



# HIGH DENSITY

## Cartridge Heaters



Precise, localized heat to meet critical performance goals.

When fast, efficient heat transfer is required, Heatron's cartridge heaters outperform other cartridge heaters. Our advanced design and construction offers superior, uniform heat and longer life.

Heatron designs products based on intelligent combinations of materials and complex component integration. With an extensive selection of options, quality engineering, premium materials and tight manufacturing controls, our products are engineered to withstand the extraordinary demands placed on them.



*Transforming your vision  
into higher-performing  
solutions.*

# High Density Cartridge Heaters

## Details Matter.

Through refinements in design, engineering, materials and closely controlled production, Heatron's cartridge heaters excel in performance and durability.

Employ controlled heat profiles, internal controls and minimal un-heated sections to remove temperature variations. See **Value Added Controls** on page 8.

Eliminate expenses related to removal of cartridge heaters from dies and other equipment with Heatron's cost-effective **Non-Stick Coating**. See page 9.

Passivation and electropolish treatment protect against corrosion and scale build up. See **Special Coatings** on page 9.

## Direct Access to Engineering Expertise

Heatron's engineers work with you from initial concept to product launch, or as an extension of your design group to bring additional expertise to your product development program. As components become smaller, denser and more complex, count on Heatron to optimize product performance while driving out waste.

## Robust ISO 9001 Quality Management

Heatron's strict adherence to agency and regulatory requirements provides lower cost and higher performance products. Our strenuous quality audit process ensures that part, yield and component criteria are met from initial design through ongoing production.

## Unparalleled Manufacturing and Assembly

Hasten time to market with turnkey manufacturing solutions for assemblies, sub-assemblies and components in our state-of-the-art facilities. Heatron follows lean manufacturing principles for high volume production.

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## Land Remediation

A land remediation provider developed a smoldering combustion process to safely destroy hazardous underground materials. Critical to the system is the initial high heat ignition required to begin the combustion. Outfitted with a custom cartridge heater, the customer experienced fast, efficient heat transfer, plus a dramatic increase in heater life compared to the previous supplier's version.

## Industrial Wastewater

To control process water within 0.05 °C for the Semiconductor industry, Heatron designed an immersion heater incorporating a moisture resistant seal, 316L stainless steel sheath and passivation. Solution heating rates were increased by determining the optimum heated section location within the overall heater length.

# Construction Features

## End Seal:

A variety of potting seals to protect from moisture ingress and contamination.

## Lead Construction:

A wide variety of high temperature lead and mounting configurations to meet all your application needs.

## Sheath:

Designed for superior corrosion resistance, compaction, strength and heat transfer.

## End Disk\*:

TIG welded in place protects the heater from moisture and contaminants.

## Magnesium Oxide:

High purity MgO swaged to provide optimum thermal transfer and dielectric strength.

## Resistance Wire:

Ni-Chrome wire is precisely wound for efficient heat, exactly where you need it.

## Connector Pins:

High purity solid nickel or nickel plated copper pins designed to optimize temperature, amperage and heater life.

## Ceramic Core:

Precise centering ensures reliable heat transfer and lower internal temperatures.



\*Eliminate the welded end disk with Heatron's **Deep Drawn Cartridge Heater**, constructed from a seamless sheath. See page 10.



## Microbial Identification

For crucial microbial strain identification and resistance information, Heatron's hybrid cartridge heater controls the test card incubation, dispersing heat quickly using forced convection.



## Process Industry

Designed for the process industry, this heat exchanger is constructed of stainless steel to resist corrosion and transfer heat to the liquid quickly and efficiently as it flows across the surface. Over temperature thermostats and thermal fuses were incorporated to eliminate additional mounting and prevent overheating.

# Design Options

## Common Options for Performance Products.

<b>Sheath*</b>	304 Stainless Steel 1400 F   760 °C	316L Stainless Steel 1400 F   760 °C	Incoloy 1600 °F   871 °C
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<b>Lead Exit</b>	Straight	Right Angle	Elbow	Double Ended	Bent Radius Sheath
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<b>Lead Wire</b>	Fiberglass	Silicone	Teflon	Teflon High Amperage	Straight Pins
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<b>Outer Jacket</b>	Stainless Steel Braid	Stainless Steel Cable	Strain Relief Spring	Silicone	Fiberglass	Steatite Ceramic Beads
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<b>End Seal</b>	Mica	Ceramic	Silicone	Teflon	Epoxy
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<b>Fittings</b>	Silicone Rubber Overmold	Post Terminal 1/2", 3/8", 1/4"	UL Listed Plug	Bolt Heater	Conduit Box
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<b>Mountings</b>	Threaded Fitting	Locating Ring	Flange
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\*Heater sheath material is subject to diameter of heater.

Contact Heatron Design Assistance for solutions outside the typical options shown.

## Agency Approvals

Heatron offers an extensive UL option list and builds to UL 60601/IEC-60601

UL E91597

CSA LR66355-1

TUV\* EN60335-1/A11 and EN61010-1A2

\*This approval gives Heatron the option of CE marking.

## Lead Options

Heatron offers a variety of leads, lead protection, seal and fitting options. Leads should be selected to withstand the maximum ambient temperature for the application.

Insulation and heater materials available with UL, CSA or Mil Spec recognition.

**Crimped On:** where the temperature at the end of the heater exceeds the maximum rated temperature of the lead wire.

**Swaged In:** for applications where leads require flexing or must be bent sharply.

**No-Heat Extension:** where leads may be exposed to excessive heat.

With thousands of possible configurations, contact Heatron Engineering for optimal design and construction ratings.

## Performance Options

### Low Leakage Current

Low leakage construction available for UL or other agency requirements.

### Dual Voltage

Engineered to operate on two separate voltage ratings.

### Dual Wattage

Engineered to operate on two different watt ratings within a single heaters to allow different process steps.

### Ground Wires

Safety feature available for most designs, the ground may be added internally or externally depending on the heater size and style.

### Three Phase

Three phase heaters for high amperage applications, and designed based on the size, wattage, and amperage.

### Centerless Grinding

For precision diameters that require a close fit between the heater and part. Lead length is restricted to 12" or requires an external connection.

### Special Marks

Certification, tracking and other identifications marks.

## Bent Radius Sheath

### Extra protection to leads.

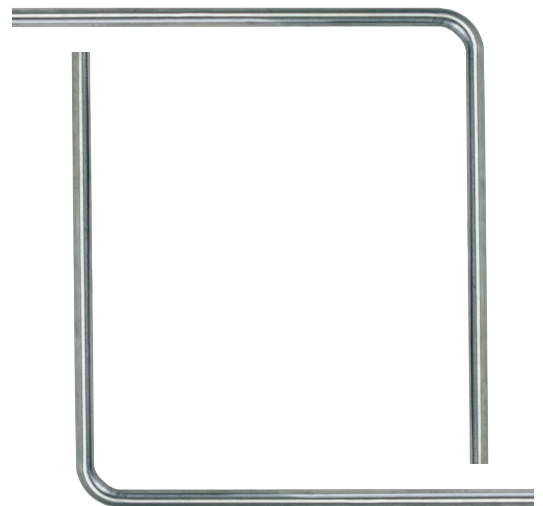
Bent cartridges are designed to offer extra protection where the leads must exit at an angle and may be exposed to high temperature or potential abrasion. The arc of the bend must be in a no-heat section.

DESIGN GUIDE

Nominal Diameter	Minimum No Heat Length	Bend Radius
in.	in.	in.
1/4	2 1/4	1/2
3/8	2 3/8	1/2
1/2	2 7/8	3/4
5/8	3 5/16	1
3/4	3 13/16	1 1/4

Nominal Diameter	Minimum No Heat Length	Bend Radius
mm	mm	mm
8	56	13
10	60	13
12.5	72	19
16	83	25
20	98	32

Max operating temperature 1000 °F (540 °C)



# Specifications

## Design Guide

Nominal Diameter	Maximum Amps*	Maximum Volts	Maximum Watts**					Minimum Watts***		
			120V 1 Phase	240V 1 Phase	480V 1 Phase	240V 3 Phase	480V 3 Phase	1"	1 1/2"	2"
1/4"	4.4	240	525	1,050				100	55	40
3/8"	7.2	480	800	1,600				65	35	25
1/2"	9.7	480	1,160	2,320				40	25	20
5/8"	23.0	480	2,760	5,520	11,000			35	20	15
3/4"	23.0	480	2,760	5,520	11,000	9,550	19,100	30	15	10

Nominal Diameter	Maximum Amps*	Maximum Volts	Maximum Watts**		Minimum Watts***			
			220V	380V	25.4 mm	38.1 mm	50.8 mm	
8.0mm	4.4	240	965			340	185	135
10.0mm	7.2	480	1,580			220	120	85
12.5mm	9.7	480	2,130			135	85	70
16.0mm	23.0	480	5,060	8,740		120	70	50
20.0mm	23.0	480	5,060	8,740		100	50	35

\* Data determined by current capability or internal parts and lead wire. Consult Heatron for higher AMPS.

\*\* Higher wattages available with design additions. Consult Heatron for higher wattage requirements.

\*\*\* Data based on space limits for resistance windings internal to the heater. For minimums at 240 volts, multiply listed wattage by 4. Consult Heatron for lower wattage requirements.

## US Size Dimensions

Diameter		Length	
Nominal	Actual	Minimum	Maximum*
	Inches		
1/4"	.245	7/8	36
3/8"	.371	7/8	48
1/2"	.495	7/8	60
5/8"	.621	1.0	72
3/4"	.745	1.0	72

## Metric Size Dimensions

Diameter		Length	
Nominal	Actual	Minimum	Maximum*
	mm		
8.0mm	6.2	22.2	915
10.0mm	9.42	22.2	1,220
12.5mm	12.57	22.2	1,520
16.0mm	15.77	25.4	1,830
20.0mm	18.92	25.4	1,830

\* Recommended maximum length; longer lengths available.

## US Size Tolerances

<b>Diameter*</b>	± 0.003 inches
<b>Length*</b>	± 3%
<b>Camber</b>	≤ 6 Inches in length: 0.006 inches > 6 inches in length: 0.02 inches per foot
<b>Wattage</b>	+5%, -10% per NEMA Standard
<b>Resistance</b>	+10%, -5% per NEMA Standard
<b>No Heat</b>	1/4 inches on disc end Minimum 1/4 inches on lead end

## Metric Size Tolerances

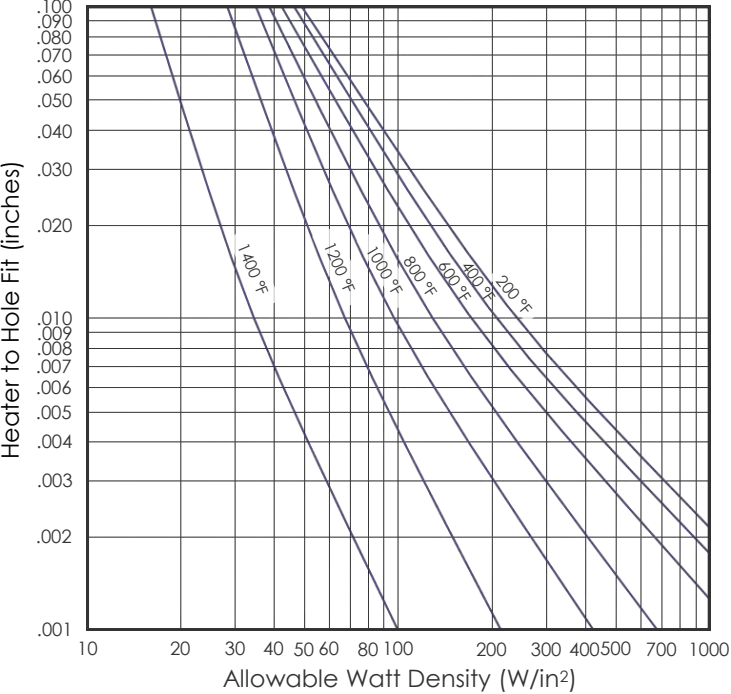
<b>Diameter*</b>	± 0.07 mm
<b>Length*</b>	± 3%
<b>Camber</b>	≤ 150mm length: 0.16mm > 150mm length: 0.25mm per 300mm
<b>Wattage</b>	+5%, -10% per NEMA Standard
<b>Resistance</b>	+10%, -5% per NEMA Standard
<b>No Heat</b>	6 mm on disc end Minimum 6 mm on lead end

\* Tighter tolerances available.

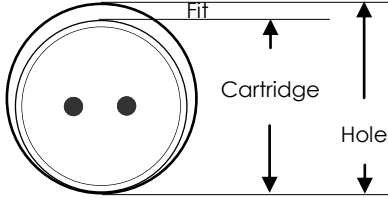
For custom solutions outside the parameters listed, please contact Heatron for design assistance.

# Specifications

## Watt Density to Heater Fit

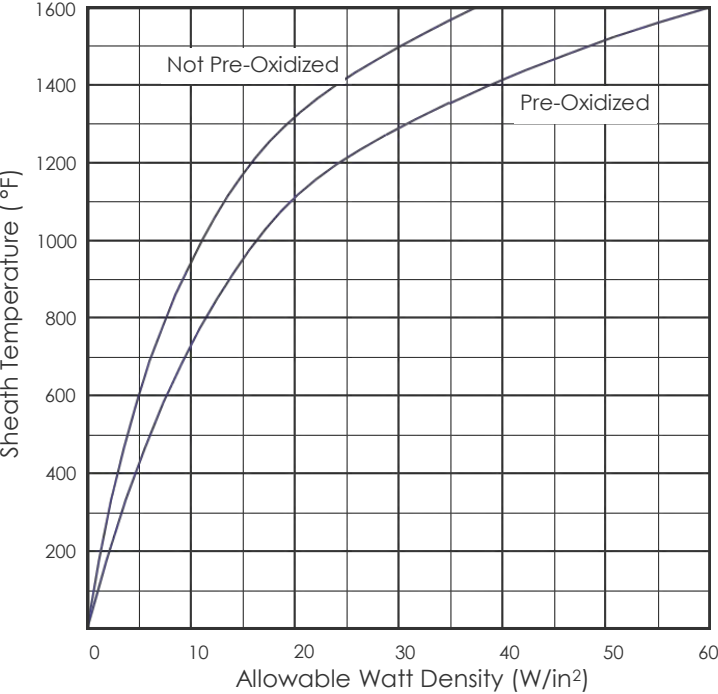


$$\text{Watt Density} = \frac{\text{Heater Wattage}}{\text{Heated Length} \times \text{Diameter} \times 3.14}$$



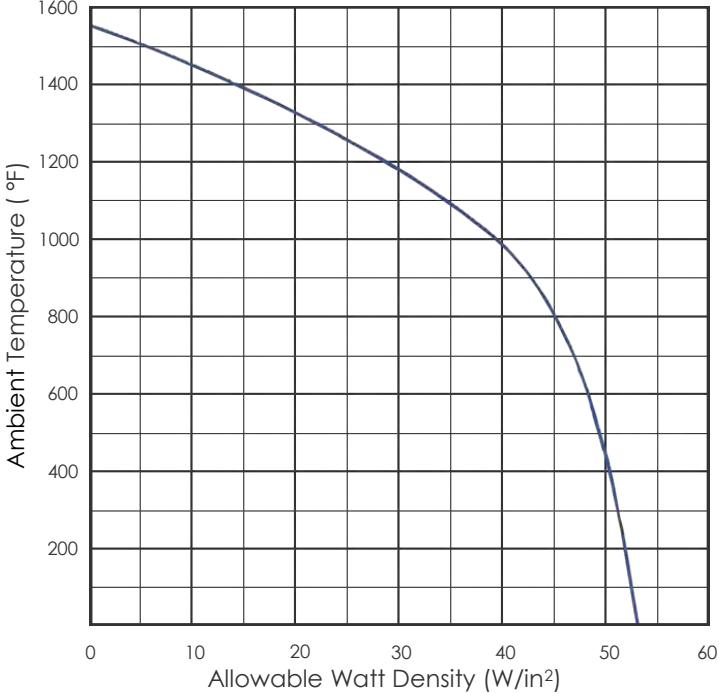
This chart can be used to help determine maximum watt density based on the temperature of the metal part and heater fit. Contact Heatron for alternatives to maximize heater life for your application.

## Watt Density to Sheath Temperature



For open air applications, this chart is based on operation in 70 °F (21 °C) ambient temperature. At 45 W/in², a pre-oxidized cartridge heater will operate at about 1450 °F sheath temperature.

## Watt Density to Ambient Air Temperature

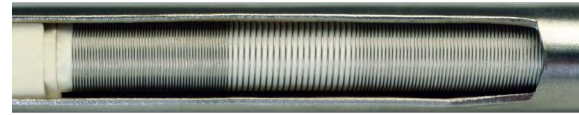


This graph shows the maximum allowable watt density when one cartridge heater is operated in air. Consult Heatron engineering for applications utilizing multiple heaters or other configurations.

# Value Added Controls

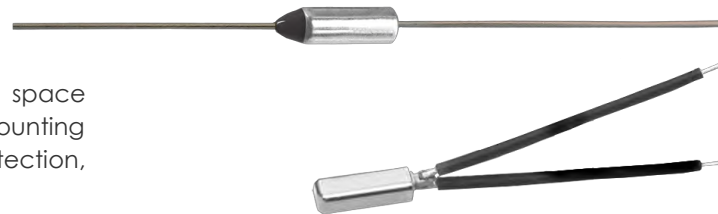
## Controlled Heat Profile (CHP)

Improve quality and yield while lowering production costs. Our Controlled Heat Profile cartridge heater is engineered to customer specific distributed wattage heat profile. The cartridge heater is designed so the wattage and heat vary along the length of the heater, eliminating hot and cold spots. Heatron's engineers will work closely with you to economically develop the proper CHP design for your unique application.



## Over Temperature Control

**Internal thermostats, thermal fuses and temperature sensors** save space over conventional methods and eliminate the need for additional mounting and hook-up. Heaters can be designed for over-temperature protection, temperature control or automatic heater start up.



Nominal Diameter	1/2"	5/8"	3/4"	12.5mm	16mm	20mm
Thermostat Rating	120 volt – 8 amps 100,000 cycles 240 volt – 8 amps 100,000 cycles					
Thermal Fuse Rating	120 volt – 15 amps 240 volt – 10 amps					

UL | CSA | TUV ratings may vary

## Internal Thermocouple

**Location A** places the thermocouple junction in the end disk. This location is recommended for sensing temperature of materials flowing past the heater tip. The thermocouple junction is available grounded and ungrounded.

**Location B** places the thermocouple junction against the inside wall of the heater sheath at any point along the heater length. This location is used to monitor the heater sheath or temperature of the part being heated. The thermocouple junction is typically grounded to the heater sheath, but is also available ungrounded. Specify if a guaranteed ground is required.

**Location C** places the thermocouple junction in the center of the heater core at any point along the heater length. This location is used to sense the heater's hottest internal temperature. The thermocouple junction is not grounded.

**Materials: J Type** Iron (+) magnetic white lead and Constantan® (-) non-magnetic red lead (Up to 1400 °F | 760 °C)

**K Type** Chromel® (+) non-magnetic yellow lead and Alumel® (-) magnetic red lead (Up to 2300 °F | 1260 °C)

Other type thermocouples available.

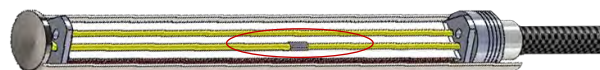
Location A



Location B



Location C





# Special Coatings

## Non-Stick Coating

Heatron's Non-Stick Coating for cartridge heaters reduces seizing of heaters in molds, improves heat transfer and extends the life of the heater. This cost-effective option mitigates expenses related to the heater's removal, downtime and potential damage to equipment.

Heatron's Non-Stick Coating also eliminates the time-consuming and messy process of applying release agents before installation. The coating is so thin that there are no special diameter bore requirements.

Non-Stick coating provides protection up to 1200 °F (649 °C) and is capable of high watt densities.



## Passivation and Electropolish

Passivation creates a protective oxide layer and removes free iron to guard against corrosion.

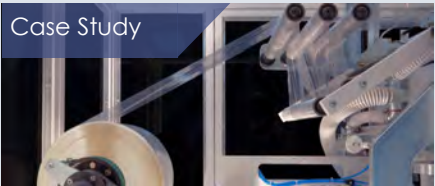
For improved corrosion resistance and an ultra smooth finish that is easier to sterilize, electropolishing removes contaminants and imperfections from the metal surface. Electropolish is highly advantageous for critical applications, such as medical and aerospace products.



Case Study

### Die Removal

A major manufacturer of dies eliminated costly machining steps when they switched to our Non-Stick coated heaters. In addition to quick installation and easy removal, Heatron's Non-Stick coating resists scraping and eliminates the need to apply release agents.



Case Study

### Package Sealing

Heatron designed the Controlled Heat Profile cartridge heater to provide uniform temperature across the surface to within 1% of set point. The heater incorporated an epoxy seal to allow the heater to be used in wash down applications.



Case Study

### Patient Warming Blanket

For stroke and heart attack treatment, this multi-cartridge heater system with over-temperature control activates the automatic, slow rewarming crucial to therapy. Efficient transfer rates allow target temperatures to be reached at an average rate of 1.63 °C/hour.

# Deep Drawn Cartridge Heater

The Seamless Metal Jacket... when heater integrity is an absolute must.

A seamless sheath construction eliminates the welded end disk to provide superior sheath integrity. As welds are subject to imperfections that can cause failure, Heatron designed a cartridge heater incased in deep drawn seamless metal to eliminate weld issues completely.

Deep Drawing refers to the process of repeatedly pulling a flat metal blank over a die and into a cavity, progressively forming a closed cylinder. This precision metal forming is ideal when the reliability of the equipment is of vital concern.



Nominal Diameter		Maximum Length		Maximum Voltage
1/2"	12.50 mm	7 1/2"	190.50 mm	480
3/4"	20.00 mm	7 1/2"	190.50 mm	480

Contact Heatron Design Assistance for solutions outside the ranges specified.

## APPLICATIONS

### Aviation

- Galley equipment
- Water heaters

### Medical and Life Science

- Fluid warming
- Vaporization
- Laboratory equipment

### Industrial

- Water, chemical or oil immersion applications
- Plastic reclamation

# Immersion Heater

Pack more heat in tighter spaces.

Immersion Heaters are ideal for heating water, water soluble solutions and other liquids of low viscosity. This compact heater with an integral fitting offers versatility in product design, minimum assembly time and ease of service.

Heatron designs to the application at hand, incorporating factors such as liquid type, temperature requirements, flow rates and scale build up.



## APPLICATIONS

### Medical and Life Science

- Fluid warming
- Chemical processing
- Laboratory equipment

### Industrial

- Plastics processing
- Food processing
- Preheat equipment

# Packaging Punch Heater

For efficient, economic operations.

Engineered for today's sophisticated packaging equipment, this built-in punch provides efficient heat transfer to the punch tip. The punch forms a bead around the hole for greater strength when the plastic package is hung for display. This works particularly well with polypropylene films.

Internal Type J or K thermocouples can be added to the tip of the punch. Thermocouples used in conjunction with an electronic temperature control allows for greater temperature accuracy and faster production cycles, while protecting the heater from overheating should the machine stop.



Shown above with optional notch tip for added tear strength.

# Heat Exchanger

Our Heater in a Jacket is the ideal heat-on-demand heat exchanger.

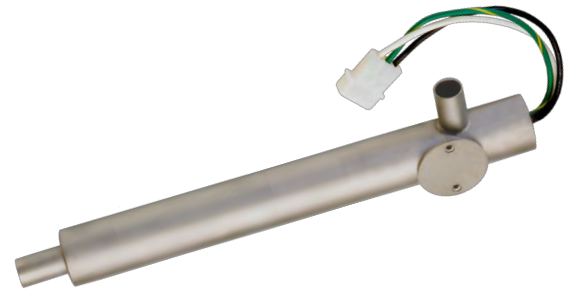
Designed to quickly and safely heat liquids, oils and gases, Heatron's heat exchanger provides faster, more efficient heat transfer.

This compact cartridge design offers higher watt density and dielectric strength compared to tubular versions. Couple this with internal controls for exceptional thermal response, energy efficiency and precisely applied heat.

DESIGN GUIDE

Construction Options

- Ports located and configured to customer fittings in any location and can be flared to ensure secure clamped connections
- Ground wire can be internally connected in heater or a ground lug welded to the heat exchanger
- Thermal wells with fittings for mounting thermocouples, thermistors, RTDs or other temperature controlling devices
- Mounting pads for disc thermostats or other thermostats welded to the heat exchanger
- Mounting brackets designed to customer specifications, including over-the-side design for non-pressurized systems



APPLICATIONS

- Oil and Gas
  - Oil heaters
  - Engine pre-heating
- Medical and Life Science
  - Fluid warming
  - Laboratory equipment
- Industrial
  - Water, chemical or oil immersion applications
  - Emergency generators

# Hybrid Cartridge Heater

Improve heat transfer to the air.

Speed heat up time by maximizing the heat transfer area with an integrated heat sink. Ideal for applications requiring fast heat dispersion using forced convection, the expanded surface area increases thermal transfer for shorter heat up times, lower sheath temperature and longer life.



APPLICATIONS

- Medical and Life Science
  - Molecular diagnostics
  - Incubators
- Industrial
  - Forced air heating
  - Land reclamation



Case Study

## Dialysis

Controlled heat for blood warming prior to re-entry, with temperature accuracy of  $\pm 0.3$  °C and equipped with an over-temp safety cutoff. The heater complies with UL 60106-1 low current leakage construction, is electropolished to inhibit corrosion, and includes computer serialization to meet FDA tracking requirements.

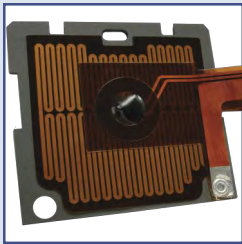


Case Study

## Sand Pile Heater

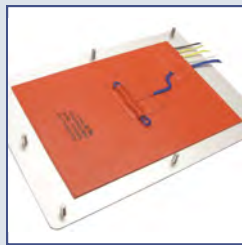
Built for wintertime masonry use, the heater continuously warms water and sand. The unit's internal thermostat cycles intermittently to keep up to 5 tons of sand and 50 gallons of water hot when temperatures are as low as 1 degree below zero.

# About Heatron



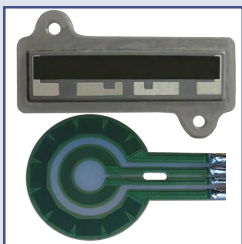
## KAPTON/POLYIMIDE ETCH

Super-thin and precise etched foil heaters with low out-gassing for a wide range of applications.



## SILICONE

High-strength fiberglass reinforcement with etched or wire-wound heating elements provide even heat in high-flex applications.



## THICK FILM

Ceramic and metal core heaters deliver high watt densities, fast response times and exceptional insulation properties.



## SPECIAL PRODUCTS

Strip and band heaters, custom forms for industry specific products.

## Key Industries

Heatron manufactures for a broad variety of markets. With Heatron's depth of expertise in all major industries, we understand the exacting demands you face and what it takes to meet them.

- |                      |                     |
|----------------------|---------------------|
| 3D Printing          | Oil and Gas         |
| Aviation             | Packaging           |
| Commercial Equipment | Plastics Processing |
| Food Service         | Process Industries  |
| Industrial Equipment | Security            |
| Laboratory Equipment | Semiconductor       |
| Medical Devices      | Telecommunications  |

## More options for higher performance solutions.

Heatron is a global leader in design, engineering and manufacturing for Heating solutions. Heatron's experienced engineers offer complete solutions, from initial concept and design to complex integration and manufacturing. By bridging the gap between concept and commercialization, we accelerate the launch of new products that become recognized leaders in a global marketplace.

Our expertise in design, manufacturing and market standards provides our customers with the documentation and knowledge of agency approvals that is essential in today's tightly regulated environment.



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## Contact a Representative: