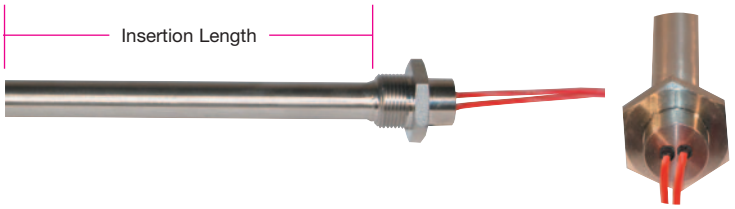
Type TH Top Hat Screw Plug

Available on HDC (except 1/8") and HDM cartridge heaters

This heater has a header cap as an integral part of the fitting. Leads exit through small holes which are sealed with epoxy for moisture protection.

Low temperature epoxy potting — 266°F (130°C), UL rated to 194°F (90°C)
Teflon® leads internally connected, rated 392°F (200°C).

➤ **Standard** 10" (254 mm) leads. Specify longer leads.



Cartridge Heater — Bulkhead Fitting Termination

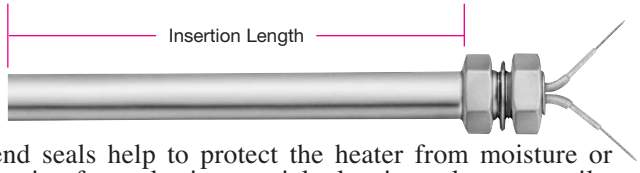
Type BF ☐ Bulkhead Fitting

Available on HDC and LDC 1/2" and 5/8" cartridge heaters

A 5/8-18 UNF fitting is attached to the end of the cartridge heater to allow for mounting the heater to the wall of a tank or enclosure. Brass fittings are silver brazed and stainless steel fittings are heli-arc welded. Includes a copper washer and jam nut. The lead wires are internally connected. Available with the potting seals listed in the table.

Type Codes for Bulkhead Fittings

Potting Seal Type	Fitting Material: Brass	Fitting Material: Stainless Steel
Low Temp Epoxy	BFA	BFJ
Silicone Rubber	BFB	BFK
Hi-Temp Epoxy	BFC	BFL



Potted end seals help to protect the heater from moisture or contamination from plastic material, cleaning solvents, or oils. The fitting cavity can be sealed with various materials such as:

BFA/BFJ **Low temperature epoxy potting** — 266°F (130°C), UL rated to 194°F (90°C)
Teflon® leads internally connected, rated 392°F (200°C).

BFB/BFK **Silicone rubber potting** — 450°F (232°C)
Silicone rubber leads internally connected, rated 392°F (200°C).

BFC/BFL **High temperature epoxy potting** — 450°F (232°C)
Teflon® leads internally connected, rated 392°F (200°C).

➤ A minimum of 1/4" unheated section below the bushing is required.

➤ **Standard** 10" (254 mm) leads. Specify longer leads.

Cartridge Heater Mounting Flange Options

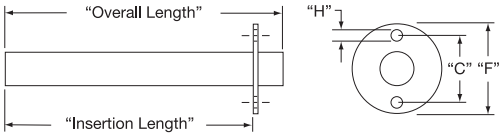
Type MFR Mounting Flange — Round

Available on HDC, HDM, and LDC cartridge heaters

Recommended for applications where excessive vibration exists and may cause the heater to back out of its mounting hole. The 16 ga. 304 SS flange is used as a means of securing the cartridge heater in place.

The default position of the flange is flush with the lead end. Specify the position of the flange when ordering.

Available through the Hi-Density Cartridge Heater Terminator Program for Same or Next Day Shipping with flush flange only



Standard Round Mounting Flanges

Heater Diameter in (mm)	"F"		"C"		"H"	
	in	mm	in	mm	in	mm
1/4 (6.35), 5/16 (7.94), 3/8 (9.53), 1/2 (12.70), 5/8 (15.88), 3/4 (19.05)	1-1/2	38.10	1-1/8	28.57	.156	3.97
7/8 (22.23), 1 (25.40), 1-1/4 (31.80)	2	50.80	1-5/8	41.28	.203	5.16

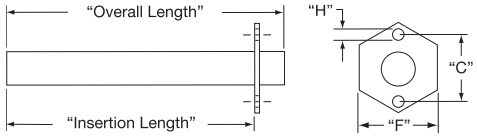
Note: 5/16" dia. cartridge heater can only be HDC; 7/8" and 1-1/4" can only be LDC.

Type MFH Mounting Flange — Hex

Available on HDC, HDM, and LDC cartridge heaters

A hex shape allows the possibility of using a wrench when removal is tight. The 16 ga. 304 SS flange is used as a means of securing the cartridge heater in place.

The default position of the flange is flush with the lead end. Specify the position of the flange when ordering.



Standard Hex Mounting Flanges

Heater Diameter		"F"		"C"		"H"	
in	mm	in	mm	in	mm	in	mm
1/4	6.35	1	25.40	3/4	19.05	.144	3.66
5/16	7.94	1	25.40	3/4	19.05	.144	3.66
3/8	9.53	1	25.40	3/4	19.05	.144	3.66
1/2	12.70	1-3/8	34.93	1-5/32	29.37	.187	4.76
5/8	15.88	1-3/8	34.93	1-5/32	29.37	.187	4.76
3/4	19.05	1-3/8	34.93	1-5/32	29.37	.187	4.76
7/8	22.26	1-7/8	47.63	1-9/16	39.69	.203	5.16
1	25.40	1-7/8	47.63	1-9/16	39.69	.203	5.16
1-1/4	31.80	1-7/8	47.63	1-11/16	42.86	.203	5.16

Custom Mounting Flanges available upon request. Consult Tempco with your requirements.

Cartridge Heater Lead Wire with Strain Relief Options

Type S3 Lead Wire Strain Relief

Available on HDC, HDM, and LDC cartridge heaters

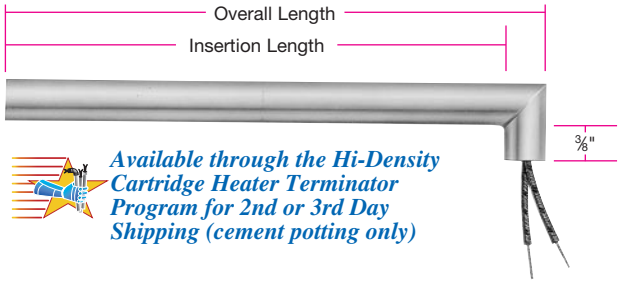
Strain relief clip for leads subject to tension and stress. A "T" type strain relief is silver brazed to the sheath.

Type S4 Right-Angle Lead Wire Strain Relief

Available on HDC, HDM, and LDC cartridge heaters

Strain relief clip for leads subject to tension and stress. A "T" type strain relief is silver brazed to the sheath and bent at a 90° angle.

Cartridge Heater Option — Angled Sheath

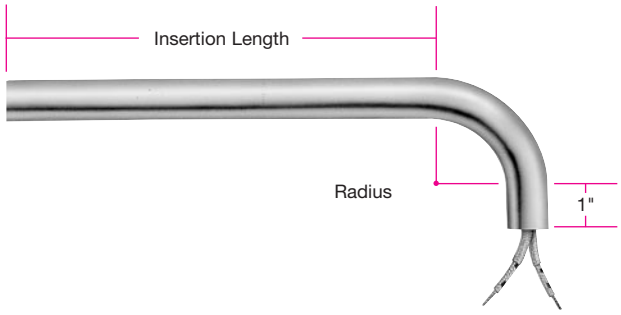


Available through the Hi-Density Cartridge Heater Terminator Program for 2nd or 3rd Day Shipping (cement potting only)

Type R3 Angled Sheath Extension

Available on HDC, HDM, and LDC cartridge heaters

The sheath extension is welded to the cartridge at a 90° angle. The standard sheath extension is 3/8" long. Specify when ordering if a longer sheath extension is required. If abrasion resistance is required, armor cable or stainless steel wire braid can be attached to the sheath extension. Available with various lead wire types and potted end seals.



Type R4 Bent Cartridge

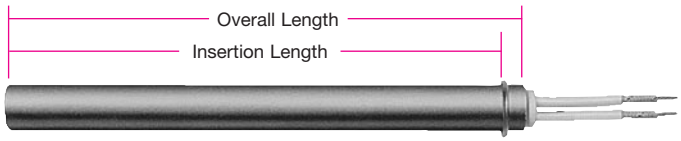
Available on HDC and HDM cartridge heaters

The heater sheath itself is bent to 90°. The bend is through a required unheated section. The standard sheath extension past the bend is 1". Specify when ordering if a longer sheath is required.

Cartridge Dia.	in	1/4	3/8	1/2	5/8	3/4	1
	mm	6.35	9.53	12.70	15.88	19.05	25.40
Bend Radius	in	5/8	5/8	3/4	1	1-1/4	1-1/2
	mm	15.88	15.88	19.05	25.40	31.75	38.10

Other Sheath Options

Cartridge Heater Locating Ring



Available through the Hi-Density Cartridge Heater Terminator Program for Same or Next Day Shipping

Type LR Locating Ring

Available on HDC, HDM, and LDC cartridge heaters

A locating ring can be attached to the heater to aid in positioning the heater for the application.

The default position of the ring is 1/4" from the lead end. Specify the position of the ring when ordering.

Cartridge Heater Pull Strap

Available through the Hi-Density Cartridge Heater Terminator Program for Same or Next Day Shipping

Type PS Pull Strap

Available on HDC, HDM, and LDC cartridge heaters

A nickel wire rope is silver brazed to the lead end of the cartridge heater sheath to assist in removing the heater.

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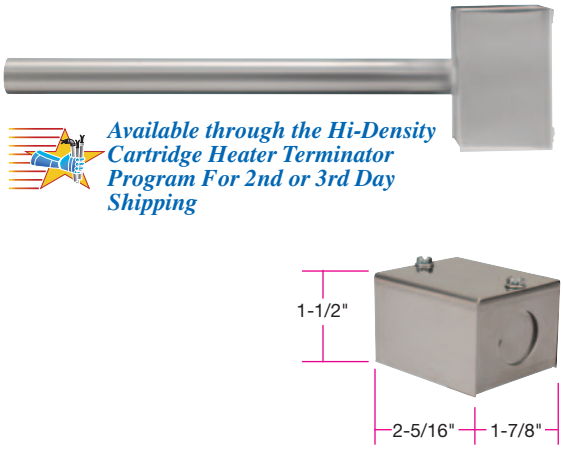
Cartridge Heater Terminal Box Options



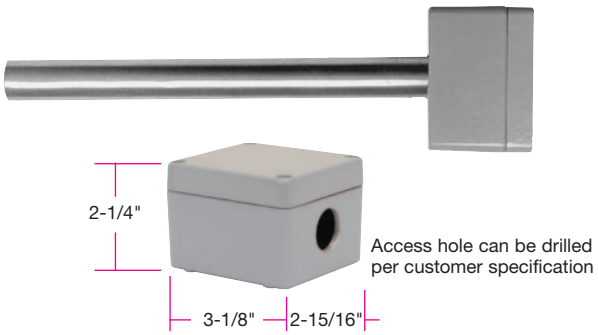
Available through the Hi-Density Cartridge Heater Terminator Program For 2nd or 3rd Day Shipping

Type E1 General Purpose Terminal Box

Available on HDC, HDM, and LDC cartridge heaters

General purpose Stainless Steel NEMA 1 electrical enclosure designed to provide protection from electrical shock. The boxes have a 5/8" conduit knockout and are welded or brazed to the cartridge sheath.

➤ A termination must be specified separately.



Type E2 Moisture Proof Terminal Box

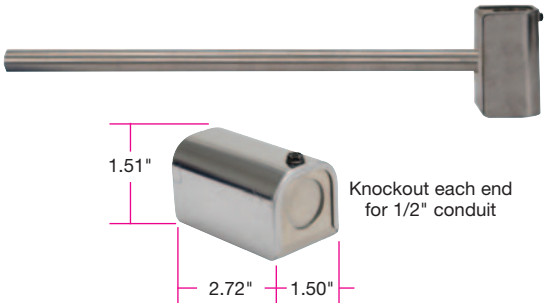
Available on HDC, HDM, and LDC cartridge heaters

NEMA 4 aluminum electrical enclosures provide protection from splashing or hose directed water, external condensation and water seepage. The box is mechanically attached to the cartridge sheath.

➤ A single 5/8" access hole is standard.

➤ A termination must be specified separately.

NOTE: Potted End Seal M2C (high temperature epoxy) or M2D (low temperature epoxy) is recommended.

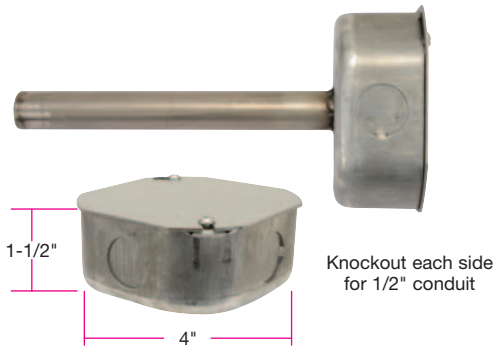


Type E4 General Purpose Terminal Box *(mailbox style)*

Available on HDC, HDM, and LDC cartridge heaters

General purpose Stainless Steel NEMA 1 electrical enclosure designed to provide protection from electrical shock. The box is welded or brazed to the cartridge sheath.

➤ A termination must be specified separately.



Type E5 Octagon Terminal Box

Available on HDC, HDM, and LDC cartridge heaters

General purpose steel NEMA 1 electrical enclosure designed to provide protection from electrical shock. The box is welded to the cartridge sheath.

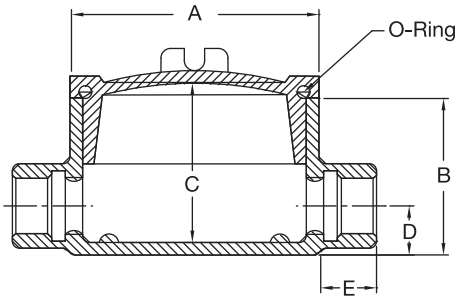
➤ A termination must be specified separately.

Type E3 ☐ Explosion Resistant Terminal Box Options

Available on HDC and HDM cartridge heaters 1/2" diameter and larger.

NEMA 4/7 electrical enclosures provide protection from contaminants, moisture, and hazardous conditions. These housings are screwed onto a heater with a single or double ended Brass or Stainless Steel fitting.

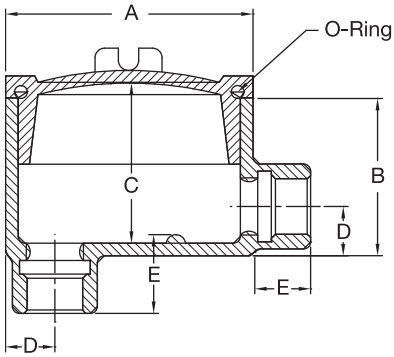
- A threaded fitting mounting termination must be specified. See pages 2-50 and 2-51.
- Other terminal box configurations available upon request.



Style ***E3C***

Housing E3C Dimensions

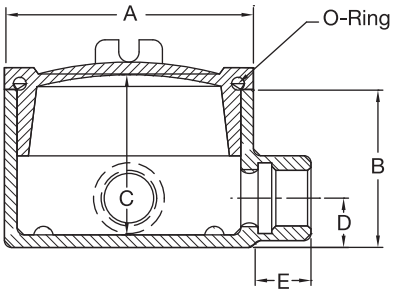
Heater Diameter(s)	Hub Size NPT	"A" (in)	"B" (in)	"C" (in)	"D" (in)	"E" (in)
1/2 & 5/8	1/2-14	2-1/2	2-1/4	2-3/16	5/8	7/8
3/4	3/4-14	2-1/2	2	2	3/4	7/8
1	1-11½	3-1/2	2-5/16	2-3/16	7/8	1



Style ***E3D***

Housing E3D Dimensions

Heater Diameter(s)	Hub Size NPT	"A" (in)	"B" (in)	"C" (in)	"D" (in)	"E" (in)
1/2 & 5/8	1/2-14	2-1/2	2-1/4	2-3/16	5/8	7/8
3/4	3/4-14	2-1/2	2-1/2	2-7/16	3/4	7/8
1	1-11½	3-1/2	2-5/16	2-3/16	7/8	1



Style ***E3L***

Housing E3L Dimensions

Heater Diameter(s)	Hub Size NPT	"A" (in)	"B" (in)	"C" (in)	"D" (in)	"E" (in)
1/2 & 5/8	1/2-14	2-1/2	2-1/4	2-3/16	5/8	7/8
3/4	3/4-14	2-1/2	2-1/2	2-7/16	3/4	7/8
1	1-11½	3-1/2	2-5/16	2-3/16	7/8	1

CAUTION

Explosion resistant terminal housings are intended to provide containment of an explosion in the enclosure only. No portion of the heater assembly outside the enclosure is covered under this NEMA rating. Abnormal use of a heater which results in excessive temperature can create hazardous conditions such as a fire. Never perform any type of service nor remove the housing cover prior to disconnecting all electrical power to the heater.

Made in USA

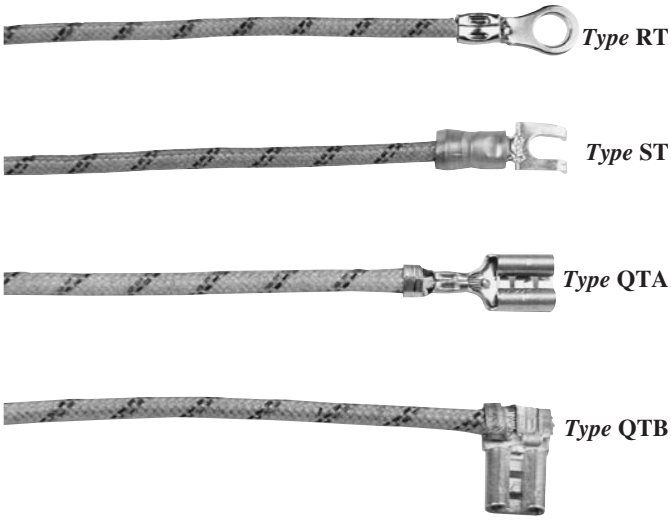
Cartridge Heater Options — Lead End Connections

Type RT Ring Terminal
Type ST Spade Terminal
Type QTA 1/4" Female Straight Quick Disconnect
Type QTB 1/4" Female Right-Angle Quick Disconnect

Available on HDC, HDM and LDC cartridge heaters

Various types of crimp terminals can be attached to the heater leads to make wiring into applications quick and easy. Non-insulated and insulated with nylon (221°F/105°C) or PVC (194°F/90°C).

Note: Specify insulation type and ring size (#6, #8, or #10) when ordering. Standard is a non-insulated #10 terminal. Consult Tempco with your requirements.

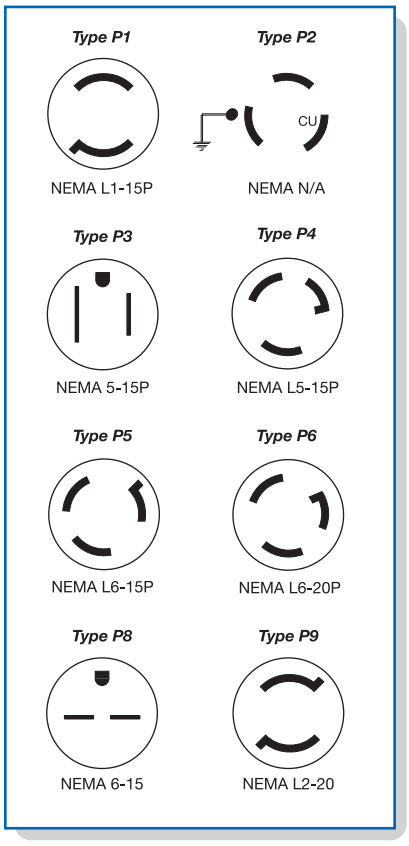


Type P ☐ Quick Disconnect Plugs

Available on HDC, HDM, and LDC cartridge heaters

Allows for the quick and easy replacement of the heater. The plug can be attached to galvanized armor cable, stainless steel armor cable, or wire braid.

Plug Type	*Description*
1	2-pole/2-wire twist locking plug, 15 amp 125 volt NEMA L1-15P (Part Number EHD-102-102)
2	2-pole/3-wire twist locking plug, 15 amp 125 volt or 10 amp 250 volt NEMA N/A. (Part Number EHD-102-107) **NOTE:** This plug is not listed by UL, and is recommended for replacement use only.
3	2-pole/3-wire straight blade plug, 15 amp 125 volt NEMA 5-15P (Part Number EHD-102-103)
4	2-pole/3-wire twist locking plug, 15 amp 125 volt NEMA L5-15P (Part Number EHD-102-113)
5	2-pole/3-wire twist locking plug, 15 amp 250 volt NEMA L6-15P (Part Number EHD-102-121)
6	2-pole/3-wire twist locking plug, 20 amp 250 volt NEMA L6-20P (Part Number EHD-102-231)
8	2-pole/3-wire straight blade plug, 15 amp 250 volt NEMA 6-15P (Part Number EHD-102-114)
9	2-pole/3-wire twist locking plug, 20 amp 250 volt NEMA L2-20P (Part Number EHD-102-104) **NOTE:** For other types of plugs, consult Tempco or specify the manufacturer's part number when ordering. See page 15-15 for additional information.



Caution! Voltage and Amperage ratings of heater and plug must match.

Available through the Hi-Density Cartridge Heater Terminator Program for Same or Next Day Shipping

View Product Inventory @ www.tempco.com

Cartridge Heater Lead Wire Options

Type MIL High Temperature Lead Wire

Available on HDC, HDM and LDC cartridge heaters

When required, high temperature lead wire can be used on most cartridge heaters. The stranded wire is insulated with mica tapes and then a treated fiberglass overbraid.

- Maximum temperature rating: 450°C (842°F)

Type TL Teflon® Leads

Available on HDC and HDM cartridge heaters

- Maximum temperature rating: 200°C (392°F)

Type HA Heat Shrink Covered Armor Cables

Available on HDC, HDM and LDC cartridge heaters

- Either the galvanized or stainless steel armor cable can be covered with moisture proof heat shrink Polyolefin tubing.

Type HTL Very High Temperature Lead Wire

Available on HDC, HDM and LDC cartridge heaters

When required, high temperature lead wire can be used on most cartridge heaters. The stranded wire is insulated with mica composite and then a treated fiberglass overbraid.

- Available wire gauge sizes: 10-18
- Maximum temperature rating: 550°C (1022°F)

Type FS ☐ Uncoated Fiberglass Sleeving

Available on HDC, HDM and LDC cartridge heaters

For effective thermal and mechanical protection, the lead wires can be covered with uncoated fiberglass sleeving.

FSA Uncoated Fiberglass sleeving on each lead separately

FSB Uncoated Fiberglass sleeving on both leads together

- Specify length when ordering.
- Maximum temperature rating: 1112°F (600°C)

Type SR ☐ Silicone Rubber Coated Fiberglass Sleeving

Available on HDC, HDM and LDC cartridge heaters

For added protection, strength, and resistance to various chemicals, the lead wires can be covered with silicone rubber sleeving.

SRA Silicone rubber coated fiberglass sleeving on each lead separately

SRB Silicone rubber coated fiberglass sleeving on both leads together

- Specify length when ordering.
- Maximum temperature rating: 200°C (392°F)

Consult Tempco with your requirements. We welcome your inquiries.

Cartridge Heater Options — Sheath Surface and Sheath Material

Type IS Incoloy® Sheath

Available on HDC and HDM cartridge heaters.

The standard sheath material for all Hi-Density Cartridge Heaters except 1" diameter is 321 stainless steel; standard for 1" diameter is 304 stainless steel. The incoloy sheath option is available on all diameters except 1/8", 5/16", 8 mm and 20 mm.

To assist you in selecting the proper sheath material, corrosion resistant ratings and chemical properties of various heater sheath materials are given in Section 16, Engineering Data, in the back of this catalog.

Type DSM Other Special Sheath Materials

If your application requires a specific alloy sheath material other than described in Type IS above, consult Tempco with your requirements.

Type PAS Passivation

Available on HDC, HDM, and LDC cartridge heaters.

Passivating is a chemical process accomplished by dipping the heater in a solution of nitric acid. The process removes surface contamination, usually iron, so that the optimum corrosion resistance of the stainless steel is maintained.

Type OAL Special Length Tolerance

Available on HDC, HDM, and LDC cartridge heaters.

If a special length tolerance different than the standard length tolerance specified on page 2-4 is required, consult Tempco with your requirements.

Type ELP Electro-Polish

Available on HDC, HDM, and LDC cartridge heaters.

Electro-Polishing is an electro-chemical process that removes surface imperfections and contaminants, enhancing the corrosion resisting ability of the heater sheath.

Type CG Centerless Grinding

Available on HDC and HDM cartridge heaters.

For applications requiring high precision fit and tolerance, the sheath can be centerless ground.

Tolerance: ±0.0005 inches (0.013 mm)

Specify diameter when ordering.

Type SDA End Disc Seals Silver Brazed
Type SDB End Disc Seals Heli-Arc Welded

Available on LDC cartridge heaters.

End discs on HDC and HDM cartridge heaters are heli-arc welded as standard.

The normally mechanically attached end discs on LD cartridge heaters can be silver brazed or heli-arc welded if desired.

Made in USA

Cartridge Heater With Built-In Internal Thermocouples

Built-in Internal Thermocouples are available on all HDC, HDM, and LDC cartridge heater diameters except for 3/16", 5/16" and 8 mm.

Notes: Type TJ4 and TK4 are not available on 1/4" and 6.5 mm diameter cartridges.

Minimum sheath length: 3" for 1/4", 3/8" and 1/2" diameter. 4" for 5/8" and 3/4" diameter.

10" leads are standard for both heater and thermocouple. Leads are internally connected. Specify longer leads.

ANSI Code	Conductor Characteristics Positive	Negative	Temperature Range °F	°C
J	Iron (Magnetic)	Constantan (Non-Magnetic)	0 to 1400	–17 to 760
K	Chromel (Non-Magnetic)	Alumel (Magnetic)	0 to 2300	–17 to 1260

For other thermocouple types consult Tempco.

Type **TJ1 and TK1**

Type TJ1 and TK1 Grounded at Disc End

The thermocouple junction is grounded to the sheath at the disc end and packed with MgO. The concave end disc is filled with silver solder and ground flat. When inserted into a flat end blind hole, it will provide fast responsive temperature readings. Widely used in Hot Runner mold probes.

TJ1 Type J thermocouple; **TK1** Type K thermocouple

Type **TJ2 and TK2**

Type TJ2 and TK2 Ungrounded at Disc End

The thermocouple junction is ungrounded, located at the end of the heater section, 1/8" behind the end disc and packed with MgO. Only provides reference temperature reading of the part being heated – slower response.

TJ2 Type J thermocouple; **TK2** Type K thermocouple

Type **TJ3 and TK3**

Type TJ3 and TK3 Ungrounded at Center

The thermocouple junction is ungrounded and is located in the center of the length and diameter of the cartridge heater. It provides internal temperature readings of the heater core. Generally used for research applications and is not recommended for controlling process temperatures.

TJ3 Type J thermocouple; **TK3** Type K thermocouple

Type **TJ4 and TK4**

Type TJ4 and TK4 Grounded at Center

The thermocouple junction is grounded to the sheath in a 1/2" unheated section located in the center of the cartridge length unless otherwise specified. It provides good temperature readings with quick response.

TJ4 Type J thermocouple; **TK4** Type K thermocouple

Type **TJ5 and TK5**

Type TJ5 and TK5 Grounded at Lead End

The thermocouple junction is grounded to the sheath at the lead end. A minimum of 3/8" of cold section is required. It provides good temperature readings with quick response.

TJ5 Type J thermocouple; **TK5** Type K thermocouple

Note: For a complete selection of standard Hi-Density Pennybottom™ Cartridge Heaters, with built-in Type J thermocouple for Hot Runner plastic molds, see pages 2-24 through 2-26.

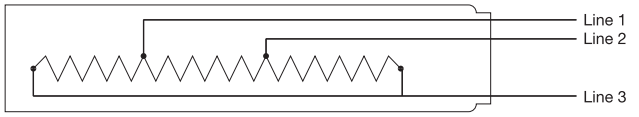
Available from stock.

Cartridge Heater Options — Internal Power Variations

Type DW Distributed Wattage

Available on HDC and HDM cartridge heaters

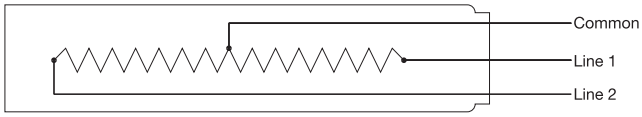
Cartridge heaters can be designed to vary the wattage along the length of the heater. Specify number of zones and the required watts and length per zone starting from the disk end. Leads can be connected externally or internally. Picture shows a heater with Type N externally connected leads. Heaters with other terminations may require a longer cold section at the lead end.



Type 3PH Three Phase

Available on HDC, HDM, and LDC cartridge heaters
1/2" diameter and larger (See page 2-4)

In order to minimize the gauge of the wiring on high wattage cartridge heaters, 3-phase elements can be designed.



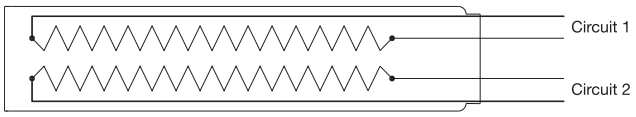
Type DV ☐ Dual Voltage

Available on HDC, HDM, and LDC cartridge heaters
3/8" diameter and larger (See page 2-4)

3/8" and 1/2" diameter heaters may require a larger diameter transition area at lead end.

Cartridge heaters can be designed using 3-wire series/parallel circuits for dual voltage applications. Whether the heater is run on the high or low voltage, the wattage will be the same.

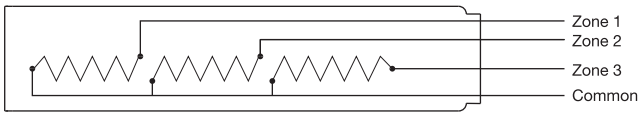
DV1 120/240 volts **DV2** 240/480 volts



Type DWV Dual Circuits

Available on HDC, HDM, and LDC cartridge heaters
1/2" diameter and larger (See page 2-4)

Independent resistance elements can be designed in a single cartridge heater for added versatility.

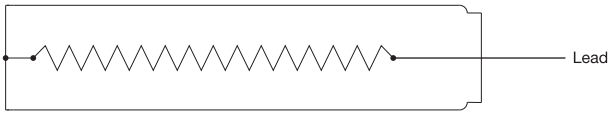


Type MHZ Multiple Heat Zones (3-Zones Maximum)

Available on HDC and HDM cartridge heaters
3/8" diameter and larger (See page 2-4)

3/8" and 1/2" diameter heaters may require a larger diameter transition area at lead end.

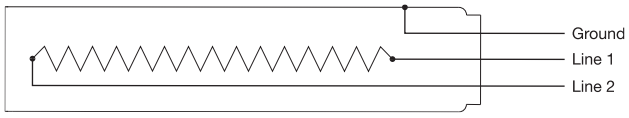
Multiple independently operated sections of the heater with a common wiring connection can be designed for increased flexibility.



Type GJ Grounded Element Winding

Available on HDC, HDM, and LDC cartridge heaters

For DC applications where the electrical circuit is negative grounded, the cartridge heater can be designed with one side of the element winding grounded to the sheath and a single lead wire exiting the cartridge heater.



Type GL Ground Lead/Sheath

Available on HDC, HDM, and LDC cartridge heaters

For those applications requiring a separate ground lead attached to the cartridge heater sheath.

Standard ground lead wire is a 10" long insulated stranded conductor. Optional insulated and color coded leads are available.

Available through the Hi-Density Cartridge Heater Terminator Program for 2nd Day Delivery

Made in USA

Cartridge Heater Internal Sensor and Control Options

Type TF Thermal Fuses

Available on HDC, HDM, and LDC cartridge heaters 1/2" diameter and larger

Thermal fuses can be built into cartridge heaters to act as a high limit for the heater in applications where the temperature must be limited to avoid dangerous situations. When the trigger point is reached, the thermal fuse will open, cutting the electrical current to the cartridge heater. Once the thermal fuse opens, it cannot be reset. Many different trigger temperatures are available.

Type TS Thermostat

Available on HDC, HDM, and LDC cartridge heaters 5/8" diameter or larger

Cartridge heaters with built-in thermostats are very efficient and economical for heating and controlling temperatures. Available with NPT or special type mounting fittings, they provide a self-contained heater mainly recommended for immersion applications. They can also be used as over-temperature safety devices. The thermostats are factory preset for the trip temperature; therefore, prototyping and testing is required to determine the exact fixed setpoint. Maximum temperature—302°F (150°C). Maximum Amps—8@120 Volts.

A minimum 2-1/2" cold section is required to house the thermostat. Consult Tempco with your requirements.

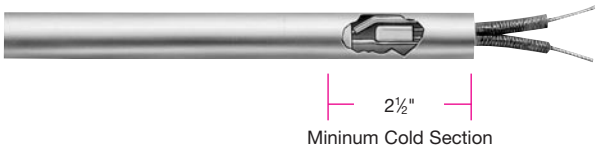
Type TM Thermistor
Type RD RTD Temperature Sensors

Available on HDC, HDM, and LDC cartridge heaters

Tempco has the ability to custom design cartridge heaters with built-in temperature sensors such as thermistors and RTDs. For specific applications that have a limited or single set point range, thermistors or RTDs in conjunction with simple electronic controllers can be an economical choice.

NOTE: For thermocouples see page 2-58.

Type **TS**



Mininum Cold Section

Cartridge Heater Option — Inspection Services and Test Reports

Standard Electrical Tests and Optional Test Reports

1. Resistance test — measures ohms at room temperature.
2. IR (insulation resistance) test — measures the insulation resistance to the flow of current. Standard test is done at 500VDC.
3. Hipot (high potential) test — a high voltage is applied between a product's current carrying conductors and its metallic enclosure to verify that the insulation is sufficient to protect the operator from electrical shock.
4. Leakage current test — measures the current that flows from any conductive part to ground.
5. Heaters can be serialized and test reports can be sent with each shipment if required. Contact Tempco with your requirements.

Optional Die Penetrant Test

This non-destructive testing can detect imperfections in weld joints. For critical applications, each individual heater's weld joints by end cap and fittings can be tested. Certified test reports will be sent with each shipment. Consult Tempco for details.

Optional Hydrostatic Pressure Test

Cartridge heaters with attached pipe fittings can be pressure tested to your specifications at Tempco. Our in-house testing capabilities can ensure that your products meet your exact specifications. Contact Tempco with your requirements.

LDA and HAC Forced Air In-Line Process Cartridge Heaters

TEMPCO manufactures a variety of Air Process Cartridge Heaters. They can be standard units or designed to the customer's specifications. The following diameter sizes are available: 3/8", 1/2", 5/8" and 3/4".

These diameters can be adapted with various types of fittings and made into any practical length.

See Section 11, Pages 11-74 through 11-77 for complete details