TEMPSENS

Thermal Engineering Solutions

www.tempsens.com

About us

Backed by over three decades of experience, Tempsens provides specialised thermal solutions. Led by a multi-generational leadership team, Tempsens has a strategic focus on integrating related product lines and customer bases for long-term growth.

Tempsens specialises in thermal engineering solutions, which includes our four key verticals, Contact Temperature Sensors, Non-contact Temperature Sensors, Electrical Heating Solutions and Specialised Cables that are tailored to the needs of the customer.

Tempsens, along with its subsidiaries and Joint Ventures, have a manufacturing presence across 4 countries and serves a wider range of industries that demand advanced thermal solutions. This strengthens its position as a trusted partner in critical applications and enhances its manufacturing capabilities.

Thermal Engineering Solutions

Since 1990

700+ EMPLOYEES

35 YEARS EXP.

9 PATENTS

OVER **3500+** CUSTOMERS

SALES IN OVER **75** COUNTRIES

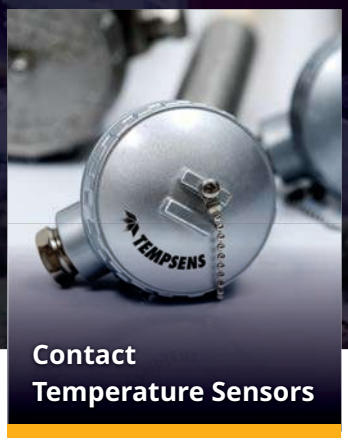
INDIA

UAE

INDONESIA

SOUTH KOREA

Our Business Units

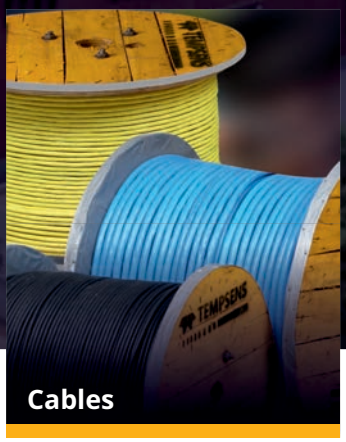


Contact Temperature Sensors

Thermocouple RTD, Gauges, Fiber Optics Sensors, Thermal Profiling Sytem, Wireless Temperature Sensors.

Conductors

Thermocouple, extension, compensating, pure nickel, heating element wires, and Cu-Ni alloys.

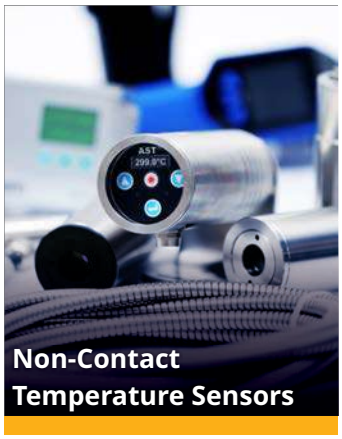


Cables

LT Control, Power, instrumentation, signal cables and Mineral Insulated Cables.

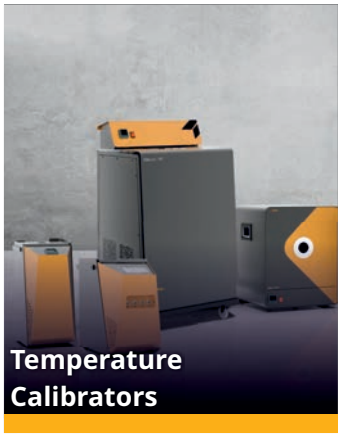
Industrial Heaters

Component, Process, Furnace Heaters, and Heat Tracing solutions.



Non-Contact Temperature Sensors

Pyrometers, Thermal Imagers and Furnace Monitoring Cameras.

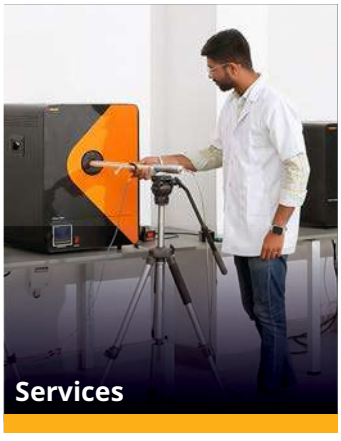


Temperature Calibrators

Temperature calibrators, master sensors and meters for contact and non contact sensor calibration.

Furnaces

Customized and standard laboratory and industrial ovens and furnaces.



Services

Temperature calibration services for contact and non contact sensors from -196 to 3000° C.

Certification

ISO Certifications

ISO 9001:2015

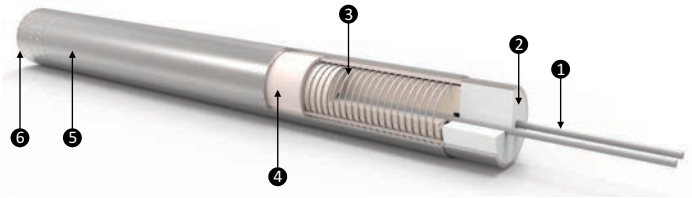
ISO 14001:2015

ISO 45001:2015

Certificate of Compliance

Hot Rod Cartridge Heaters

The engineers at Tempsens instruments have developed a cartridge heater that exceeds the performance and durability of other cartridge heaters. Through refinements in the swaging process, specially designed cores, careful selection of magnesium oxide fill, nickel chromium resistance wire, stainless steel tubing, and carefully controlled production processes, HotRods routinely outperform other cartridge heaters in difficult applications.
HotRods are available in a wide variety of diameters and configurations.



1. High temperature lead wires for temperatures up to 550°C.
2. High impact ceramic cap retards contamination and is suitable for high vibration applications. Deep holes in cap prevent fraying of leads when bent.
3. Nickel-chromium resistance wire for maximum heater life, evenly wound for even heat distribution.
4. High purity magnesium oxide fill selected for maximum dielectric strength and thermal conductivity, highly compacted for maximum heat transfer.
5. Stainless steel sheath / Inconel sheath for oxidation and corrosion resistance in wide variety of environment.
6. TIG welded end disc to prevent contamination and moisture absorption.

Standard Specification

Nominal Diameter	Minimum Diameter	Maximum Diameter	Max. Lead Wire Gauge	Max. Amps	Max. Volts
1/8"	2.97	3.17	24	5	300
1/4"	6.19	6.32	22	9	300
6mm	5.82	5.97	22	9	300
6.5mm	6.35	6.47	22	9	300
5/16"	7.77	7.89	22	9	300
8mm	7.84	7.97	22	9	300
3/8"	9.37	9.49	18	15	300
10mm	9.56	9.98	18	15	300
12mm	11.83	11.96	18	15	300
12.5mm	12.34	12.48	18	15	480
1/2"	12.55	12.67	18	15	480
13mm	12.85	12.97	18	15	480
17/32	13.33	13.46	18	15	480
5/8"	15.72	15.84	14	26	480
16mm	15.84	15.97	14	26	480
17mm	16.84	16.96	14	26	480
11/16"	17.32	17.44	14	26	480
19mm	18.84	18.97	14	26	480
3/4"	18.89	19.02	14	26	480
20mm	19.86	19.98	14	26	480
1"	25.24	25.37	14	26	480
25.4mm	25.24	25.37	14	26	480

Maximum Allowable Watt Density

Clearance (mm)	Block temperature (°C)					
	649	538	427	316	205	94
0.050	140	270	300	300	300	300
0.076	120	205	295	300	300	300
0.101	100	175	240	300	300	300
0.127	90	145	200	285	300	300
0.177	70	100	150	200	250	300
0.254	60	90	110	150	200	225
0.381	50	75	95	110	140	165
0.762	40	60	80	90	100	110
1.524	30	40	50	55	65	65
2.540	25	35	45	50	50	50

Clearance is determined by taking the hole diameter and subtracting the heater diameter.
Watt density is calculated by:

$$\frac{\text{Wattage}}{\text{Heated Lth} \times \text{Diameter} \times 3.14}$$

Cycling reduces heater life and high cycling applications should use lower numbers.

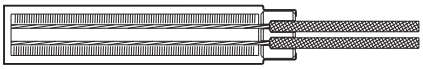
Lead Wire Characteristics

Wire Type	Temperature	Max. Temperature	Comments
Ultralead	250°C	450°C	Excellent, durable wire, good for high temperature application
Teflon	250°C	450°C	Good for areas where a small diameter wire is needed
Silicon Rubber	250°C	450°C	Good moisture resistance
Braided Silicon Rubber	250°C	450°C	Inexpensive wire good for non abrasive applications
MGT	250°C	450°C	Good high temperature wire
SJO Cord	94°C	90°C	Rubber jacket, resistant to all and moisture. for use on 3/8" dia. and larger

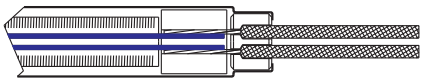
Hot Rod Cartridge Heaters

Swaged in Leads

Swaged in leads are ideal for applications where there is a lot of movement or the leads must be bent sharply upon exiting the heater.



In heaters under 3 " long, the leads go directly in to the core, resulting in an unheated section the length of the ceramic end piece.



In heaters over 3 " long the leads make a connection with the power pins in a short unheated section.

Teflon Seal

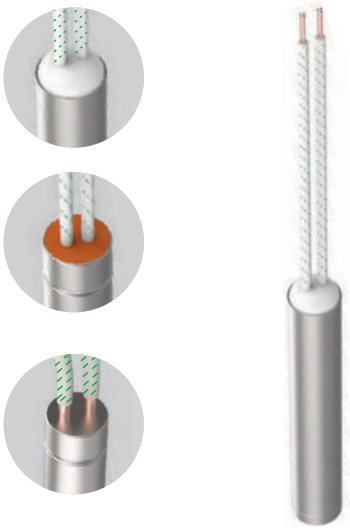
When an effective moisture or oil seal is needed, a swaged in teflon seal with teflon leads provides an effective barrier.

Silicone Rubber Seal

A high temperature silicone rubber seal used with silicone rubber lead wires provides an effective moisture seal up to 400°F (200°C). It is generally the most impervious of the moisture seals.

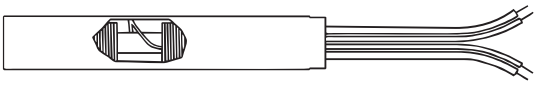
Epoxy Seal

Epoxy potting forms a good moisture seal with more mechanical strength than a silicone rubber seal. Regular epoxy is rated at 350°F(177°C)and epoxylite is rated at600°F(316°C). In order to protect the seal.



Thermocouples

Type 'J' and type 'K' thermocouples can be installed to monitor part temperatures. A thermocouple mounted against the heater sheath in the center of the heater gives a good approximation of block temperature, especially when there is a good fit between the heater and the block. A thermocouple mounted in the tip is useful for monitoring liquid temperatures, or material flowing past the end of the heater. Unless otherwise specified thermocouple leads will be the same length as the heater leads. Standard thermocouple wire insulation is teflon, other types are available upon request.



Swaged in Braid

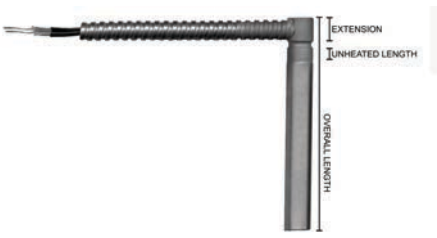
Swaged in stainless steel braid provides excellent abrasion protection while allowing the leads to be bent in a tight radius. Because the braid is swaged in, it is extremely resistant to pulling out of the heater.

Distributed Wattage:

Distributed wattage Hotrods (with a higher watt density on the ends than the rest of the heater) can be used to compensate for end losses in blocks. Distributed wattage Hotrods are available in all diameters.

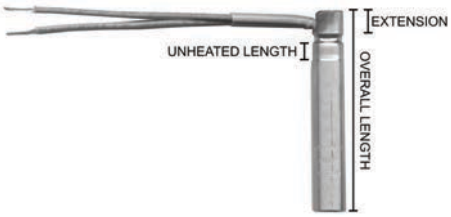
Right Angle Stainless Steel Conduit

Right angle stainless steel conduit offers the same advantages as swaged in stainless steel conduit but allows use in tight spaces.



Right Angle Leads

Right angle leads are ideal for applications where space is limited. Leads are covered with a silicon impregnated fiberglass sleeve where they exit the heater

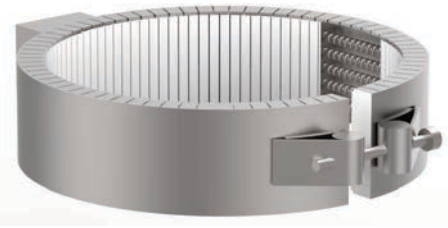


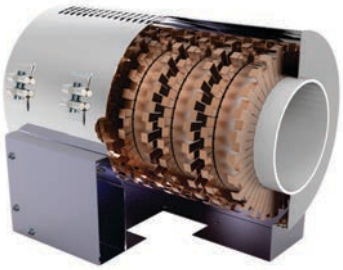
Applications

- Thermoforming
- Plastic welding
- Portion packaging
- Form fill and seal

Ceramic Band Heaters & Blower Assembly

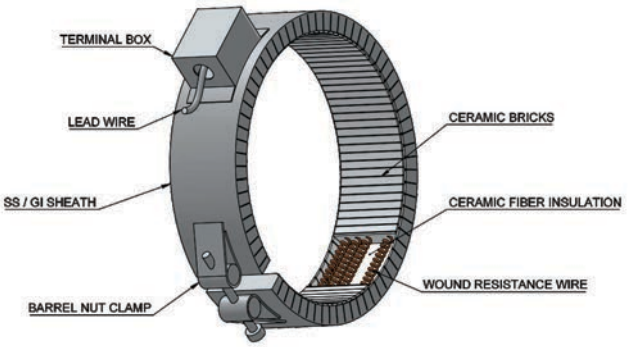
Ceramic band heaters are medium-to-high temperature heaters that have 648°C as a maximum working temperature. In a ceramic band heater, nickel-chrome wire is embedded in a flexible outer wall made of special, interlocking ceramic tiles (KNUCKLES), which are assembled like a brick wall. The element winding is designed to heat the ceramic blocks to the point at which they radiate energy into the barrel as well as conduct energy by being in contact with the barrel - fit is not as critical as in other types of bands.





Construction

- **Stainless Steel Sheath :** Generally we use aluminium coted sheath for oxidation resistance in a wide variety of environment but can also provide SS304 stainless steel as per application requirements.
- **Screw Terminals :** Screw terminals for maximum amperage carrying capacity and firm connection with the winding.
- **Terminal Box :** To provide protection against exposed terminals and helps guard terminals from spill over's, dripping. Various terminal type use such as crimp on lead ceramic connector type with using of copper lug crimping and SS bolded terminal.
- **Resistance Wire :** Nickel Chromium 80/20 resistance wire for maximum heater life evenly wound for even heat distribution.
- **Ceramic Fiber Insulation :** Ceramic fibers are used as insulation materials, because of their ability to withstand high temperatures.
- **Ceramic Knuckles :** High purity aluminium oxide ceramic knuckles selected for heating element winding process and maximum dielectric strength and thermal conductivity highly compacted for maximum heat transfer



Technical Specifications

Application	Sheath Material
Sheath Material	Aluminium coated or SS
Insulation Material	Ceramic Fiber Blanket
Watt Density	Up to 45 W/in2
Watt Ratings	500-5000W
Voltage	120 V & 240 V, single phase, 2 phase and 3 phases
Width	25MM – 250MM
Diameter	40 MM minimum to expand up to 1200 mm in 3 parts

Features and Benefits

- Uniform heat distribution
- Various termination styles
- High degree of flexibility

Applications

- Plastic injection molding machine
- Plastic extrusion machine.
- Waste incineration.
- Pipeline heating
- Semiconductor industry

Ceramic Band Heaters

Ceramic band heaters are medium-to-high temperature heaters that have 648°C as a maximum working temperature. These durable heaters can have optional in-built ceramic fiber jackets that make them energy efficient. Ceramic band heaters are available with different terminal styles, are fully flexible, and can accommodate holes and cut-outs. In a ceramic band heater, nickel-chrome wire is embedded in a flexible outer wall made of special, interlocking ceramic tiles (KNUCKLES), which are assembled like a brick wall. A ceramic fiber insulating mat and a stainless Steel/Aluminised Steel jacket cover this assembly. This construction prevents heat loss and reduces electrical consumption by 20%. Ceramic band heaters can be manufactured with different clamping mechanisms, terminations styles, holes and cut-outs, perforations. The element winding is designed to heat the ceramic blocks to the point at which they radiate energy into the barrel as well as conduct energy by being in contact with the barrel - fit is not as critical as in other types of bands.

Construction

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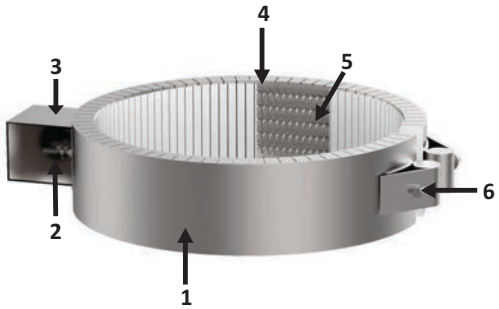
6. **Ceramic Knuckles :** High purity aluminium oxide ceramic knuckles selected for heating element winding process and maximum dielectric strength and thermal conductivity highly compacted for maximum heat transfer



Applications

- Reduce power consumption
- Conserve heat
- High degree of flexibility
- Uniform heat distribution
- Various termination styles

Maximum Allowable Watt Density in Watt/Sq. Inch

Cylindrical Temp °C	1.5-3" I.D	3-10" I.D.	20
94	52	47	41
150	51	46	40
205	50	45	39
260	46	42	36
315	41	38	31
370	37	33	27
425	29	25	20

Technical Data Sheet For Ceremic Heater

Application	Sheath Material
Sheath Material	Aluminium coated or SS
Insulation Material	Ceramic Fiber Blanket
Watt Density	Up to 45 W/in2
Watt Ratings	500-5000W
Voltage	120 V & 240 V, single phase, 2 phase and 3 phases
Width	25MM – 250MM
Diameter	40 MM minimum to expand up to 1200 mm in 3 parts

Note - For more custom design requirements please contact factory

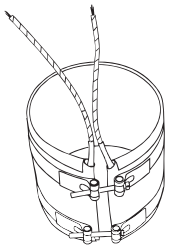
Advantage of Ceramic Band Heater

- Lower operating cost
- Good heat transfer
- Longer heater life
- Higher operating temp.
- Flexible-easy to install

Ceramic Band Heaters

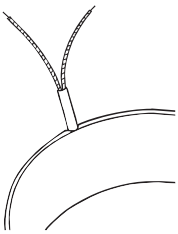
Fibreglass Lead & Stainless Steel Braid terminations

Order Type L1/B1



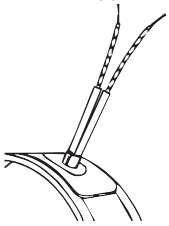
- Leads exiting both sides of gap are standard unless otherwise specified.
- High temperature fiberglass leads are rated to 455°C.
- Standard lead length is 10”

Order Type L2/B2



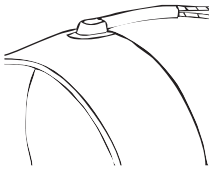
- Lead wires exiting 180 degrees from gap are common on nozzle
- heater applications.
- 1.5” of sleeve protection is standard on lead exits.

Order Type L3/B3



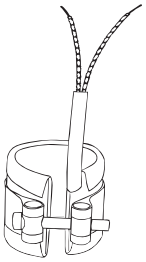
- Leads exiting straight out the side are available on any construction.
- Leads exit through a brass eyelet.

Order Type L4/B4



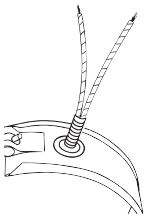
- Leads may exit at right angle out of cap from any position on the heater.
- 1.5” of sleeve protection is standard.

Order Type L5/B5



- Lead wires on one side of gap are available on any construction.
- Common exit for small band heaters.
- Standard gap is .300”

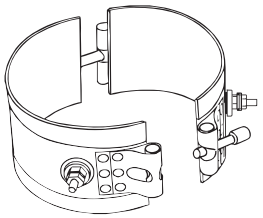
Order Type L6/B6



- Stainless steel spring provides extra support, protecting leads from sharp bends.

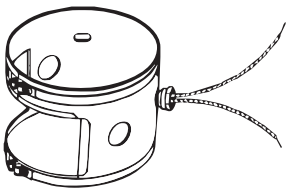
Marathon Special Constructions

Two Piece



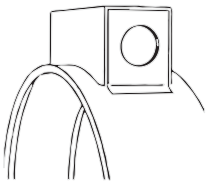
- Two piece construction is available for easy nstallation and removal.
- Please specify total wattage when ordering
- Min. I.D. 3”

Holes



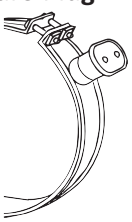
- Band Heaters can be manufactured with custom holes or slots for thermocouples or special mounting needs.
- Minimum of 1/2” is required from the hole to the edge of the heater.

Terminal Box



- Terminal boxes are excellent for preventing electrical shock or electrical shorts. Terminals boxes are available on any clamping or construction style.

Euro Plug



- European type plugs are
- available upon request.
- 1” x 1.75” x 1”

Mica Band Heaters

Mica band heaters offer efficient and economical solutions for heating cylindrical surfaces that require external indirect heating. They are ideal solution for high watt density and high temperature application. It uses nickel chromium resistance strip as heating element which is precisely wound on a dielectric material for even heat distribution. The heating element is insulated within a mica core enclosed in a metal sheath which provides exceptional insulation, dielectric strength and heat transfer capability for faster heat up and longer heater life.

Heaters can incorporate various sized holes and cut-outs and are customizable for various dimensions, wattages, voltages and materials to suit different applications requirements. Mica band heaters can also accommodate built in thermocouple which helps in controlling temperature more accurately. Thermocouples can be type “J” or type “K”, grounded or ungrounded.

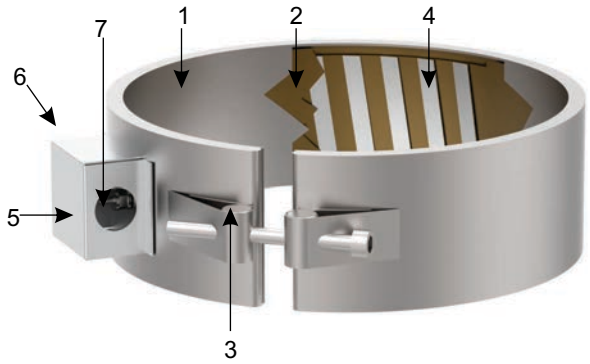
Technical Specifications

Sheath Material	Stainless Steel, Galvanized Iron
Max Sheath Temp.	425 °C
Voltage	120 V & 240 V, single phase, 2 phase and 3 phases
Watt density	up to 45w/in2
Minimum diameter	2”
Minimum width	1”
Wattage tolerance	+5%, -10%
Resistance tolerance	+10%, -5%

Note : For custom design requirements please contact factory

Construction

1. **SS/Aluminised Sheath** for good thermal conductivity and oxidation/corrosion resistance at elevated temperatures.
2. **Mica Insulation** provides excellent electrical insulation and resistant to moisture.
3. **Clamping Band** designed to maintain clamping pressure and firm contact with the cylinder surface thus eliminating air gaps at the contact
4. **Nickel Chromium Resistance Strip** evenly wound for uniform heat distribution and reliable accuracy.
5. **Terminal Box** to provide protection against exposed terminals and helps guard terminals from spill over's, dripping.
6. **Lead Protection** is available where abrasion is a problem.
7. **Stainless Steel** screw terminals for maximum amperage carrying capacity and firm connection with the winding.



Applications

- Plastic Injection, Extrusion and Moulding Processes
- Plastic Processing Industry,
- Chemical Industries
- Food Processing Industries
- Oil Lubricating Unit
- External Tank & Vessel Heating
- Blown Film Dies

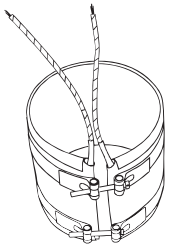
Advantage

- Various shape options in mica strip heater
- Reasonably high temp
- Good efficiency
- Good lifetime
- Low cost
- Less in thickness

Mica Band Heaters

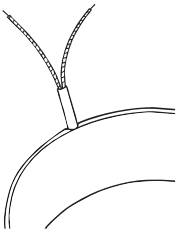
Fibreglass Lead & Stainless Steel Braid terminations

Order Type L1/B1



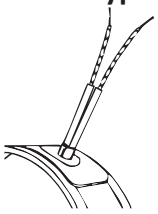
- Leads exiting both sides of gap are standard unless otherwise specified.
- High temperature fiberglass leads are rated to 455°C.
- Standard lead length is 10”

Order Type L2/B2



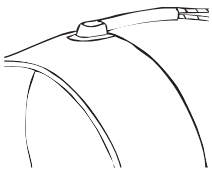
- Lead wires exiting 180 degrees from gap are common on nozzle
- heater applications.
- 1.5” of sleeve protection is standard on lead exits.

Order Type L3/B3



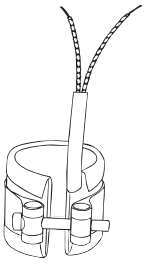
- Leads exiting straight out the side are available on any construction.
- Leads exit through a brass eyelet.

Order Type L4/B4



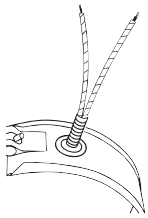
- Leads may exit at right angle out of cap from any position on the heater.
- 1.5” of sleeve protection is standard.

Order Type L5/B5



- Lead wires on one side of gap are available on any construction.
- Common exit for small band heaters.
- Standard gap is .300”

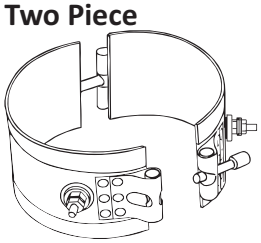
Order Type L6/B6



- Stainless steel spring provides extra support, protecting leads from sharp bends.

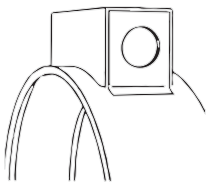
Marathon Special Constructions

Two Piece



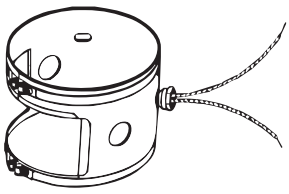
- Two piece construction is available for easy nstallation and removal.
- Please specify total wattage when ordering
- Min. I.D. 3”

Terminal Box



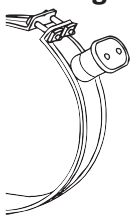
- Terminal boxes are excellent for preventing electrical shock or electrical shorts. Terminals boxes are available on any clamping or construction style.

Holes



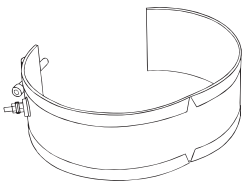
- Band Heaters can be manufactured with custom holes or slots for thermocouples or special mounting needs.
- Minimum of 1/2” is required from the hole to the edge of the heater.

Euro Plug



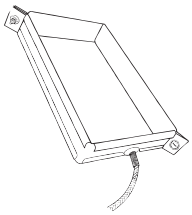
- European type plugs are
- available upon request.
- 1” x 1.75” x 1”

Expandable



- Expandable Mica Heaters allow you to open the heaters to the diameters of the barrel for easy installation.
- Min. I.D. 3”
- Heaters should only be opened all the way one time.

Box



- Box or rectangular heaters are efficient for heating dies on plastic extruders or the barrels of twin extruders.
- They can be manufactured in one or two piece construction.

Ceramic & Finned Strip Heaters

Strip Heaters are an outstanding industrial heating product and are extremely effective in surface heating applications. They are composed of a resistance wire, uniformly coiled and stretched inside a ceramic insulator along the length and width of the heater to uniform heating. The assembly is embedded in a stainless steel sheath to have high mechanical strength and corrosion resistance and is filled with high purity magnesium oxide to remove air pockets and thus providing excellent thermal conductivity and dielectric strength. Available with or without mounting tabs, they can be either clamped or bolted onto solid surfaces.

For air heating applications, strip heaters incorporated with fins to maximize surface area increase heat transfer rates and thus provides more efficient heating. Finned Strip Heaters both forced and natural convection air heating. Continuous spiral fins are permanently furnace to the sheath. Lower sheath temperature and element life are all maximized by this finned construction as fins improve heat transfer in free or forced air applications.

Construction

1. Nickel Chromium Resistance coil maximum life, uniformly stretched for even heat distribution.
2. Stainless steel sheath for oxidation and corrosion resistance in wide variety of environment. Suitable for temperatures high as 650°C.
3 High Purity magnesium oxide for maximum dielectric strength, thermal conductivity and maximum heat transfer.
4 Ceramic Insulator to insulate resistance wire coil from the outer sheath.
5 High Temperature Lead Wires temperatures up to 550°C

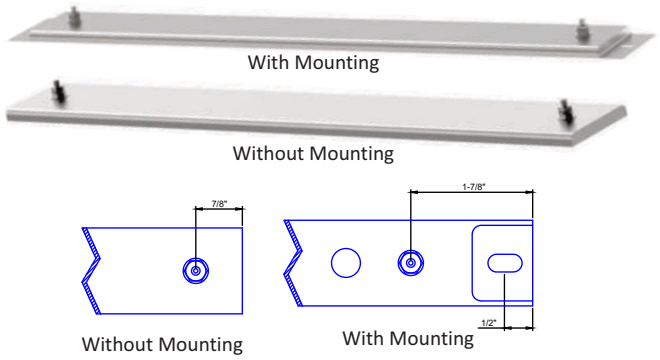
Technical Specifications and Tolerances

- **Sizes** - 1 ½" wide, 5/16" to 3/8" Thick, 5 ½" to 48"length
- **Sheath Material -** Stainless steel
- **Maximum Sheath Temperature -** 650°C
- **Maximum Watt Density :** 45 W/in2
- **Maximum Voltage -** 480 V
- **Wattage Tolerance -** +5%, -10%
- **Resistance Tolerance -** +10%, -5%
- **Note :** For Custom design requirement, contact factory.

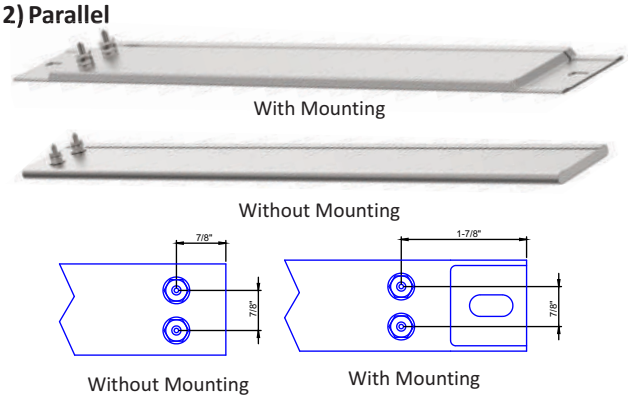
Termination Options

1) Screw Termination

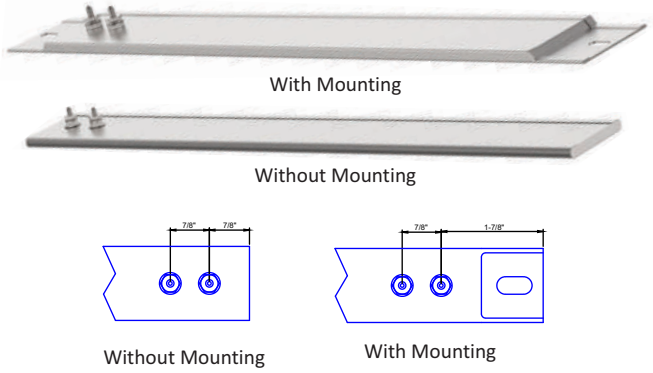
1) Both End



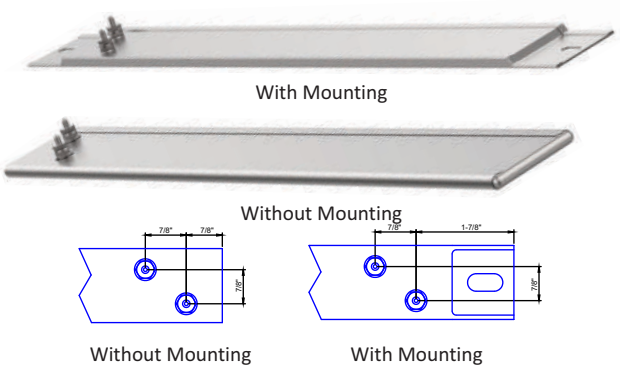
2) Parallel



3) Offset



4) Tandem

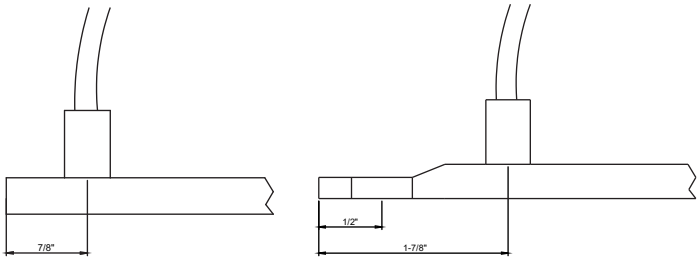


Ceramic & Finned Strip Heaters

2) Lead wire termination Options

(a) Side of Heater

b) Top of Heater



Without Mounting

With Mounting

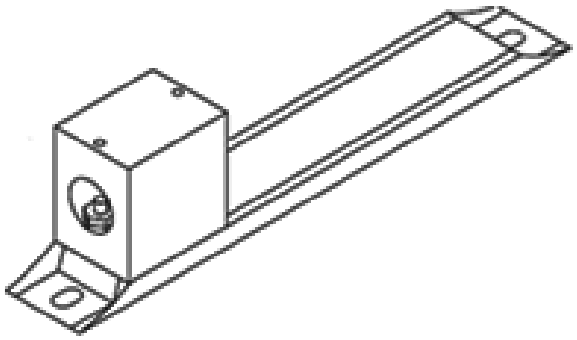
3) Lead wire Protection termination

Lead Wire Protection Termination- Lead wires exiting through the heaters can be provided with protective covering of-

- Stainless Steel Braid - stainless steel braid provides excellent abrasion protection while allowing the leads to bent in a tight radius
- Stainless Steel Flexible Conduit - Flexible conduit provides maximum protection to leads from abrasion but cannot bent as sharply as stainless steel braid.
- Copper Elbow and Stainless Steel Flexible Conduit - flexible conduit can be attached with a copper elbow.
- Sleeking
- Silicon Rubber Fiber Glass Sleeking- Maximum temperature 200°C, can sleeve both leads together or each lead separately.
- Fiberglass Sleeking- Maximum temperature 240°C, Good for lead protection

Terminal Box

Terminal box are used to cover the terminals and hence act as an safety feature. It also guards heater terminals from spillover, dripping.



Features And Benefits

- Available with or without mounting tabs
- Easy and economic to install
- Corrosion and vibration resistant
- Durable, versatile and easy to control
- Uniform Heat Distribution
- Suitable for higher temperatures

Applications

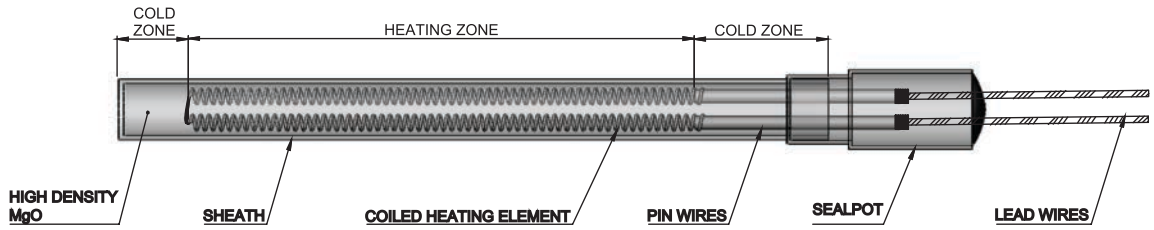
- Surface Heating
- Process Air Heating
- Winterizing
- Space Heating
- Food warming
- Packaging and sealing
- Laboratory equipment
- Autoclaves and ovens

Coil Heaters

Coil heaters are an advance concept of thermal engineering temperature control and quick response. Thermocouple can and are also known as high performance tubular heaters orbe of type 'J' and type 'K', and can be terminated anywhere cable heaters. Coil heaters offers high heating profile and within the coil section.

high performance in compact spaces up to temperatures as Available with variety of wattages, surface loads, high as 750°C. Available in Various cross sections and sizes, customized heat distribution, wall thickness and mounting coil heaters are not only straight and coil form but can be options coil heaters found its applications in variety of formed into almost in any geometrical shape. Coil heaters industries and are economically feasible one. Coil heaters can be closely wound to provide concentrated heat or can be are also available with various exit styles and configurations stretched to fulfil distributed wattage needs. Coil heaters to suit the requirement of the application.

Construction

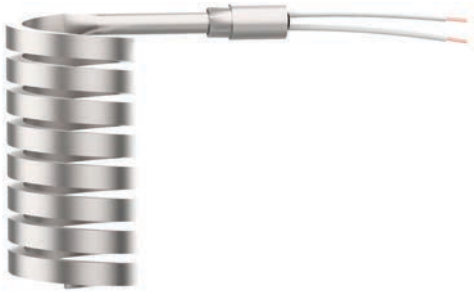


1. Nickel Chromium Resistance wire for maximum life.
2. High Purity magnesium oxide fill selected for maximum dielectric strength and thermal conductivity, highly compacted for maximum heat transfer.
3. Stainless steel sheath / Inconel sheath for oxidation and corrosion resistance in wide variety of environment.
4. Thermocouple for precise temperature control (type 'J' and type 'K' thermocouple Coil heaters are available in various termination options, coil configuration, exit styles and clamping options.

Coiling Option

Circular Profile

Rectangular/Square Profile



Termination Option

One End Termination

Both End Termination

Coil Heaters

Coil Configurations

Coiled with Distributed wattage

Coiled Together

Conical

Spiral

Meander

Exit Styles

Tangential

Axial

Radial

Central

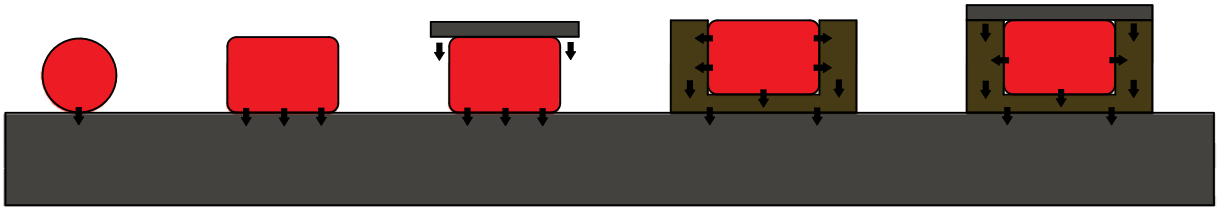
Clamping and Other Option

Metal Sleeve

Axial Clamping

Tangential Clamping

Permissible Watt Density



ROUND
6W/cm^2
39W/inch

FLAT
7.5W/cm^2
48W/inch

FLAT+
RADIANT
7.5W/cm^2
48W/inch

PRESSED
12.5W/cm^2
81W/inch^2

PRESSED +
RADIANT
15W/cm^2
97W/inch^2

Coil Heaters

Technical Specifications

Heater	FCH-FT-1 x 1.6	FCH-FT-1.3 x 2.3	FCH-FT-1.8 x 3.2	FCH-FT-2.5 x 4.3	FCH-FT-3.4 x 3.4	FCH-RD-1.8	FCH-RD-2.7	FCH-RD-3.5	FCH-RD-4.5	FCH-RD-5.7	FCH-FT-4.1 x 6.7
Sizes (mm)	1.0 x 1.6	1.3 x 2.3	1.8 x 3.2	2.5 x 4.3	3.4 x 3.4	1.8	2.7	3.5	4.5	5.7	4.1 x 6.7
Specification	Flat					Round					Flat
Sheath Material	Stainless Steel / Incoloy										
Maximum Sheath temperature	Max 750°C										
Maximum Wattage (W)	200	450	600	1000	1000	450	600	700	800	2000	2000
Maximum Voltage	230 V									415 V	
Wattage tolerance	± 10%										
Resistance Tolerance	± 10%										
Length tolerance	± 5%										
Minimum Bending Radius	Twice the Sheath Diameter/Width										
Inner diameter Tolerance Ø<12 mm	-0.05 to -0.2										
Inner diameter Tolerance Ø<30 mm	-0.1 to -0.3										
Inner diameter Tolerance Ø<40 mm	-0.2 to -0.4										
Unheated Zone Length	10 mm on bottom end, 50 mm at the terminal end. Larger lengths available on request.										

Availability (△)

Sizes (mm)	1.0 x 1.6	1.3 x 2.3	1.8 x 3.2	2.5 x 4.3	3.4 x 3.4	4.1 x 6.7	1.8	2.7	3.5	4.5	5.7
Thermocouple (Type J/ Type K)	External	External	Internal	Internal	Internal	Internal	External	Internal	Internal	Internal	Internal
Tangential Clamping	△	△	△	△	△	△	△	△	△	△	△
Axial Clamping		△									
Metal sleeve	△	△	△	△	△	△	△	△	△	△	△

Note : All heaters can be designed for various lengths in accordance with various wattages up to maximum specified wattage limit.

Lead wire options

Wire Type	Temperature Rating	Maximum Recommended Temperature	Comments
Ultralead	250°C	450°C	Excellent, durable wire, good for high temperature application
Teflon	250°C	250°C	Good dielectric strength
Silicon Rubber	200°C	200°C	Good moisture resistance
Braided Silicon rubber	200°C	200°C	Inexpensive wire good for non abrasive applications.
Fibre Glass	400°C	400°C	Excellent resistance to heat, flame, abrasion, oil, and chemicals. Excellent dielectric properties.

Coil Heaters

Lead Wire Protection Termination-

- Stainless Steel Braid -stainless steel braid provides excellent abrasion protection while allowing the leads to bent in a tight radius
- Stainless Steel Flexible Conduit-Flexible conduit provides maximum protection to leads from abrasion but cannot bent as sharply as stainless steel braid.
- Fiberglass Sleeving- Good for lead protection against abrasion and allow more flexibility of lead wires.

End Seal Options

- **Teflon Seal :** Teflon seal is used where an effective sealing is required against moisture and oil contamination. Teflon lead wire is used in conjunction with teflon seal to provide an effective barrier.
- **Silicon Rubber Seal :** High temperature silicon rubber seal in conjunction with silicon rubber lead wires provides an effective moisture seal up to 400°F (200°C). It is the most impervious seal of all the other moisture seals.
- **Epoxy Seal :** Epoxy potting forms a good moisture seal with more mechanical strength than a silicon rubber seal. Regular Epoxy is rated at 260°C and epoxylite is rated at 350°C.
- **Cement Potting :** rovides protection against some thicker liquids and dust, however it is not waterproof. It is also somewhat brittle and subject to cracking in high impact or high vibration applications. Used for temperatures upto 1425°C.
- **Glass Seal :** Glass seal provides effective sealing against moisture and oil contamination and can be used upto tempertures as high as 1200°C.

Application

- Zinc Die Casting Machine
- Packaging Machines- Sealing bar and jaws
- Plastics and die casting industries -Machine nozzles
- Hot runner system - Nozzles, Bushings & Distribution plates
- Tube Extrusion
- Pipe Forming
- Small Manifold heating
- Hot Metal forming dies and punches
- Semiconductor manufacturing and wafer processing

Advantages

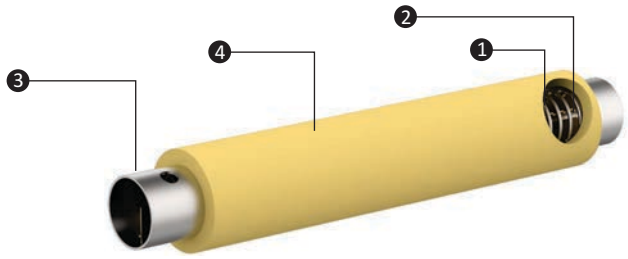
- High heating profile in compact spaces
- High performance and economical
- Precise Temperature control
- Fast response time
- Integrated Thermocouple
- Available in variety of coiling and exit styles

Air Heaters

Marathon made air heaters features an open coil of high resistance wire electrically isolated in a stainless steel sheath. Using an open coil for heating is the most efficient type of electric heating and is also the most economically feasible one. As it exposes the maximum heating element surface area directly to the airflow, it provides fast heat up time and improved efficiency. It design facilitates lower maintenance and easy, inexpensive replacement parts.

It is constructed of high grade nickel chromium wire coils Evenly wounded on mica sheet, placed in center of an SS304 Sheath, and electrically isolated using a layer of flexible mica wrapped inside of sheath. These heaters are widely used in hot air dryers

Construction



1. Nickel chromium Resistance wire coils for maximum heater life evenly wounded for even heat distribution
2. Mica Sheet for holding coils in place and are dielectric, lightweight, resilient and stable high temperatures.
3. Stainless Steel Sheath for corrosion resistance and high strength.
4. Glass wool insulation for high thermal resistance with low thermal conductivity.
5. Teflon coated control cable & thermistor cable for superior insulation and suitable for high voltage application.
6. Mica Insulation having dielectric property to isolate high resistance coil from sheath.

Technical Specifications

Sheath Material	SS304
Sheath Outer Diameter	63.5 mm, 101.6 mm
Wattage	Various Wattage available ranging from 2 kW to 30 kW
Watt Density	Up to 77 W/inch2
Glass wool Insulation	Up to 1200°C
Wattage tolerance	+5%, -10%
Resistance tolerance	-5%, +10%

Note : For custom design requirements please contact factory

Advantages

- Fast heat up time
- Increased Efficiency
- Lower maintenance
- Easy installation
- Easy and inexpensive replacement

Application

- Hot Air Dryer

Sillicon Rubber Heaters

Silicon rubber heater are extremely thin and flexible and can be constructed in any geometry to fit on almost any type of contours. Their thin design and direct bonding to the application facilitates efficient and rapid heat transfer resulting in faster heating and lower wattage requirement. Silicone Rubber Heaters offer a very high watt density and their versatile design permits higher or lower heat concentration zones to meet distributed wattage requirements. They can be pre-formed to complex shapes and can withstand mechanical shock and vibration. They can also accommodate Thermostats or RTD for precise temperature controls. For ease of connectivity, termination can be provided at any location. Different mounting methods such as pressure sensitive adhesive, field applied adhesive, Velcro etc. are available according to the requirement. Silicone

Rubber Heaters are available in two types-

Wire wound elements consist of the resistance wire wound on a fiber glass cord for support and stability. Wire wound is recommended and preferred for all large and small sized heaters.

Etched foil heaters are made with a thin metal foil (.001") as the resistance element. The etched foil heater provides exceptional heat transfer compared to wire wound elements, due to its large flat surface area.

Construction

1 **The lead wire** consists of high temperature resistance wire wound around a fiberglass core for added support and flexibility
2 **Silicone rubber** are rugged, moisture and chemical resistant, flame retardant, have high dielectric strength.
3 **Nickel Chromium Resistance wire** for maximum life, evenly wound for even heat distribution. Vulcanization process is used to attach the power leads and cord sets to the heater windings.

Technical Specifications

- **Wattage Tolerance :** Wire Wound +5%, -10%
  Etched Foil + 10%, -10%
- **Voltage :** 12V to 600V
- **Max. Operating Temperature :** 230°C
- **Maximum size :** length 1″ to 120″
- **Width :** 1 to 36″
- **Thickness :** 0.056" standard, other thicknesses available
- **Maximum operating temp. :** 450°F
- **Voltage :** 12V to 600V

Note : For custom design requirements please contact factory

Design Option

Ground Mesh

For grounding purposes a second layer of insulating material and a conductive grid can be added to the heater. The heater comes with a ground wire. Marathon Heater offers several design options to meet various application requirements.

Silicone Rubber Sponge Insulation

To improve heater efficiency, 1/16", 1/8", 1/4", 3/8" or 1/2" insulation can be bonded to the outside of the heater. Closed cell silicone sponge is extremely flexible and has a Temperature range of "-75°C to 250°C".

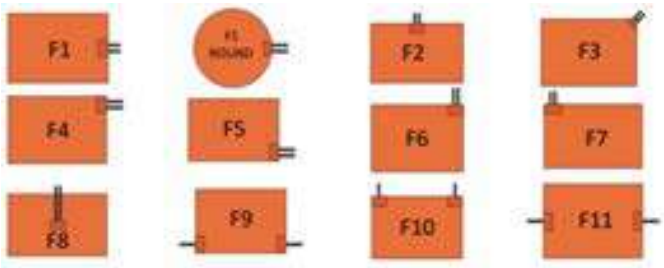
Round Heaters

Round shapes are also available. Round heaters are best attached to tooling with PSA.

Silicone Rubber Enclosure Heaters

Enclosure heaters are used to maintain temperature in any type of electrical box. Typical applications include ATM's, control

Fexible Heater Lead Location Options



Sillicon Rubber Heaters

Mounting Methods

Pressure Sensitive Adhesive : Here are several options for installation or mounting Silicone Rubber Heaters. An easy mounting method is to peel and stick. PSA is attached directly to one side of the heater. Just peel away the protective liner and attach the heater to the desired tool. PSA is rated to a continuous temperature of 300°F and a maximum intermittent temperature of 350°F. It is not recommended for curved surfaces. The heater should be installed within 6 months of manufacture.

Factory Vulcanizing : Another method of installation is to send your tool to the Marathon Heater factory. The tool is placed in a vacuum able and the SRH is vulcanized directly to the tool. This is the strongest bond available.

Field applied adhesive : SRH may also be attached with field applied adhesive; Marathon Heater will supply the required RTV to adhere the heater to the desired surface. We offer a room temperature curing adhesive. Apply a thin film of RTV on the entire bottom of the heater. After positioning the heater on the part, use a roller to remove all air trapped between the heater and the part. The RTV should be allowed to cure for 24 hours.

Temperature Controls for Silicone Rubber Heaters:

Marathon Heater Silicone Rubber heaters can accommodate pre- set or adjustable thermostats, thermal cut-offs,RTDs and Type J thermocouples. Each has a specific temperature range and maximum amperage capability . The most common type of temperature control are pre-set and adjustable thermostats. They can be mounted to sense the temperature of the surrounding atmosphere or to sense the part temperature. Not recommended for low voltage applications

.Thermocouples & RTDs are small and are easily embedded anywhere on the heater.

Drum Heaters

Marathon Heater Drum Heaters are an easy way to heat up drum contents. Various sizes and lengths allow you to heat up practically any drum, pail or barrel. Uniform heat prevents scorching or degradation of the contents. The silicone rubber band heater is placed below the level of the fluid. The easy spring lock-up provides movement of the band when content levels fluctuate. The band style drum heater can be used on plastic, alloy or just about any material.

Springs and Grommet : Each end of the spring is attached to a grommet securing the heater to the tool. Grommets are spaced approximately 2" apart

Velcro : 1''Wide Velcro secure the heater to the tool. Temp range 200°c

Band Style Drum Heater applications include:

- Freeze protection
- Viscosity control
- Speeding up the flow of liquids
- Maintaining product consistency

Features

- Easy installation with spring loaded fastener.
- 3 conductor cord set.
- Internally grounded.
- Can be wrapped around any object
- Options thermocouples, RTD's, holes and cut-outs.

Applications

- Easy installation with spring loaded fastener.
- 3 conductor cord set.
- Internally grounded.
- Can be wrapped around any object
- Options thermocouples, RTD's, holes and cut-outs.

PRINTED FEXIBLE HEATER

Marathon makes printed flexible heaters can be customized in various sizes.

The printed heaters have uniform temperature distribution with easy mounting. The heaters can be designed with concentrating power where it is needed. The heating element can be trace with widened or narrowed structures as per requirements.

Marathon makes printed flexible PTC heaters has self-regulating properties through which it can automatically control the temperature (40^{o}C/ 60^{o}C/ 90^{o}C). The PTC ink is selected as per required temperature. The electrical resistance of material increases with increase of the temperature. It is capable of controlling the temperature itself by regulating it heating power via its electric resistance to temperature.

Construction

The printed heaters can be developed using different types of conductive and resistive inks. The heating element can be patterned on flexible base (PET/ Polyimide/ PEN etc.) using the required ink. The pattern is covered with same as base material or laminating it with an insulating material.

An additional layer of PSA can be placed at bottom to mount directly on the surface to be heated

Flexible Printed heater

Flexible Printed PTC heater

Termination

The termination pads or areas allow for attachment of lead wires by clamping or bonding through conductive epoxy. The termination pads should be the highly conductive

Advantages and Benefits

1. Formulating the pastes with a wide resistance range to deliver sufficient wattage
2. Adjusting printing width and depth to supplement the resistivity of the paste
3. Capability to apply heat with very predictable heat distribution across the surface or just in certain areas
4. Different shapes and geometry to fit target areas for unique heating patterns.

Unique Characteristics

Printed Flexible Heaters offer low mass, low leakage current.

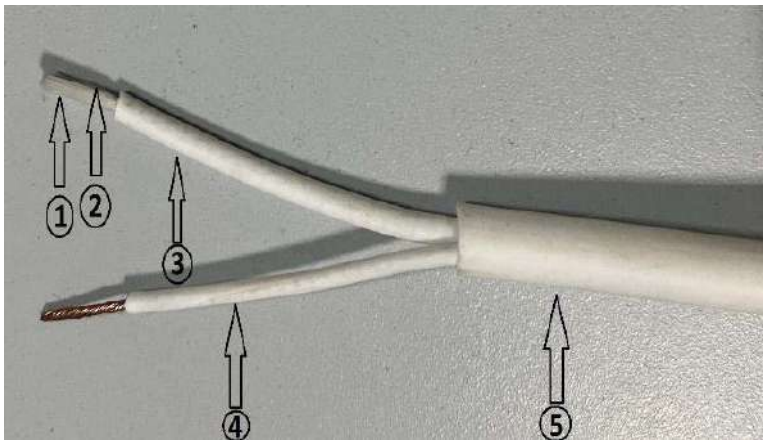
- Temperature: 105°C to 120 °C
- Low out-gassing
- Durable, safe and reliable
- Water and acid resistant
- Minimal material waste, resulting in lower production costs compared to etched, where sheets are chemically etched to create the circuit.
- It is an additive process with selective deposition capability
- Consume less power
- Cost effective and easy fabrication

Technical Specifications

Max Length	~20 inches
Max Width	~18 inches
Thickness	0.150 - 0.50 mm
Watt Density	0.3 W/cm²
Wattage Tolerance	+10%
Maximum Temperature	Permanent temperatures of up to 100°C (max. 120°C for short periods)
Voltage	1 V to 240V AC or DC
Heating Element	Silver/ Carbon/ PTC

FROST PROTECTION HEATING CABLES (FPC-TC)

Construction



- Fibre-Glass Thread
- Resistance Wire in Spiral
- Silicone Insulation
- Silicone Insulated Return Wire
- Silicone Insulated Outer Jacket

Introduction

Marathon Frost protection Heating Cable is used in colder climates to keep water or other fluid flowing by preventing it from freezing in pipelines. It can also heat the water passing through the pipes. It is often used in mountainous areas and places where the temperature goes below freezing; it's commonly found in metallic and plastic water pipelines, sanitary pipes, and water containers, among other things.The key USP of Marathon Heater's Freeze Protection is built-in thermostat for individual control and invisible cold tail. In severe cold, this specifically engineered cable maintains a constant flow of fluid or heat up objects.

Construction Data

Heating element	Resistance Wire
Heating element Insulation	Silicone
Braiding	Tinned Copper Braid
Outer Jacket	Silicone

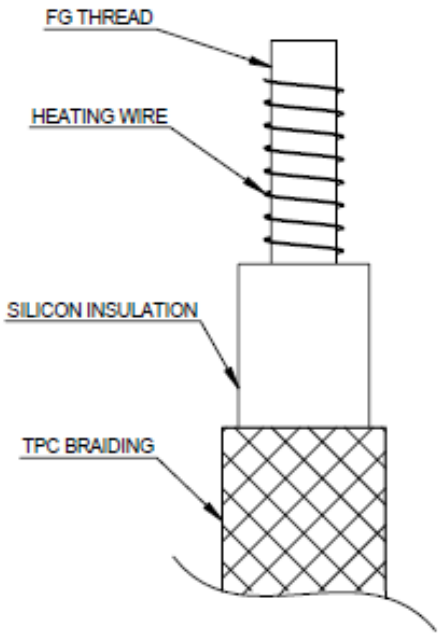
Cable Specifications

Output wattage at 20°C	03 ~ 40 Watt/Mtr / Customise
Min Bending radius	5 Times of Cable OD
Voltage	220 ~ 240 VAC / Customise
Insulation Colour	White / Customise

Cable Features

- Invisible cold cable (Optional)
- Extremely Flexible
- 100 % Water proof
- Double insulation

FROST PROTECTION HEATING CABLES (FPC-M1)



Construction

A resistance wire is precisely wrapped around a core of extremely durable, heat-resistant material, FG Thread. Silicone rubber is used to insulate the core by extrusion process. To give it more mechanical strength and a path for earthing, TPC braiding provided.

Introduction

This specifically engineered cable to prevent the forming or melting the ice in refrigeration and food storage system especially in doors. Commercial coolers and freezers make considerable use of insulated heating cable. It is typically applied around glass or door decets to stop ice or condensation from forming. A range of different commercial refrigeration systems and chilled food display units are a few examples of further frequent uses.

Construction Data

Heating element	Single Resistance Wire
Number of Core	Single
Heating Element Insulation	Silicone (White / Customise)
Braiding	Tin Plated Copper Braid

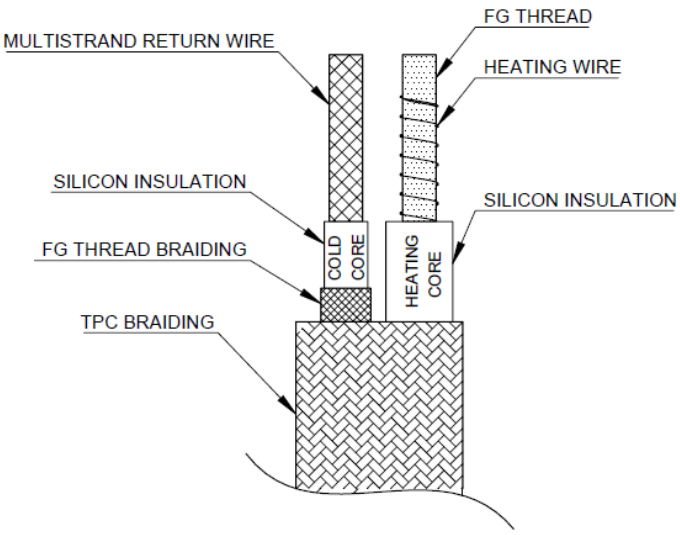
Cable Specifications

Output Resistance at 20°C	03 ~ 750 Ohm/Mtr / Customise
Min Bending radius	5 Times of Cable OD
Applied Voltage	220 ~ 240 VAC / Customise
Insulation Colour	White / Customise
Insulated Heating Wire OD	3.7 ± 0.3 mm / Customise
Final Braided OD	4.4 mm (Approx.)
Outer Jacket	No (Optional)

Cable Features

- Extremely Flexible
- 100 % Water proof
- Optional: Jacket
- Optional: Double insulation

FROST PROTECTION HEATING CABLES (FPC-M2)



Construction

A resistance wire is precisely wrapped around a core of extremely durable, heat-resistant material FG Thread. Silicone rubber is used to insulate the core by an extrusion process.A multi-strand return wire insulated with silicone & braided with FG thread placed parallel to the heating wire (FPC-M2).To give it more mechanical strength and a path for earthing, TPC braiding provided.

Introduction

This specifically engineered cable to prevent the forming or melting the ice in refrigeration and food storage systems especially in doors. Commercial coolers and freezers make considerable use of insulated heating cable.It is typically applied around glass or door edges to stop ice or condensation from forming. A range of different commercial refrigeration systems and chilled food display units are a few examples of further frequent uses.

Construction Data

Heating Element	Single Resistance Wire
Number of Core	Single
Heating Element Insulation	Silicone (White / Customise)
Return Wire Insulation	Silicone (White / Customise)
Braiding	FG Thread on Return Wire & TPC on Both Core Combined

Cable Specifications

Output Resistance at 20°C	03 ~ 750 Ohm/Mtr / Customise
Min Bending radius	5 Times of Cable OD
Applied Voltage	220 ~ 240 VAC / Customise
Insulation Colour	White / Customise
Insulated Heating Wire OD	3.7 ± 0.3 mm / Customise
Insulated Return Wire OD:	2.5 ± 0.2 mm (Customise)
Final Braided OD	7.0 mm (Approx.)
Outer Jacket	No (Optional)

Cable Features

- Extremely Flexible
- 100 % Water proof
- Optional: Jacket
- Optional: Double insulation

Aluminum Foil Heater

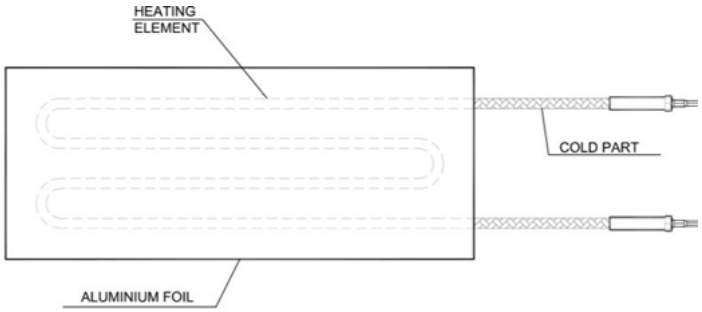
MI Thermocouples

Electric resistance heaters with foil backing are being produce to fulfil specific specifications for size, shape, layout, cut-outs, lead wire, and lead termination. The heaters can have dual wattages, dual voltages, built-in temperature control, and sensors. The Aluminium foil heaters can be mechanically affixed with rivets, sheet metal screws, or other mechanical devices, or they can be mounted to a surface using an integrated adhesive. For more demanding applications, a semi-rigid Aluminium backing plate delivers structural support. The Aluminum foil heater has a moisture resistance heater, it is very low cost heater compared to others than.

It can be easily install with an adhesive blocking system, there has used of highly flexible/high Thermal conductivity of Aluminium foil, it makes possible to regulate the temperature quickly. There has used high grade of Aluminium foil that will sustain the 650°c of temperature, The temperature of cable 150°c will be continuously operating. There has to be a cold Lead of 3.5 (Customized) meter for the power supply with XLPE/Silicon Insulated and PVC Sheathed.

Temperature can be controlled using thermal regulators (thermostats)

Construction



- Conductor Alloy- Nichrome 80/ Alloy 875/ Alloy 815/ Nickel 200/ Alloy 30/ Alloy 15/ Alloy 10/ Alloy 5/ Alloy 27 / Alloy 50/Copper/ Stainless Steel/ Customize
- nsulation - PTFE/Silicon/Customize
- Max. continuous Temperature- 105°c/125°c/150°c/200°c/
- Earthing through aluminum sheets.

Application

- Key element to provide heat in Radiant Panel Heater used to heat-up the different spaces.
- Maintaining the ideal temperature for food on serving utensils such buffet tables, warming boxes and cabinets, salad bars, chafers, and other similar items
- To heat equipment such as cylinders, test tube heaters, magnetic stirrers, chambers, containers, pipelines, beakers, and more.
- In order to supply heat for equipment such as incubators, blood warmers, in vitro fertilization heaters, operating tables, befouled warmers, anesthetic heaters, and more
- To provide radiant heat
- To prevent condensation on mirrors and battery warming
- Defense against freezing or maintaining temperature in vertical or horizontal tanks
- Protection from freezing for plate heat exchangers.
- Electronic or electric control box anti-condensation
- Refrigerated display cabinets, household items, and medical equipment anti-condensation.

Aluminum Foil Heater

Construction Data

Resistance Wire Alloy	Alloy- Nichrome 80/ Alloy 875/ Alloy 815/ Nickel 200/ Alloy 30/ Alloy 15/ Alloy 10/ Alloy 5/ Alloy 27 / Alloy 50/Copper/ Stainless Steel/ Customize.
Power Range	50 – 3300 watt
Voltage range	120, 230 Volt & Customize
Heating Material	Aluminum Foil sandwiched between two thin sheets of aluminum
Max. Continuous Temperature	200°C
Insulation Type	XLPE/Silicon/FEP/ETFE/ECTFE/FPA/PTFE/Customized.
Cold Lead	XLPE/Silicon Insulated 105°c/ Customise
Cold Lead Connection Type	Crimp with Connector

Technical Specification

Product Name	Aluminum Foil Heater
Function	Anti-condensation, Freeze Protection, Mirror condensation prevention and medical equipment anti-condensation
Features/Benefits	Earthing of the aluminum sheets.
	Voltage – any voltage on request
	Resistance to moisture
	Easy to Install (when ordered with the adhesive backing)
	Low mass means fast heat-up time
	High flexibility
	Material -Full body aluminum foil.
Material	FEP/PFA/ETFE/PTFE/XLPE/Silicon//Customize Insulated Wire
Resistance Range at 20°C	3500ohm/m -0.169 Ohm/m
Applied Voltage	12, 24,110, 230V / customize single Phase
Watt Density	Up to 40 watt/m
Temperature Range	Up to 200°c
Standard width	Customize as per requirement

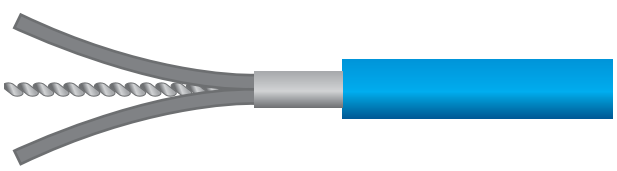
Floor Heating Cables

Nothing matches to radiant floor heating. It is more comfortable than any other type of heating system. Radiant floor heating is the most energy-efficient way of delivering heat. There is no other floor heating option that compares in terms of comfort. Radiant floor heating is a low-temperature technology that may be regulated individually in each area. Because it warms the people and item directly rather than heating air.

Advantages of Marathon Heating Cables

- Easy installation and can be installed in any area in the house and any type of flooring.
- Can be an excellent option for low-energy homes.
- Works quietly from beneath the tiles/plywood.
- Underfloor heating distributes heat where it is needed, resulting in maximum heat efficiency and only very little heat loss.
- For optimal protection, Marathon floor heating cables are insulated using XPLE/ETFE/FEP/PTFE on both the conductors and PVC (HR-FR) on the outer jacket.
- Marathon floor heating cables have been developed particularly to deliver primary heating beneath a variety of flooring. To facilitate 'tape-down' installation, the cables are also available into the preassembled fiber glass mats.
- Marathon floor heating cables are completely grounded and comes with a 3.5 meter long cold lead wire for power connection.
- Easy to control required temperature in all weather by digital temperature controller with thermostat.

(FHC-SX-06) (FHC-SX-10)



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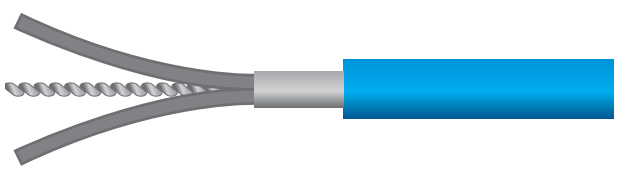

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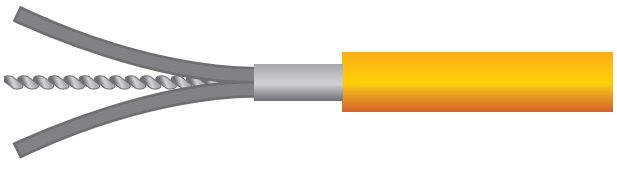

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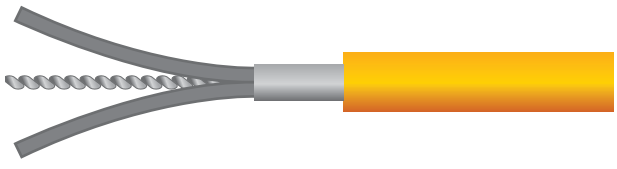
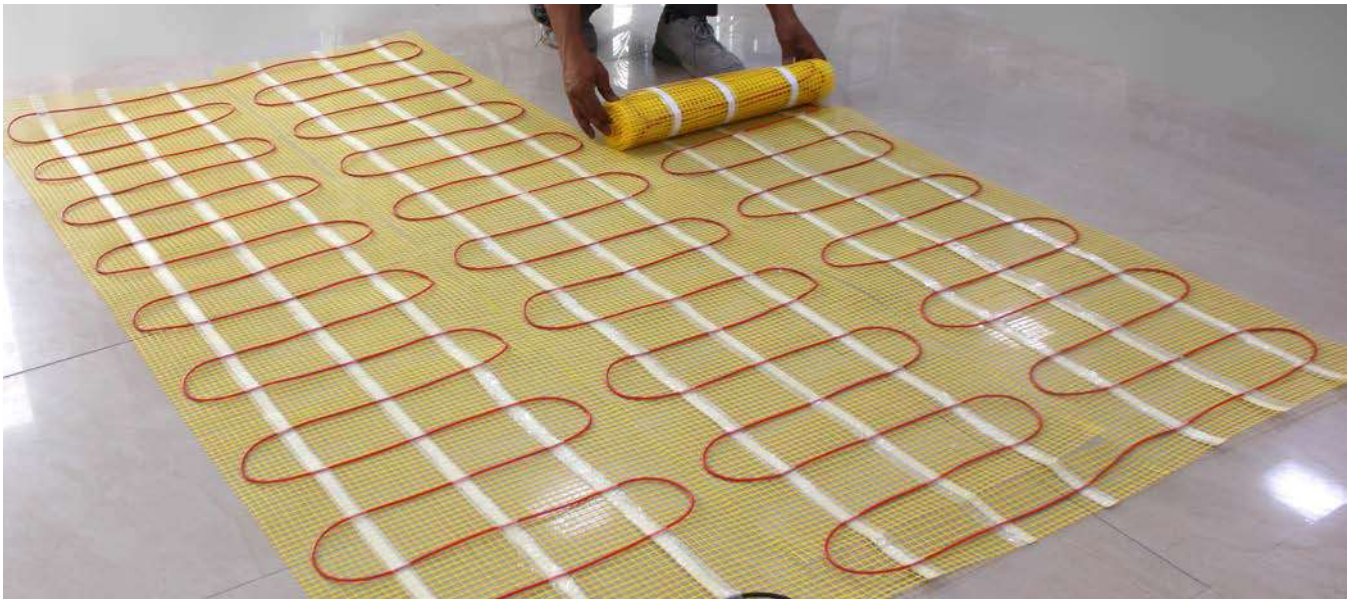


Floor Heating Cables

Nothing matches to radiant floor heating. It is more comfortable than any other type of heating system. Radiant heating is also the most energy-efficient way of delivering heat. There is no other heating option that compares in terms of comfort. Radiant floor heating is a low-temperature technology that may be regulated individually in each area. Because it warms the people and item directly rather than heating air.

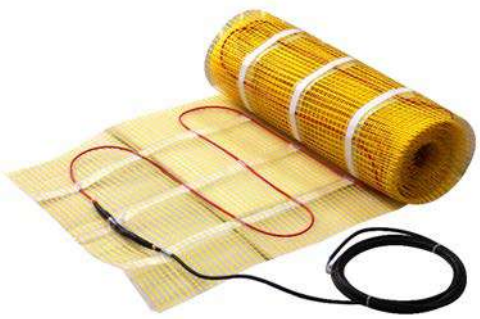


Advantages of Marathon Heating Mats

- Easy installation and can be installed in any area in the house and any type of flooring.
- Can be an excellent option for low-energy homes.
- Works quietly from beneath the tiles/plywood.
- Underfloor heating distributes heat where it is needed, resulting in maximum heat efficiency and only very little heat loss.
- For optimal protection, Marathon floor heating mats are insulated using XPLE/ETFE/FEP/PTFE on both the conductors and PVC (HR-FR) on the outer jacket.
- Marathon floor heating mats have been developed particularly to deliver primary heating beneath a variety of flooring. To facilitate 'tape-down' installation, the mats are also available into the preassembled fiber glass mats.
- Marathon floor heating mats are completely grounded and comes with a 3.5 meter long cold lead wire for power connection.
- Easy to control required temperature in all weather by digital temperature controller with thermostat.

FHM-SX-100

FHM-DF-150 (FHM-SX-200)



Roof & Gutter Snow Melting Cables

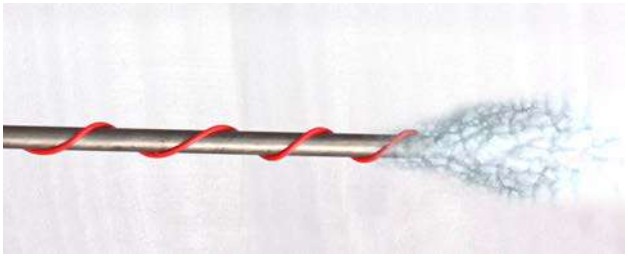
Marathon Roof & Gutter Snow Melting Cables provides the most effective approach to heat a Roof & Gutter uniformly to de-icing the snow. Direct heating will give a faster reaction time and more temperature control options. Any snow on the Roof & Gutter will de-ice rapidly with safety. Roof & Gutter Snow Melting Cables are hygienic, safe and economical.

Applications

- Easy installation and can be installed in any area of the roof.
- Can be an excellent option for low-energy homes.
- It distributes heat where it is needed, resulting in maximum heat efficiency and only very little heat loss.
- Easy to control required temperature in all weather by digital temperature controller with thermostat.
- For optimal protection, these cables are insulated using XPLE on both the conductors and PVC (HR-FR) on the outer jacket.
- It aids the consumers in cold regions, when temperatures drop below zero degrees, in reducing roof damage and preventing icicles and frozen facades.
- Marathon Roof & Gutter Snow Melting Cables comes with a 5 meter long cold lead wire for power connection.

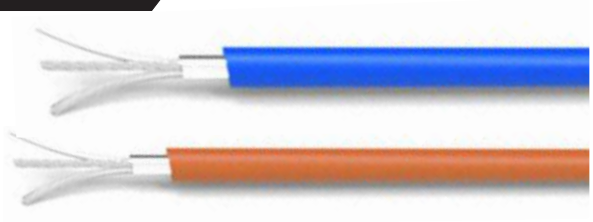
Frost Free Heating Cable

Marathon Frost Free Heating Cable are used in colder climates to keep water flowing by preventing it from freezing in pipe lines. It can also heat the water passing through your clients' pipes. It is often used in mountainous areas and places where the temperature goes below freezing. It's commonly found in metallic and plastic water pipelines, sanitary pipes, and water containers, among other things. The key USP of Marathon Heater's Freeze Protection is built-in thermostatic control. If in severe cold, this specifically engineered cable maintains a constant flow of water



Industrial Heating Cables

(IHC-xx-xx)

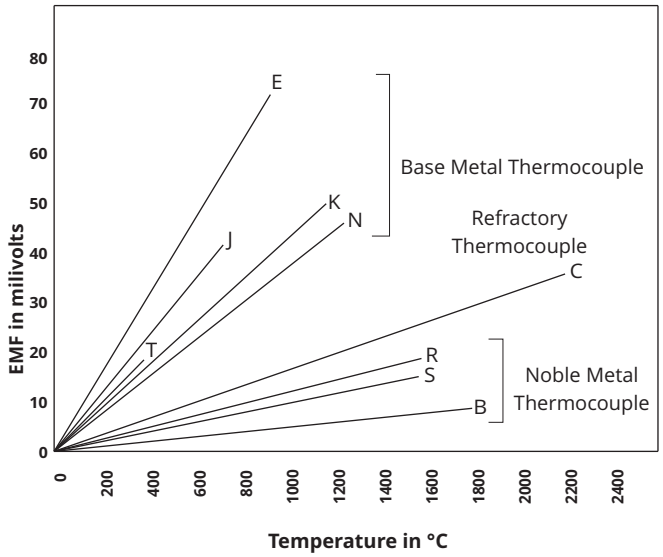


Marathon Industrial Heating Cables provides the most effective approach to heat a space or object uniformly. Our direct heating cables will deliver a soothing heating whereas required. Direct heating will give a faster reaction time and more temperature control options.

BASICS OF THERMOCOUPLES & RTDS

Thermocouples

Thermocouples consist of two dissimilar metals joined at one end, generating a thermoelectric voltage based on the temperature difference between the joined and open ends.



Tolerance Table for Type of Thermocouples

Type of T/C	Material (+ & -)	Temp. Range(°C)	Tolerance Grade	
			Standard	Special
T	Copper & Constantan	-200°C to 350°C	±1.0°C or ±0.75%	±0.5°C or ±0.4%
J	Iron & Constantan	0°C to 750°C	±2.2°C or ±0.75%	±1.1°C or ±0.4%
E	Chromel & Constantan	-200°C to 900°C	±1.7°C or ±0.5%	±1.0°C or ±0.4%
K	Chromel & Alumel	-200°C to 1250°C	±2.2°C or ±0.75%	±1.1°C or ±0.4%
N	Nicrosil & Nisil	-270°C to 1300°C	±2.2°C or ±0.75%	±1.1°C or ±0.4%
S	90% Platinum+10% Rhodium & Platinum	0°C to 1450°C	±1.5°C or ±0.25%	±0.6°C or ±0.1%
R	87% Platinum+13% Rhodium & Platinum	0°C to 1450°C	±1.5°C or ±0.25%	±0.6°C or ±0.1%
B	70% Platinum + 30% Rhodium & 94% Platinum + 6% Rhodium	650°C to 1700°C	±0.5%	- - -
C	95% Tungsten+5% Rhenium & 74% Tungsten+26% Rhenium	0°C to 2320°C	4.5°C or ±1.0%	- - -

Thermocouple Insert Construction

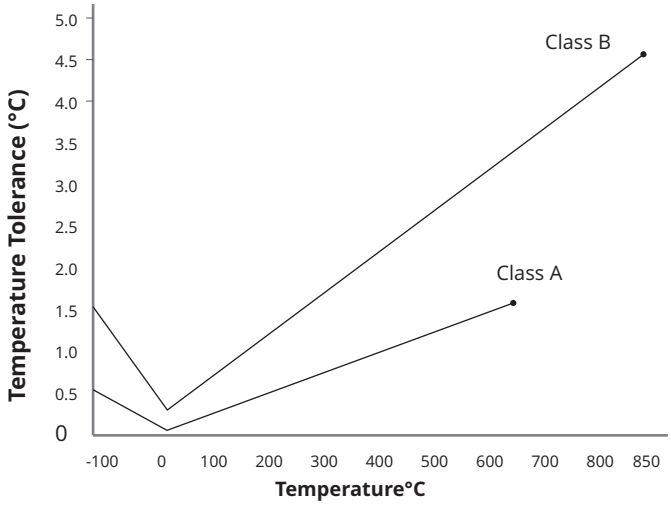
RTD

Resistance thermometers operate using metals that change their electrical resistance when exposed to heat.

Platinum is the most widely used material for industrial RTDs, though copper and nickel are also utilized for specific applications.

The resistance measured at 0°C, known as R□, is a critical parameter. The most common RTD element is platinum, with a resistance of 100 Ω at 0°C, hence the designation Pt100.

Platinum RTDs are suitable for temperatures ranging from -200°C to 850°C, though in most industrial applications, they are typically used up to 400°C.



Tolerance Table for Type of RTD(as per IEC 751) Pt100

Temperature	Class A (±)	Class B (±)
-200°C	0.55°C	1.3°C
-100°C	0.35°C	0.8°C
0°C	0.15°C	0.3°C
100°C	0.35°C	0.8°C
200°C	0.55°C	1.3°C
300°C	0.75°C	1.8°C
400°C	0.95°C	2.3°C
500°C	1.15°C	2.8°C
600°C	1.35°C	3.3°C
700°C	-	3.8°C
800°C	-	4.3°C
850°C	-	4.6°C

RTD Insert Construction

THERMOCOUPLES

MI Thermocouples

Mineral Insulated Thermocouples, commonly known as MgO (Magnesium Oxide) Thermocouples, are widely used in various process and laboratory applications. These thermocouples are available in all element types, with a diverse range of sheath diameters and materials. Renowned for their robust and flexible design, MI thermocouples are capable of withstanding high temperatures, making them a preferred option for numerous temperature measurement applications.

Type	K, N, J, T, E
Sheath Size (MI)	0.25, 0.5, 1.0, 1.5, 3.0, 4.5, 6.0, 8.0 mm, Other size on request
Sheath Material	SS321, SS316, SS310, HRS 446, Inconel 600, Nimonic, Pyrosil, Platinum etc.
Configuration	Simplex/Duplex/Multipoint
Special	• Miniature Thermocouple with minimum 0.25 mm Dia • Swaged Tip Thermocouples • Tube Temperature Skin Type Thermocouples • Special Sensors as per ASTM-E235 for critical application • High Wall Thickness Thermocouple

RESISTANCE TEMPERATURE DETECTORS

Mineral Insulated RTDs

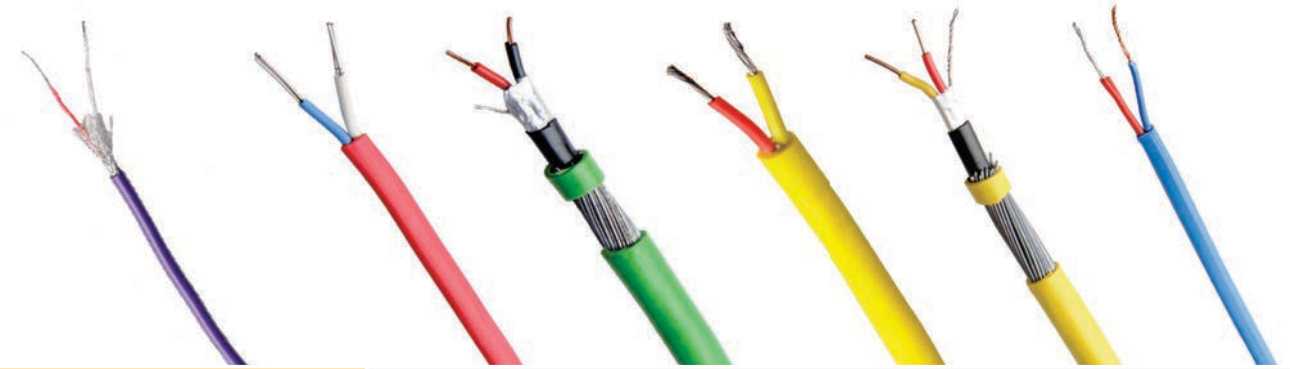
Mineral Insulated Resistance Thermometers are made with Platinum-measuring resistors (Pt100Ω) in accordance with DIN IEC 751 standards. The measuring resistor is connected to the inner conductors, embedded within the assembly, and enclosed by a metal sheath, ensuring a hermetically sealed design.

Type	Pt100, Pt200, Pt500, Pt1000, Pt5000 etc.
No. of Wires	2, 3, 4 wires
Sheath Size (MI)	1.5, 3.0, 4.5, 6.0, 8.0 mm
Configuration	Simplex/Duplex/Multipoint
Special	• Vibration proof RTDs for Bearing & DG sets • Motor & Transformer winding temperature RTDs • Handheld & Probe in various designs • Strap on RTDs for Nuclear application • High Temperature RTDs. • Autoclave Thermocouple & RTD.

CABLES

Thermocouple Cables

Thermocouple cables are designed for direct temperature measurement. In contrast, thermocouple extension or compensating wires are specifically used to transmit the thermocouple signal from the sensor to an instrument for accurate readings.



Construction	Single or Multi Pair
Voltage Grade	Up to 1.1 KV
Conductor	TC, EX, C (as per below table)
Type of Conductor	K, T, J, E, N, R, S, B, D, C
Conductor Size	AWG 12 to AWG 34
Conductor Stranding	Solid or Multi Strand
Core Insulation	PVC, XLPE, LSZH, PE, PTFE, FEP, PFA, PEEK, Silicon, ETFE, Polyiomide, Fiber Glass, Ceramic Fiber, Alumina Yarn
Screening (If applicable)	Aluminum Foil with drain wire / Mesh Braided
Inner/Outer Sheath	PVC, LSZH, PTFE, FEP, PFA, ETFE, Silicon, Polyimide, Fiber Glass, Ceramic Fiber, PUR, Alumina Yarn
Armouring (If applicable)	G.I. Armouring (For High Temperature insulations)/SS Braiding
Color Code	As per below table
Standards	ANSI MC 96.1, IEC 584.3, IS 8784,JSS 51034, JSS 51038, IS1554, IS8130, IS7098-I, IS5831, IS3975, IEC 60228, IEC 60502, IEC60332, IS9968

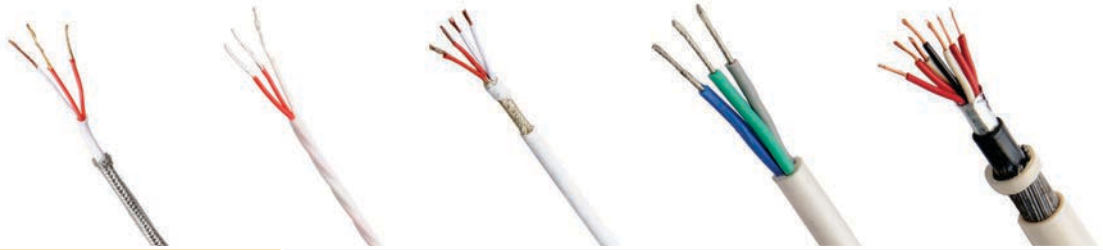
Colour Code & Accuracy of Thermocouple, Extension& Compensating Cables

T/CTYPE	CONDUCTOR		CONDUCTOR COMBINATIONS		COLOR CODE		TOLERANCE CLASS AS PER IEC 584.3		CABLE TEMP. RANGE°C
	EXTENSION CABLE	COMPENSATING CABLE	+LEG	-LEG	IEC 5843:1989	ANSI/MC96.1	CLASS 1	CLASS 2	
K			CHROMEL	ALUMEL			±1.5°C or 0.4% of T	±2.5°C or 0.75% of T	0°C TO +1100°C
	KX		CHROMEL	ALUMEL			±1.5°C	±2.5°C	-25°C TO +200°C
		KCA	IRON	CONSTANTAN			-	±2.5°C	0°C TO +150°C
		KCB	COPPER	CONSTANTAN			-	±2.5°C	0°C TO +100°C
T			COPPER	CONSTANTAN			±0.5°C or 0.4% of T	±1.0°C or 0.75% of T	-185°C TO +300°C
	TX		COPPER	CONSTANTAN			±0.5°C	±1.0°C	-25°C TO +100°C
J			IRON	CONSTANTAN			±1.5°C or 0.4% of T	±2.5°C or 0.75% of T	+20°C TO +700°C
	JX		IRON	CONSTANTAN			±1.5°C	±2.5°C	-25°C TO +200°C
N			NICROSIL	NISIL			±1.5°C or 0.4% of T	±2.5°C or 0.75% of T	0°C TO +1100°C
	NX		NICROSIL	NISIL			±1.5°C	±2.5°C	-25°C TO +200°C
E			CHROMEL	CONSTANTAN			±1.5°C or 0.4% of T	±2.5°C or 0.75% of T	0°C TO +800°C
	EX		CHROMEL	CONSTANTAN			±1.5°C	±2.5°C	-25°C TO +200°C
R		RCA	COPPER	COPPER LOW VALUE NICKEL			-	±2.5°C	0°C TO +100°C
S		SCA	COPPER	COPPER LOW VALUE NICKEL			-	±2.5°C	0°C TO +100°C
B		BC	COPPER	COPPER			-		0°C TO +100°C
D		DC	ALLOY 203*	ALLOY 225*			-	±4.5°C	0°C TO +100°C
C		CC	ALLOY 405*	ALLOY 426*			-	±4.4°C	0°C TO +100°C

CABLES

RTD Triad Cables

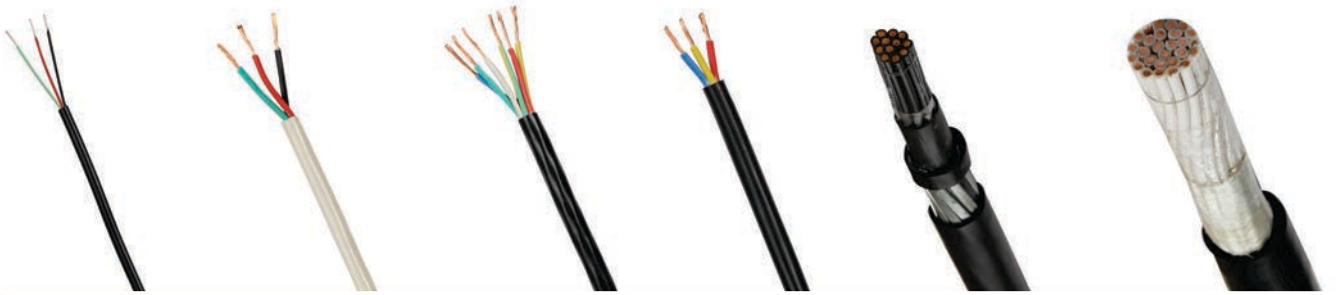
RTD triad cables are designed to transmit RTD signals to control rooms or field-mounted Instruments.



Construction	Single or Multi Triads
Voltage Grade	Up to 1.1 KV
Conductor	Electrolytic Grade Bare Copper/Tinned Copper/SPC/NPC
Conductor Size	0.50, 0.75, 1.0, 1.5 Sq. mm up to 48 triad
Conductor Stranding	Solid or Multi Strand
Core Insulation	PTFE, FEP, Silicon, PFA, PVC, PE, XLPE, LSZH Polymer etc.
Screening Method (If applicable)	Individual and Overall / Overall Shield
Screening (If applicable)	Aluminum Foil with drain wire / Mesh Braided Type
Inner/Outer Sheath	PTFE, FEP, Silicon, PFA, PVC, PUR, LSZH Polymer etc.
Armouring (If applicable)	G.I. Armouring/SS Braiding/G.I. Braiding (For High Temperature insulations)
Standards	As per BS 5308 Part 1 and Part 2, IS 1554, EN 50288-7, IS7098, DIN 43760, JSS 51038, JSS51034, IS7098-I, IS8130, IS3975, IS5831, IS9968

LT Control & Power Cables

Control & Power cables are designed for voltage ratings up to 1.1 kV and are available with a variety of insulation & sheath options. Power cables transfer energy from a source to equipment, control cables send signals to control the functioning of equipment.



Construction	Single or Multi Core
Voltage Grade	Up to 1.1 KV
Conductor	Electrolytic Grade Bare Copper/Tinned Copper
Conductor Size	0.50, 0.75, 1.0, 1.5, 2.5, 4.0, 6.0, 10.0, 16.0, 25.0, 35.0 upto 300Sq. mm
Conductor Stranding	Solid or Multi Strand
Core Insulation	PVC, HR PVC, PE, XLPE, LSZH Polymer, FR PVC, FRLS PVC, XLPO etc.
Screening (If applicable)	Aluminum Foil with drain wire / Mesh Braided Type (for Control Cable)
Inner/Outer Sheath	PVC, HR PVC, PE, LSZH Polymer, FR PVC, FRLS PVC, PUR, XLPO etc.
Armouring (If applicable)	G.I Round Wire/Flat Strip Armouring (As per IS3975:99), G.I. Braiding
Standards	As per IS694, IS1554, IS7098, IEC60227, IEC60502-1, IEC60332, IEC60228, IS8130, IS3975, IS5831

Facilities

Welding and Brazing

- Laser Welding Machines
- Programmable Micro Plasma Welding Machines
- TIG Welding Machines with Pulse Modulation And Rotary Positioner
- Induction Brazing Machines
- Resistance Welding Machines
- Brazing Sets (Oxy-Acetative)
- Deep Penetration Welding Machines

Heater Plant

- Swaging Machines
- Laser Marking Machines
- Laser Cutting Machine
- Bright Annealing Machine
- Engraving Machines
- Coil Making Machines
- High Frequency Annealing Machines
- MgO Filling Towers
- Rolling Machine & Skinning Machines
- Vacuum Presses
- CNC Breading Machines

MI Cable Plant

- Draw Bench 50 meters, Horizontal Draw Benches
- Annealing Furnaces
- MI Polishing Machines
- MgO Plant

Machining

- CNC Turning Centers
- Turn Mill Centers
- VMC Machines
- Deep Hole Drilling Machines upto 1500mm Drilling Capacity
- Milling Centers
- Manual Lathe Machines
- Cutting Machines

Testing and Facilities

- Digital Multimeter
- Digital Clamp Tester
- High Voltage Tester
- Digital Insulation & Continuity Tester
- Micrometer
- Vernier Caliper (0-200mm)
- Vernier Caliper (0-1000mm)
- DFT Meter
- Pressure Gauge
- Digital Lux Meter
- Sound Level Meter
- X-Ray Machine
- Vibration Test Bench
- Temperature Gun
- RT Film Viewer
- Ultrasonic Thickness Gauge

Services

Calibration Services

The Tempsens Calibration Center is an independent unit of Tempsens Instruments (India) Limited, with laboratories located in Udaipur and Indonesia. It is accredited to ISO/IEC 17025:2017 standards, offering a comprehensive range of temperature calibration services. Tempsens accredited fixed-point temperature calibration facilities. Our lab features highly stable calibration furnaces, precise measuring instruments, and accurate master sensors that are traceable to both national and international standards.

CC-2840
Udaipur Lab

LK-345-IDN
Indonesia Lab

Operating in accordance with ISO/IEC 17025:2017 standards, we offer calibration services for contact-type sensors within a temperature range of -196°C to 1600°C. Non-contact sensors can be calibrated from 0°C to 3000°C. Additionally, our laboratory is accredited for on-site temperature calibration.We provide both in-lab and on-site calibration services for furnaces and baths from -80°C to 1600°C, as well as black body calibration from 50°C to 1700°C. Our services also include furnace/ chamber calibration (TUS) with multiple sensors, covering a range of -80°C to 1200°C.

IN HOUSE CALIBRATION FACILITY

Quality Measured/ Instruments	Temperature Range	Calibration & Measurement Capacity
Contact Type RTD, Thermocouple Thermometers	-196°C -180°C to -80°C -80°C to 0°C >0°C to 250°C >250°C to 650°C >650°C to 1200°C > 1200°C to 1600°C	0.05°C 0.05°C 0.03°C 0.04°C 0.08°C 1.30°C 2.20°C
Non-Contact Type Pyrometer	-40°C to 0°C -30°C to -15°C -15 to 250°C >250°C to 400°C >500°C to 1700°C >1700°C to 3000°C	2.70°C 2.40°C 2.16°C 2.44°C 3.74°C 7.08°C
Heat Flux Meter	25 Kw/m^2 to 75 Kw/m^2 (2.57mV to 7.57mV)	0.08mV

ON SITE CALIBRATION FACILITY

Quality Measured/ Instruments	Temperature Range	Calibration & Measurement Capacity
Contact Type RTD, Thermocouple Thermometers	-100°C to -25°C -25°C to 0°C >0°C to 250°C >250°C to 650°C >650°C to 1200°C	0.07°C 0.07°C 0.04°C 0.08°C 1.30°C
Non-Contact Type Pyrometer	-15°C to 250°C >250°C to 400°C >400°C to 1200°C 1200°C to 1700°C	2.16°C 2.44°C 3.50°C 3.74°C
Multipoint Position Calibration of Chamber, Oven, Furnaces (Thermal Mapping (TUS))	-80°C to 200°C >200°C to 1200°C	0.50°C 5.75°C

PRIMARY TEMPERATURE CALIBRATION FACILITIES

Quality Measured/ Instruments	Temperature Range	Calibration & Measurement Capacity
Calibration of SPRT/ PRTS/ Thermocouple etc.	Triple Point of Water (0.01°C) Melting Point of Gallium (29.7646°C) Freezing Point of Tin (231.928°C) Freezing Point of Zinc (419.527°C) Freezing Point of Aluminum (660.323°C)	0.0038°C 0.0065°C 0.0065°C 0.0071°C 0.0075°C
Calibration of Thermocouple at Secondary Fixed Point	Melting Point of Gold (1064.18°C)	0.72°C
	Melting Point of Palladium (1554.8°C)	0.83°C

TEMPSENS

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