Yeti 55 ton - Pro Series O&M Manual

Introduction & Warnings

Thank you for purchasing the Yeti 55 ton- PRO SERIES rosin press, we appreciate your business. The Yeti 55 ton- PRO SERIES - rosin press is an industrial solvent less rosin extractor. This unit uses heat and pressure to make the highest quality products on the market.

This manual provides maintenance and operating instructions, read and understand the entire manual prior to operation.

Results of this unit may differ between users. Please have a good understanding of the method provided, if you have any questions please refer to our Instagram: @sasquash_rosinpress or You
can also email us at
strorderinfo@gmail.com

Warning

DO NOT TOUCH PLATENS ONCE HEATED, DO NOT EXCEED 250F DEGREES

EQUIPMENT SUMMARY & SPECS.

YETI 55 TON - PRO SERIES - ROSIN PRESS

- Frame - Custom "C" Frame
  Made from fully welded, mild steel. Engineered and Machined for strength and durability.
  16"W x 24" L x 60" H (comes built on cart)
  Weight 780lbs

- Upper Platen assembly
  Contains Upper platen and insulation
  ALL PARTS ARE REMOVABLE AND REPLACABLE IF NEEDED

- Upper Platen
  (1) 1" x 8" x 16" solid aluminum bar with two holes tapped for easy removal.
  5/16-18 x ¾ grade 8 bolts
  DO NOT EXCEED 250F

- 1" x 8" x 16" Lower Platen
- solid aluminum bar with FOUR holes bored through Includes a mounting plate, Insulation and THREE shaft system that prevents misalignment. four inches with a one quarter inch diameter. One hole threaded ¼-20 for thermocouple. DO NOT EXCEED 250F

- Cartridge Heaters
  8 total. ¼" x 8" x 250W (1000w) Per plate
- Thermocouple
  Small wire threaded between cartridges heaters on both platen's (dual heated plates) Reads temperature

Installation

Yeti 55 ton - PRO SERIES - Rosin Press. Come with PE172 Electric pump.

- Default Temp is set at 220F
  NOTE: To change temperature;

- Make sure cartridge heaters are inserted all the way into the platens, these may slide out slightly from shipping.
- Plug in
- Turn switch on, the Touch Screen will boot up and then display temperature and pressure
- *For Air operated foot pedal, make sure you have an air compressor capable of 110 PSI
- insert hydraulic hose from the pump into the fitting coming out of the hydraulic ram on the press. MAKE SURE FITTING IS INSERTED ALL THE WAY AND HAND TIGHTENED, being sure to hold the hose firmly against the press as you tighten, It is not necessary to remove, but easier if you are moving/ relocating the press.
- Make sure the pump is on a flat surface, and that the air release valve is open (located on foot pedal) for air release when in use. Valve will be closed for shipping.
- Prime- hook up airline to foot pump (with air release valve open) and operate the plate up and down a few times to ensure hose is filled with oil. Continue until the platen operates smoothly. OR with Hand pump, simply hook up the pump to the press, close the valve on pump, and proceed to lower the lever.

NOTE: EACH TIME THE HOSE IS REMOVED, A VERY SMALL AMOUNT OF OIL WILL ESCAPE IN THE PROCESS, HAVE A RAG READY WHEN REMOVING).

Any operational questions, please refer to the OPERATION section of the manual, or email strorderinfo@gmail.com also call 951.200.4173

Operation

Operation is made very simple with the YETI 55 TON - PRO SERIES rosin press.

- Make sure all steps were properly taken during installation
- Allow press to fully heat to desired temp. should be around 10-20 minutes
- Do not leave ON unattended
- Pre-heat material by bringing plates down far enough to have both plates touching your bag, increase once oil starts to yield
- **If you are not using the press for more than 24 hours, disconnect the pump from the press - Put the pump valve in the "release" position before attempting to remove or reconnect the pump**

IF YOU HAVE ANY ISSUES PLEASE CALL 951-200-4173

Maintenance

Yeti 55 ton- PRO SERIES rosin press is virtually maintenance free.
The only maintenance required is to keep the platens clean.

• Cleaning:

Rubbing alcohol is the easiest way to clean the platens.

if you notice rosin build up on the thermocouple - Unplug the unit, and

Unscrew the thermocouple located between the cartridge heaters- DO

NOT TOUCH platens unless you know they are cool

Lift lower platens and slide out to the right slowly, REMEMBER: There are four inch heaters inserted all the way through the upper and lower platen

Make sure cartridge heater slide all the way out before pulling platens away from the YETI 55 Ton - PRO SERIES

Use a 1/2in wrench to remove the upper platen and lower platen.

NOTE

If your press will not release/open

1. Be sure that your pump is in the RELEASE position
2. Check that the connection FROM the pump TO the back of the press is tightened ALL THE WAY, even a few “twists” too little can cause this, and the plate pressure will not release
   (May need channel lock or vicegrip pliers)

3. **When storing your press, be sure to bring the plates about half way down in order to keep a positive seal in the hydraulic. Hydraulic fluid may slide by otherwise.**

Limited Lifetime Warranty

This Limited Lifetime Warranty applies to products manufactured by Support The Roots LLC.

What does this Limited Lifetime Warranty cover?

This Limited Lifetime warranty covers and any defects in material or workmanship under normal use over the lifetime of the product.

During the Warranty Period, Support The Roots LLC. Will repair or replace, at no charge MINUS the shipping cost, and ONLY products or parts of a product that proves defective because of improper material or workmanship, under normal use and maintenance.

Products not manufactured by Support The Roots LLC, such as electrical components are subject to a 90 day limited warranty.

What we will do to correct the problem?

Support The Roots LLC, will either repair the product at no charge minus shipping cost, using new or refurbished replacement parts.

How long does the coverage last?

The Warranty Period for hydraulic and fabricated parts will be covered for the lifetime of the product.

The Warranty Period for all electrical components purchased by Support The Roots LLC, is 90 days from the date of purchase.

Support the Roots

What does this limited lifetime warranty not cover?

This Limited Lifetime Warranty does not cover any problems that are caused by:

- Conditions, malfunctions or damage not resulting from defects in material or workmanship.
- Conditions, malfunctions or damage resulting from any other pumps different than those verified and offered by us.*

*If you are unsure your pump qualifies it is your responsibility to call us to verify

What do you have to do?

To obtain warranty service, you must first contact us at Strorderinfo@gmail.com or 951-200-4173 to determine the problem and the most appropriate solution for you.

As the demand for availability of clean meds rises, the popularity of rosin has also climbed.
It was once that people would rely on pressing or processing flower for the best quality extracts. But lately, the market has elevated to wanting a “higher” quality, more refined product. Thus, leading to the rise of HASH rosin.
Collection methods of resins/kief and washing techniques can range from one “Hash-Artist” to another, but there is no denying that Hash Rosin seems to be the next big thing in Pressing Rosin.

By stripping away the resins from the plant matter itself, it allows for the pressed oil to be, virtually, free from plant matter, which ultimately leads to a cleaner, tastier, more potent product than just pressing the flower itself. It can also prevent ingesting any foreign containments since the hash is washed through Micron screens which in some cases are so small, not even a blood cell could squeeze through.

Since our presses use heat and pressure to extract the oils from the plant, the care and quality of the flower during the growing process is crucial, particularly to rosin. If the plant had fallen victim of pests or pesticide sprays, those elements could still be present on the buds themselves and would then be secreted through the oil. Pesti Dabs anyone?

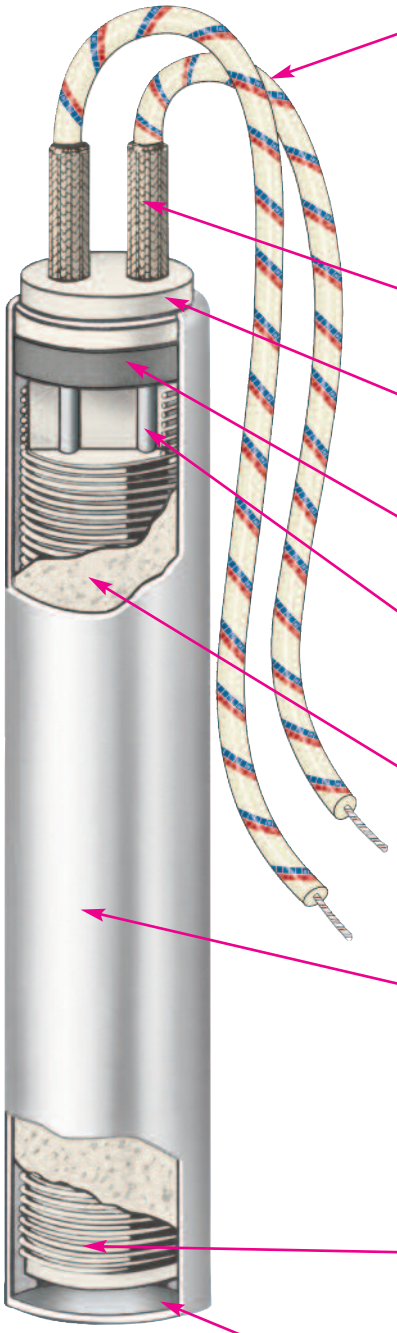
So be sure, if you do press, or smoke rosin, that you are aware of the quality of the flower going into the process, in order to understand what the finished product may be. Remember not all strains (OR EVEN PHENOTYPES OF THE SAME STRAIN) are created equal, so don’t be put off if one strain or plant presses a lighter color than another or doesn’t yield (express as much) as much as another.

Its fair to say, the higher the THC content in the plant, the more rosin you will be left with. For example, (not always but it’s a good rule of thumb) If you press a plant that has been tested at 25% THC, you should expect about a 25% return from that flower. (3.5g of flower would produce about .9g of rosin: 3.5 x 25% = .87). If you’re ever curious if the plant will yield, it may be beneficial to know if it’s a high THC strain.

When it comes to extracts, Our Sasquash Rosin press combines the best quality parts, with American Made machinery to provide you with the smoothest, most reliable press on the market that takes the worry out of whether the press is truly SQUASHING every bit of oil from the Flower or Hash. You’ll be able to focus on your craft and continue your path to producing top quality SOLVENTLESS product.

HI-Density

CARTRIDGE HEATER FEATURES



A The standard termination for Hi-Density Cartridge Heaters is Type N, 10" (254 mm) long nickel conductor lead wires externally connected to 1-1/4"(32 mm) solid conductor terminal pins. The lead wires have fiberglass insulation and are UL approved for temperatures up to 482°F (250°C). Mica insulated UL approved wires for temperatures up to 842°F (450°C) are optional.

Note: To meet the requirements of your application we offer over 40 standard termination styles to select from that will solve many of the most common application problems. See pages 2-39 through 2-60.

B High temperature fiberglass sleeve provides maximum electrical insulation to the crimp connector used to splice the nickel conductors to the flexible leads.

C Ceramic end cap prevents nickel conductors from shorting out against sheath when sharp bending of the leads is required. The ceramic cap may be eliminated in some cases to optimize the heater watt density.

D Ceramic end cap and swaged-in lava plug protect the internal cartridge from outer contamination. Other types of seals can also be provided.

E Solid conductor terminal pins are used to ensure a good electrical connection between the nickel conductor lead wires and the resistance wire. They are sized for the maximum current rating of the heater.

F A high purity Magnesium Oxide (MgO) powder consisting of custom grain sizes is used to fill all remaining space inside the sheath. Heater is then swaged, which compacts the magnesium oxide grains into a solid mass, thereby increasing thermal conductivity and dielectric strength.

G Standard sheath material is 321 Stainless Steel. It provides high temperature strength up to 1200°F (650°C), good thermal conductivity, and resistance to corrosion and scaling. Alloy 321 is a Nickel-Chromium Stainless Steel modified with the addition of Titanium. For higher operating temperatures up to 1400°F (760°C) or corrosive immersion heating applications, Incoloy® 800 is available. Consult Tempco for other sheath materials.

H Grade "A" Nickel-Chrome resistance wire precisely wound on a high purity magnesium oxide core places the resistance wire as close to the inside of the sheath as possible while maintaining dielectric strength. This provides excellent heat transfer and long heater life with the highest possible watt densities.

I Welded end disc made from the same material as the sheath provides a positive seal against moisture and other contaminants.

Agency Approvals

Hi-Density Cartridge Heaters are UL recognized and CSA certified in many design variations under UL File Number E65652 and CSA File Number 043099.

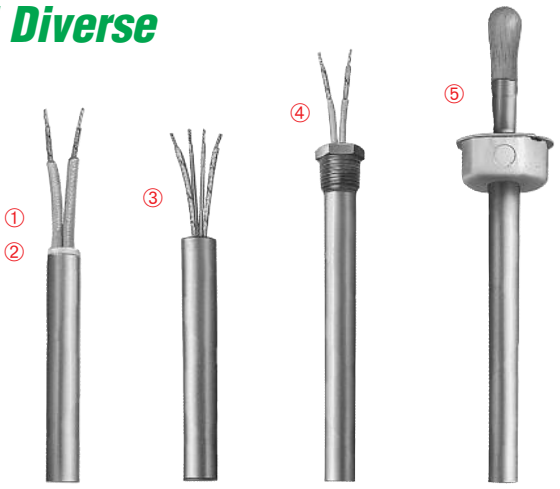
If you require UL and/or CSA Agency Approval, please specify when ordering.

View Product Inventory @ www.tempco.com

TEMPCO *Offers the Most Comprehensive and Diverse Selection in Hi-Density Cartridge Heaters*

Since Their Introduction in 1972, Hi-Density Cartridge Heaters Have Evolved and Today Offer a Multitude of Diverse Product Options:

1. **(HDC)** A Hi-Density cartridge heater in US sizes (see page 2-4).
2. **(HDM)** A Hi-Density cartridge heater in Metric sizes (see page 2-28).
3. **(HDP)** Pennybottom™, A Hi-Density cartridge heater with a Built-in Thermocouple and Flat Copper end disc. (see page 2-24).
4. **(HDL)** A Hi-Density cartridge heater designed with NPT Fittings for Immersion heating (see page 2-23).
5. **(HDB)** Bolt Heater, A Hi-Density cartridge heater designed for assisting in the assembly of large machinery (see page 2-61).



Hi-Density Cartridge Heaters provide maximum processing temperature capability

- Higher watt densities permit smaller heaters to be used without sacrificing life expectancy. This results in up-front as well as long-term cost savings.
- Swaged construction provides maximum support for the resistance wire and excellent heat transfer characteristics, improving the overall life expectancy of the cartridge heater.
- Termination styles and special features allow customization to any application.
- Applications up to 1400°F (760°C)

Typical Applications

- *Plastic Extruders*
- *Hot Runner Molds*
- *Hot Stamping*
- *Medical Equipment*
- *Packaging Equipment*
- *Molds*
- *Aerospace*
- *Sealing Bags*
- *Semi-Conductor*
- *Plastic Molding*
- *Shoe Machinery*
- *Food Processing*
- *Heating Gases and Liquids*
- *Glue Guns*
- *Laminating Presses*
- *Platens*
- *Scientific Equipment*
- *Food Service Equipment*

Hi-Density Cartridge Heaters are Classified in Two Distinct Categories

Multi-Purpose Use

The Multi-Purpose Use Cartridge Heaters represent Tempco's commitment to value-added customer service as we maintain in Stock over 65,000 Semi-Finished Hi-Density Cartridge Heater Substrates, offering a combination of over 1000 sizes in industry standard diameters and lengths ranging from 1" (25.4 mm) to 36" (914.4 mm) in a complete spectrum of wattages and operating voltages. Multi-Purpose Use Cartridge Heaters are the solution for a multitude of original equipment manufacturers (OEMs) or maintenance (MRO) applications.

Available through the Terminator Program. Complete details are found on pages 2-12 through 2-21.

Highly Engineered Specific Purpose Use

Tempco has been at the forefront of addressing the challenges of Original Equipment Manufacturers (OEMs) in a broad segment of diversified industries. As a company we are uniquely qualified and committed to providing value-added expertise in engineering and manufacturing capabilities that span over three decades of acquired knowledge, assisting customers in developing highly engineered specific use cartridge heaters for dependable and reliable performance. Let us provide the optimal solution to your thermal loop system and cartridge heater design challenges. Engineering assistance can be found on pages 2-5 through 2-7.

Consult Us With Your Requirements. We Welcome Your Inquiries.

Ordering Information

Custom Manufactured

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 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 2-60)
- ❑ Lead Length
- ❑ Cable/Braid length
- ❑ Special Features
- ❑ Application Type
- ❑ Operating Temperature

Hi-Density Cartridge Heater Specifications

PERFORMANCE RATINGS

Max. Temperature: ❖1400°F (760°C)

Max. Watt Density: 100-300 W/in² (15.5-46.5 W/cm²) depending on heater size & operating temperature.

NOTE: The maximum operating temperature and the life expectancy of a cartridge heater is dependent on two main factors:

1. The maximum recommended sheath temperature (**❖1200°F for a standard heater**)
2. The maximum ambient temperature for the termination selected.

Consult Tempco if you require a recommendation for your application.

DIMENSIONAL SPECIFICATIONS

Nominal Diameter	1/8"		1/4"		5/16"		3/8"		1/2		5/8"		3/4"		1"	
	in	(mm)	in	(mm)	in	(mm)	in	(mm)	in	(mm)	in	(mm)	in	(mm)	in	(mm)
Actual Diameter	.122	(3.10)	.246	(6.25)	.308	(7.82)	.371	(9.42)	.496	(12.60)	.621	(15.77)	.746	(18.95)	.996	(25.30)
Diameter Tolerance	±.002	(.051)	±.002	(.051)	±.002	(.051)	±.002	(.051)	±.002	(.051)	±.002	(.051)	±.003	(.076)	±.003	(.076)
Minimum Length	1.25	(31.8)	1	(25.40)	1	(25.40)	1	(25.40)	1	(25.40)	1	(25.40)	1-1/4	(31.75)	1-3/4	(44.45)
Maximum Length	12	(305)	36	(914)	36	(914)	48	(1219)	60	(1524)	72	(1829)	72	(1829)	72	(1829)
Length Tolerance Heaters up to 5" (127 mm) long	±3/32	(2.4)	±3/32	(2.4)	±3/32	(2.4)	±3/32	(2.4)	±3/32	(2.4)	±3/32	(2.4)	±1/8	(3.2)	±1/8	(3.2)
Length Tolerance Heaters over 5" (127 mm) long	—		±2% of Sheath Length													
Camber Tolerance Heaters to 12" (305 mm) long	—		0.010"(.254 mm) per foot of length													
Camber Tolerance Heaters over 12" (305 mm) long	—		0.020"(.508 mm) per foot of length													

A certain amount of Camber is unavoidable. With a slight force, Hi-Density Cartridge Heaters will flex enough to fit into a straight reamed hole.

ELECTRICAL SPECIFICATIONS

Nominal Diameter	1/8"	1/4"	5/16"	3/8"	1/2"	5/8"	3/4"	1"
Maximum Voltage	240	240	240	240	240	480*	480*	480*
Maximum Amperage (see next line for exceptions)	3.0	4.4	4.5	6.7	10.5	23	23	23
†Maximum Amperage for Types C1C, C1D, C2C, C2D, CS, F, M3, R1B, S1, S2, SA, W & W3 Terminations	—	3.0	3.0	5.5	7.6	9.7	9.7	9.7
Minimum Wattage at 120V on a 1" long Heater	—	50	45	45	50	50	—	—
Minimum Wattage at 120V on a 2" long Heater	5	20	20	20	20	20	20	20
Maximum Wattage at 120V	360	525	540	800	1260	2760	2760	2760
Maximum Wattage at 240V	720	1050	1080	1600	2520	5520	5520	5520
Maximum Wattage at 480V	—	—	—	—	—	11,000	11,000	11,000
Wattage Tolerance	+10,-15%	Plus 5%, Minus 10%						
Resistance Tolerance	+15,-10%	Plus 10%, Minus 5%						

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

*480V when applicable. Consult Tempco.

LENGTH TOLERANCE FOR:
– LEAD WIRES
– WIRE BRAID LEADS
– ARMOR CABLE LEADS

Up to 36": -1/2", +1" (-12.7 mm, +25.4 mm)
36" to 72": -1", +2" (25.4 mm, +50.8 mm)
Above 72": ±4" (101.6 mm)

Note: Specifications detailed on this page are standard. Consult Tempco if your application requires tighter tolerances or has other special requirements.

TEMPERATURE COEFFICIENT OF RESISTANCE

The electrical resistance (ohms) of the heater resistance wire increases with temperature rise.

Tempco standard Hi-Density Cartridge Heaters are manufactured with ohms (cold ohms) 3.3% lower than the actual calculated ohms (hot ohms) to compensate for this increase.

AVAILABLE ELECTRICAL FEATURES

Diameter	Dual Volts	3-Phase	Dual Circuits	Multiple Heat Zones (maximum 3 zones)
1/8"	No	No	No	No
1/4"	No	No	No	No
5/16"	No	No	No	No
3/8"	Yes*	No	No	Yes*
1/2"	Yes*	Yes	Yes	Yes*
5/8"	Yes	Yes	Yes	Yes
3/4"	Yes	Yes	Yes	Yes
1"	Yes	Yes	Yes	Yes

Consult factory for maximum wattages and voltages.

* Heaters may require a larger diameter transition area at lead end.

View Product Inventory @ www.tempco.com

Recommendations for Improving the Life of Hi-Density Cartridge Heaters

Tempco Hi-Density 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 a particular application is the primary 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 inch 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/in^2) is calculated using the following formula:

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

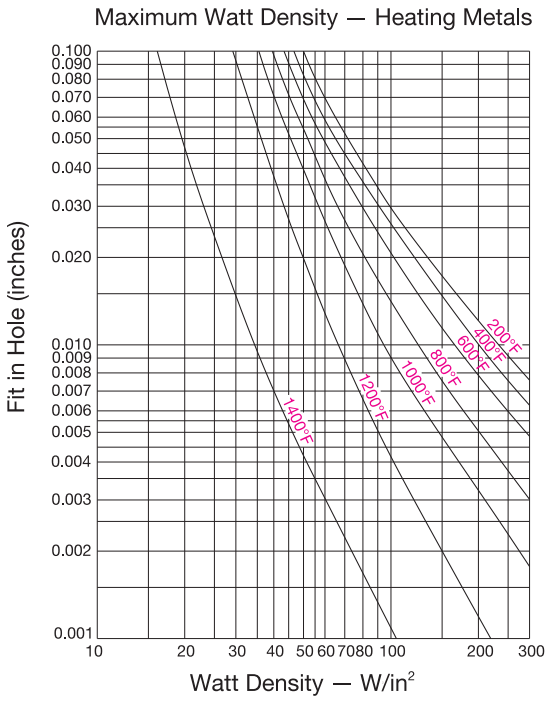
Heated length is the overall length of the heater minus any unheated (cold) sections. Standard Type N, Hi-Density cartridge heaters have 3/8" at the lead end and 1/4" at the disc end unheated. This would mean a 6" long heater would have 5-3/8" effective heated length. Unheated sections vary with type 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 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).

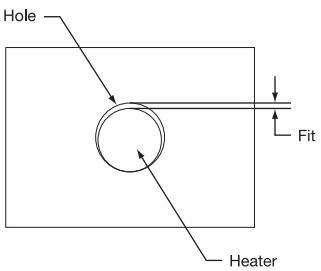
A Hi-Density cartridge heater designed at the maximum recommended watt density allows the smallest heater to be used to obtain the required wattage with good service life. All things being equal, using a lower watt density heater will typically provide optimized service life.

Fig. 1 Recommended Watt Density for Heating Metal Parts



The graph shows the recommended maximum watt density for Tempco Hi-Density cartridge heaters at different operating temperatures and fit, when the heater is installed in an oxidized mild steel block. The thermocouple is located 1/2" 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 Hi-Density Cartridge Heaters

Continued from previous page...

Determining Fit

When heating a platen, mold, die or hot runner probe with Hi-Density 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 3/8" nominal OD Hi-Density cartridge heater has an actual diameter of .371" ±.002, which translates to a minimum diameter of .369". If used in a .376" ±.002 hole, the fit would be .009" (.378" – .369" = .009").

When medium watt density heaters (less than 60 watts per square inch) 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 .003" to .008" 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 ±.0005".

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 2-5) 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 2-5) shows the effect of operating temperature in determining the maximum recommended watt density on a steel platen where the sensor is located 1/2" 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.

Common Causes of Cartridge Heater Failures

Contamination

Contamination is a major cause of heater failure. Moisture, hydraulic oils, and melted plastic are the most common contaminants that are seen on failed heaters. Since the magnesium oxide insulation in a Hi-Density heater is hygroscopic in nature, moisture is easily absorbed into the heater and typically results in premature heater failure. Moisture absorption during machine washdown or cleanup also is a frequent problem. These contaminants, which are electrically conductive, will short out the heater. Most probably, the failures will be at the lead end of the heater and in some cases can split or blow a hole on the heater sheath. The disc end of a Hi-Density cartridge heater is welded shut with a stainless steel disc.

Generally, contaminants enter the heater through the lead end of the heater. The high temperature lead wires used on Hi-Density heaters have fiberglass or mica insulation. Oil and moisture can wick through the insulation on the lead wire into the heater. Tempco offers a wide variety of terminations to avoid this problem, including epoxy seals, Teflon® seals, convoluted cables, welded end discs, Teflon® insulated lead wires and SJO cable. However, there are temperature limitations on many of these terminations.

Note: If you should encounter premature cartridge heater failure, consult Tempco. Our team of professionals will have the solution to your problem.

Excessive Flexing of Leads

Tempco Hi-Density heaters use flexible grade A nickel stranded lead wires with fiberglass or mica insulation. On certain terminations the lead wires are connected externally to solid nickel conductor pins. In applications where there is excessive movement or vibration, the solid pins could break due to fatigue. A simple solution is to give enough slack on the leads to minimize the stress on the solid pins or provide an internal lead wire connection within the heater. Tempco also offers strain relief brackets and springs to prevent this problem.

Where heater leads can wear out by abrasion due to excessive flexing of the leads, Tempco offers several abrasion resistant terminations. See pages 2-41 through 2-47.

Lack of Heat Sink

Hi-Density heaters are designed with minimum unheated (cold) sections. If the heated sections project from the platen or mold, these sections will get extremely hot due to lack of heat transfer. This will lead to premature heater failure. Tempco can manufacture heaters with cold sections anywhere along the length of the heater to prevent overheating of the heater sheath.

When a Hi-Density heater is used as a liquid immersion heater, make sure the heater's sheath length is completely immersed in the liquid. The heater lead end should not be immersed in liquid, since most of the lead end seals are only moisture resistant, not moisture proof.

Recommendations for Improving the Life of Hi-Density Cartridge Heaters

High Operating Temperature

Tempco Hi-Density heaters are designed to operate at sheath temperatures up to 1400°F (760°C). When process temperatures approach the maximum heater sheath temperature, make sure the sheath temperature doesn't exceed its limitations. Location of the thermocouple and the type of temperature and power controls are factors that affect sheath temperature and potential overshoot conditions.

Although the heater is designed to run at temperatures up to 1400°F (760°C), heater lead wires and terminations are rated for much lower temperatures. Care should be taken to make sure that the heater lead end temperatures do not exceed their limitations. Heaters can be made longer with unheated sections at the lead end to bring the lead end out of the high temperature area. Tempco can also provide you with a high temperature wiring harness, which can withstand temperatures up to 1400°F (760°C). See page 15-5 in the accessories section for details.

High Wattage Rating

Heaters with very high wattage ratings can create temperature overshoots, uneven temperature distribution and high heater sheath temperatures, causing premature heater failure.

For liquid immersion heaters, maximum watt density depends on the type of liquid being heated. The heavier 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.

Scale and Sludge Buildup

In liquid immersion applications, periodic cleaning of the heater sheath is necessary to remove any scale buildup on the sheath. Scale can accumulate on the sheath and cause the heater to overheat and fail. When used to heat liquid in a tank, be sure to clean any sludge from the bottom of the tank. A heater sheath covered with sludge will overheat and fail.

Note: As explained in the above paragraphs, the single major cause for cartridge heater failure is the selection of the wrong type of heater lead end termination for the specific application. To assist you in selecting the right termination type, pages 2-39 through 2-57 give detailed descriptions of over 40 terminations designed to solve many of the common application problems. If you need further assistance, consult Tempco.

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 at maximum 1/2" 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.

BNS Anti-Seize Cartridge Heater Coating

This high temperature, electrically insulating and thermally conductive coating will minimize oxidation and improve heat transfer from heater to the object being heated.

Brush a thin layer of paste or spray lightly over the cartridge heater prior to inserting the heater into a hole.

CAUTION — Do not apply over lead wires or other bare current carrying conductors, since the water in the paste and spray can cause an electrical short circuit.

13 oz.
Aerosol spray can
Part Number: CML00010

- Temperature Range 1562°F (850°C)
- High Heat Transfer

4 oz.
Paste w/brush applicator top
Part Number: CML00020

- Temperature Range 1562°F (850°C)
- High Heat Transfer

Note: Formulated to assist in the removal of cartridge heaters.

All Items Available from Stock

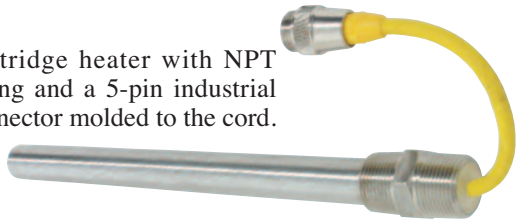
Highly Engineered Custom Manufactured Specific Use Cartridge Heaters

Meeting the Challenges of Original Equipment Manufacturers with Custom Engineering

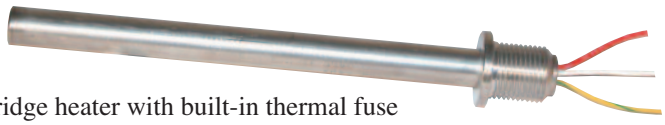
Tempco has been at the forefront of addressing the challenges of original equipment manufacturers (OEMs) in diversified industries, when dependable and reliable performance of custom engineered cartridge heaters is crucial to the overall operating efficiency and quality of their equipment and machinery.

Tempco is a company uniquely qualified and committed to providing value-added expertise in engineering and manufacturing that spans over four decades of acquired knowledge, assisting customers in developing highly engineered specific use cartridge heaters for equipment and/or machinery systems.

Cartridge heater with NPT fitting and a 5-pin industrial connector molded to the cord.

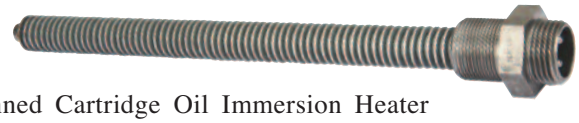


Cartridge heater for continuous air heating application with Incoloy® sheath, custom machined fitting and silicone rubber moisture barrier.



Cartridge heater with built-in thermal fuse and ground wire for X-Ray processing equipment.

Cartridge heater with built-in thermostat, pipe fitting and ground leads for oil heating in waste handling equipment.



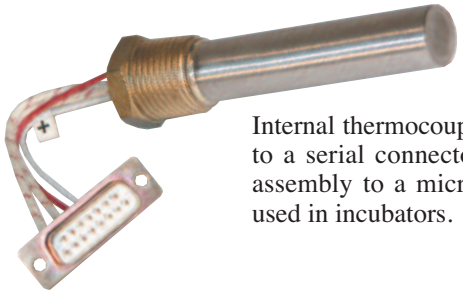
Finned Cartridge Oil Immersion Heater with a liquid-tight electrical termination.

Complete a New Project on Time, Improve Efficiencies and Reduce Cost

Consult Tempco, your strategic partner, in the early stages of a new project requiring cartridge heaters, or to improve a troublesome existing application. By doing so you allow Tempco to place at your disposal our team of professionals, offering you our vast knowledge in product design and manufacturing expertise. We can provide you with the optimal solution to your thermal loop system and cartridge heater design challenges.

Tempco offers you the perfect balance in quality and service with value-added technology. These pictures depict a small sampling of the cartridge heaters we have developed for special applications. Put our knowledge and experience to work for you.

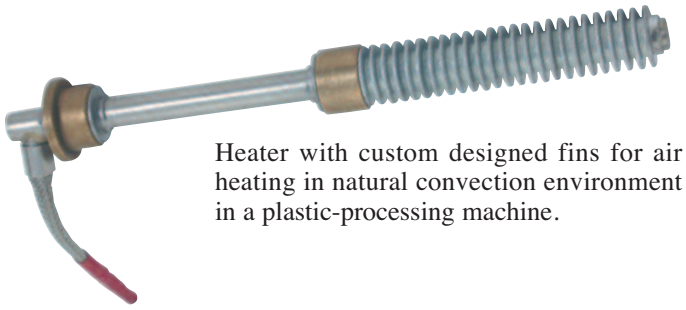
Our capabilities are limited only by your imagination.
Consult us with your requirements.
We welcome your inquiries.



Internal thermocouple is wired to a serial connector for easy assembly to a microprocessor used in incubators.

Incoloy® fitting and seamless Incoloy® 800 sheath material used in an aviation application.

Straight armor cable and adjustable bayonet cap for easy assembly.

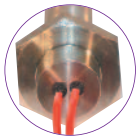


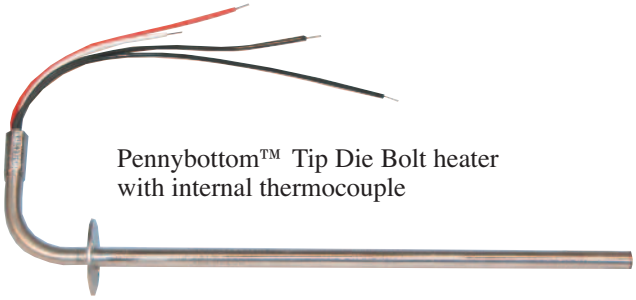
Heater with custom designed fins for air heating in natural convection environment in a plastic-processing machine.

View Product Inventory @ www.tempco.com

Highly Engineered Custom Manufactured Specific Use Cartridge Heaters

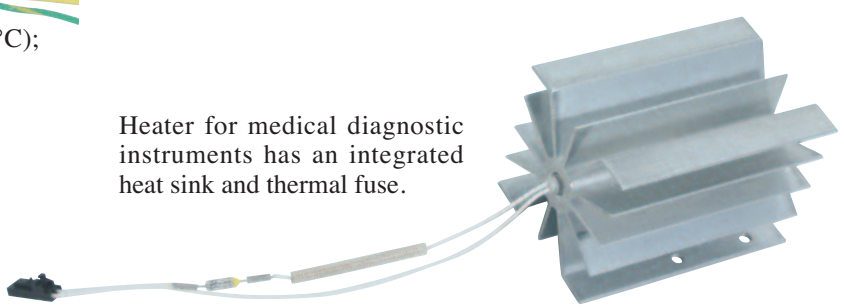
The heater has a header cap as an integral part of the fitting. Leads exit through small holes that are sealed with epoxy for moisture protection.





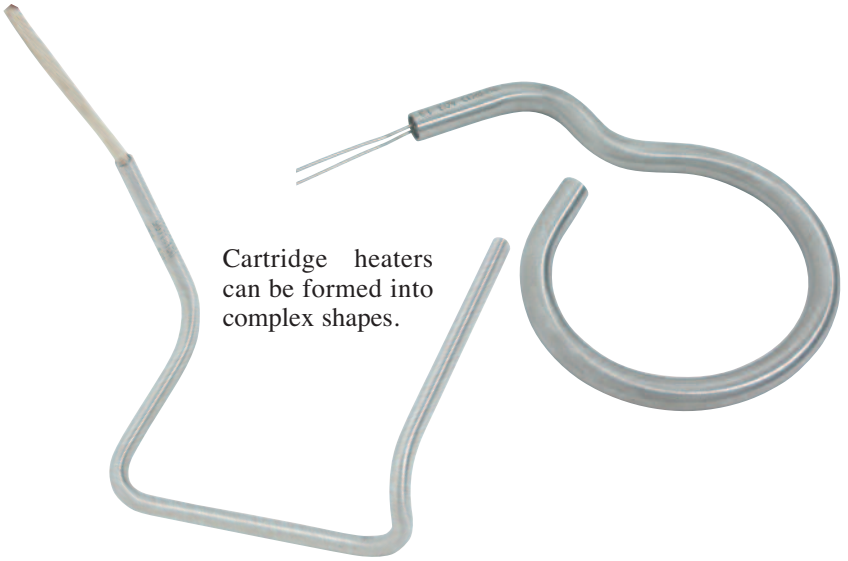
Pennybottom™ Tip Die Bolt heater with internal thermocouple

Heater designed to run continuously at 1202°F (650°C); built-in isolated thermocouple and ground wire.



Heater for medical diagnostic instruments has an integrated heat sink and thermal fuse.

SJO cord and molded plug for automotive air conditioning recharging units.



Cartridge heaters can be formed into complex shapes.

Optional Inspection Services and Test Reports

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.

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.

Electrical Tests

Our state of the art test meter can perform AC/DC dielectric withstand test (Hypot) up to 5000 volts while measuring leakage current in micro amps. It can also measure Insulation resistance (IR) and heater element resistance. Heaters can be serialized and test reports can be sent with each shipment if required.

Consult Tempco with Your Requirements.
We Welcome Your Inquiries.

Hi-Density 1/8" Diameter Miniature Cartridge Heaters

PERFORMANCE RATINGS

Max. Temperature: 1200°F (649°C)

Max. Watt Density: 100-200 W/in² (15.5-31 W/cm²) depending on operating temperature.

NOTE: The maximum operating temperature and the life expectancy of a cartridge heater is dependent on two main factors:

1. The maximum recommended sheath temperature
2. The maximum ambient temperature for the termination selected

Consult Tempco if you require a recommendation for your application.

DIMENSIONAL SPECIFICATIONS

Nominal Diameter	1/8" in	(mm)
Actual Diameter	.122	(3.10)
Diameter Tolerance	±.002	(.051)
Minimum Length	1.25	(31.8)
Maximum Length	12	(305)
Length Tolerance Heaters up to 5" (127 mm) long	±3/32	(2.4)
Length Tolerance Heaters over 5" (127 mm) long	±2% of Sheath Length	

SHEATH MATERIAL

Type 304 Stainless Steel

ELECTRICAL SPECIFICATIONS

Nominal Diameter	1/8"
Maximum Voltage	240
Maximum Amperage	3.0
Maximum Wattage at 120V	360
Maximum Wattage at 240V	720
Wattage Tolerance	+10,-15%
Resistance Tolerance	+15,-10%

1/8" Actual .122" (3.10 mm) Diameter Hi-Density Cartridge Heaters with Type N Termination (10" leads)

Sheath Length in	Sheath Length mm	Watts	Watt Density W/in²	Watt Density W/cm²	Part Number 120V	Part Number 240V
1¼	31.8	25	90	14	HDC19100	—
1¼	31.8	35	126	20	HDC19101	—
1¼	31.8	50	180	28	HDC19102	—
1½	38.1	30	80	12	HDC19103	—
1½	38.1	60	160	25	HDC19104	—
2	50.8	40	70	11	HDC19105	—
2	50.8	50	87	13	HDC19106	HDC19112
2	50.8	100	175	27	HDC19107	HDC19113
2½	63.5	50	68	11	HDC19108	—
3	76.2	60	64	10	HDC19109	—
3½	88.9	70	62	10	HDC19110	—
4	101.6	80	60	9	HDC19111	HDC19114

Note: 1/8" Diameter Hi-Density Cartridge Heaters are made-to-order only. ***Standard lead time is 3 weeks.***

Custom Manufactured

Custom Engineered/Manufactured 1/8" Hi-Density Cartridge Heaters

(Refer to pages 2-2 through 2-9)

Because cartridge heaters can be very application specific, consult Tempco with your special requirements. For sizes, electrical ratings and any other design features required but not listed in the catalog, Tempco will custom engineer and manufacture to your specifications.

Consult Us with Your Requirements. We Welcome Your Inquiries.

1/8" Diameter Cartridge Heaters Termination Types

Type N External Pins with Leads
(Standard Termination)

- Minimum 1/4" cold section at lead end is required
- 24 ga ultralead leads temperature rating: 482°F (250°C)
- Leads externally crimped to nickel pins
- **Standard** 10" (254 mm) leads. Specify longer leads.

Type F Internally Connected Flexible Leads

- Minimum 1/2" cold section at lead end is required
- High temperature fiberglass leads temperature rating: 842°F (450°C)
- Maximum Voltage: 120V
- **Standard** 10" (254 mm) leads. Specify longer leads.

Type M3 Teflon® End Plug Seal with Teflon® Leads

- Minimum 1/2" cold section at lead end is required
- 24 ga Teflon® insulated leads temperature rating: 392°F (200°C)
- Moisture resistant swaged Teflon® seal
- **Standard** 10" (254 mm) leads. Specify longer leads.

Type C1B SS Cable, Mechanically Fastened

- Minimum 1/4" cold section is required
- Provides maximum protection for abrasive environment
- Maximum Voltage: 120V
- **Standard** 10" (254 mm) cable over 12" (305 mm) leads. Specify longer leads or cable.

Type W SS Braid, Mechanically Fastened

- Minimum 1/4" cold section is required
- Offers sharp bending and abrasion protection
- Maximum Voltage: 120V
- **Standard** 10" (254 mm) cable over 12" (305 mm) leads. Specify longer leads or cable.

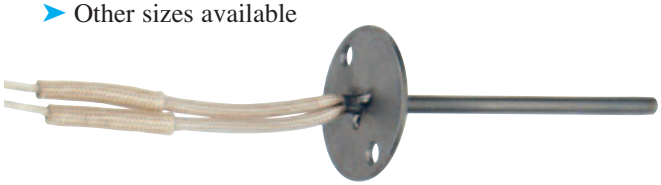
1/8" Diameter Cartridge Heaters Mounting Options

Type R4 Bent Cartridge

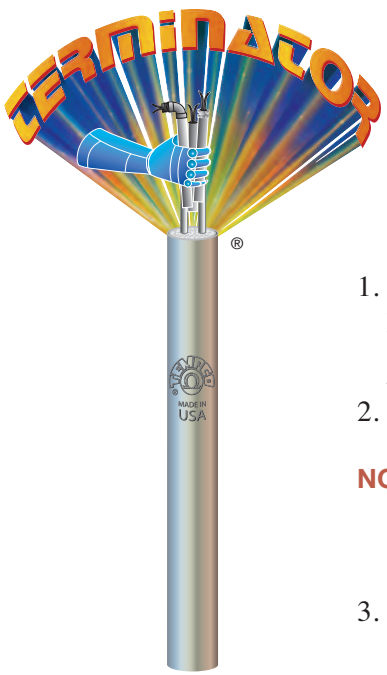
- Heater Sheath is bent up to 90°
- Bend is through a required cold section
- Standard sheath extension past the bend is 1"

Type MFR Mounting Flange

- 1" diameter; 2 × 9/64" mounting holes are standard
- Other sizes available



Custom Terminated Multi-Purpose Use Cartridge Heaters from the Terminator Program



Tempco stocks over 1000 different Semi-Finished Hi-Density Cartridge Heaters in diameters 1/4", 5/16", 3/8", 1/2", 5/8" and 3/4".

These cartridge heaters are semi-finished (substrates), offering you the option to finish them by choosing from 19 program-qualified lead end terminations and options. Cartridge heaters will be ready for shipment within 1 to 3 days, depending on the termination/option selected.

Ordering Information — Follow These Simple Steps

1. Select an available 1/4" through 3/4" Hi-Density cartridge heater from the stock lists on pages 2-14 through 2-21. The Part Numbers in the tables are for heaters with termination Type N (10" long externally connected lead wires). ***Call Tempco for part numbers for stock heaters with other Terminator Program terminations.***
2. Refer to the Program-Qualified Lead Terminations Reference Photos below and on page 2-13 to select the cartridge heater termination type best suited for your application.

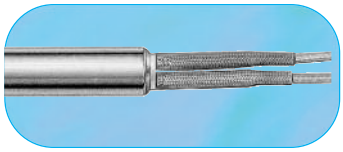
NOTE: Type "N" (10" long externally connected plain lead wires) is the most common termination applied in the Terminator program. ***If a termination other than Type N is selected, a new permanent part number will be assigned when your order is placed.***

3. Specify your lead requirements in the event that the standard supplied lengths for Plain Leads (10"), Braid or Armor Cable (10" over 12" leads) are not suited for your application.
4. Specify the Quantity.

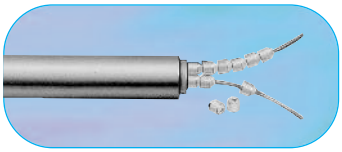
These Program-Qualified Lead Terminations and Options for Stock Cartridge Heater Substrates will ship Same or Next Day when ordered before 2PM (CST).

Terminations

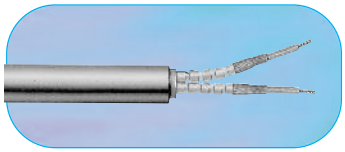
***Type* N**
Standard Leads
(page 2-39)



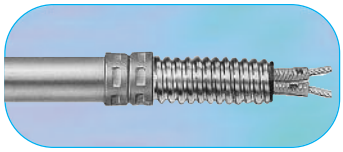
***Type* B**
Ceramic Bead Insulation
(page 2-48)



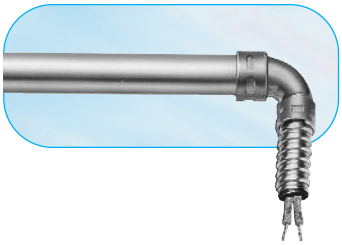
***Type* BL**
Ceramic Bead and Leads
(page 2-48)



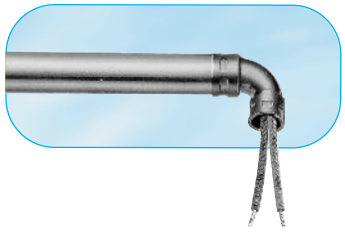
***Type* C1A & C1B** *only*
Straight Armor Cable
(page 2-43)



***Type* C2A & C2B**
Right-Angle Armor
Cable with Copper Elbow
(page 2-47)

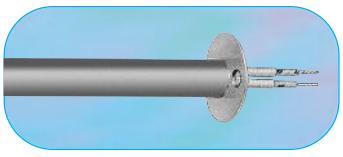


***Type* R1A**
Right-Angle Leads with
Copper Elbow
(page 2-44)

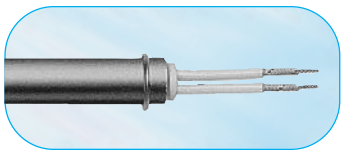


Options

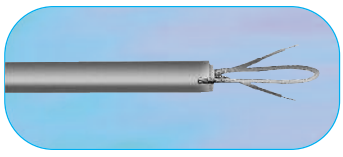
***Type* MFR**
Mounting Flange Round
(page 2-52)



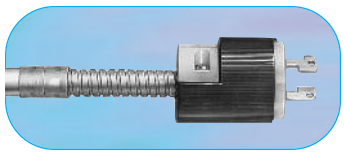
***Type* LR**
Locating Ring
(page 2-52)



***Type* PS**
Pull Strap
(page 2-52)



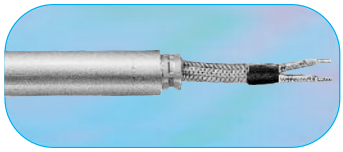
***Type* P**
Quick Disconnect Plug
(page 2-56)



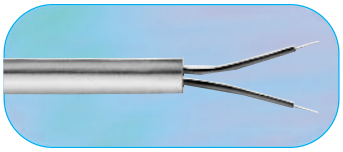
These Program-Qualified Lead Terminations and Options for Stock Cartridge Heater Substrates will ship 2nd or 3rd Day when ordered before 2PM (CST).

Terminations

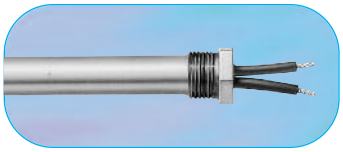
Type W
Straight Wire Braided Leads
(page 2-42)



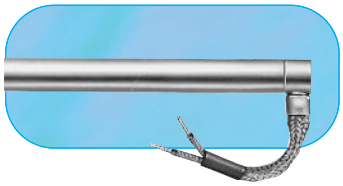
Type M2A & M2E
Potted Lead End Seal
(Cement Only)
(page 2-40)



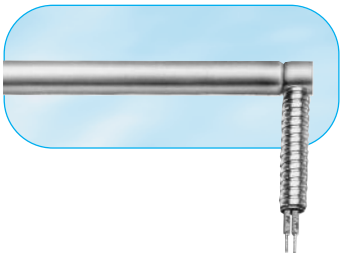
Type CMB & CMP
Single Threaded Fitting
(page 2-50)



Type W1A & W1B
Right-Angle Wire
Braided Leads
(page 2-46)



Type C3A, C3B, C3C & C3D
Right-Angle Armor Cable
(page 2-47)



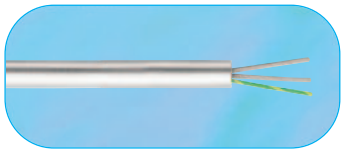
Type R2A & R2B
Right-Angle Leads
(page 2-45)

Options

Type R3
Angled Sheath Extension
(Cement Potting Only)
(page 2-53)

Type E1
General Purpose Box
(page 2-54)

Type GL
Ground Lead Sheath
(page 2-59)



Complete specifications and details on these terminations can be found on the specified catalog page numbers.

Custom Manufactured

Custom Engineered/Manufactured Hi-Density Cartridge Heaters

(Refer to pages 2-2 through 2-9)

Because cartridge heaters can be very application specific, consult Tempco with your special requirements. For sizes, electrical ratings and any other design features required but not listed in the catalog, Tempco will custom engineer and manufacture to your specifications.

Consult Us with Your Requirements. We Welcome Your Inquiries.

STOCK — *Immediate Delivery through the* TERMINATOR *Lead Conversion Program*

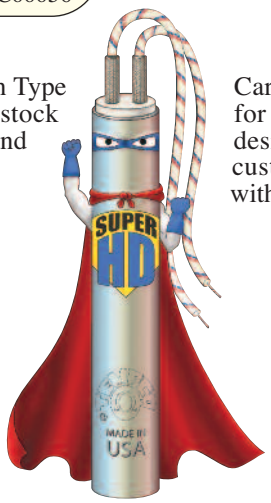
1/4" *Actual .246" (6.25 mm) Diameter Hi-Density Cartridge Heaters*

Part Numbers listed are for stock Cartridge Heaters terminated with 10 inch long leads (Type N Termination).
Other Terminator Program terminations and options can also be applied to stock heaters (see Ordering Information).

Sheath Length in	Sheath Length mm	Watts	Watt Density W/in²	Watt Density W/cm²	Part Number 120V	Part Number 240V
1	25.4	50	127	20	HDC00001	—
1	25.4	80	204	32	HDC00002	—
1	25.4	100	255	40	HDC00003	HDC00004
1	25.4	150	382	59	HDC00005	—
1⅛	28.6	100	204	32	HDC00006	—
1¼	31.8	50	85	13	HDC00007	—
1¼	31.8	75	127	20	HDC00008	—
1¼	31.8	100	170	26	HDC00009	—
1¼	31.8	125	212	33	HDC00010	—
1¼	31.8	150	255	40	HDC00011	HDC00012
1¼	31.8	200	340	53	—	HDC00013
1¼	31.8	225	382	59	—	HDC00014
1½	38.1	50	64	10	HDC00015	—
1½	38.1	75	92	14	HDC08691	—
1½	38.1	100	127	20	HDC00016	HDC00017
1½	38.1	150	191	30	HDC00018	HDC00019
1½	38.1	175	223	35	HDC00020	HDC00021
1½	38.1	200	255	40	HDC00022	HDC00023
1½	38.1	250	318	49	—	HDC00024
1¾	44.5	75	76	12	HDC00025	—
1¾	44.5	150	153	24	HDC00026	—
1¾	44.5	300	306	47	—	HDC00027
2	50.8	50	42	7	HDC00028	—
2	50.8	80	68	11	HDC00029	—
2	50.8	100	85	13	HDC00030	HDC00031
2	50.8	125	106	17	HDC00032	HDC00033
2	50.8	150	127	20	HDC00034	HDC00035
2	50.8	200	170	26	HDC00036	HDC00037
2	50.8	250	212	33	HDC00038	HDC00039
2	50.8	300	255	40	—	HDC00040
2¼	57.2	200	146	23	HDC10139	HDC00041
2½	63.5	150	95	15	—	HDC00042
2½	63.5	200	127	20	HDC00043	HDC00044
2½	63.5	250	159	25	HDC00045	HDC00046
2¾	69.9	200	113	18	—	HDC00048
3	76.2	75	38	6	HDC00049	—
3	76.2	100	51	8	HDC00050	HDC00051
3	76.2	125	64	10	—	HDC00052
3	76.2	150	76	12	HDC00053	HDC00054
3	76.2	200	102	16	HDC00055	HDC00056
3	76.2	250	127	20	HDC00057	HDC00058
3	76.2	300	153	24	HDC00059	HDC00060
3	76.2	350	178	28	—	HDC00061
3½	88.9	200	85	13	—	HDC00062
3½	88.9	300	127	20	HDC00063	HDC00064
3¾	95.3	300	118	18	—	HDC00065
4	101.6	100	36	6	HDC00066	—
4	101.6	150	55	9	HDC00067	—
4	101.6	175	64	10	HDC00068	HDC00069
4	101.6	200	73	11	HDC00070	HDC00071
4	101.6	250	91	14	HDC00072	HDC00073
4	101.6	300	109	17	HDC00074	HDC00075
4	101.6	400	146	23	—	HDC00076
4½	114.3	125	40	6	HDC00077	—
4½	114.3	200	64	10	HDC00078	—
4½	114.3	500	159	25	—	HDC00079
5	127.0	200	57	9	—	HDC00080
5	127.0	250	71	11	—	HDC00081
5	127.0	300	87	14	HDC22940	—
5	127.0	350	99	15	HDC00082	HDC00083
5	127.0	400	113	18	HDC00084	HDC00085
5¾	146.1	350	85	13	HDC00086	HDC00087
6	152.4	150	35	5	HDC00088	—
6	152.4	200	46	7	—	HDC00089
6	152.4	300	69	11	HDC00090	HDC00091
6	152.4	400	93	14	HDC00092	HDC00093
6	152.4	450	104	16	HDC00094	HDC00095
6	152.4	600	139	22	—	HDC00096
6½	165.1	500	106	17	HDC00097	HDC00098
7	177.8	500	98	15	HDC20502	—
7	177.8	600	118	18	—	HDC00099
7½	190.5	525	95	15	HDC00100	—
8	203.2	300	51	8	HDC00101	—
8	203.2	600	102	16	—	HDC00102
9	228.6	675	101	16	—	HDC00103
9½	241.3	525	74	12	HDC00104	—
10	254.0	750	101	16	—	HDC00105
11	279.4	600	73	11	—	HDC00106
13	330.2	725	74	12	—	HDC00107

Ordering Information

Order by Part Number for stock Cartridge heaters with Type N termination. Call Tempco for part numbers for stock heaters with other Terminator Program terminations and options (see pages 2-12 & 2-13).



Custom Engineered/Manufactured

Cartridge Heaters can be application specific; therefore for sizes, electrical ratings, terminations and any other design features not listed in this catalog **TEMPCO** will custom manufacture to your specifications. Consult us with your requirements.

STOCK — *Immediate Delivery through the* TERMINATOR *Lead Conversion Program*

5/16" Actual .308" (7.82 mm) Diameter Hi-Density Cartridge Heaters

Part Numbers listed are for stock Cartridge Heaters terminated with 10 inch long leads (Type N Termination).
Other Terminator Program terminations and options can also be applied to stock heaters (see Ordering Information).

Sheath Length in	Sheath Length mm	Watts	Watt Density W/in²	Watt Density W/cm²	Part Number 120V	Part Number 240V
2	50.8	150	102	16	HDC00108	—
2½	63.5	150	76	12	HDC00109	—
2½	63.5	200	102	16	HDC00110	HDC00111
3	76.2	225	92	14	HDC00112	HDC00113
3⅜	85.7	160	57	9	HDC00114	—
3½	88.9	250	85	13	HDC00115	—
4	101.6	275	80	12	HDC00117	HDC00118
5	127.0	350	79	12	HDC00119	HDC00120
5½	139.7	250	51	8	HDC00121	—
6	152.4	450	83	13	HDC00122	HDC00123
7½	190.5	600	87	14	—	HDC00124

3/8" Actual .371" (9.42 mm) Diameter Hi-Density Cartridge Heaters

Part Numbers listed are for stock Cartridge Heaters terminated with 10 inch long leads (Type N Termination).
Other Terminator Program terminations and options can also be applied to stock heaters (see Ordering Information).

Sheath Length in	Sheath Length mm	Watts	Watt Density W/in²	Watt Density W/cm²	Part Number 120V	Part Number 240V
1	25.4	50	85	13	HDC00125	—
1	25.4	100	170	26	HDC00127	—
1	25.4	150	255	40	HDC00128	HDC00129
1	25.4	200	340	53	—	HDC00130
1¼	31.8	100	113	18	HDC00133	—
1¼	31.8	150	170	26	HDC00135	HDC00136
1¼	31.8	200	226	35	HDC00137	HDC00138
1⁵⁄₁₆	33.3	100	104	16	HDC00139	HDC00140
1⁵⁄₁₆	33.3	150	157	24	HDC00141	—
1⅜	34.9	150	146	23	HDC00142	HDC00143
1⁷⁄₁₆	36.5	100	91	14	HDC00144	—
1½	38.1	30	25	4	HDC00146	—
1½	38.1	50	42	7	HDC00147	HDC00148
1½	38.1	75	64	10	HDC00149	—
1½	38.1	100	85	13	HDC00150	HDC00151
1½	38.1	125	106	17	—	HDC00152
1½	38.1	150	127	20	HDC00153	HDC00154
1½	38.1	200	170	26	HDC00155	HDC00156
1½	38.1	250	212	33	HDC00157	HDC00158
1¾	44.5	150	102	16	HDC00160	HDC00161
1¾	44.5	200	136	21	—	HDC00163
1¾	44.5	250	170	26	HDC00164	HDC00165
1¹³⁄₁₆	46.0	150	97	15	—	HDC00166
1¹³⁄₁₆	46.0	200	129	20	HDC00167	—
1⅞	47.6	250	154	24	HDC00169	—
2	50.8	50	28	4	HDC00170	—
2	50.8	75	42	7	HDC00171	—
2	50.8	100	57	9	HDC00172	HDC00173
2	50.8	125	71	11	HDC00174	—
2	50.8	150	85	13	HDC00175	HDC00176
2	50.8	200	113	18	HDC00177	HDC00178
2	50.8	250	141	22	HDC00179	HDC00180
2	50.8	300	170	26	HDC00181	HDC00182
2	50.8	350	198	31	—	HDC00183
2	50.8	400	226	35	HDC00184	HDC00185
2	50.8	500	283	44	HDC00186	HDC00187
2¼	57.2	75	36	6	HDC00189	—
2¼	57.2	100	49	8	HDC00190	—
2¼	57.2	125	61	9	HDC00191	HDC00192
2¼	57.2	150	73	11	—	HDC00193
2¼	57.2	175	85	13	HDC00194	—
2¼	57.2	200	97	15	—	HDC00196
2¼	57.2	250	125	19	HDC00197	
2¼	57.2	300	146	23	HDC00199	HDC00200
2¼	57.2	350	170	26	HDC00201	HDC00202
2¼	57.2	400	194	30	—	HDC00204
2¼	57.2	500	243	38	—	HDC00205
2⅜	60.3	75	34	5	HDC00206	—
2⅜	60.3	165	75	12	—	HDC00207
2⅜	60.3	300	136	21	—	HDC00210
2½	63.5	100	42	7	HDC00213	HDC00214
2½	63.5	125	53	8	HDC00215	—
2½	63.5	150	64	10	—	HDC00216
2½	63.5	200	85	13	HDC00217	HDC00218
2½	63.5	250	106	17	HDC00219	HDC00220
2½	63.5	300	127	20	HDC00221	HDC00222
2½	63.5	350	149	23	—	HDC00223
2½	63.5	400	174	27	HDC00224	—
2½	63.5	500	212	33	HDC00227	HDC00228
2¾	69.9	400	151	23	—	HDC00231
2¹³⁄₁₆	71.4	300	110	17	—	HDC00235
3	76.2	100	34	5	HDC00236	HDC00237
3	76.2	125	42	7	HDC00238	—
3	76.2	150	51	8	HDC00239	—
3	76.2	200	68	11	HDC00240	HDC00241
3	76.2	250	85	13	HDC00242	HDC00243
3	76.2	300	102	16	HDC00244	HDC00245
3	76.2	375	127	20	HDC00247	—
3	76.2	400	136	21	HDC00249	HDC00250
3	76.2	500	170	26	HDC00251	HDC00252
3	76.2	600	204	32	—	HDC00253
3	76.2	750	255	40	—	HDC00254
3⅝	84.1	500	151	23	HDC00255	—
3½	88.9	125	35	6	HDC00256	—
3½	88.9	200	57	9	—	HDC00257
3½	88.9	225	64	10	—	HDC00258
3½	88.9	250	71	11	HDC00259	HDC00260
3½	88.9	300	85	13	HDC00261	HDC00262
3½	88.9	350	99	15	HDC00263	HDC00264
3½	88.9	400	113	18	—	HDC00265
3½	88.9	500	141	22	HDC00266	HDC00267
3¹³⁄₁₆	96.8	150	38	6	HDC00269	—
3¹³⁄₁₆	96.8	500	128	20	—	HDC00270
4	101.6	100	24	4	HDC00272	—
4	101.6	125	30	5	HDC00273	HDC00274
4	101.6	150	36	6	HDC00275	—
4	101.6	175	42	7	HDC00276	—
4	101.6	200	49	8	HDC00277	HDC00278

STOCK — Immediate Delivery through the TERMINATOR Lead Conversion Program

Continued from previous page...

3/8" Actual .371" (9.42 mm) Diameter Hi-Density Cartridge Heaters

Part Numbers listed are for stock Cartridge Heaters terminated with 10 inch long leads (Type N Termination).
Other Terminator Program terminations and options can also be applied to stock heaters (see Ordering Information).

Sheath Length in	Sheath Length mm	Watts	Watt Density W/in²	Watt Density W/cm²	Part Number 120V	Part Number 240V
4	101.6	250	61	9	HDC00279	HDC00280
4	101.6	300	73	11	HDC00281	HDC00282
4	101.6	350	85	13	HDC00283	HDC00284
4	101.6	400	97	15	HDC00285	HDC00286
4	101.6	450	109	17	—	HDC00288
4	101.6	500	121	19	HDC00289	HDC00290
4	101.6	600	146	23	—	HDC00292
4	101.6	700	170	26	—	HDC00293
4	101.6	750	182	28	—	HDC00294
4¼	108.0	300	68	11	—	HDC00295
4¼	108.0	750	170	26	—	HDC00296
4½	114.3	250	53	8	—	HDC00297
4½	114.3	300	64	10	HDC00298	HDC00299
4½	114.3	450	95	15	HDC00302	HDC00303
4½	114.3	500	106	17	HDC00304	HDC00305
4¾	120.7	300	60	9	—	HDC00307
4 13/16	122.2	300	59	9	—	HDC00308
4 13/16	122.2	500	98	15	—	HDC00309
5	127.0	150	28	4	HDC00312	HDC00313
5	127.0	200	38	6	HDC00314	HDC00315
5	127.0	250	47	7	HDC00316	—
5	127.0	300	57	9	HDC00317	HDC00318
5	127.0	350	66	10	—	HDC00319
5	127.0	400	75	12	HDC00320	HDC00321
5	127.0	500	94	15	HDC00323	HDC00324
5	127.0	600	113	18	—	HDC00327
5	127.0	700	132	21	—	HDC00328
5	127.0	750	141	22	—	HDC00329
5	127.0	800	151	23	—	HDC00330
5	127.0	1000	189	29	—	HDC00331
5¼	133.3	200	36	6	—	HDC00332
5½	139.7	250	42	7	HDC00334	HDC00335
5½	139.7	550	93	15	—	HDC00338
5½	139.7	600	102	16	—	HDC00339
5½	139.7	1000	170	26	—	HDC00340
5¾	146.1	400	65	10	—	HDC00341
5¾	146.1	600	97	15	HDC00342	HDC00343
6	152.4	200	31	5	HDC00344	—
6	152.4	250	39	6	HDC00345	HDC00346
6	152.4	300	46	7	HDC00347	HDC00348
6	152.4	400	62	10	HDC00349	HDC00350
6	152.4	500	77	12	HDC00351	HDC00352
6	152.4	600	93	14	HDC00353	HDC00354
6	152.4	675	104	16	—	HDC00355
6	152.4	750	116	18	HDC00356	HDC00357
6	152.4	800	123	19	—	HDC00358
6	152.4	900	139	22	—	HDC00359
6	152.4	1000	154	24	—	HDC00360
6½	165.1	600	85	13	—	HDC00361
6½	165.1	1000	141	22	—	HDC00362
7	177.8	250	33	5	HDC00365	HDC00366
7	177.8	350	46	7	—	HDC00367
7	177.8	400	52	8	HDC00368	—
7	177.8	500	65	10	—	HDC00369
7	177.8	600	78	12	HDC00370	HDC00371
7	177.8	750	98	15	—	HDC00373
7	177.8	775	101	16	—	HDC00374
7	177.8	1000	131	20	—	HDC00375
7½	190.5	600	73	11	—	HDC00377
7½	190.5	725	88	14	—	HDC00378
7½	190.5	850	103	16	—	HDC00379
7½	190.5	1000	121	19	—	HDC00380
7 13/16	198.4	750	87	14	—	HDC00381
8	203.2	250	30	5	HDC07944	—
8	203.2	300	34	5	HDC00382	HDC00383
8	203.2	400	45	7	HDC00384	—
8	203.2	450	51	8	HDC00385	—
8	203.2	500	57	9	HDC00386	HDC00387
8	203.2	600	68	11	HDC00388	HDC00389
8	203.2	700	79	12	—	HDC00390
8	203.2	750	85	13	—	HDC00391
8	203.2	900	102	16	—	HDC00392
8	203.2	1000	113	18	—	HDC00393
8⅞	219.1	500	52	8	—	HDC00395
9	228.6	200	20	3	HDC00396	HDC00397
9	228.6	500	50	8	—	HDC00398
9	228.6	885	88	14	—	HDC00399
9	228.6	1000	100	16	—	HDC00400
9½	241.3	200	19	3	HDC00401	—
9½	241.3	600	57	9	—	HDC00402
9½	241.3	1000	94	15	—	HDC00403
10	254.0	400	36	5	HDC00405	—
10	254.0	500	45	7	—	HDC00407
10	254.0	600	54	8	HDC00408	HDC00409
10	254.0	700	63	10	—	HDC00410
10	254.0	750	67	10	—	HDC00411
10	254.0	1000	89	14	—	HDC00413
10	254.0	1500	134	21	—	HDC00415
10 13/16	274.6	375	31	5	—	HDC00416
12	304.8	400	30	5	HDC00417	—
12	304.8	500	37	6	—	HDC00418
12	304.8	600	44	7	HDC00419	HDC00420
12	304.8	750	57	9	—	HDC14222
12	304.8	1000	74	11	—	HDC00421
12	304.8	1500	113	18	—	HDC06225
12 13/16	325.4	1000	69	11	—	HDC00422
13	330.2	1000	70	11	—	HDC07200
14	355.6	600	39	6	—	HDC22941
14	355.6	750	47	7	—	HDC00423
16	406.4	600	34	5	—	HDC22942
16	406.4	1200	66	10	—	HDC00424
18	457.2	1000	58	9	—	HDC22943
20	508.0	1000	53	8	—	HDC09305
24	609.6	1000	38	6	—	HDC10234

Ordering Information

Order by Part Number for stock Cartridge heaters with Type N termination. Call Tempco for part numbers for stock heaters with other Terminator Program terminations and options (see pages 2-12 & 2-13).

Custom Engineered/Manufactured

Cartridge Heaters can be application specific; therefore for sizes, electrical ratings, terminations and any other design features not listed in this catalog **TEMPCO** will custom manufacture to your specifications. Consult us with your requirements.

View Product Inventory @ www.tempco.com

STOCK — Immediate Delivery through the TERMINATOR Lead Conversion Program

1/2" Actual .496" (12.60 mm) Diameter Hi-Density Cartridge Heaters

Part Numbers listed are for stock Cartridge Heaters terminated with 10 inch long leads (Type N Termination). Other Terminator Program terminations and options can also be applied to stock heaters (see Ordering Information).

Sheath Length in	Sheath Length mm	Watts	Watt Density W/in²	Watt Density W/cm²	Part Number 120V	Part Number 240V
1	25.4	50	64	10	HDC00426	—
1	25.4	150	191	30	HDC00427	—
1	25.4	200	255	40	—	HDC00428
1¼	31.8	50	42	7	HDC00429	—
1¼	31.8	125	106	17	HDC00430	HDC00431
1¼	31.8	180	153	24	—	HDC00432
1¼	31.8	200	170	26	—	HDC00433
1¼	31.8	250	212	33	—	HDC00434
1½	38.1	50	32	5	HDC00435	—
1½	38.1	150	95	15	HDC00436	HDC00437
1½	38.1	200	127	20	HDC00438	HDC00439
1¾	44.5	100	51	8	HDC00440	—
1¾	44.5	200	102	16	—	HDC00441
1¾	44.5	250	127	20	HDC00442	—
1¾	44.5	400	204	32	—	HDC00443
2	50.8	75	32	5	HDC00444	—
2	50.8	100	52	8	—	HDC22944
2	50.8	150	64	10	HDC00445	—
2	50.8	175	74	12	HDC00446	—
2	50.8	200	85	13	HDC00447	HDC00448
2	50.8	250	106	17	HDC00449	HDC00450
2	50.8	300	127	20	HDC00451	HDC00452
2	50.8	400	170	26	HDC00453	HDC00454
2	50.8	500	212	33	HDC00455	—
2	50.8	600	255	40	—	HDC00456
2	50.8	700	297	46	—	HDC00457
2¼	57.2	75	27	4	HDC00458	—
2¼	57.2	100	36	6	HDC00459	—
2¼	57.2	125	45	7	HDC00460	—
2¼	57.2	150	55	9	HDC00461	—
2¼	57.2	250	91	14	HDC00462	HDC00463
2¼	57.2	300	109	17	—	HDC00464
2¼	57.2	400	146	23	HDC00465	HDC00466
2¼	57.2	500	182	28	HDC00467	HDC00468
2⅜	60.3	100	34	5	HDC00470	HDC00471
2⅜	60.3	125	42	7	HDC00472	—
2⅜	60.3	250	85	13	HDC00473	HDC00474
2⅜	60.3	400	136	21	—	HDC00475
2⅜	60.3	500	170	26	HDC00476	HDC00477
2½	63.5	100	32	5	HDC00478	HDC00479
2½	63.5	125	40	6	HDC00480	—
2½	63.5	150	48	7	—	HDC00481
2½	63.5	200	64	10	HDC00482	HDC00483
2½	63.5	250	80	12	HDC00484	HDC00485
2½	63.5	300	95	15	HDC00486	HDC00487
2½	63.5	400	127	20	HDC00489	HDC00490
2½	63.5	500	159	25	HDC00491	HDC00492
2⁹⁄₁₆	65.1	300	93	14	—	HDC00493
2⁹⁄₁₆	65.1	350	108	17	HDC00494	—
2¾	69.9	250	71	11	HDC00495	—
2¾	69.9	400	113	18	HDC00496	HDC00497
3	76.2	125	32	5	HDC00498	HDC00499
3	76.2	150	38	6	HDC00500	HDC00501
3	76.2	200	51	8	—	HDC00502
3	76.2	250	64	10	HDC00503	HDC00504
3	76.2	300	76	12	HDC00505	HDC00506
3	76.2	350	89	14	HDC00507	—
3	76.2	400	102	16	HDC00508	HDC00509
3	76.2	500	127	20	HDC00510	HDC00511
3	76.2	600	153	24	HDC00512	HDC00513
3	76.2	750	191	30	HDC00514	HDC00515
3	76.2	1000	255	40	HDC00516	—
3½	88.9	250	53	8	HDC00517	HDC00518
3½	88.9	300	64	10	—	HDC00519
3½	88.9	350	74	12	—	HDC00520
3½	88.9	400	95	15	—	HDC08472
3½	88.9	500	106	17	HDC00522	HDC00523
3½	88.9	750	159	25	—	HDC00524
3½	88.9	1000	212	33	—	HDC00525
3¾	95.3	500	98	15	—	HDC00526
3¹³⁄₁₆	96.8	250	48	8	—	HDC00527
3¹³⁄₁₆	96.8	500	96	15	HDC00528	—
4	101.6	150	27	4	HDC00529	HDC00530
4	101.6	200	40	6	—	HDC07555
4	101.6	250	45	7	HDC00531	HDC00532
4	101.6	300	55	9	HDC00533	HDC00534
4	101.6	350	64	10	HDC00536	HDC00537
4	101.6	400	73	11	HDC00538	HDC00539
4	101.6	500	91	14	HDC00540	HDC00541
4	101.6	550	100	16	HDC00542	HDC00543
4	101.6	600	109	17	—	HDC00544
4	101.6	750	136	21	HDC00545	HDC00546
4	101.6	1000	182	28	—	HDC00547
4	101.6	1200	218	34	—	HDC00548
4⁵⁄₁₆	109.5	550	92	14	HDC00550	—
4½	114.3	250	40	6	HDC00551	—
4½	114.3	350	56	9	—	HDC00552
4½	114.3	500	80	12	HDC00553	HDC00554
4½	114.3	650	103	16	HDC00555	HDC00556
4½	114.3	750	119	19	HDC00557	HDC00558
4½	114.3	1000	159	25	—	HDC00559
4¾	120.7	200	30	5	—	HDC00560
4¹³⁄₁₆	122.2	250	37	6	HDC00561	—
4¹³⁄₁₆	122.2	300	44	7	—	HDC00562
4¹³⁄₁₆	122.2	1000	148	23	—	HDC00563
5	127.0	200	28	4	HDC00565	HDC00566
5	127.0	250	35	6	HDC00567	—
5	127.0	300	42	7	—	HDC00568
5	127.0	350	50	8	HDC00569	HDC00570
5	127.0	400	57	9	HDC00571	HDC00572
5	127.0	500	71	11	HDC00573	HDC00574
5	127.0	550	78	12	—	HDC00575
5	127.0	600	85	13	—	HDC00576
5	127.0	625	88	14	—	HDC00577
5	127.0	750	106	17	HDC00578	HDC00579
5	127.0	800	113	18	—	HDC00580
5	127.0	1000	141	22	—	HDC00581
5¼	133.4	250	34	5	HDC00582	HDC00583
5¼	133.4	1000	134	21	—	HDC00584
5½	139.7	200	25	4	—	HDC00585
5½	139.7	500	64	10	HDC00586	HDC00587
5½	139.7	650	83	13	—	HDC00588
5½	139.7	750	95	15	HDC00589	HDC00590
5¾	146.1	350	42	7	—	HDC00591
5¾	146.1	700	85	13	HDC00592	HDC00593
5¹³⁄₁₆	147.6	300	36	6	—	HDC00594

STOCK — *Immediate Delivery through the TERMINATOR Lead Conversion Program*

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1/2" Actual .496" (12.60 mm) Diameter Hi-Density Cartridge Heaters

Part Numbers listed are for stock Cartridge Heaters terminated with 10 inch long leads (Type N Termination).
Other Terminator Program terminations and options can also be applied to stock heaters (see Ordering Information).

Sheath Length in	Sheath Length mm	Watts	Watt Density W/in²	Watt Density W/cm²	Part Number 120V	Part Number 240V
6	152.4	200	23	4	—	HDC00595
6	152.4	250	29	5	HDC00596	HDC00597
6	152.4	300	35	5	HDC00598	HDC00599
6	152.4	350	41	6	HDC00600	HDC00601
6	152.4	450	52	8	—	HDC00602
6	152.4	500	58	9	HDC00603	HDC00604
6	152.4	600	69	11	—	HDC00605
6	152.4	750	87	14	HDC00606	HDC00607
6	152.4	850	98	15	HDC00609	HDC00610
6	152.4	875	101	16	—	HDC00611
6	152.4	1000	116	18	HDC00612	HDC00613
6	152.4	1200	139	22	—	HDC00614
6	152.4	1500	183	28	—	HDC16228
6⅜	161.9	1000	108	17	—	HDC00615
6½	165.1	500	53	8	HDC00616	HDC00617
6½	165.1	1000	106	17	—	HDC00618
6¾	171.5	500	51	8	HDC00619	HDC00620
7	177.8	250	24	4	HDC00621	—
7	177.8	340	33	5	—	HDC00622
7	177.8	400	39	6	—	HDC00623
7	177.8	500	49	8	HDC00624	HDC00625
7	177.8	600	59	9	HDC00626	HDC00627
7	177.8	700	69	11	—	HDC00628
7	177.8	750	73	11	HDC00629	HDC00630
7	177.8	1000	98	15	HDC00631	HDC00632
7	177.8	1500	147	23	—	HDC00633
7½	190.5	500	45	7	HDC00634	HDC00635
7½	190.5	1000	91	14	—	HDC00636
7¾	196.9	1000	88	14	—	HDC00637
8	203.2	200	17	3	—	HDC00639
8	203.2	300	25	4	HDC00640	HDC00641
8	203.2	500	42	7	HDC00642	HDC00643
8	203.2	600	51	8	—	HDC00644
8	203.2	750	64	10	HDC00645	HDC00646
8	203.2	800	68	11	HDC00647	HDC00648
8	203.2	1000	85	13	HDC00650	HDC00651
8	203.2	1200	102	16	—	HDC00653
8	203.2	1500	127	20	—	HDC00654
8	203.2	2000	170	26	—	HDC00655
8½	215.9	300	24	4	—	HDC00656
8½	215.9	500	40	6	—	HDC00657
8½	215.9	1000	80	12	HDC00658	HDC00659
8¾	222.3	1000	77	12	—	HDC00660
9	228.6	500	37	6	—	HDC00661
9	228.6	750	56	9	—	HDC00662
9	228.6	1000	75	12	HDC00663	HDC00664
9	228.6	1325	99	15	—	HDC00665
9	228.6	1500	112	17	—	HDC00666
9½	241.3	500	35	6	—	HDC00667
9½	241.3	800	57	9	—	HDC00668
9½	241.3	1000	71	11	—	HDC00669
10	254.0	500	34	5	HDC00670	HDC00671
10	254.0	750	50	8	—	HDC00672
10	254.0	800	54	8	—	HDC00673
10	254.0	1000	67	10	HDC00674	HDC00675
10	254.0	1250	84	13	—	HDC00677
10	254.0	1500	101	16	—	HDC00678
10	254.0	2000	134	21	—	HDC00679
10½	266.7	1500	95	15	—	HDC00680
11	279.4	500	30	5	HDC00681	—
11	279.4	1000	61	9	—	HDC00682
11	279.4	1500	91	14	—	HDC00683
11	279.4	2000	121	19	—	HDC00684
11½	292.1	1525	88	14	—	HDC00685
12	304.8	500	28	4	HDC00686	HDC00687
12	304.8	600	33	5	HDC00688	HDC00689
12	304.8	1000	55	9	HDC00690	HDC00691
12	304.8	1100	61	9	—	HDC00692
12	304.8	1500	83	13	—	HDC00693
12	304.8	2000	111	17	—	HDC00694
12½	317.5	1675	89	14	—	HDC00695
13½	342.9	500	24	4	—	HDC00696
14	355.6	1000	47	7	—	HDC00697
14	355.6	1700	80	12	—	HDC00698
14	355.6	2300	108	17	—	HDC00699
15	381.0	800	35	5	—	HDC00700
15	381.0	1000	44	7	—	HDC00701
15	381.0	1500	66	10	—	HDC00702
15	381.0	2000	88	14	—	HDC00703
16	406.4	800	33	5	—	HDC00704
16	406.4	1000	41	6	—	HDC00705
16	406.4	2000	84	13	—	HDC17207
16½	419.1	2200	88	14	—	HDC00706
17	431.8	1000	39	6	—	HDC00707
18	457.2	750	27	4	—	HDC00708
18	457.2	1000	36	6	—	HDC00709
18	457.2	1500	55	9	—	HDC00710
18	457.2	1700	62	10	—	HDC00711
18	457.2	2000	73	11	—	HDC00712
20	508.0	1000	34	5	—	HDC11652
24	609.6	1000	28	4	—	HDC14867

Ordering Information

Order by Part Number for stock Cartridge heaters with Type N termination. Call Tempco for part numbers for stock heaters with other Terminator Program terminations and options (see pages 2-12 & 2-13).

Custom Engineered/Manufactured

Cartridge Heaters can be application specific; therefore for sizes, electrical ratings, terminations and any other design features not listed in this catalog **TEMPCO** will custom manufacture to your specifications. Consult us with your requirements.

STOCK — Immediate Delivery through the TERMINATOR Lead Conversion Program

5/8" Actual .621" (15.77 mm) Diameter Hi-Density Cartridge Heaters

Part Numbers listed are for stock Cartridge Heaters terminated with 10 inch long leads (Type N Termination).
Other Terminator Program terminations and options can also be applied to stock heaters (see Ordering Information).

Sheath Length in	Sheath Length mm	Watts	Watt Density W/in²	Watt Density W/cm²	Part Number 120V	Part Number 240V
1¼	31.8	50	34	5	HDC00713	—
1¼	31.8	200	136	21	HDC00714	HDC00715
1¼	31.8	250	170	26	HDC00716	HDC00717
1½	38.1	250	127	20	HDC00719	HDC00720
2	50.8	100	34	5	HDC00721	—
2	50.8	125	42	7	HDC00722	—
2	50.8	200	68	11	HDC00723	HDC00724
2	50.8	250	85	13	HDC00725	HDC00726
2	50.8	300	102	16	—	HDC00727
2	50.8	400	136	21	—	HDC00728
2	50.8	500	170	26	—	HDC00729
2	50.8	750	255	40	—	HDC00730
2¼	57.2	100	29	5	HDC00731	—
2¼	57.2	125	36	6	HDC00732	—
2¼	57.2	250	73	11	HDC00733	HDC00734
2¼	57.2	350	102	16	HDC00735	HDC00736
2⅜	60.3	280	76	12	HDC00739	HDC00740
2½	63.5	180	46	7	HDC00742	—
2½	63.5	275	70	11	HDC00743	HDC00744
2½	63.5	400	102	16	HDC00745	HDC00746
2½	63.5	720	183	28	—	HDC00747
3	76.2	150	31	5	HDC00748	—
3	76.2	180	37	6	HDC00749	—
3	76.2	250	51	8	HDC00750	HDC00751
3	76.2	350	71	11	HDC00752	HDC00753
3	76.2	400	81	13	HDC00754	—
3	76.2	500	102	16	HDC00755	HDC00756
3	76.2	600	122	19	—	HDC00757
3	76.2	720	147	23	—	HDC00758
3	76.2	750	153	24	—	HDC00759
3¼	82.6	200	37	6	HDC00760	—
3¼	82.6	800	148	23	—	HDC00761
3½	88.9	525	89	14	—	HDC00762
3¾	95.3	525	82	13	HDC00763	HDC00764
4	101.6	250	36	6	HDC00766	HDC00767
4	101.6	300	44	7	—	HDC00768
4	101.6	350	51	8	HDC00769	—
4	101.6	400	58	9	—	HDC00770
4	101.6	500	73	11	HDC00771	HDC00772
4	101.6	550	80	12	—	HDC00773
4	101.6	600	87	14	—	HDC00774
4	101.6	750	109	17	HDC00775	HDC00776
4	101.6	1000	146	23	—	HDC00777
4½	114.3	500	64	10	—	HDC00780
4½	114.3	750	95	15	HDC00783	HDC00784
4½	114.3	1000	127	20	—	HDC00785
4¾	120.7	750	90	14	—	HDC00787
5	127.0	250	28	4	HDC00788	HDC00789
5	127.0	500	57	9	—	HDC00790
5	127.0	750	85	13	HDC00791	HDC00792
5	127.0	875	99	15	—	HDC00793
5	127.0	1000	113	18	HDC00794	HDC00795
5⅜	136.5	800	84	13	HDC00796	HDC00797
5½	139.7	800	81	13	—	HDC00800
5¾	146.1	500	49	8	—	HDC00801
5¾	146.1	1500	146	23	—	HDC00802

Sheath Length in	Sheath Length mm	Watts	Watt Density W/in²	Watt Density W/cm²	Part Number 120V	Part Number 240V
6	152.4	300	28	4	HDC00804	HDC00805
6	152.4	500	46	7	HDC00806	HDC00807
6	152.4	750	69	11	—	HDC00808
6	152.4	1000	93	14	HDC00809	HDC00810
6	152.4	1200	111	17	—	HDC00811
6	152.4	1500	139	22	HDC00812	HDC00813
6½	165.1	350	30	5	HDC00814	HDC00815
6½	165.1	500	42	7	HDC00816	HDC00817
6½	165.1	900	76	12	—	HDC00818
6½	165.1	1400	119	18	—	HDC00819
6¾	171.5	500	41	6	—	HDC00820
6¾	171.5	1000	81	13	—	HDC00821
7	177.8	500	39	6	HDC00822	HDC00823
7	177.8	750	59	9	—	HDC00824
7	177.8	1000	78	12	HDC00825	HDC00826
7	177.8	1500	118	18	—	HDC00827
7½	190.5	325	24	4	HDC00828	—
7½	190.5	1300	95	15	—	HDC00829
7¾	196.9	400	28	4	—	HDC00830
7¾	196.9	1000	70	11	—	HDC00831
8	203.2	400	27	4	—	HDC00832
8	203.2	500	34	5	HDC00833	HDC00834
8	203.2	750	51	8	—	HDC00835
8	203.2	850	58	9	—	HDC00836
8	203.2	1000	68	11	HDC00837	HDC00838
8	203.2	1200	81	13	HDC00839	HDC00840
8	203.2	1500	102	16	HDC00841	HDC00842
8	203.2	2000	136	21	—	HDC00843
8¾	222.3	450	28	4	HDC00845	—
8¾	222.3	1800	111	17	—	HDC00846
9	228.6	500	30	5	—	HDC00847
9	228.6	750	45	7	—	HDC00848
9	228.6	1000	60	9	—	HDC00849
9	228.6	1500	90	14	—	HDC00850
9½	241.3	975	55	9	—	HDC00851
10	254.0	500	27	4	HDC00852	HDC00853
10	254.0	650	35	5	HDC00855	—
10	254.0	750	40	6	—	HDC00856
10	254.0	800	43	7	—	HDC00857
10	254.0	1000	54	8	HDC00858	HDC00859
10	254.0	1500	80	13	HDC00860	HDC00861
10	254.0	2000	107	17	—	HDC00862
11	279.4	1000	49	8	—	HDC00863
11	279.4	1400	68	11	—	HDC00864
11	279.4	2000	97	15	—	HDC00865
12	304.8	500	22	3	HDC00866	HDC00867
12	304.8	600	27	4	HDC00868	—
12	304.8	775	34	5	—	HDC00869
12	304.8	900	40	6	—	HDC00870
12	304.8	1000	44	7	HDC00871	HDC00872
12	304.8	1500	66	10	HDC00873	HDC00874
12	304.8	2000	89	14	—	HDC00875
13	330.2	1000	41	6	—	HDC00876
13	330.2	1500	61	10	—	HDC00877
14	355.6	925	35	5	HDC00878	—
14	355.6	1000	38	6	—	HDC00879

STOCK — Immediate Delivery through the TERMINATOR Lead Conversion Program

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5/8" Actual .621" (15.77 mm) Diameter Hi-Density Cartridge Heaters

Part Numbers listed are for stock Cartridge Heaters terminated with 10 inch long leads (Type N Termination).
Other Terminator Program terminations and options can also be applied to stock heaters (see Ordering Information).

Sheath Length in	Sheath Length mm	Watts	Watt Density W/in²	Watt Density W/cm²	Part Number 120V	Part Number 240V
14	355.6	1500	57	9	—	HDC00880
14	355.6	3700	140	22	—	HDC00881
15	381.0	750	26	4	—	HDC00882
15	381.0	1000	35	5	—	HDC00883
15	381.0	2400	84	13	—	HDC00884
15	381.0	4000	140	22	—	HDC00885
16	406.4	1000	33	5	—	HDC00886
16	406.4	2500	82	13	—	HDC00887
16	406.4	4500	148	23	—	HDC00888
17	431.8	1000	31	5	—	HDC00889
18	457.2	900	26	4	—	HDC00890
18	457.2	1000	29	5	—	HDC00891
18	457.2	1500	44	7	—	HDC00892
18	457.2	3000	87	14	—	HDC00893
18	457.2	4700	137	21	—	HDC00894
19	482.6	1000	28	4	—	HDC00895
20	508.0	1000	26	4	—	HDC00896
20	508.0	1500	39	6	—	HDC00897
20	508.0	3500	91	14	—	HDC00898
20	508.0	4700	123	19	—	HDC00899
24	609.6	1000	22	3	—	HDC00900
24	609.6	2000	43	7	—	HDC00901
24	609.6	4700	102	16	—	HDC00902
25¼	641.4	1500	31	5	—	HDC00903
30	762.0	2800	48	8	—	HDC00904
36	914.4	3000	43	7	—	HDC00905

3/4" Actual .746" (18.95 mm) Diameter Hi-Density Cartridge Heaters

Part Numbers listed are for stock Cartridge Heaters terminated with 10 inch long leads (Type N Termination).
Other Terminator Program terminations and options can also be applied to stock heaters (see Ordering Information).

Sheath Length in	Sheath Length mm	Watts	Watt Density W/in²	Watt Density W/cm²	Part Number 120V	Part Number 240V
2	50.8	200	57	9	HDC00906	—
2	50.8	800	226	35	—	HDC00907
2¼	57.2	200	49	8	HDC00908	—
2¼	57.2	800	194	30	—	HDC00909
3	76.2	250	42	7	HDC00910	—
3	76.2	500	85	13	HDC00911	HDC00912
3	76.2	600	102	16	HDC00913	HDC00914
3	76.2	1000	170	26	—	HDC00915
3½	88.9	250	35	6	HDC00916	HDC00917
3½	88.9	350	50	8	—	HDC00918
3½	88.9	500	71	11	HDC00919	—
3½	88.9	1000	141	22	—	HDC00920
3¾	95.3	250	33	5	HDC00921	—
3¾	95.3	500	65	10	—	HDC00922
3¾	95.3	1000	131	20	—	HDC00923
4	101.6	250	30	5	HDC00924	—
4	101.6	500	61	9	HDC00926	HDC00927
4	101.6	750	91	14	—	HDC00928
4	101.6	1000	121	19	HDC00929	HDC00930
4½	114.3	350	37	6	HDC00931	—
4½	114.3	875	93	14	HDC00932	HDC00933
4½	114.3	1400	149	23	—	HDC00934
4¾	120.7	750	75	12	—	HDC00935
5	127.0	300	28	4	HDC00936	HDC00937
5	127.0	500	47	7	—	HDC00938
5	127.0	750	71	11	—	HDC00939
5	127.0	1000	94	15	HDC00940	HDC00941
5	127.0	1200	113	18	—	HDC00942
5¾	146.1	1000	81	13	—	HDC00943
6	152.4	500	39	6	HDC00944	HDC00945
6	152.4	750	58	9	—	HDC00946
6	152.4	1000	77	12	HDC00947	HDC00948
6	152.4	1200	93	14	—	HDC00949
6	152.4	1500	116	18	—	HDC00950
6	152.4	2000	154	24	—	HDC00951
7	177.8	500	33	5	HDC00952	HDC00953
7	177.8	1000	65	10	HDC00954	HDC00955
7	177.8	1500	98	15	HDC00956	HDC00957
7	177.8	2000	131	20	—	HDC00958
7⅞	193.7	450	27	4	—	HDC00959
8	203.2	350	20	3	—	HDC00961
8	203.2	500	28	4	HDC00962	HDC00963
8	203.2	700	40	6	—	HDC00964
8	203.2	1000	57	9	—	HDC00965
8	203.2	1350	76	12	—	HDC00966
8	203.2	2000	113	18	HDC00967	HDC00968
9	228.6	350	17	3	—	HDC00969
9	228.6	500	25	4	—	HDC00970

Ordering Information

Order by Part Number for stock Cartridge heaters with Type N termination. Call Tempco for part numbers for stock heaters with other Terminator Program terminations and options (see pages 2-12 & 2-13).

Custom Engineered/Manufactured

Cartridge Heaters can be application specific; therefore for sizes, electrical ratings, terminations and any other design features not listed in this catalog **TEMPCO** will custom manufacture to your specifications. Consult us with your requirements.

STOCK — Immediate Delivery through the TERMINATOR Lead Conversion Program

3/4" Actual .746" (18.95 mm) Diameter Hi-Density Cartridge Heaters

Part Numbers listed are for stock Cartridge Heaters terminated with 10 inch long leads (Type N Termination).
Other Terminator Program terminations and options can also be applied to stock heaters (see Ordering Information).

Sheath Length in	Sheath Length mm	Watts	Watt Density W/in²	Watt Density W/cm²	Part Number 120V	Part Number 240V
9	228.6	1000	53	8	—	HDC22945
9	228.6	1200	60	9	—	HDC00971
9	228.6	1800	90	14	—	HDC00973
9¾	247.7	2000	92	14	—	HDC00974
10	254.0	600	27	4	—	HDC00975
10	254.0	1000	45	7	—	HDC00976
10	254.0	1200	54	8	—	HDC00977
10	254.0	1500	70	11	—	HDC22946
10	254.0	2000	89	14	HDC00978	HDC00979
10½	266.7	550	23	4	—	HDC00980
11	279.4	1000	40	6	—	HDC00981
11¾	298.5	2000	75	12	—	HDC00983
12	304.8	800	30	5	—	HDC00984
12	304.8	1000	37	6	—	HDC00985
12	304.8	1200	44	7	—	HDC00986
12	304.8	1500	55	9	—	HDC00987
12	304.8	2000	74	11	HDC00988	HDC00989
12	304.8	2500	92	14	—	HDC00990
12	304.8	4000	148	23	—	HDC00991
13	330.2	1000	34	5	—	HDC00992
14	355.6	800	25	4	—	HDC00993
14	355.6	1000	31	5	—	HDC00994
14	355.6	1125	35	6	HDC00995	—
14	355.6	1250	39	6	—	HDC00996
14	355.6	1400	44	7	—	HDC00997
14	355.6	2500	79	12	—	HDC00998
14	355.6	4500	141	22	—	HDC00999
14¾	374.7	1500	45	7	—	HDC01000

Sheath Length in	Sheath Length mm	Watts	Watt Density W/in²	Watt Density W/cm²	Part Number 120V	Part Number 240V
15	381.0	1000	29	5	—	HDC01001
15	381.0	1500	44	7	—	HDC01002
16	406.4	1000	27	4	—	HDC01003
16	406.4	1175	32	5	HDC01004	—
16	406.4	1500	41	6	—	HDC01005
16	406.4	1800	49	8	—	HDC01006
16	406.4	3000	82	13	—	HDC01007
16	406.4	4700	129	20	—	HDC01008
17	431.8	1000	26	4	—	HDC01009
17¾	450.9	850	21	3	—	HDC01010
18	457.2	1000	24	4	—	HDC01011
18	457.2	1250	30	5	HDC01012	—
18	457.2	1450	35	6	—	HDC01013
18	457.2	2000	49	8	—	HDC01014
18	457.2	3250	79	12	—	HDC01015
18	457.2	5000	121	19	—	HDC01016
19	482.6	1000	23	4	—	HDC01017
20	508.0	1000	22	4	—	HDC01018
20	508.0	1150	25	4	—	HDC01019
20	508.0	2050	45	7	—	HDC01020
20	508.0	2250	49	8	—	HDC01021
20	508.0	5250	114	18	—	HDC01022
24	609.6	1000	18	3	—	HDC01023
24	609.6	1375	25	4	—	HDC01024
24	609.6	2000	36	6	—	HDC01025
24	609.6	2750	50	8	—	HDC01026
24	609.6	5500	99	15	—	HDC01027
36	914.4	2500	30	5	—	HDC01028

Ordering Information

Order by Part Number for stock Cartridge heaters with Type N termination. Call Tempco for part numbers for stock heaters with other Terminator Program terminations and options (see pages 2-12 & 2-13).

Custom Engineered/Manufactured

Cartridge Heaters can be application specific; therefore for sizes, electrical ratings, terminations and any other design features not listed in this catalog **TEMPCO** will custom manufacture to your specifications. Consult us with your requirements.

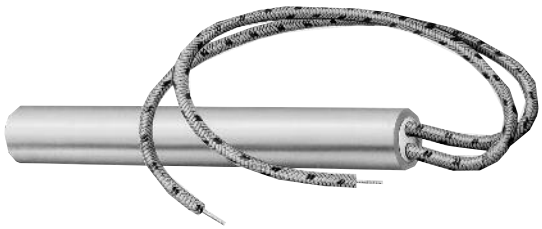
1" Dia. Actual .996" (25.30 mm) Hi-Density Cartridge Heaters with Type N termination 10" leads

Sheath Length in	Sheath Length mm	Watts	Watt Density W/in²	Watt Density W/cm²	Part Number 120V	Part Number 240V
3	76.2	750	101	16	—	HDC02662
3½	88.9	565	63	10	—	HDC02663
5	127.0	1000	73	11	—	HDC02664
7⅞	200.0	500	22	3	HDC02665	HDC02666
8	203.2	1500	65	10	—	HDC02667
8¾	222.3	875	34	5	—	HDC02668
11½	292.1	1000	29	5	HDC02669	—
13	330.2	1000	26	4	HDC02670	—
14	355.6	2700	64	10	—	HDC02671
15	381.0	1000	22	3	HDC02672	—

Sheath Length in	Sheath Length mm	Watts	Watt Density W/in²	Watt Density W/cm²	Part Number 120V	Part Number 240V
16	406.4	1800	37	6	—	HDC02673
17⅜	441.3	2400	46	7	—	HDC02674
20	508.0	1000	16	3	—	HDC02675
20	508.0	2800	46	7	—	HDC02676
25	635.0	1725	23	3	HDC02677	HDC02678
40	1016.0	4400	36	6	—	HDC02679
49	1244.6	3725	25	4	—	HDC02680
50½	1282.7	945	6	1	—	HDC02681
57	1447.8	2800	16	3	—	HDC02682
60	1524.0	1500	8	1	—	HDC02683

Note: 1" Dia. Hi-Density Cartridge Heaters are made-to-order only. Refer to ordering information on page 2-3.
Standard lead time is 3 weeks.

STOCK Cartridge Heaters with Type F Flexible Lead Termination



Type F Internally Connected Flexible Leads 10" Long

This lead termination provides flexibility; the lead wires are internally connected to the terminal pins. The lead wires can be sharply bent as they exit the ceramic insulating cap without exposing the bare wire.

1/4" Diameter Actual .246" (6.25 mm)

Sheath Length in	Sheath Length mm	Watts	Volts	Watt Density W/in²	Watt Density W/cm²	Part Number
1	25.4	80	120	204	32	HDC05603
1½	38.1	50	120	64	10	HDC06151
1½	38.1	200	120	255	40	HDC10869
2	50.8	200	240	170	26	HDC01989
2	50.8	250	240	212	33	HDC05179
2	50.8	300	240	255	40	HDC04556
2½	63.5	300	240	191	30	HDC07119
3	76.2	75	120	38	6	HDC10412
3	76.2	300	240	153	24	HDC04490
4	101.6	400	240	146	23	HDC04200
5¾	146.1	350	120	94	15	HDC04732

3/8" Diameter Actual .371" (9.42 mm)

Sheath Length in	Sheath Length mm	Watts	Volts	Watt Density W/in²	Watt Density W/cm²	Part Number
1¼	31.8	150	240	170	26	HDC06254
1¼	31.8	200	240	226	35	HDC04349
1½	31.8	250	120	212	33	HDC04402
2	50.8	250	240	141	22	HDC04291
2	50.8	350	240	198	31	HDC11345
2½	63.5	250	240	106	16	HDC07496
2½	63.5	350	240	149	23	HDC04759
2½	63.5	500	240	212	33	HDC05359
3	76.2	300	240	102	16	HDC02094
3	76.2	375	240	127	20	HDC06779
3½	88.9	350	240	99	15	HDC04861
4	101.6	400	120	97	15	HDC04560
4	101.6	500	240	121	19	HDC04552
5½	139.7	1000	240	170	26	HDC05431
7	177.8	350	240	46	7	HDC05303
12	304.8	1000	240	74	11	HDC05833

1/2" Diameter Actual .496" (12.60 mm)

Sheath Length in	Sheath Length mm	Watts	Volts	Watt Density W/in²	Watt Density W/cm²	Part Number
2	50.8	300	240	127	20	HDC03872
3⅛	79.4	500	240	121	19	HDC11162
3 13/16	96.8	250	240	48	7	HDC10330
4	101.6	500	240	91	14	HDC04676
4	101.6	600	240	109	17	HDC03878
5	127	500	240	71	11	HDC04701
6	152.4	500	240	58	9	HDC04677
6	152.4	750	240	87	14	HDC04352
6	152.4	1000	240	116	18	HDC03887
7	177.8	750	240	73	11	HDC03893
8	203.2	500	240	42	7	HDC02265
8	203.2	1000	240	85	13	HDC02263
10	254	1000	240	67	10	HDC04220

5/8" Diameter Actual .621" (15.77 mm)

Sheath Length in	Sheath Length mm	Watts	Volts	Watt Density W/in²	Watt Density W/cm²	Part Number
3	76.2	750	240	153	24	HDC04483
6	152.4	600	240	56	9	HDC11240
6	152.4	1000	240	93	14	HDC07353

All Items Available from Stock

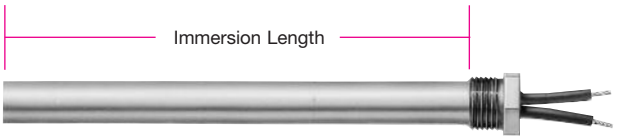
Note: Custom Engineered/Manufactured Hi-Density Cartridge Heaters with Type F Flexible Lead Termination

Refer to ordering information on page 2-3.

Standard Size Stock Type CM 1/2" & 3/4 NPT Screw Plug Hi-Density Cartridge Immersion Heaters

Hi-Density Cartridge Immersion Heaters are designed for heating water and other liquids. The high watt density capability of this heater permits greater heat dissipation in a given area than would a tubular immersion heater.

However, it is important to note that allowable watt density depends on the material being heated. For water heating, watt densities of several hundred watts per square inch are possible; oil heating may be limited to 5 to 20 watts per square inch.



Design Features

- *Passivated Incoloy® Sheath*
- *10" long Teflon® Insulated Lead Wires*
- *Brass Fitting*
- *Epoxy Seal at Lead End 266°F (130°C) Standard UL Rating 194°F (90°C)*

Note: See pages 2-50 & 2-51 for other fitting options

Diameter	Heater Immersion Length in	mm	Watts	Watt Density W/in²	W/cm²	Part Number 120V	240V	480V
5/8" Incoloy® Sheath 1/2 NPT Fitting	1½	38.1	100	41	6	HDL00001	—	—
	1½	38.1	400	163	25	—	HDL00002	—
	3½	88.9	250	39	6	HDL00003	HDL00004	—
	3½	88.9	1000	157	24	—	HDL00005	HDL00006
	7⅞	200.0	500	33	5	HDL00007	HDL00008	—
	7⅞	200.0	2000	134	21	—	HDL00009	HDL00010
	12	304.8	750	33	5	HDL00011	HDL00012	—
	12	304.8	3000	130	20	—	HDL00013	HDL00014
3/4" Incoloy® Sheath 3/4 NPT Fitting	4¼	108.0	500	53	8	HDL00015	HDL00016	—
	4¼	108.0	750	80	12	HDL00017	HDL00018	—
	4¼	108.0	1000	106	16	HDL00019	HDL00020	—
	4⅝	117.5	300	29	5	HDL00021	HDL00022	—
	4⅝	117.5	1200	116	18	—	HDL00023	HDL00024
	4¾	120.7	375	35	5	HDL00025	HDL00026	—
	4¾	120.7	1500	141	22	—	HDL00027	HDL00028
	5¾	146.1	500	39	6	HDL00029	HDL00030	—
	5¾	146.1	2000	154	24	—	HDL00031	HDL00032
	6¼	158.8	500	35	5	HDL00033	HDL00034	—
	6¼	158.8	2000	141	22	—	HDL00035	HDL00036
	6½	165.1	625	42	7	HDL00037	HDL00038	—
	6½	165.1	2500	170	26	—	HDL00039	HDL00040
	7¼	184.2	750	45	7	HDL00041	HDL00042	—
	7¼	184.2	3000	182	28	—	HDL00043	HDL00044
	9	228.6	1000	49	8	HDL00045	HDL00046	—
	9	228.6	4000	194	30	—	HDL00047	HDL00048
	10½	266.7	750	31	5	HDL00049	HDL00050	—
	10½	266.7	3000	124	19	—	HDL00051	HDL00052
	10¾	273.1	1250	51	8	HDL00053	HDL00054	—
	10¾	273.1	5000	202	31	—	HDL00055	HDL00056
	12½	317.5	1500	52	8	—	HDL00057	—
	12½	317.5	6000	208	32	—	—	HDL00058
	13⅜	346.1	1000	32	5	HDL00059	HDL00060	—
	13⅜	346.1	4000	127	20	—	HDL00061	HDL00062
	16	406.4	2000	54	8	—	HDL00063	—
	16	406.4	8000	216	33	—	—	HDL00064
	19¼	489.0	2500	56	9	—	HDL00065	—
	19¼	489.0	10000	223	35	—	—	HDL00066

Ordering Information

Stock Heaters

Part Numbers listed above are for 1/2" and 3/4" NPT Brass Screw Plug Cartridge Immersion Heaters with Type CM termination and 10" long leads. ***Standard lead time is 72 hours.***

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 Cartridge Immersion Heater to meet your requirements. ***Standard lead time is 3 weeks.***

Please Specify the following:

- ❑ Screw Plug NPT Size
- ❑ Screw Plug material (Brass or SS)
- ❑ Sheath material (Incoloy®, 321 SS)
- ❑ Element Watt Density
- ❑ Immersion Length
- ❑ Heated Length
- ❑ Wattage
- ❑ Voltage
- ❑ Termination types
- ❑ Lead Length

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

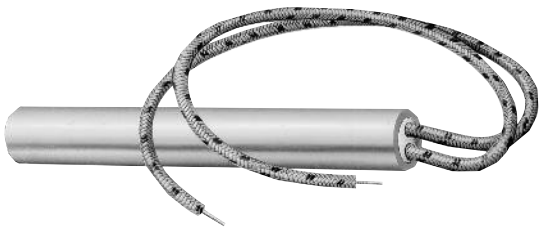
Type N External Pins with Leads

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

Standard Termination — LDC Low-Density Cartridge Heaters



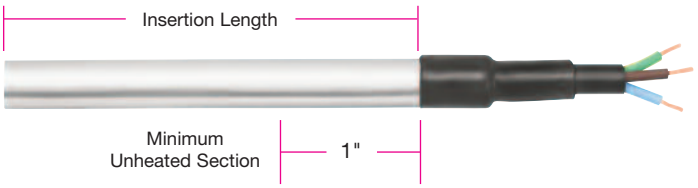
Type F Internally Connected Flexible Leads

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.

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: 450°F (232°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 (548°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**

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

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

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.

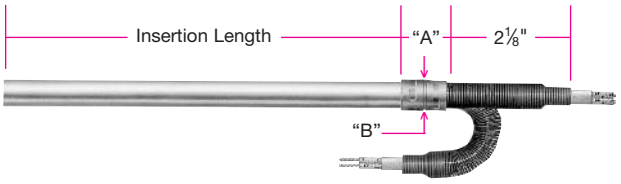
S1B Silver brazed spring.

- 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.

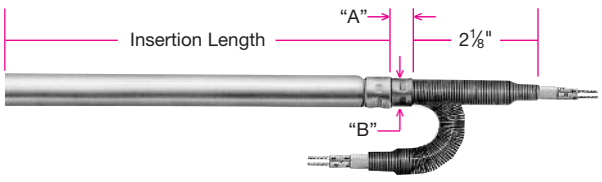
Dimensions for Type S1

	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	23.81	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

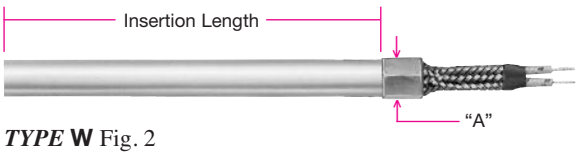


***TYPE* S1** Fig. 2

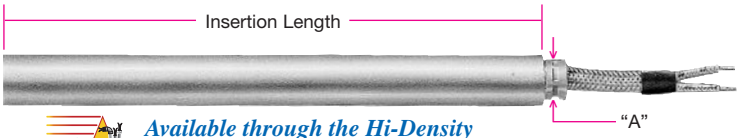


Cartridge Heater — Flexible Braid Abrasion Resistant Terminations

TYPE **W** Fig. 1



TYPE **W** Fig. 2



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

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

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
3/4	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 W2 ☐ Embedded Wire Braided Leads

Available on HDC, HDM and LDC cartridge heaters

Stainless Steel braid embedded into seal offers moisture resistance and abrasion protection.

W2A Fiberglass Leads with Cement Potting
- Cement potting temperature rating: 1000°F (538°C)
- Standard lead wire temperature rating: 482°F (250°C)

W2B Teflon® Leads with High Temperature Epoxy
- High temperature epoxy temp. rating: 450°F (232°C)
- Standard lead wire temperature rating: 392°F (200°C)

W2C Teflon® Leads with Low Temperature Epoxy
- Low temperature epoxy temp. rating: 266°F (130°C) UL rated to 194°F (90°C)
- Standard 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) braid over 12" (305 mm) leads. Specify longer braid/leads.

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

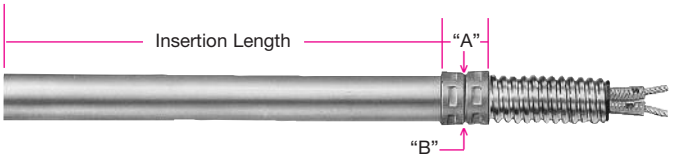
- Standard lead wire temperature rating: 482°F (250°C)

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

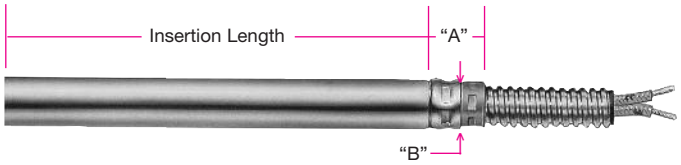


C1A and C1B are available through the Hi-Density Cartridge Heater Terminator Program for Same or Next Day Shipping

Dimensions for Type C1

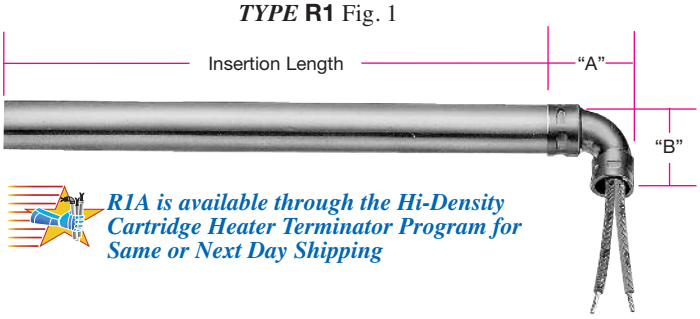
	Diameter in	Diameter mm	Fig.	"A" Dim. in	"A" Dim. mm	"B" Dim. in	"B" Dim. mm	Cable Dia.
Hi-Density Cartridge Heaters	1/4	6.35	1	11/16	17.46	5/16	7.94	1/4
	5/16	7.94	1	11/16	17.46	7/16	11.11	1/4
	3/8	9.53	1	11/16	17.46	7/16	11.11	3/8
	1/2	12.70	1	13/16	20.64	9/16	14.29	1/2
	5/8	15.88	1	1	25.40	3/4	19.05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



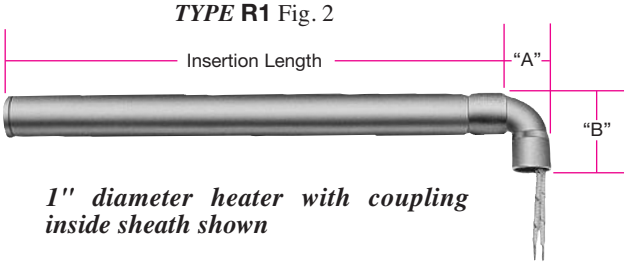
Cartridge Heater — Plain Leads Right-Angle Terminations

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

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
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
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

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

Cartridge Heater — Flexible Spring Abrasion Resistant Right-Angle Terminations

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. Same as C3 and W1 except plain leads. 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)

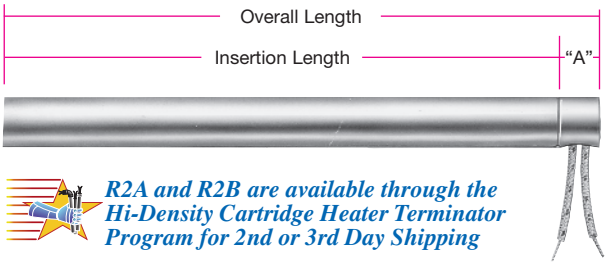
R2C Silicone rubber potting, welded lead end disc
- ➤Silicone Rubber potting temperature rating: 450°F (232°C)
- ➤Standard silicone rubber lead wire temperature rating: 392°F (200°C)

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.



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

Dimensions for types R2

Diameter in	Diameter mm	Availability HD	Availability LD	"A" Dim. in	"A" Dim. mm
3/16	4.76	No	No	—	—
1/4	6.35	Yes	Yes	5/16	7.94
5/16	7.94	Yes	No	5/16	7.94
3/8	9.53	Yes	Yes	7/16	11.11
1/2	12.70	Yes	Yes	9/16	14.29
5/8	15.88	Yes	Yes	9/16	14.29
3/4	19.05	Yes	Yes	9/16	14.29
7/8	22.23	No	Yes	5/8	15.88
15/16	23.81	No	Yes	5/8	15.88
1	25.40	Yes	Yes	5/8	15.88
1-1/4	31.75	No	Yes	5/8	15.88

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.

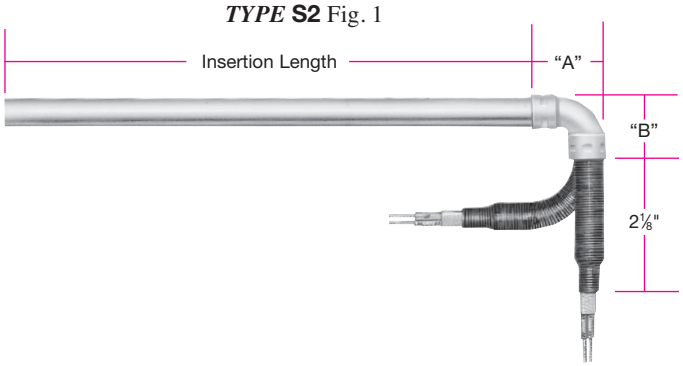
➤ Standard fiberglass lead wire temperature rating HDC and HDM: 842°F (450°C), LDC: 482°F (250°C)

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

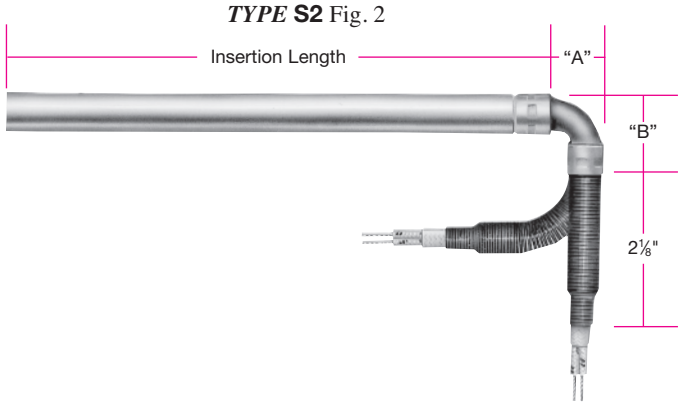
Dimensions for Type S2

	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

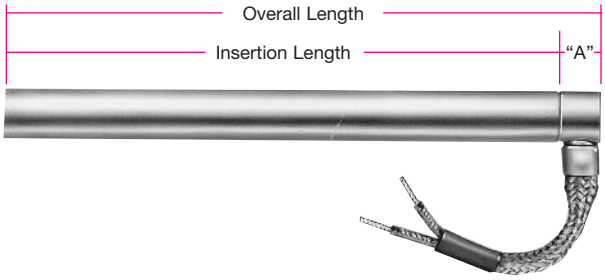
***TYPE* S2** Fig. 1



***TYPE* S2** Fig. 2



Cartridge Heater — Flexible Braid Abrasion Resistant Right-Angle Terminations



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

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		Availability		"A" Dim.	
in	mm	HD	LD	in	mm
3/16	4.76	No	No	—	—
1/4	6.35	Yes	Yes	5/16	7.94
5/16	7.94	Yes	No	5/16	7.94
3/8	9.53	Yes	Yes	7/16	11.11
1/2	12.70	Yes	Yes	9/16	14.29
5/8	15.88	Yes	Yes	9/16	14.29
3/4	19.05	Yes	Yes	9/16	14.29
7/8	22.23	No	Yes	5/8	15.88
15/16	23.81	No	Yes	5/8	15.88
1	25.40	Yes	Yes	5/8	15.88
1-1/4	31.75	No	Yes	5/8	15.88

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

Cartridge Heater — Armor Cable Abrasion Resistant Right-Angle Terminations

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

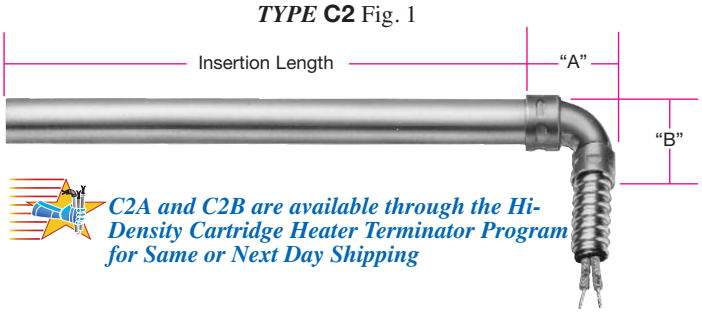
C2B Stainless steel armor cable, mechanically fastened

C2C Galvanized armor cable, silver brazed

C2D Stainless steel armor cable, silver brazed

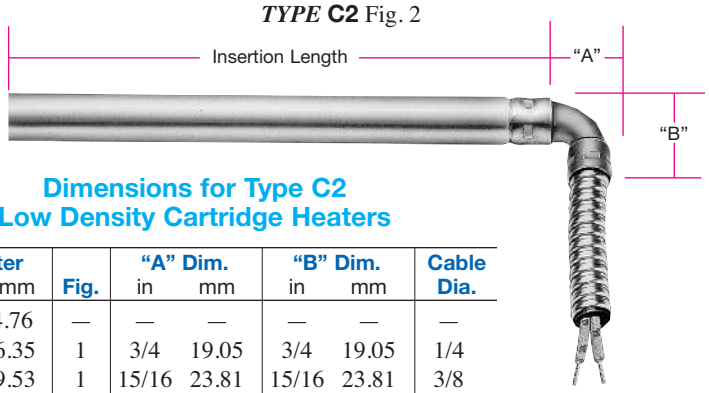
- Minimum 3/8" up to 1" unheated section at the lead end is required.
- Standard fiberglass lead wire temperature rating HDC and HDM: 842°F (450°C), LDC: 482°F (250°C)
- **Standard** 10" (254 mm) cable over 12" (305 mm) leads. Specify longer cable or leads.

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



Dimensions for Type C2 Hi-Density Cartridge Heaters

Diameter in	Diameter mm	Fig.	"A" Dim. in	"A" Dim. mm	"B" Dim. in	"B" Dim. mm	Cable Dia.
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

Dimensions for Type C2 Low Density Cartridge Heaters

Diameter in	Diameter mm	Fig.	"A" Dim. in	"A" Dim. mm	"B" Dim. in	"B" Dim. mm	Cable Dia.
3/16	4.76	—	—	—	—	—	—
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 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.

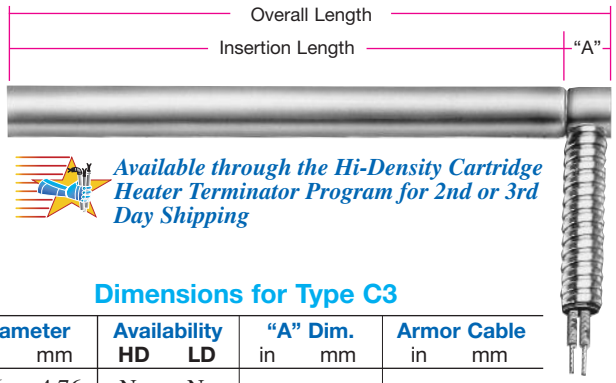
C3A Cement potting and silicone varnish with no lead end disc, galvanized cable

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.



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

Dimensions for Type C3

Diameter in	Diameter mm	Availability HD	Availability LD	"A" Dim. in	"A" Dim. mm	Armor Cable in	Armor Cable mm
3/16	4.76	No	No	—	—	—	—
1/4	6.35	Yes	Yes	5/16	7.94	1/4	6.35
5/16	7.94	Yes	No	5/16	7.94	1/4	6.35
3/8	9.53	Yes	Yes	7/16	11.11	3/8	9.53
1/2	12.70	Yes	Yes	9/16	14.29	1/2	12.70
5/8	15.88	Yes	Yes	9/16	14.29	1/2	12.70
3/4	19.05	Yes	Yes	9/16	14.29	1/2	12.70
7/8	22.23	No	Yes	5/8	15.88	1/2	12.70
15/16	23.81	No	Yes	5/8	15.88	1/2	12.70
1	25.40	Yes	Yes	5/8	15.88	1/2	12.70
1-1/4	31.75	No	Yes	5/8	15.88	1/2	12.70

Cartridge Heater — Screw Terminations

Type T1 Screw Terminals

Available on LD 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	3/4	1/4	1-3/8
1-1/4	1¼-11½	7/8	5/16	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** — 450°F (232°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).

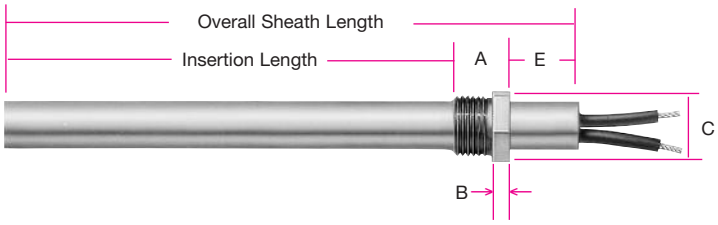
- A minimum of 1/4" cold section below the bushing is required.
- **Standard** 10" (254 mm) leads. Specify longer leads.

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.

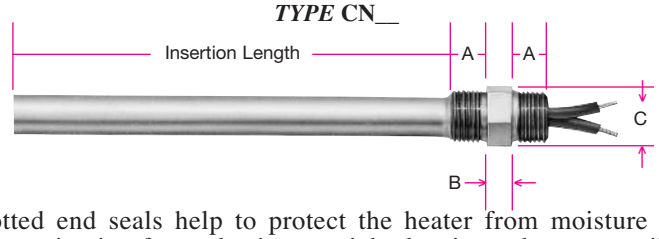
Standard NPT Bushing Dimensions

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	3/4	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
Hi-Temp Epoxy	CND	CNR

TYPE CN__



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** — 450°F (232°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" cold 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

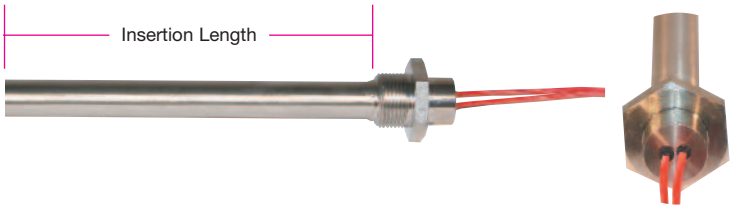
Available on HDC (except 1/8") and HDM cartridge heaters

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

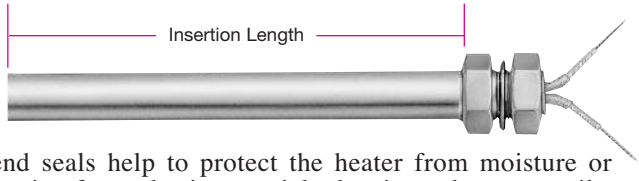
Type BF ☐ Bulkhead Fitting

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" cold section below the bushing is required.

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

Cartridge Heater Mounting Flange Options

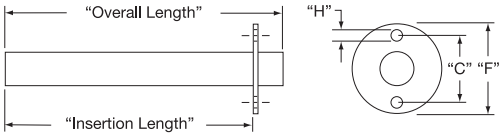
Type MFR Mounting Flange — Round

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

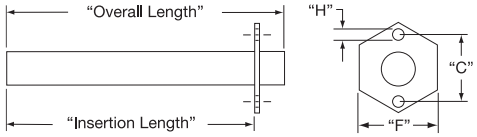
Note: 5/16" dia. cartridge heater can only be HDC; 7/8" and 1-1/4" can only be LDC.

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

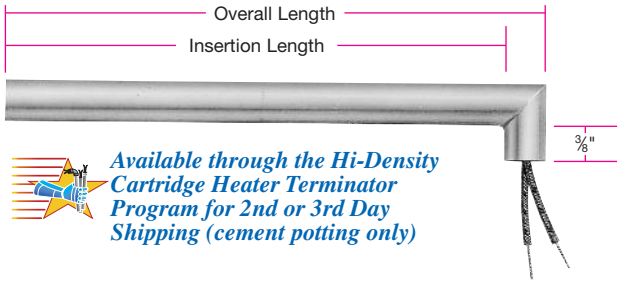
Strain relief clip for leads subject to tension and stress. A "T" type strain relief is silver brazed to the sheath.

Type S4 Right-Angle Lead Wire Strain Relief

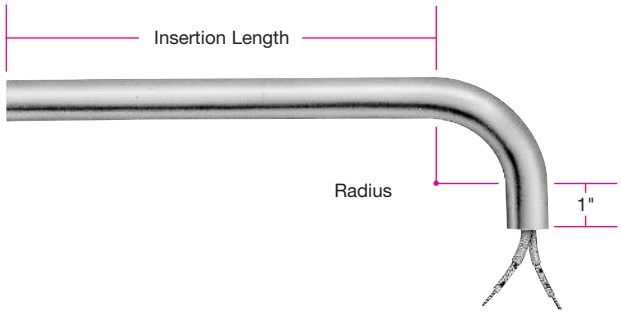
Available on HDC, HDM, and LDC cartridge heaters

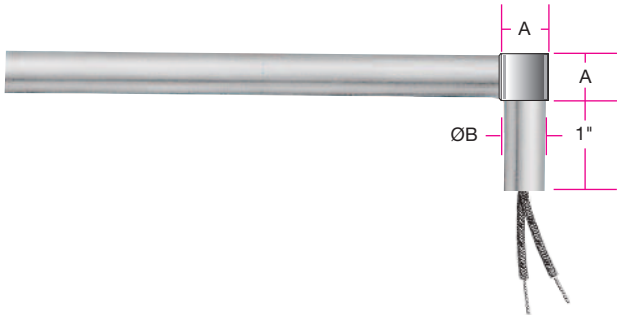
Strain relief clip for leads subject to tension and stress. A "T" type strain relief is silver brazed to the sheath and bent at a 90° angle.

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 silver brazed to the cartridge at a 90° angle. The leads are internally connected. 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 cold 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**	1/2	1/2	3/4	1	1-1/4	1-1/2
	mm	12.70	12.70	19.05	25.40	31.75	38.10

Type R5 Square Block with Tube Extension

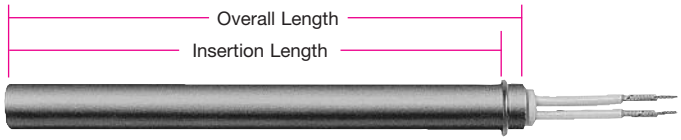
Available on HDC, HDM, and LDC cartridge heaters

The tube extension is silver brazed or tack welded to a square S/S block. The standard tube length is 1", but different lengths can be specified. Available with various lead wire types, abrasion resistant options or potted end seals.

Heater Diameter		"A"		"B"	
in	mm	in	mm	in	mm
1/4	6.35	7/16	11.11	5/16	7.94
3/8	9.53	1/2	12.70	3/8	9.52
1/2	12.70	5/8	15.87	1/2	12.70
5/8	15.88	3/4	19.05	5/8	15.87
3/4	19.05	1	25.40	11/16	17.46

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

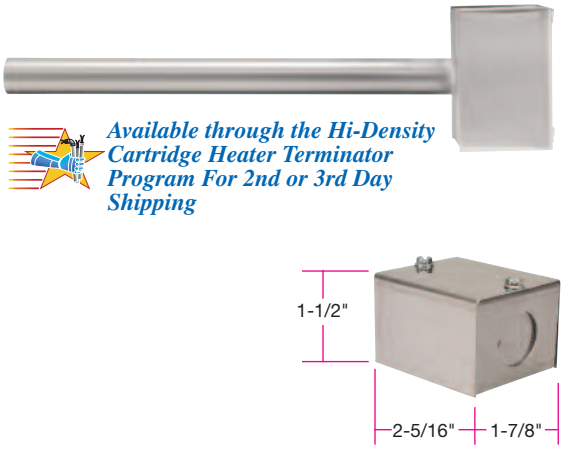
Available through the Hi-Density Cartridge Heater Terminator Program for Same or Next Day Shipping

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.

Cartridge Heater Terminal Box Options



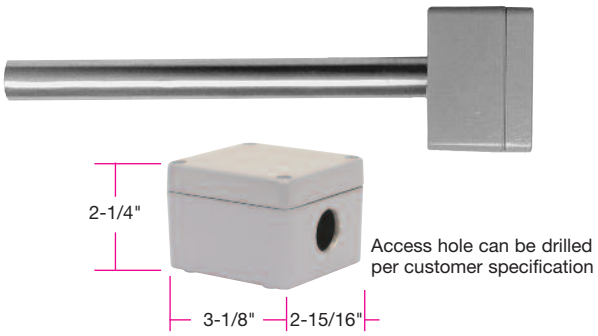
Available through the Hi-Density Cartridge Heater Terminator Program For 2nd or 3rd Day Shipping

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

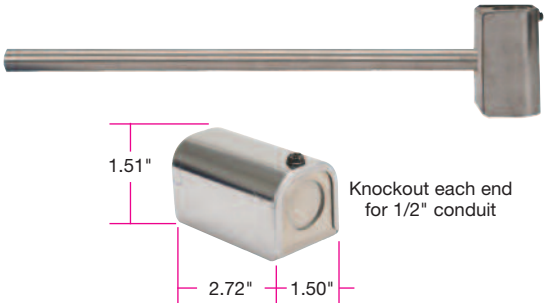
Available on HDC, HDM, and LDC cartridge heaters

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.

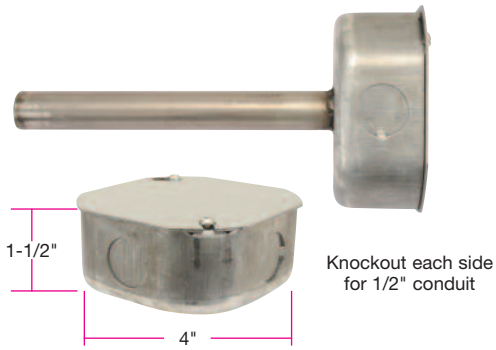


Type E4 General Purpose Terminal Box *(mailbox style)*

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.

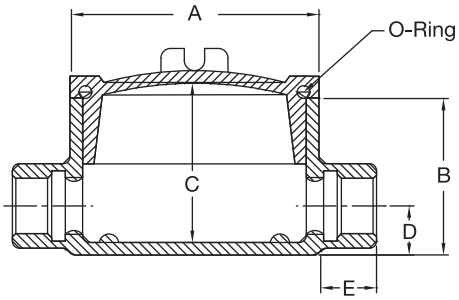
➤ A termination must be specified separately.

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.

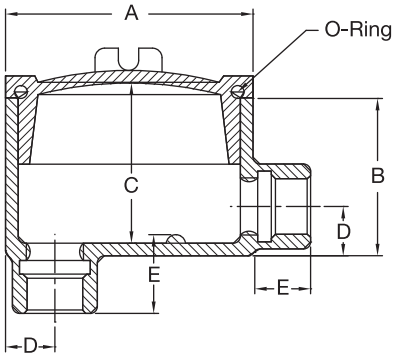
- A threaded fitting mounting termination must be specified. See pages 2-50 and 2-51.
- Other terminal box configurations available upon request.



Style ***E3C***

Housing E3C Dimensions

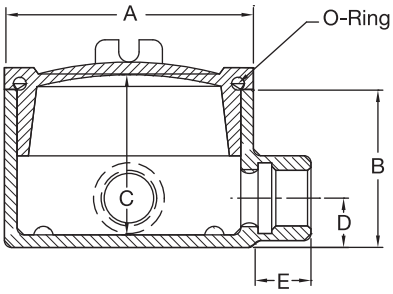
Heater Diameter(s)	Hub Size NPT	"A" (in)	"B" (in)	"C" (in)	"D" (in)	"E" (in)
1/2 & 5/8	1/2-14	2-1/2	2-1/4	2-3/16	5/8	7/8
3/4	3/4-14	2-1/2	2	2	3/4	7/8
1	1-11½	3-1/2	2-5/16	2-3/16	7/8	1



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.

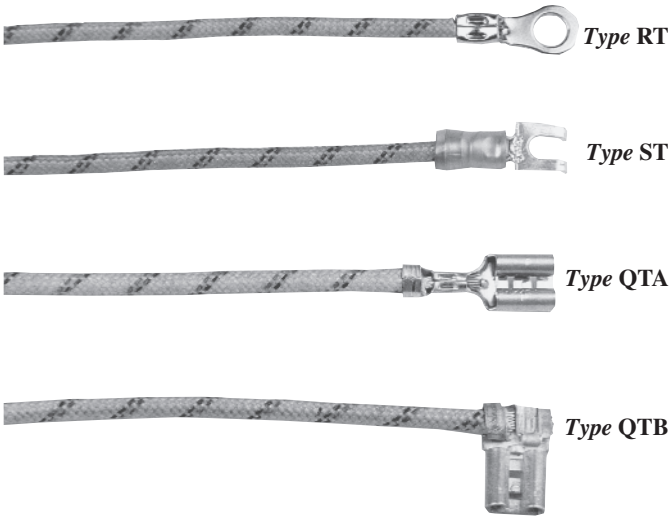
Cartridge Heater Options — Lead End Connections

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.

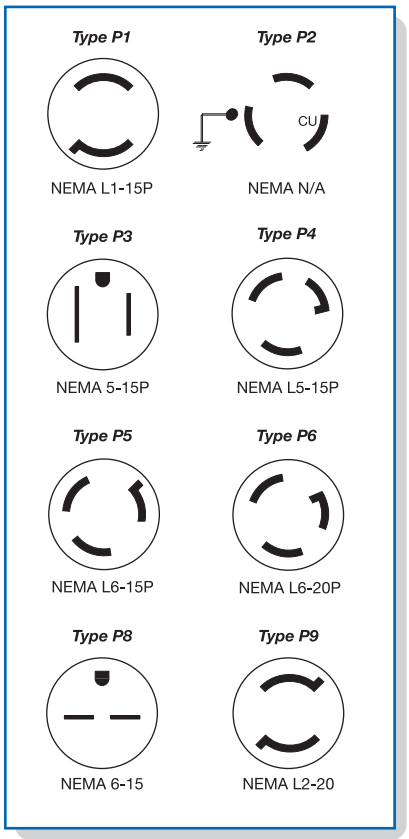


Type P☐ Quick Disconnect Plugs

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-102-122)
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

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 PVC 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 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.

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.

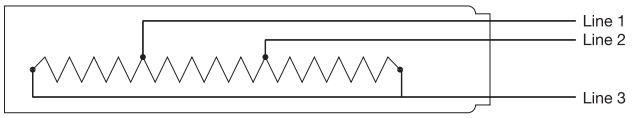
Available from stock.

Cartridge Heater Options — Internal Power Variations

Type DW Distributed Wattage

Available on HDC and HDM cartridge heaters

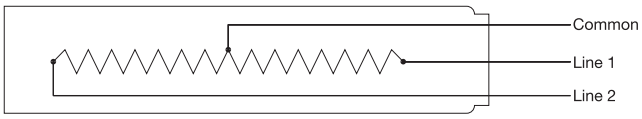
Cartridge heaters can be designed to vary the wattage along the length of the heater. Specify number of zones and the required watts and length per zone starting from the disk end. Leads can be connected externally or internally. Picture shows a heater with Type N externally connected leads. Heaters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

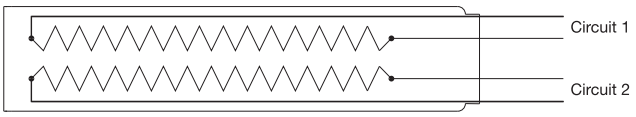


Type DV☐ Dual Voltage

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.

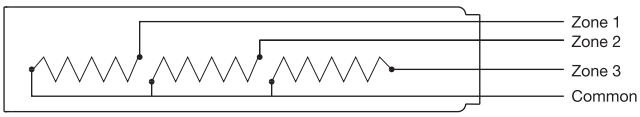
DV1 120/240 volts **DV2** 240/480 volts



Type DWV Dual Circuits

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

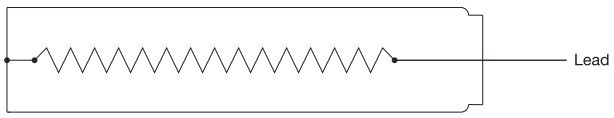
Independent resistance elements can be designed in a single cartridge heater for added versatility.



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.

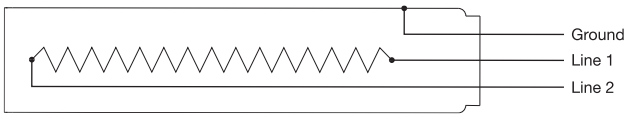
Multiple independently operated sections of the heater with a common wiring connection can be designed for increased flexibility.



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.



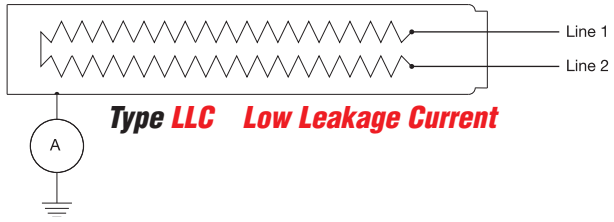
Type GL Ground Lead/Sheath

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



Type LLC Low Leakage Current

Available on HDC, HDM, and LDC cartridge heaters

Low leakage current construction is available for those applications such as medical products that require strict conformity to the requirements of regulatory agencies.

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.

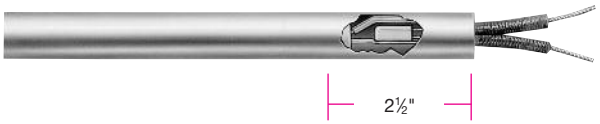
Type TM Thermistor
Type RD RTD Temperature Sensors

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

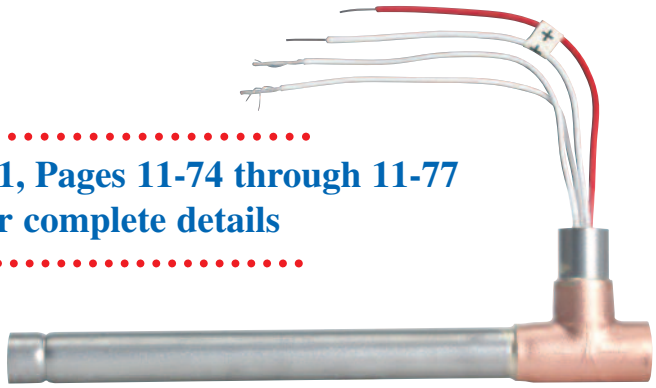
Cartridge heaters with attached pipe fittings can be pressure tested to your specifications at Tempco. Our in-house testing capabilities can ensure that your products meet your exact specifications. Contact Tempco with your requirements.

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



4.3-inch Operator Interface
HG1G Series

OPERATOR INTERFACE PART NUMBERS

Display screen	Operation Style	Communication	Bezel color	Part Number
4.3-inch TFT color LCD 65,536 colors	Touchscreen (analog resistive)	COM LAN USB 1 USB 2	Black	HG1G-4VT22TF-B
			Silver	HG1G-4VT22TF-S

SPECIFICATIONS

General Specifications

Electrical Specifications	Rated Power Voltage	12-24V DC
	Power Voltage Range	10.2 to 28.8V DC
	Power Consumption	8W maximum 4W maximum when not using USB interface (USB2)
	Allowable Momentary Power Interruption	10ms maximum (voltage 20.4 to 28.8V DC) 1ms maximum (voltage 10.2 to 20.4V DC)
	Inrush Current	40A maximum
	Dielectric Strength	1,000V AC, 10mA, 1 minute between power and FG terminals
Environmental Specifications	Operating Temperature	–20 to +55°C (no freezing)
	Operating Humidity	10 to 90% RH (no condensation)
	Storage Temperature	–20 to +70°C (no freezing)
	Storage Humidity	10 to 90% RH (no condensation)
	Pollution Degree	2
	Vibration Resistance	5 to 8.4Hz amplitude 3.5 mm, 8.4 to 150Hz, acceleration 9.8m/s^2 10 cycles (100 minutes) on each of three mutually perpendicular axes
	Shock Resistance	147m/s^2, 11ms 5 shocks on each of three mutually perpendicular axes
	Noise Immunity	Fast transient/burst test, Power terminals: ±2kV, Communication line: ±1kV (IEC/EN 61131-2, IEC/EN 61000-4-4)
	Electrostatic Discharge	Contact ±6kV, air ±8kV (IEC/EN 61131-2, IEC/EN 61000-4-2)
	Corrosion Immunity	Free from corrosive gases
Structure	Mounting	Panel mounting (panel thickness: 1.0 to 5.0mm)
	Degree of Protection	IP66F/IP67F (IEC 60529, JIS C0920) (see JIS C 0920 Annex 1 for "F") (front part when mounted) *1 IP65F/IP67F when panel thickness is below 1.5mm TYPE 4X TYPE 13 *2, Class I Div 2
	Dimensions	128 W ×102 H × 31.8 D mm
	Weight (approx.)	300g

• Do not use the HG1G in an environment subject to strong ultraviolet rays, otherwise the LCD quality will deteriorate.
*1: Protection degree of the front surface after mounting. Operation not guaranteed.
*2: Operation not guaranteed under environments using certain types of oils.

PRODUCT DESCRIPTION

The super-bright, compact 4.3-inch HG1G has most of the features and functionalities found in a larger screen, including monitoring and control via PC, tablet or smartphone. It supports multiple protocols simultaneously, FTP Server function and best-in-class LED backlight life of 70,000 hours. HG1G can be mounted in portrait or landscape to fit your needs. It also supports a wide range of operating temperatures from -20 to 55 degrees C, and is rated IP66F/67F, Type 4X & Type 13, and Class 1 Div 2. It's flexible and small enough to fit in a tight space, and priced to fit a tight budget.

KEY FEATURES

- Supports up to four protocols simultaneously
- Remote monitor and control
- FTP Server Function
- Operating temperatures: -20°C to 55°C
- 65,536 colors with 800cd/m^2
- 480 x 272 Pixel Resolution
- LED backlight lifespan: >70,000 hours
- Portrait or landscape mounting
- Rated power voltage: 12-24V DC
- Two Serial ports, 2 USB ports and an Ethernet port
- IP66F/IP67F, Type 4X, Type 13, Class 1 Div 2

SPECIFICATIONS (CON'T)

Display Specifications

Display	TFT color LCD
Color/Shade	65,536
Effective Display Area	95.04 W × 53.836 H mm
Display Resolution	480 W × 272 H pixels
View Angle	Right and left 70°, up 60°, down 65°
Backlight	White LED
Backlight Life	70,000 hours *1
Brightness	800cd/m^2 *2
Brightness Adjustment	32 levels
Backlight Replacement	N/A

*1 Backlight life refers to time until the brightness reduces by half. It is an expected value after use at 25°C and not guaranteed. Actual backlight life depends on the operating environment and conditions.

*2 Brightness of LCD when operating condition is 25°C.

Operation Specifications

Switching Element	Analog resistive membrane
Operating Force	3N maximum
Mechanical Life	1,000,000 operations
Acknowledgement Sound	Electronic buzzer

Function Specifications

Screen Types	Base screen, popup screen, system screen
No. of Screens	Base screen: 3,000 max. Popup screen: 3,015 max.
User Memory	12MB (including expansion fonts)
Parts	Bit Button, Word Button, Goto Screen,Print Button Key Button, Multi Button, Keypad, Selector Switch, Potentiometer, Numerical Input, Character Input, Pilot Lamp, Multi-State Lamp, Picture Display, Message Display, Message Switching Display, Alarm List Display, Alarm Log Display, Numerical Display, Bar Graph, Trend Chart, Pie Chart, Meter, Calendar, Bit Write Command, Word Write Command, Goto Screen Command,Print Command Screen Script Command, Multi Command,Timer
Calendar	Year, Month, Day, Hour, Min., Sec., Day of Week ±90 sec per month (at +25°C)
Power Failure Backup Data	Calendar, log data, keep internal relay, keep internal register
Battery	Recommended replacement time: every 5 years (at +25°C)

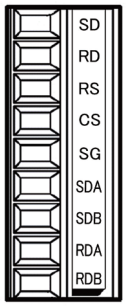
Interface Specifications

Serial Interface 1 (COM1) *1	RS232C	**Electrical Characteristics**	EIA RS232C compliant
		Transmission Speed	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 187500 bps
		Synchronization	Asynchronous
		Communication Method	Half or full duplex
		Control System	Hardware control or none
	RS422/485	**Electrical Characteristics**	EIA RS422/485 compliant
		Transmission Speed	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 187500bps *2
		Synchronization	Asynchronous
		Communication Method	Half or full duplex
		Control System	None
	Connector		Detachable 9-pin terminal block
Ethernet Interface (LAN)		**Interface**	IEEE802.3u (10BASE-T/100BASE-TX compliant
		Connector	Modular connector (RJ45)
USB Interface (USB1)		**Interface**	USB 2.0 high speed (480Mbps)
		Connector	USB Type Mini-B connector
USB Interface (USB2)		**Interface**	USB 2.0 Full speed (12Mbps)
		Connector	USB Type Mini-A connector

*1: RS232C and RS 422/485 can be used simultaneously. *2: 187,500bps available only with SIEMENS SIMATIC S7-300/400 series (MPI port direct connection).

Serial Interface Terminal Arrangement

Name	I/O	Function	Communication Type
SD	OUT	Send Data	RS232C
RD	IN	Receive Data	
RS	OUT	Request to Send	
CS	IN	Clear to Send	
SG	—	Signal Ground	RS232C, RS422/485
SDA	OUT	Send Data (+)	RS422/485
SDB	OUT	Send Data (–)	
RDA	IN	Receive Data (+)	
RDB	IN	Receive Data (–)	



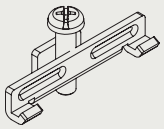
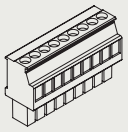
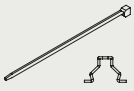
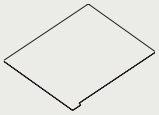
ACCESSORIES

Software and Cable Part Numbers

Name	Part No. (Ordering No.)	Package Quantity	Description
Application Software	SW1A-W1C	1	Automation Organizer Software Suite (includes WindO/I-NV4)
USB Maintenance Cable	HG9Z-XCM2A	1	USB Programming Cable USB-miniB
PLC Connection Cable *1	FC6A-KC1C	1	Communication cable between IDEC HMIs and FC6A (RS232/RS485)

*1: For the applicable connection cable to connect with the PLC of other than IDEC, refer to WindO/I -NV4 External Device Setup Manual included in the system configuration software Automation Organizer. The manual is also available on IDEC's website.

Maintenance Part Numbers

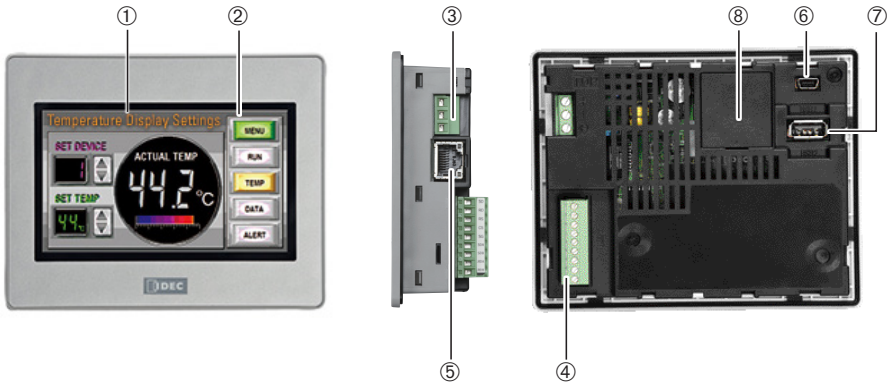
Name		Part No. (Ordering No.)	Package Quantity	Description
Mounting Clip		HG9Z-4K2PN04	4	Two clips are supplied with HG1G.
Serial Interface Connector (detachable 9-pin terminal block)		HG9Z-XT09V	1	One plug (terminal block type) is supplied.
Replacement Battery		HG9Z-XR1	1	Lithium battery CR2032 (one battery is supplied)
USB Cable Lock Pin		HG9Z-XU1PN05	5	Used to lock USB cable (for USB1, USB2). Two pins are supplied with HG1G.
Protective Sheet *2	 (Size: 121.6 × 95.6mm, thickness: 0.188mm)	HG9Z-1D4PN05	5	For 4.3 inch (5 pcs/pack) (used to protect the LCD)

*2: The protective sheet is UV resistant, however, resistance against direct sunlight in outdoor usage is not guaranteed. Used to protect the display screen.

STARTER KITS

Part Numbers	Description
SMARTTOUCH-1G-B	HMI Kit - HG1G TFT 65K COLOR BLK Bezel, Power Supply, Software, and Programming Cable
KIT-FC6A-16-RA-HG1G	PLC/HMI Kit - FC6A 16IO 100–240V AC Relay Output, and HG1G TFT LCD black bezel, Power Supply, Software and cables
KIT-FC6A-16-RC-HG1G	PLC/HMI Kit - FC6A 16IO 24V DC Relay Output, and HG1G TFT LCD black bezel, Power Supply, Software and cables
KIT-FC6A-24-RA-HG1G	PLC/HMI Kit - FC6A 24IO 100–240V AC Relay Output, and HG1G TFT LCD black bezel, Power Supply, Software and cables
KIT-FC6A-24-RC-HG1G	PLC/HMI Kit - FC6A 24IO 24V DC Relay Output, and HG1G TFT LCD black bezel, Power Supply, Software and cables

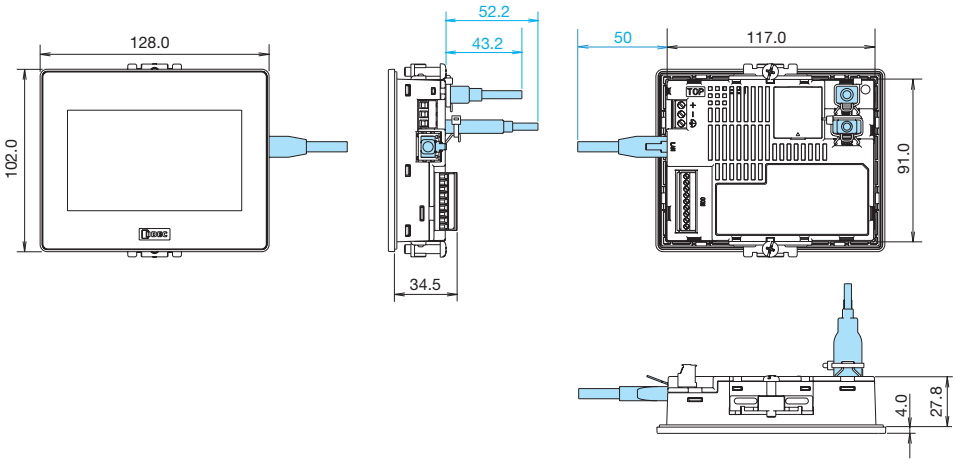
HARDWARE



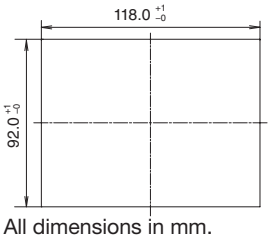
No.	Name
①	Display
②	Touchscreen
③	Power Supply Terminal
④	Serial Interface (COM)

No.	Name
⑤	Ethernet Interface (LAN)
⑥	USB Interface (USB1)
⑦	USB Interface (USB2)
⑧	Battery Cover

DIMENSIONS



Panel Cut-out



All dimensions in mm.

Panel thickness: 1.0 to 5.0mm

- Dimensions in blue show the mounting dimensions of the cable.
- Dimensions in the figure vary depending on the type of cable connected.
- Install the HG1G into a panel cut-out by tightening the two mounting clips (supplied) to a torque of 0.2 to 0.3 N·m.
- Do not use excessive force to tighten, otherwise the HG1G may be distorted. Also waterproof characteristics may be lost.

COMPATIBLE PLCS

Manufacturer	Series
IDEC	MICROSmart
	SmartAXIS Pro/Lite
	MICROSmart (Ethernet)
	SmartAXIS Pro/Lite (Ethernet)
Mitsubishi	MELSEC-A (link unit)
	MELSEC-QnA (link unit)
	MELSEC-Q (link unit)
	MELSEC-Q (Ethernet)
	MELSEC-FX
	MELSEC-FX (Ethernet)
OMRON	SYSMAC-C
	SYSMAC-CS
	SYSMAC-CJ1
	SYSMAC-CJ2
	SYSMAC-CP1
	SYSMAC (Ethernet)
Allen-Bradley	PLC-5 (Half Duplex)
	SLC-500 (Half Duplex)
	MicroLogix (Full Duplex)
	ControlLogix (Full Duplex)
	CompactLogix (Full Duplex)
	FlexLogix (Full Duplex)
	ControlLogix (Ethernet/IP, Ethernet/IP [Logix Native Tag])
	CompactLogix (Ethernet/IP, Ethernet/IP [Logix Native Tag])
	PLC-5 (Ethernet/IP)
	SLC 500 (Ethernet/IP)
	MicroLogix (Ethernet/IP)
SIEMENS	S7-200
	S7-300 (connects to CPU)
	S7-300 (link unit)
	S7-400
	S7-1200 (Ethernet)
Keyence	KV-700/1000/3000/5000
	KV Nano
	KZ
	KV
	KV (Ethernet)
Hitachi	S10mini
	S10V
JTEKT	TOYOPUC-PC2J
	TOYOPUC-PC3J
Toshiba Machine Works	TC200
	TCmini
GE Fanuc Automation	Series90-30
	VersaMax

Manufacturer	Series
Schneider Electric	Twido
Modicon	Modbus RTU Master
	Modbus RTU Slave
	Modbus ASCII Master
	Modbus TCP Client
	Modbus TCP Server
Panasonic	FP Series
Yaskawa Electric	MP
	MP (Ethernet)
Koyo	DirectLOGIC 05
	DirectLOGIC 06
	DirectLOGIC 205
	KOSTAC SZ
	KOSTAC SU
	KOSTAC SU (Ethernet)
Fanuc	Power Mate
	Series
Yokogawa Electric	FA-M3
	FA-M3 (Ethernet)
Fuji Electric	FREX-PC
	MICREX-F
	MICREX-SX
	MICREX-SX (Ethernet)
Toshiba	PROSEC T Series
	V Series
LS Industrial Systems	MASTER-K
VIGOR	VB
	VH
Emerson	FloBoss
Equipment Systems	EH (Ethernet)

IDEC Corporation • 1175 Elko Drive • Sunnyvale, CA 94089 • 800-262-IDEC (4332) • Fax: 408-745-5258 • www.IDEC.com/usa

CERTIFICATE OF COMPLIANCE

Certificate Number	20160727-E102542
Report Reference	E102542-20110527
Issue Date	2016-JULY-27
Issued to:	IDEC CORP 6-64 NISHIMIYAHARA 2-CHOME YODOGAWA-KU, OSAKA 532-0004 JAPAN
This is to certify that representative samples of	PROGRAMMABLE CONTROLLERS SEE ADDENDUM PAGE FOR MODELS
	Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.
Standard(s) for Safety:	UL508 - Industrial Control Equipment CSA C22.2 NO. 142-M1987 - Process Control Equipment
Additional Information:	See the UL Online Certifications Directory at www.ul.com/database for additional information

Only those products bearing the UL Certification Mark should be considered as being covered by UL's Certification and Follow-Up Service.

Look for the UL Certification Mark on the product.

Bruce Mahrenholz, Director North American Certification Program

UL LLC

CERTIFICATE OF COMPLIANCE

Certificate Number	20160727-E102542
Report Reference	E102542-20110527
Issue Date	2016-JULY-27

This is to certify that representative samples of the product as specified on this certificate were tested according to the current UL requirements.

Models:

HG2G Series, 5.7 inch type
HG2G-5ST22VF-W, -5ST22VF-B, -5ST22VF-S
HG2G-5ST22TF-W, -5ST22TF-B, -5ST22TF-S
HG2G-5FT22TF-W, -5FT22TF-B, -5FT22TF-S.

HG4G Series, 12.1 inch type
HG4G-CJT22TF-B, -CJT22MF-B.

HG1G Series, 4.3 inch type
HG1G-4VT22TF-W, -4VT22TF-B, -4VT22TF-S
HG1G-4VT22TG-W, -4VT22TG-B, -4VT22TG-S
HG1G-4VT22TH-W, -4VT22TH-B, -4VT22TH-S
HG1G-4VT22TJ-W, -4VT22TJ-B, -4VT22TJ-S

Bruce Mahrenholz, Director North American Certification Program

UL LLC

POWER TEAM®

SPX Hydraulic Technologies
5885 11th Street
Rockford, IL 61109-3699 USA
powerteam.com

Tech. Services: (800) 477-8326
Fax: (800) 765-8326
Order Entry: (800) 541-1418
Fax: (800) 288-7031

User Manual for:
PE8 Series
PE17 Series

Electric-Powered

8 & 17 Series
Two-Stage Hydraulic Pump

Form No. 1000559
Rev. 0 February 3, 2012

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Rev. 0 February 3, 2012

Description

The 17 series hydraulic pumps are designed to have a maximum of 690 bar (10,000 psi) at a flow rate of 278 cc/min (17 cu. in/min). A pump can be valved for use with either single- or double-acting cylinders.

The 8 series pump all the same features as the 17-series. The 8-series is equipped with a 1.9 kW (½ HP) 1,725 RPM electric motor where the 17-series is equipped with a 1.9 kW (½ HP) 3,450 RPM electric motor. All pumps come fully assembled, less fluid, and ready for work.

PE8/17-Series Electric / Hydraulic Pumps

The 17 series uses an induction motor. Refer to the *Performance* section of this manual for motor ratings.

Electric Motor

The PE17-series pumps are equipped with .4 kW (1/2 hp), 3,450 rpm, single-phase, thermal protected induction motor; 10 ft. remote control cord. Low amperage draw; small generators and low amperage circuits can be used as power source. Extremely quiet noise level (67-81 dBA).

The PE8-series pumps are equipped with 1,725 rpm, single-phase, thermal protected induction motor.

Figure 1. PE172SM

Figure 2. PE84

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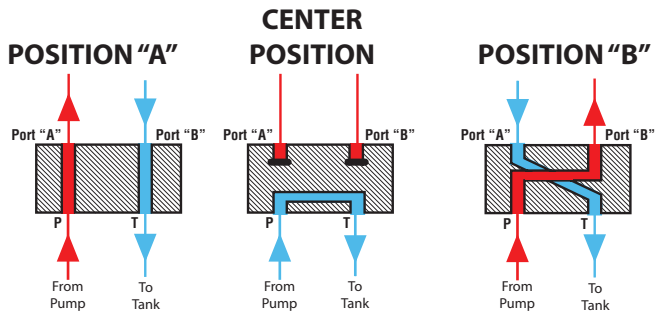
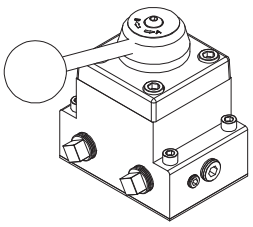
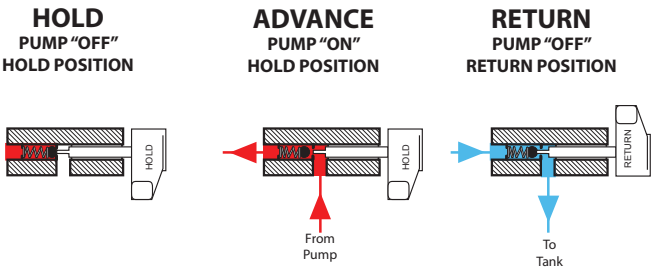
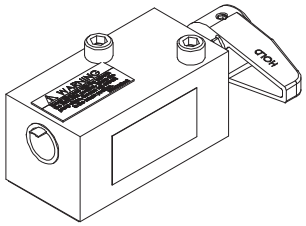
Control Valves

Max. Capacity: 690 Bar (10,000 PSI)

	Valve Function	Use with Cylinder Type	Valve No.
PE84 PE174		Single-and double-acting	9500 4-way, 3-position, pump mounted manual detented
		Diagrams	
			

	Valve Function	Use with Cylinder Type	Valve No.
PE172 PE172M		Single acting	9517 2-way, 2-position, pump mounted manual detented
		Diagrams	
			

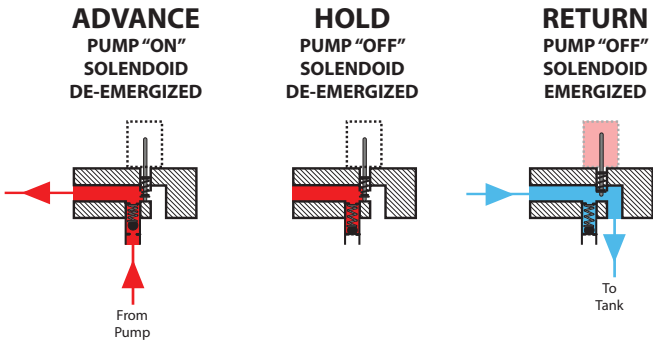
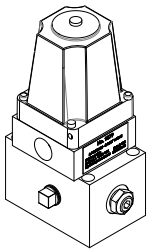
	Valve Function	Use with Cylinder Type	Valve No.
PE172S PE172SM		Single acting	9579 3-way, 2-position, pump mounted solenoid operated, normally closed
		Diagrams	
			

Table 1. Pump Configurations

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Control Valves continued

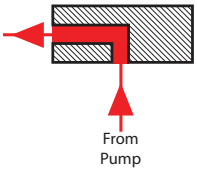
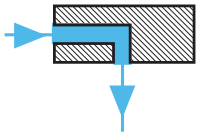
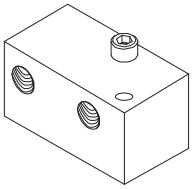
<table>
<tr><td rowspan="3">PE172A
PE172AM</td><td>Valve Function</td><td>Use with Cylinder Type</td><td>Valve No.</td></tr>
<tr><td rowspan="2">ADVANCE
PUMP “ON”
 
From Pump
RETURN
PUMP “OFF”
 
To Tank</td><td>Single acting</td><td>45554 Auto/Dump manifold advance return</td></tr>
<tr><td colspan="2">Diagrams
  </td></tr>
</table>

Table 1. Pump Configurations (continued)

Safety Symbols and Definitions

The safety signal word designates the degree or level of hazard seriousness.

DANGER: Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING: Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION: Used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

IMPORTANT: Important is used when action or lack of action can cause equipment failure, either immediate or over a long period of time.

Safety Precautions

WARNING:

- **The following procedures must be performed by qualified, trained personnel who are familiar with this equipment. Operators must read and understand all safety precautions and operating instructions included with the pump. If the operator cannot read these instructions, operating instructions and safety precautions must be read and discussed in the operator's native language.**
- **These products are designed for general use in normal environments. These products are not designed for lifting and moving people, agri-food machinery, certain types of mobile machinery, or in special work environments such as: explosive, flammable, or corrosive. Only the user can decide the suitability of this product in these conditions or extreme environments. Power Team will supply information necessary to help make these decisions. Consult your nearest Power Team facility.**

- **Safety glasses must be worn at all time by the operator and anyone within sight of the unit. Additional personal protection equipment may include: face shield, goggles, gloves, apron, hard hat, safety shoes, and hearing protection.**

- **The owner of this tool must ensure that safety-related decals are installed, maintained, and replaced if they become hard to read.**

- **Shut OFF the motor before opening any connections in the system.**
- **The guide cannot cover every hazard or situation so always do the job with SAFETY FIRST.**

Pump

WARNING:

- **Do not exceed the hydraulic pressure rating noted on the pump nameplate or tamper with the internal high pressure relief valve. Creating pressure beyond rated capacities can result in personal injury.**
- **Retract the system before adding fluid to prevent overfilling the pump reservoir. An overfill can cause personal injury due to excess reservoir pressure created when cylinders are retracted.**
- **The load must be under operator control at all times.**

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- **Do not connect pump to hydraulic system powered by another pump.**

Electric Motor

WARNING:

- **Electrical work must be performed and tested by a qualified electrician per local directives and standards.**
- **Disconnect the pump from the power supply and relieve pressure before removing the motor case cover or performing maintenance or repair.**
- **Check the total amperage draw for the electrical circuit you will be using. *For example: Do not connect a pump that may draw 25 amps to a 20 amp fused electrical circuit.***
- **Never use an ungrounded power supply with this unit.**
- **Changing the voltage is an involved and, if incorrectly performed, hazardous procedure. Consult the manufacturer for specific information before attempting rewiring.**
- **Wire pump motors for counterclockwise rotation when viewed from the shaft end of the motor.**

- **Do not attempt to increase the power line capacity by replacing a fuse with another fuse of higher value. Overheating the power line may result in fire.**
- **Exposing electric pumps to rain or water could result in an electrical hazard.**
- **Avoid conditions that can cause damage to the power cord, such as abrasion, crushing, sharp cutting edges, or corrosive environment. Damage to the power cord can cause an electrical hazard.**

Hoses

WARNING:

- **Before operating the pump, tighten all hose connections using the correct tools. Do not overtighten. Connections should be only secure and leak-free. Overtightening can cause premature thread failure or high pressure fittings to split at pressures lower than their rated capacities.**

- **Should a hydraulic hose rupture, burst, or need to be disconnected, immediately shut off the pump and shift the control valve twice to release pressure. Never attempt to grasp a leaking hose under pressure with your hands. The force of escaping hydraulic fluid could cause serious injury.**
- **Do not subject the hose to potential hazard, such as fire, sharp surfaces, heavy impact, or extreme heat or cold. Do not allow the hose to kink, twist, curl, or bend so tightly that the fluid flow within the hose is blocked or reduced. Periodically inspect the hose for wear, because any of these conditions can damage the hose and possibly result in personal injury.**
- **Do not use the hose to move attached equipment. Stress can damage the hose and possibly cause personal injury.**

- **Hose material and coupler seals must be compatible with the hydraulic fluid used. Hoses also must not come in contact with corrosive material such as creosote-impregnated objects and some paints. Consult the manufacturer before painting a hose. Never paint the couplers. Hose deterioration due to corrosive materials may**

result in personal injury.

- Avoid straight line tubing connections in short runs. Straight line runs do not provide for expansion and contraction due to pressure and/or temperature changes.
- Eliminate stress in the tube lines. Long tubing runs should be supported by brackets or clips. Tubes through bulkheads must have bulkhead fittings. This makes easy removal possible and helps support the tubing.
- Carefully inspect all hoses and fittings prior to use. Before each use, check entire hose for cuts, leaks, abrasion or bulging of cover, or damage or movement of couplings. If any of these conditions exist, replace the hose immediately. NEVER attempt to repair the hose.

Cylinder

DANGER:

- Do not exceed rated capacities of the cylinders. Excess pressure may result in personal injury.
- Avoid off-center loads that could damage the cylinder and/or cause loss of the load.
- Read and understand all safety and warning decals and instructions for devices attached.
- Inspect each cylinder and coupler before each shift or usage to prevent unsafe conditions from developing.
- Do not use cylinders if they are damaged, altered or in poor condition.
- Do not use cylinders with bent or damaged couplers or damaged port threads.
- Under certain conditions, the use of an extension with a hydraulic cylinder may not be advisable and could present a dangerous condition.
- Avoid pinch points or crush points that can be created by the load or parts of the cylinder.
- To help prevent material fatigue if the cylinder is to be used in a continuous application, the load should not exceed 85% of the rated capacity or stroke.
- Cylinder must be on a stable base which is able to support the load while pushing or lifting.
- To help prevent personal injury, use shims, friction material or constraints to prevent slippage of the base or load.
- Do not set poorly-balanced or off-center loads on a cylinder.
- The load can tip or the cylinder can “kick out” and cause personal injury.
- Do not use the locking collar on a threaded piston as a stop. The threads may shear resulting in loss of the load.
- If this component is used to lift or lower loads, be certain that the load is under operator control at all times and that others are clear of the load.
- Do not drop the load.
- As the load is lifted, use blocking and cribbing to guard against a falling load.

- To help prevent personal injury, do not allow personnel to go under or work on a load before it is properly cribbed or blocked. All personnel must be clear of the load before lowering.

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- **Never use extreme heat to disassemble a hydraulic cylinder or ram. Metal fatigue and/or seal damage will result and can lead to unsafe operating conditions.**

IMPORTANT

- **Keep the cylinder clean at all times.**
- **While at a job site, when the cylinder is not in use, keep the piston rod fully retracted and upside down.**
- **Always use protective covers on disconnected quick couplers.**
- **When mounting cylinders or rams using the internal piston rod threads, collar threads, threaded tie rods or base mounting holes, the threads must be fully engaged. Always use SAE grade 8 or better fasteners when attaching components to cylinders or rams and tighten securely.**
- **Limiting the stroke and pressure on all cylinders will prolong their life.**

Initial Setup

1. Remove all packing materials from the assembled unit.
2. Inspect the unit upon arrival. The carrier, not the manufacturer, is responsible for any damage resulting from shipment.

Filling the Pump Reservoir

Most pumps are shipped without hydraulic fluid in the reservoir. Hydraulic fluid may have been shipped in a separate container, but if hydraulic fluid is needed, use only approved Power Team hydraulic fluid rated at AW 46 47 cSt @ 38°C (215 SUS @ 100°F). If low temperature requirements are needed, use hydraulic fluid 5.1 cSt @ 100°C (451 cSt @ -40°C).

1. Clean the area around the filler cap to remove debris. Debris in the hydraulic fluid can damage the polished surfaces and precision-fit components of this pump.
2. Remove the filler cap and insert a clean funnel with a filter.
3. Fill the reservoir with hydraulic fluid to 1.3–3.8 cm (0.5–1.5 in.) from the cover plate.
4. Replace the filler cap. Verify the breather-hole is open, if applicable.

NOTE: If hydraulic fluid foaming becomes a problem, reduce the hydraulic fluid level to 2" below the cover plate.

Hydraulic Connections

1. Clean the areas around the fluid ports of the pump and cylinders.
2. Inspect all threads and fittings for signs of wear or damage, replace as needed.
3. Clean all hose ends, couplers or union ends.
4. Remove the thread protectors from the hydraulic fluid outlets.
5. Connect the hose assembly to the hydraulic fluid outlet, and couple the hose to the cylinder.

CAUTION: To prevent personal injury from leaking hydraulic fluid, seal all hydraulic connections with a high-quality, non-hardening, pipe thread sealant.

IMPORTANT: Sealant tape or non hardening sealer tape can be used to seal hydraulic connections if only one layer of tape is used. Apply tape carefully, two threads back, to prevent it from being pinched by the coupler and broken off inside the system. Loose pieces of sealant could travel through the system and obstruct the flow of fluid or cause jamming of precision-fit parts.

Electric Motor Operation

Motor voltages are not changeable. They are:

12 VDC - 11-14 VDC

120 VAC - 90-130 VAC 50/60 Hz

220 VAC - 190-240 VAC 50/60 Hz

1. Verify the valve is in the neutral or hold position.
2. Connect the motor to a power supply.

Caution:

- **The correct voltage is required for the pump to operate. Verify the voltage rating on the pump motor name plate matches the outlet or power source you are using. Low voltage may cause: an overheated motor; a motor that fails to start under load; motor surging when trying to**

start; or a stalled motor before maximum pressure is reached.

- **Check the voltage at the motor with the pump running at full pressure.**
- **Never run the motor on long, light gauge extension cords. Refer to Table 2. Minimum Recommended Gauge Table.**

3. Start the pump and shift as required.
4. Turn off the pump when not in use.

AMPS at Maximum Hyd. Pressure	Electrical Cord Size AWG (mm^2) 3.2 Volt Drop Length of Electrical Cord							
	mm^2				AWG			
	0-8 m	8-15 m	15-30 m	30-46 m	0-25 ft	25-50 ft	50-100 ft	100-150 ft
6	0.75	1	1.5	2.5	18	16	14	12
10	0.75	1.5	2.5	4	18	14	12	10
14	1	2.5	4	6	16	12	10	8
18	1.5	2.5	6	6	14	12	8	8
22	1.5	4	6	10	14	10	8	6
26	2.5	4	6	10	12	10	8	6
30	2.5	4	10	16	12	10	6	4

Table 2. Minimum Recommended Gauge Table

Bleeding Air from the System

After all connections are made, the hydraulic system must be bled of any trapped air. Refer to Figure 3. With no load on the system and the pump vented and positioned higher than the hydraulic device, cycle the system several times. If you are in doubt about venting your pump, read the operating instructions for your pump. Check the reservoir fluid level and fill to proper level with Power Team hydraulic fluid as necessary. If there is a problem contact the Power Team.

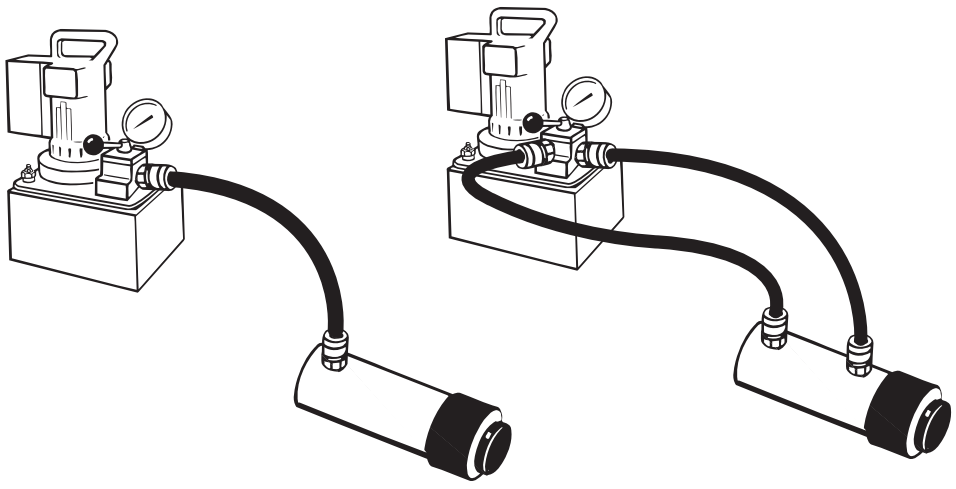

Figure 3. System Bleeding

IMPORTANT: Some spring return cylinders or rams have a cavity in the rod which forms an air pocket. This type of cylinder or ram should be bled when positioned upside down or lying on its side with the port facing upward.

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Hydraulic Pressure Gauge (optional)

Automatic Dump Valve

To monitor line pressure when using an automatic dump valve, a tee fitting is used between the valve and the pressure switch to adapt a hydraulic pressure gauge.

Posi-Check Valve

If a Posi-Check valve is used, a hydraulic gauge shows zero pressure when the valve is switched to the neutral (hold) position. Cylinder pressure, however, is held without loss.

To install a hydraulic pressure gauge:

1. Refer to Figure 4. Remove the pipe plug from the valve's gauge port.

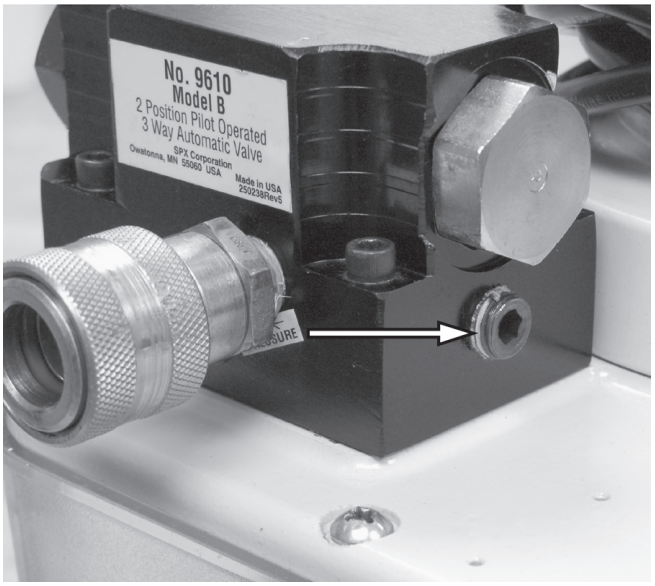

Figure 4. Gauge Port

2. Refer to Figure 5. Install sealant tape or non hardening sealer to a 45 degree elbow (PN 9678). Install the elbow as shown.
3. Install sealant tape or non hardening sealer to the gauge.

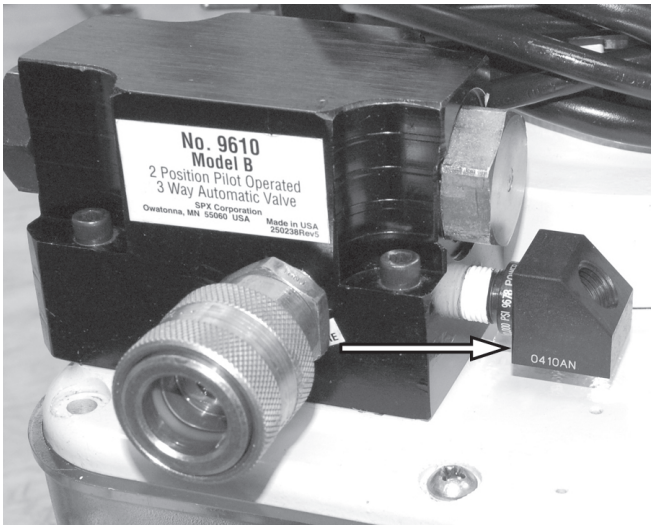

Figure 5. Elbow Installation

4. Refer to Figure 6. Install the pressure gauge.

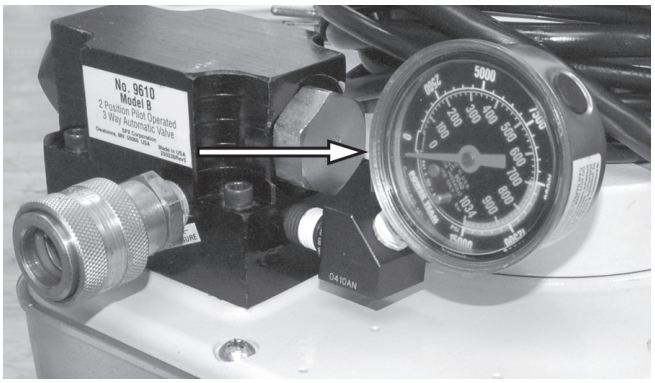

Figure 6. Pressure Gauge Installation

Operating Instructions

Bleeding Air from the System

1. Cycle the hydraulic system until operation is smooth and consistent.
2. Check the pump reservoir level. Add Power Team hydraulic fluid as needed.

Electric Motor Control Operation

1. Connect the power cord to an appropriate power source.
2. Place the motor control switch in the ON position or the REMOTE position, if applicable.
3. Depending on system requirements:

Refer to Figure 7. This remote will start and run the pump motor as long as the button is pressed. Switch will automatically return to OFF position when button is released and pump motor will turn off.

Figure 7. Momentary ON-OFF Push Button Remote Motor Control

Refer to Figure 8. This remote will start and run the pump motor as long as the button is held in the ON position. Switch will automatically return to OFF position when button is released and pump motor will turn off. Generally used with 2-Way, 2-Position valves.

Figure 8. Momentary ON-OFF Remote

Refer to Figure 9. This remote will start and run the pump motor to advance or retract of the cylinder when released it allows the pressure to be held.

4. Press the rocker switch toward the Advance side of the switch and hold to extend the cylinder.
5. Press the rocker switch toward the Retract side of the switch and hold to retract the cylinder.
6. Release the rocker switch and the pump will stop but the system will hold. Generally used on 4-Way-2-Position valves.

Figure 9. Advance-Hold-Retract Remote

Pressure Regulating Controls

To ensure accuracy and low pressure differential (approx. 20 Bar 300 PSI) throughout the pressure range (69-690 Bar (1,000-10,000 PSI) depending on the pump model), the pressure switch should be used with the pressure regulating valve. The pressure switch must be set at a pressure lower than the pressure regulating valve to work correctly.

- The pressure regulating valve can be adjusted to bypass fluid at a given pressure setting while the pump continues to run.
- The pressure switch can be adjusted to stop the pump at a given pressure setting.

Adjusting The Pressure Regulating Valve (if equipped). All others are factory preset.

Note: For easy adjustment of the pressure regulating valve, always adjust the pressure by increasing to the desired pressure setting.

1. Loosen the locknut on the pressure regulating valve.
2. Use a screwdriver to back out the adjusting screw a few turns in a counterclockwise direction. This decreases the setting to a lower-than-desired pressure.
3. The pump must be completely connected. Set the motor control toggle switch on RUN, and push the START button.
4. With the screwdriver, slowly turn the adjusting screw in a clockwise direction. This gradually increases the pressure setting. When the desired pressure is reached, lock the adjusting screw in position by tightening the locknut.

Notes:

- *The pressure range is from 69-690 Bar (1,000-10,000 PSI), depending on the pump model.*
- *The pressure switch must be set at a higher pressure than working range to prevent shut down during adjustment. It is also possible to bypass the pressure switch contacts by holding the start switch or remote control switch so the motor runs continuously.*

Adjusting The Pressure Switch

Generally, the pressure switch should be used with the pressure regulating valve. A pressure switch can be used alone for operating electrical devices such as motors, solenoids, and relays, which are located elsewhere in the circuit.

1. Loosen the locknut on the pressure switch, and turn the adjusting screw in a clockwise direction. This increases the pressure setting to a higher than desired pressure.
2. Adjust the pressure regulating valve to the desired pressure setting by using the procedure previously outlined.
3. With the pump running and bypassing fluid at the desired pressure, slowly turn the pressure switch adjusting screw in a counterclockwise direction, decreasing the pressure switch setting until the pump motor shuts off.
4. Lock the adjusting screw in position by tightening the locknut.
5. Release pressure. Run the pump to check the pressure setting and cut-out of the motor. It may be necessary to make a second adjustment.

Note: When the pressure switch setting is reached, the motor shuts off. However, the "coast" of the motor continues to deliver fluid for a brief period. The pressure regulating valve bypasses this surplus fluid, preventing it from going into the system. As a result, the pressure differential can be held to approximately 20 Bar (300 PSI).

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Performance Specifications

The information in the following charts can be used as a basis to determine if the system is performing as expected during operation.

Pump	RPM	Amp Draw at 690 Bar (10,000 PSI) (115V)	Amp Draw at 690 Bar (10,000 PSI) (230V)	dB A at Idle and 690 Bar (10,000 PSI)
PE8	1,725	10	15	67/81
PE17	3,450	10	15	67/81

Table 3. Drive Unit Requirements

Pump	Max. Pressure Output Bar (PSI)	Fluid Delivery** (cu. in./min. @)					
		0 Bar (0 PSI)	7 Bar (100 PSI)	50 Bar (700 PSI)	70 Bar (1,000 PSI)	345 Bar (5,000 PSI)	690 Bar (10,000 PSI)
PE8	690 Bar (10,000 PSI)	145	95	-	-	10	8
PE17	690 Bar (10,000 PSI)	290	190	-	-	20	16
**** Typical delivery. Actual flow varies with field conditions.**							

Table 4. Fluid Pressure Chart

General Maintenance

WARNING:

- **Disconnect the unit from the power supply before performing maintenance or repair procedures.**
- **Repairs and maintenance are to be performed in a dust-free area by a qualified technician.**

System Evaluation

The components of your hydraulic system — cylinders, pumps, hoses, and couplings — all must be:

- Rated for the same maximum operating pressure.
- Correctly connected.
- Compatible with the hydraulic fluid used.

A system that does not meet these requirements can fail, possibly resulting in serious injury. If you are in doubt about the components of your hydraulic system, contact Power Team Technical Support.

Inspection

Keep a dated and signed inspection record of the equipment. An inspection checklist (Form No. 105503) is available on request from your nearest Power Team facility. Before each use, the operator or other designated personnel should visually inspect for the following conditions:

- Cracked or damaged cylinder.
- Excessive wear, bending, damage, or insufficient thread engagement.
- Leaking hydraulic fluid.
- Scored or damaged piston rod.
- Incorrectly functioning or damaged heads and caps.
- Loose bolts or cap screws.
- Damaged or incorrectly assembled accessory equipment.
- Modified, welded, or altered equipment.
- Bent or damaged couplers or port threads.

Periodic cleaning

WARNING: Contamination of the hydraulic fluid could cause the valve to malfunction. Loss of the load or personal injury could result.

Establish a routine to keep the hydraulic system as free from debris as possible.

- Seal unused couplers with dust covers.
- Keep hose connections free of debris. Equipment attached to a cylinder must be kept clean.
- Keep the breather-hole in the filler cap clean and unobstructed.
- Use only Power Team hydraulic fluid. Replace hydraulic fluid as recommended, or sooner if the fluid becomes contaminated. Never exceed 300 hours of use between fluid changes.

Hydraulic Fluid Level

1. Check the fluid level in the reservoir after each 10 hours of use. The fluid level should be 1.3–3.8 cm (0.5–1.5 in.) from the top of the fill hole when all cylinders are retracted.
2. Drain, flush, and refill the reservoir with an approved Power Team hydraulic fluid after every 300 hours of use. The frequency of fluid changes depends upon general working conditions, severity of

use, the overall cleanliness and care given to the pump. Fluid should be changed more frequently when the system is not operated regularly indoors.

Draining And Flushing The Reservoir

IMPORTANT: Clean the pump exterior before the pump interior is removed from the reservoir.

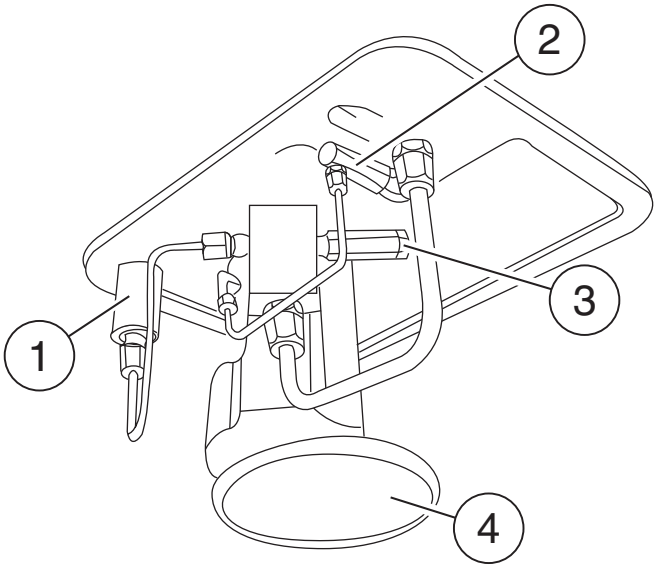
1. Remove the ten screws that fasten the motor and pump assembly to the reservoir.

IMPORTANT: Do not damage the gasket or bump the filter or pressure regulating valves when lifting the pump and motor off the reservoir. See Figure 10.

2. Drain fluid and clean the inside of the reservoir. Fill with a suitable nonflammable flushing fluid. Rinse the filter clean.
3. Place the pump and motor assembly back onto the reservoir and secure with four corner screws.

IMPORTANT: Connect a hose to the advance/ retract port of the pump manifold. Place the other end of the hose into the fluid filler plug hole.

4. Run the pump for several minutes. Then disconnect the motor and pump assembly, and drain and clean the inside of the pump reservoir.
5. Fill the reservoir to 1.3–3.8 cm (0.5–1.5 in.) below the cover plate with an approved, high-grade hydraulic fluid. Place the pump and motor assembly (with gasket) onto the reservoir. Thread in ten screws and tighten securely and evenly.



Item	Description
1	Pressure Regulating Valve
2	Accumulator (not used on all models)
3	High Pressure Relief Valve
4	Filter

Figure 10. Pump Assembly

Adding Hydraulic Fluid To The Reservoir

1. Retract the cylinder(s) devices.
2. Disconnect the power supply.
3. Clean the entire area around the filler plug.
4. Remove the filler plug, and install a clean funnel with a filter.
5. Use only Power Team hydraulic fluid rated at AW 46 47 cSt @ 38°C (215 SUS @ 100°F). If low temperature requirements are needed, use hydraulic fluid 5.1 cSt @ 100°C (451 cSt @ -40°C).

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Sound Reduction - Electrically Powered Motor

The electrically powered hydraulic pump operates in the 67–81 dBA range. If further sound reduction is desired, any of the following options will help reduce the sound level.

1. Install a pressure switch to automatically shut off the motor when maximum pressure is reached (holding cycle).
2. Contact Power Team Hydraulic Technology technical support for products more suitable to your application.

Hose Connections

CAUTION: To prevent personal injury from leaking hydraulic fluid, seal all hydraulic connections with a high-quality, non-hardening, pipe thread sealant.

IMPORTANT: Sealant tape or non-hardening sealer tape can be used to seal hydraulic connections if only one layer of tape is used. Apply tape carefully, two threads back, to prevent it from being pinched by the coupler and broken off inside the system. Loose pieces of sealant could travel through the system and obstruct the flow of fluid or cause jamming of precision-fit parts.

Storage

Store the unit in a dry, well-protected area where it will not be exposed to corrosive vapors, dust, or other harmful elements. If a unit has been stored for an extended period of time, it must be thoroughly inspected before it is used.

Checking Brushes on Universal Motors

To help prevent premature failure of the armature, check the brushes periodically:

1. Remove the metal brush cover plates.
2. Remove the brush holder caps and brush assemblies.
3. The brush assemblies must be replaced if they are 4.5mm (1/8") long or less. See Figure 11.
4. Install brush assemblies, brush holder caps, and metal brush cover plates.

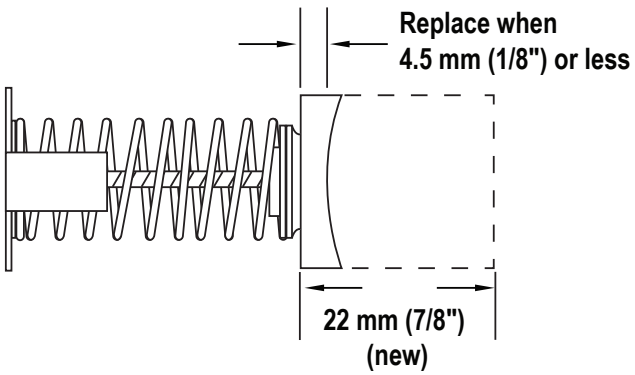

Figure 11. Brush Inspection

Troubleshooting Guide

WARNING:

- **Repair work or troubleshooting must be performed by qualified personnel who are familiar with this equipment.**

- **Disconnect the power supply before removing the electrical cover. Electrical work should be performed by a qualified electrician.**

- **Check for system leaks by using a hand pump to apply pressure to the suspect area. Watch for leaking fluid and follow it back to its source. Never use your hand or other body parts to check for a possible leak.**

Notes:

- *For a detailed parts list or to locate a Power Team Authorized Hydraulic Service Center, contact your nearest Power Team facility.*
- *Plug the outlet ports of the pump when checking for leakage to determine if the leakage is in the pump, in the cylinder, or in the tool.*

Problem	Cause	Solution
Electric motor does not run.	1. Unit is not plugged in.	*1. Plug in unit.*
	2. No voltage supply.	*2. Check line voltage.*
	3. Broken lead wire or defective power cord plug.	*3. Replace defective parts.*
	4. Defective motor.	*4. Replace or repair motor.*
Pump is not delivering hydraulic fluid or delivers only enough hydraulic fluid to advance cylinder(s) partially or erratically.	1. Hydraulic fluid level too low.	*1. Fill reservoir to 1-1/2" below the cover plate, maximum.*
	2. Air in system.	*2. Bleed the system.*
	3. Debris is in pump or filter is plugged.	*3. Pump filter should be cleaned and, if necessary, pump should be dismantled and all parts inspected and cleaned.*
	4. Cold hydraulic fluid or hydraulic fluid is too heavy (hydraulic fluid is of a higher viscosity than necessary).	*4. Change to lighter hydraulic fluid.*
	5. Relief valve or low pressure unloading valve out of adjustment.	*5. Readjust as needed.*
	6. Sheared drive shaft key(s).	*6. Replace.*
	7. Motor rotating in wrong direction.	*7. Reverse rotation.*

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Problem	Cause	Solution
Pump will not build full pressure.	1. Faulty pressure gauge.	*1. Calibrate gauge.*
	2. Check for external leakage.	*2. Seal any faulty pipe fittings with pipe sealant.*
	3. Inspect the pump for internal leakage.	*3. Same procedure as above but for leaks around the entire inner mechanism. If there are no visible leaks the low-to-high pressure ball check may be leaking. Remove all parts. Inspect the check body for any damage to the seat areas. Clean and reseat if necessary. Inspect the ball for damages and replace if necessary, then reassemble.*
	4. Sheared key(s).	*4. Replace.*
	5. High pressure pump inlet or outlet ball checks in the pump are leaking.	*5. Reseat or replace valve head.*
Automatic valve will not build full pressure	1. Unloading pressure is too low.	*1. Increase unloading pressure per chart, sheet 3 of 4.*
	2. Defective or oversize seat on automatic valve.	*2. Replace ball and seat.*
Electric motor cuts out.	1. Extension cord is too long and/ or not of sufficient gauge.	*1. Replace.*
	2. Faulty motor.	*2. Replace and repair.*
	3. Overheated motor can trip circuit breaker in shop power panel.	*3. Allow motor to cool, reset circuit breaker located in shop power panel.*
Foaming hydraulic fluid.	1. Hydraulic fluid being splashed by counter weight.	*1. Lower hydraulic fluid level to approximately 38 mm (1.5 inches) below the cover plate.*
Cylinder(s) will not retract.	1. Check the system pressure; if the pressure is zero, the control valve is releasing pressure and the problem may be in the cylinder(s), mechanical linkage connected to cylinder(s), or quick-disconnect couplings.	*1. Check the cylinders for broken return springs and check couplers to ensure that they are completely coupled. Occasionally couplers have to be replaced because one check does not stay open in the coupled position.*
	2. Inadequate air pressure (air motor only).	*2. Increase air pressure.*
Pump delivers excess hydraulic fluid pressure.	1. Pressure gauge is not accurate.	*1. Calibrate gauge.*
	2. Relief valve not properly set.	*2. Reset the relief valve.*

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Troubleshooting Guide continued

Problem	Cause	Solution
Automatic valve will not release pressure.	1. Sticking piston.	*1. Remove, clean and polish.*
	2. High pressure hydraulic fluid is leaking past the low-to-high pressure check. This hydraulic fluid leaks back to the piston in the automatic valve, keeping the piston closed.	*2. Seat the ball check. Inspect and replace any faulty components.*

Power Team Facilities

UNITED STATES

SPX Hydraulic Technologies
5885 11th Street
Rockford, IL 61109-3699
USA
Telephone:1-815-874-5556
FAX: 1-815-874-7853

Cust. Service/Order Entry
Tel: 1-800-541-1418
FAX: 1-800-288-7031
E-mail:
info@powerteam.com

Technical Services
Tel: 1-800-477-8326
FAX: 1-800-765-8326

CHINA

No. 1568 Hua Shan Road
International Park Center
Shanghai 200052, China
Tel: 86 (21) 2208-5888
FAX: 86 (21) 2208-5682
E-mail
infochina@powerteam.com

FAR EAST

7 Gul Circle
Singapore 629563
Singapore
Tel: (65) 6265-3343
FAX: (65) 6265-6646
E-mail:
infoasia@powerteam.com

EUROPE

Albert Thijsstraat 12
6471 WX Eygelshoven
The Netherlands
Tel: 31 (45) 5678877
FAX: 31 (45) 5678878
E-mail
infoeurope@powerteam.com

For more information, Internet address: http://www.powerteam.com

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