



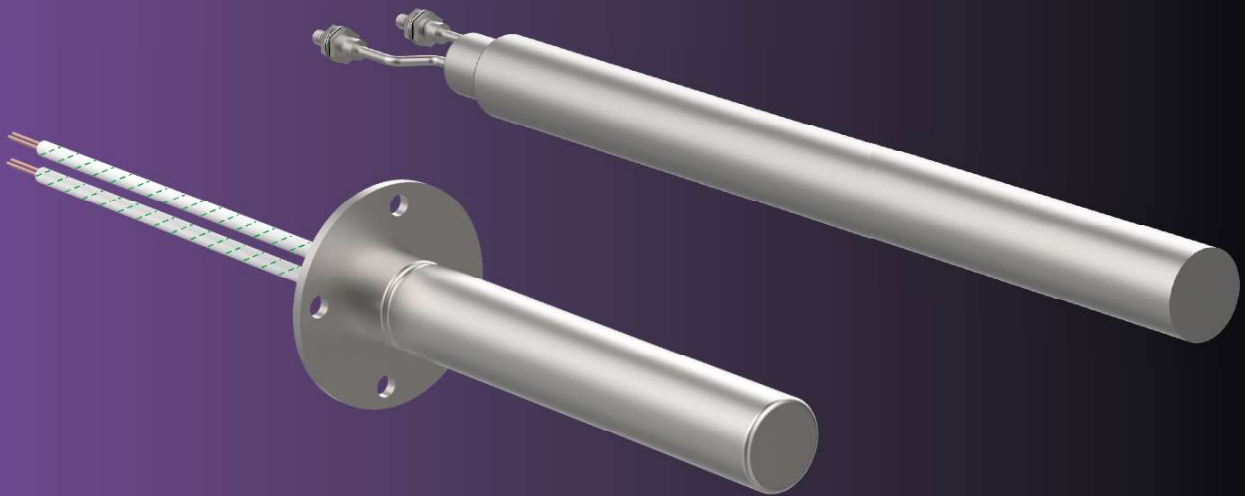
Marathon
Tempens

ENGINEERED SOLUTIONS
FOR HEATING & SENSING

ISO 9001-2015



HIGH WATT DENSITY CARTRIDGE HEATERS



MARATHON HEATER (I) PVT. LTD.

188A, B-169 (Part), B-188 & B-189 (A), Road No.-5, M.I.A., Madri, Udaipur, (Rajasthan.) INDIA 313 003

Ph.: +91 294 3507749, Fax: +91 294 3507731, Cell No. : +91 9351159988

E-mail : info@marathonheat.com, akhil@marathonheat.com

www.marathonheat.com

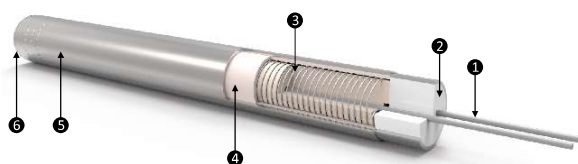
HOT ROD CARTRIDGE HEATERS

Hot Rod Cartridge Heaters are designed to provide uniform heating and excellent heat transfer rate through the heating surface. Facilitated with individually controllable heating zones, various process requirements such as zone specific heating and distributed wattage requirement can be achieved with precise and uniform temperatures. Heaters are constructed with minimal spacing between sheath and heating element to maintain lower internal temperatures which results in smaller sized heaters operating at higher

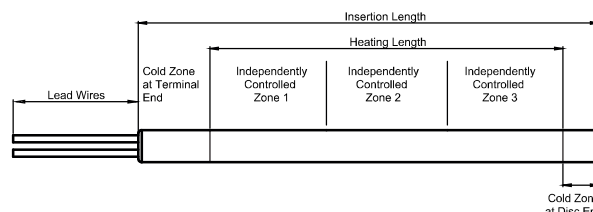
watt densities.

Constructed of high grade Nickel Chromium resistance wire wound on specially designed cores, separated from metal sheath using high purity magnesium oxide fill, all centered and tightly compacted in SS/Inconel tubing through refined swaging process, results in heaters with minimal air gap, high resistance to corrosion and oxidation, and increased life which makes Marathon make cartridge heater best in class with high performance and longer durability.

Construction



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 prevents fraying of lead when bent.
3. Nickel Chromium Resistance wire for maximum 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



- **Sheath Length**- Total length of the heater from the point of beginning of termination to the end of unheated zone at the disc end.
- **Insertion length**- Length of heater measured from unheated zone at terminal end to the unheated zone at disc end.
- **Independently controlled heating zones**-One, Two or Three Independently controllable heating zones are provided depending on the requirement of the customer. These zones can be of different wattages and lengths.
- **Heated Length** -Combination of all heating zones.
- **Unheated zone** – No heat generation takes place in these zones. These are of varying lengths as required by the customer.

Technical Specifications

- **Sheath material** : Stainless steel, incoloy
- **Design temperatures** UPTO 760°C (1400°F).
- **Watt densities** of up to 300 W/in2.
- **Maximum Voltage** up to 480 V.
- **Standard Sheath Length** tolerance is $\pm 3\%$. (Special Tolerance Available on request)
- **Wattage tolerance** is +5%, -10%.
- **Resistance tolerance** is +10%, -5%.

Note - For custom design requirements please contact sales@marathonheat.com

Thermocouple

- Cartridge heaters can also accommodate internal thermocouple which helps in controlling temperature of heater more accurately. Thermocouples can be type "J" or type "K", grounded or ungrounded, and can be attached at the disc end or middle of the heater.
- Thermocouple lead wire is 24 gauge unless specified, thermocouple leads are of the same length

Technical Specifications

Nominal diameter	Minimum diameter	Maximum diameter	Std. Lead wire gauge	Max amps with std. Lead wire	Max lead wire gauge	Maximum amps	Maximum volts
1/8"	3.022	3.14	24	3.6	24	3.6	240
1/4"	6.19	6.32	24	6	22	9	300
6 mm	5.82	5.97	24	6	22	9	300
6.5 mm	6.35	6.47	24	6	22	9	300
5/16"	7.77	7.89	24	6	22	9	300
8 mm	7.84	7.97	24	6	22	9	480
3/8"	9.37	9.49	22	9	18	15	480
10 mm	9.86	11.96	22	9	18	15	480
12 mm	11.83	12.48	22	9	18	15	480
12.5 mm	12.34	12.67	22	9	18	15	480
1/2"	12.55	12.97	22	9	18	15	480
13 mm	12.85	13.46	22	9	18	15	480
17/32"	13.33	15.84	22	9	18	15	480
14 mm	13.84	13.97	18	15	14	26	480
5/8"	15.72	15.84	18	15	14	26	480
16 mm	15.84	15.97	18	15	14	26	480
17 mm	16.84	16.96	18	15	14	26	480
11/16"	17.32	17.44	18	15	14	26	480
19 mm	18.84	18.97	18	15	14	26	480
3/4"	18.89	19.02	18	15	14	26	480
25 mm	24.84	24.96	18	15	14	26	480
1"	25.24	25.37	18	15	14	26	480

Note : For custom design requirements please contact sales@marathonheat.com

Maximum Watt Density For Heating Metals

Hole Clearance	Block temperature in °C					
	649	538	427	316	205	94
0.05	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
2.54	25	35	45	50	50	50

Lead Wire Options

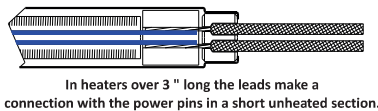
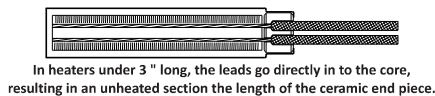
Wire Type	Temp. Rating	Maximum Recommended Temp.	Comments
Ultra lead	250°C	450°C	Excellent, durable wire, good for high temperature application
Teflon	250°C	450°C	Good dielectric strength
Silicon Rubber	250°C	450°C	Good moisture resistance
Braided Silicon rubber	250°C	450°C	Inexpensive wire good for non abrasive applications.
MGT	450°C	450°C	Superior high temperature resistance
SJO cord	94°C	90°C	Rubber Jacket, resistance to oil and moisture. For use on 3/8" diameter and larger.

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Termination Options

Swaged in Leads

- Swaged in Leads are ideal for application where there is excessive movement or leads are required to bend sharply upon exiting the heater.
- In heaters under 3" long, leads wire goes directly into the core whereas in heaters over 3" long, leads are connected to power pins in unheated section.
- Also remember, if the leads are required to be inserted completely into the hole, they are exposed to the block temperature (maximum temperature for standard leads is 550°C)
- Unless specified, all heaters will be supplied with Swaged in Leads.



Crimped on Leads

- The connection between the leads and the power pins are made outside the heater using connectors. Crimp on leads are generally used where the temperature at the end of the heater exceeds the maximum allowable temperature of the lead wire.
- Not recommended for the applications where the leads must be bent sharply at the heater exit.
- Connectors are covered by high volt silicon rubber coated fiber glass sleeve.



Right angle Leads

- Right angle leads are ideal for application with tight spaces. Leads are covered with a silicon impregnated fiberglass sleeve where they exit the heater.



Copper Elbow and Stainless Steel Flexible Conduit

- Right angle flexible conduit can also be attached with a copper elbow. This method can also be used to attach right angle flexible conduit to stock heaters.



Copper coupler and stainless steel flexible conduit

- Flexible conduit can also be attached to the sheath using a copper coupler. This method can also be used to attach right angle flexible conduit to stock heaters.

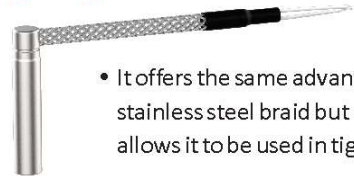


Swaged in Stainless Steel Braid

- Swaged in stainless steel braid provides excellent abrasion protection while allowing the leads to bent in a tight radius. As the braid is swaged in, it retards the braid from being pulled out of the heater.



Right Angle Stainless Steel Braid



- It offers the same advantage as that of swaged in stainless steel braid but right angle arrangement allows it to be used in tight space

Stainless Steel Flexible Conduit

- Flexible conduit provides maximum protection to leads from abrasion but cannot bend as sharply as stainless steel braid. Flexible conduits are also swaged in, thus provide the same benefit of not being pulled out of the heater.



Right Angle Stainless Steel Flexible Conduit



- It offers the same advantage as that of stainless steel flexible conduit but right angle arrangement allows it to be used in tight spaces.

Ceramic Beads

- When the temperature at the exit of the heater exceeds 590°C, ceramic beads protect the wire until conventional insulation can be utilize.



Sleeving

- Silicon Rubber Fiber Glass Sleeking Maximum temperature 200°C, can sleeve both leads together or each lead separately.
- Fiberglass Sleeking Maximum temperature 240°C, Can be used for lead protection and used over crimps.





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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.



Epoxy Seal

- Epoxy potting forms a good moisture seal with more mechanical strength than a silicon rubber seal. Regular Epoxy is rated at 350°F (177°C) and epoxylite is rated at 600°F (316°C).



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.



Cement

- Provides 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 up to 2600°F (1425°C).



Fitting Options

Single Ended NPT Fitting

- Fittings are available in brass and stainless steel. Brass fittings are brazed on and stainless steel fittings can be either brazed or welded on.



Double Ended NPT Fitting

- Double ended fittings are normally used when it is desirable to mount a box on an immersion heater. Fittings are available in stainless steel and brass.



Flanges

- Flanges are used to hold heater in place preventing heaters from being backed out during operation. These flanges are welded on the lead end of the heater. They are 1/16" thick.



Other Option

Bent Hot Rod

- Heaters can be bent at any angle from 10°C to 120°C. Heaters are bent at the unheated section.
- Option of bending is available in most of the heaters.



Double Ended

- Hot rods are also available with electrical termination on each end. Heaters can be made with lead wire, straight pins, or screw terminals.



Applications

- Semiconductor chamber heating.
- Semiconductor wire and die bonding.
- Freeze protection and deicing of equipment in cold climates or applications.
- Humidity control
- Patient comfort heating used in medical devices
- Metal die casting
- Seal bars used in packaging equipments
- High temperature glass forming equipment

Features & Benefits

- Easy to maintain and install.
- Economical
- Efficient Operation