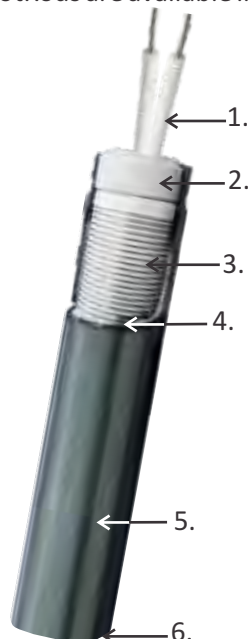


The engineers at Marathon Heater have developed a cartridge heater that exceeds the performance and durability of other cartridge heaters. Through refinements in the swaging process, specially designed cores, careful selection of magnesium oxide fill, nickel chromium resistance wire, stainless steel 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 450° 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. 304 stainless steel sheath for oxidation resistance in a wide variety of environments. 316 stainless steel and Incoloy are also available. Please consult the application guide in the back for help in determining which material is best for your application.
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
1/4"	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	9.86	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

Lead Wire Characteristics

Wire Type	Temp. Rating	Max. Temp. (Recommended)	Comments
Ultralead	250°C	450°C	Excellent, durable wire, good for high temperature applications
Teflon	250°C	250°C	Good for areas where a small diameter wire is needed.
Silicon Rubber	200°C	200°C	Good moisture resistance
Braided Silicon Rubber	200°C	200°C	Inexpensive wire good for non abrasive applications
MGT	450°C	450°C	Good high temperature wire
SJO cord	90°C	90°C	Rubber jacket, resistant to oil and moisture. For use on 3/8" dia. and larger

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
2.54	25	35	45	50	50	50

Clearance is determined by taking the hole diameter and subtracting the heater diameter.

Watt density is calculated by:

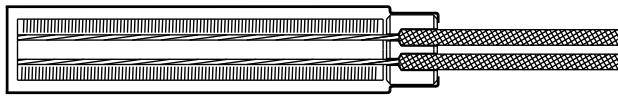
Wattage

Heated Lth x Diameter x 3.14

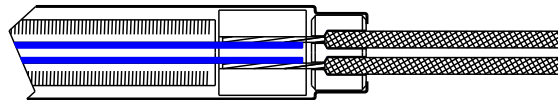
Cycling reduces heater life and high cycling applications should use lower numbers.

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.

Crimped on Leads

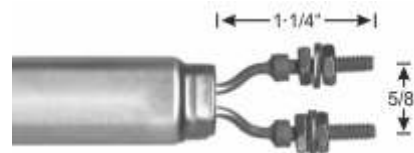
Crimped on leads are generally used where the temperature at the end of the heater exceeds the maximum rated temperature of the lead wire. Crimped on leads are not recommended for applications where the leads must be bent sharply near the heater, or in applications where the leads will be subject to a lot of flexing.



Post Terminals

Post terminals (also called screw terminals or stud terminals) are used in applications where easy lead replacement is desirable.

They work great with ring terminals or fork terminals. Post terminals are only available for heaters 355.6mm diameter and up. Terminals are #6-32 and supplied with 2 stainless steel washers and 2 stainless steel nuts on each stud.



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 at 600°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.



Stainless Steel Flexible Conduit

Flexible conduit provides maximum lead protection from abrasion but can not be bent as sharply as stainless steel braid. Flexible conduit is swaged into the heater for maximum protection. (Flexible conduit is also known as armor or hose)



Copper Coupler and Stainless Steel Flexible Conduit

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



Hex Head Pipe Fittings

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



Double Ended Threaded NPT Fittings

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

Small flanges can be welded on the lead end of the heater. Flanges can be used to hold a heater in place to prevent backing out during operation. Flanges also assist in heater removal. Flanges are 1/16" thick.



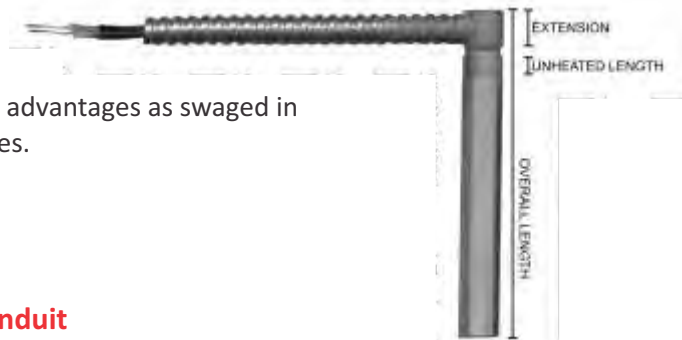
Distributed Wattage:

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.



Copper Elbow and Stainless Steel Flexible Conduit

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



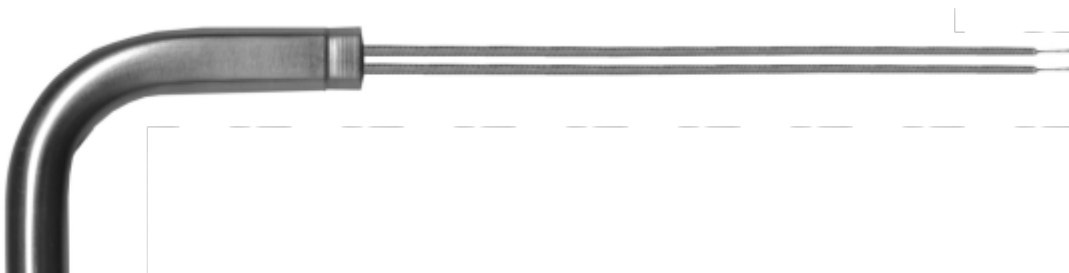
Right Angle Stainless Steel Braid

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



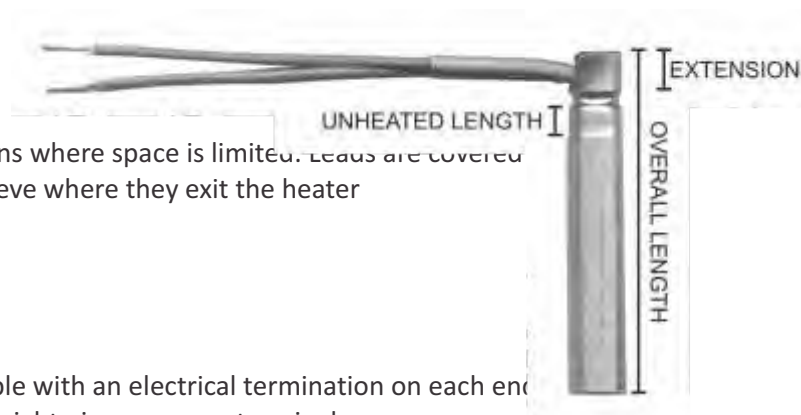
Bent HotRod

Hot Rods can be bent at any angle from 10° to 120°. Heaters must be bent in an unheated section and can be constructed with most of the other options shown in this Catalogue



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



Double Ended Heater

HotRod cartridge heaters are also available with an electrical termination on each end. Heaters can be made with lead wires, straight pins, or screw terminals

