Southeast Thermal Systems LLC

Flexible Heaters

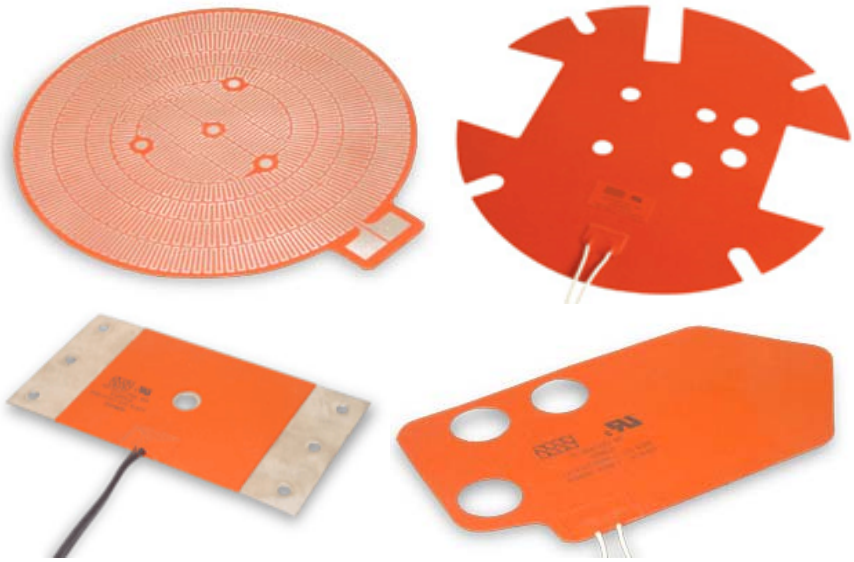
Applications:

- De-icing and Anti-icing Equipment
- Outdoor Electrical and Electronic Enclosures
- Oil Pumps and Reservoirs Presses
- Aircraft Galley Equipment
- Electric Motor Dehumidifying
- Heat Sealing
- Medical, Laboratory and Veterinary Equipment
- Dispensing Equipment
- Automobiles and other Vehicles
- Packaging Equipment
- Freeze Protection for Drains in Refrigeration Equipment
- Vacuum Chambers
- Autoclaves
- Antenna Deicing
- Optical Equipment Spacecraft
- Farm Animal Feeders
- Aircraft Air Intake
- Laser Printers
- Photocopy Equipment
- Glue and Laminate Curing
- Consumer Appliances
- Hydraulic Equipment Aerospace Composite Bonding
- Battery Heating
- Photography Developing Gyroscopes
- Floor Processing Equipment
- Food Service Equipment
- Vending Equipment

Flexible Heaters are designed for the aerospace and defense industries. Common were such applications as maintaining constant temperatures in the instrumentation of aircraft, satellites, navigation, guidance and radar equipment.

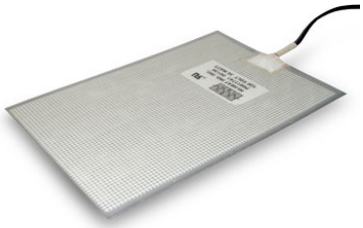
The versatility of this product has since been widely recognized as thousands of uses have been discovered. Flexible heaters are regularly specified because of their light weight, thin profile, low thermal mass and flexibility. The abilities to provide an infinite array of patterns and concentrations of heat are additional characteristics. Complex shapes, contours and three-dimensional patterns are possible. Many mounting methods are available for the application of Flexible Heaters. Computer generated specifications and state-of-the-art manufacturing technologies produce the most effective Flexible Heater performance possible.

Silicone Rubber Heaters are rugged, moisture and chemically resistant and are easily bonded or cemented to heat sinks or other parts to be heated. Temperatures from -80 to 390°F (-62 - 200°C) in a wide range of watt densities are regularly supplied. The thin profile transfers heat quickly because the actual resistance element is so close to the heated part. Silicone Rubber Heaters can be insulated with silicone sponge rubber bonded to one side. Another way to lower radiated and convected heat losses is to apply an aluminized foil surface to the heater back. Very little is added to the overall thickness. A common application of Silicone Rubber Heaters is Wrap Around Drum Heating.

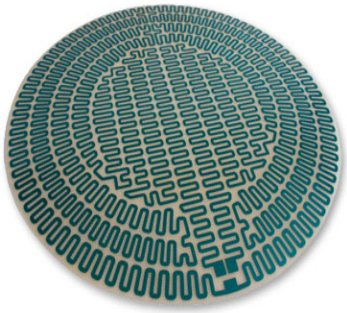


Southeast Thermal Systems LLC **Flexible Heaters**

Resistant Elements



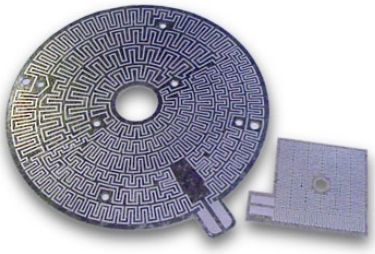
Wire Wound Element:
A fine gauge resistance wire is spiralled around a fiberglass core. The element is placed in a specifically designed pattern and vulcanized to either a silicone rubber, neoprene substrate, or polyester. Advantages versus etched foil elements are: Physical strength; flexibility; smaller production quantity; conforms well to small radius bends and larger possible sizes.



Etched Foil Element:
The manufacturing process of etched foil elements is adapted from the production of printed circuit boards. A nickel resistance alloy foil is acid etched to the specific pattern, then vulcanized to the sheath material. Advantages versus wire wound are: Higher watt densities; greater area coverage of element over heater sheath; higher production quantities and complex heat distribution.

Termination:
Silicone leads for temperatures to 390°F (200°C) are most often supplied, but many other types are available. The leads are attached to the element within the transition area and covered with a patch of the same material as the sheath. The entire lead transition assembly is then vulcanized to the heater sheath. Leads can be arranged to exit at about any point on the element sheath, corner, or from an external tab. Neoprene, silicone and Teflon leads along with SJ and HPN cord and plug sets can be supplied. Silicone Rubber leads are standard unless otherwise specified. Teflon leads are also available. 14, 16, 20 or 24 gauges are sized by requirement. Maximum lead length is 72". Available with Patch and Strain Relief Tab.

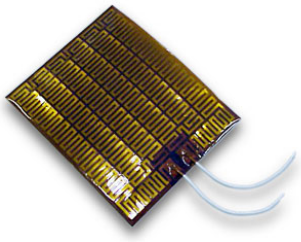
Mica Etched Foil



This unit is constructed with two layers of high temperature mica with the etched foil element between layers. The heater is rigid and must be clamped in place, between two plates for good heat transfer and support during operation. Very high temperatures of up to 1100°F (595°C) can be achieved with correct application. Mica is a hydroscopic material and should not be used in high moisture areas. Watt densities in excess of 40 watts per sq. in. are possible, depending on the operating temperature of the process. Power lead exits are covered with ceramic and the lead exit area needs to be supported.

Flexible Heaters

Kapton Polyimide Etched Foil Heaters



Kapton®, polyimide is a lightweight flexible film that maintains outstanding mechanical, chemical and electrical properties over extreme temperature ranges. Polyimide has more than 35 years of proven performance as the flexible material of choice in applications involving high, 200°C (392°F), and very low, -195° C (-319°F), temperatures.

These low thermal mass heaters have fast warm-ups and quick response because the elements run cooler, they have longer life as well. Polyimide's properties and the moisture resistant construction make these heaters the preferable product in high humidity areas, wash down zones and in applications requiring repeated sterilizations. They are also ideal for service in harsh environments. (Available with built-in Thermocouple)

Etched foil polyimide heaters can be fabricated in an unlimited range of shapes, sizes and wattages. Their thin, lightweight design (0.005" thick) allows close thermal contact for maximum heating efficiency, and also permits close adaptation to the contours of the part.

Hi-Heat Industries designs these heaters with distributed wattages, eliminating edge loss compensation. Superior heat transfer and exceptionally uniform heat output result in a faster warm-up cycle and longer life.

Kapton® is a registered trademark of DuPont™.

Forced Air Heaters

Enclosures protecting electronic equipment require heaters for freeze protection and prevention of humidity and moisture accumulation. Hi-Heat Industries has developed a core competency in the protection of telecommunications hardware, networking equipment, high-tech security systems and control systems. We can lend our expertise for your application whether it is for OEM requirements or retrofitting existing enclosures.

Depending on the application, enclosure heaters can be manufactured with wire wound or etched foil heating elements, and insulated for more efficiency. Heaters can be manufactured to be applied with adhesive or factory vulcanized to an aluminum mounting plate. We can customize the delivery in a forced air or static system. Many enclosure heater assemblies include thermostats, cords and plugs, insulation and built-in controls. Many enclosure heater assemblies include thermostats, cords, plugs, insulation and built-in controls.

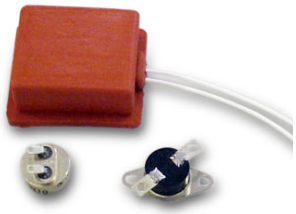
Southeast Thermal Systems LLC **Flexible Heaters**

Enclosure Heaters

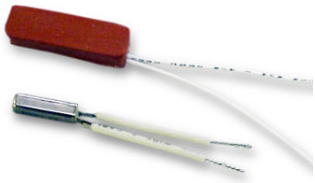
WATTS @ 120 VOLTS	HEATED AREA	MOUNTING PLATE SIZE	MOUNTING FLANGE W/ (2) 5/16" X 1/2" slotted holes	PART NUMBER
35	2" x 5"	3" x 5"	1/2" x 5"	STS-SRH2007
70	2" x 10"	3" x 5"	1/2" x 10"	STS-SRH2008
140	4" x 10"	5" x 10"	1/2" x 10"	STS-SRH2009
50	2" x 5"	3" x 5"	1/2" x 5"	STS-SRH2010
75	3" X 5"	4" X 5"	1/2" x 5"	STS-SRH2011
100	2" x 10"	3" x 10"	1/2" x 10"	STS-SRH2012
200	4" x 10"	5" x 10"	1/2" x 10"	STS-SRH2013
50	2" x 5"	3" x 5"	1/2" x 5"	STS-SRH2015
75	3" x 5"	4" x 5"	1/2" x 5"	STS-SRH2016
100	2" x 10"	3" x 10"	1/2" x 10"	STS-SRH2017
200	4" x 10"	5" x 10"	1/2" x 10"	STS-SRH2018
250	5" x 10"	6" x 10"	1/2" x 10"	STS-SRH2019
WATTS @ 240 VOLTS	**HEATED AREA**	**MOUNTING PLATE SIZE**	**MOUNTING FLANGE W/ (2) 5/16" X 1/2" slotted holes**	**PART NUMBER**
35	2" x 5"	3" x 5"	1/2" x 5"	STS-SRH3007
70	2" x 10"	3" x 5"	1/2" x 10"	STS-SRH3008
140	4" x 10"	5" x 10"	1/2" x 10"	STS-SRH3009
50	2" x 5"	3" x 5"	1/2" x 5"	STS-SRH3010
75	3" X 5"	4" X 5"	1/2" x 5"	STS-SRH3011
100	2" x 10"	3" x 10"	1/2" x 10"	STS-SRH3012
200	4" x 10"	5" x 10"	1/2" x 10"	STS-SRH3013
50	2" x 5"	3" x 5"	1/2" x 5"	STS-SRH3015
75	3" x 5"	4" x 5"	1/2" x 5"	STS-SRH3016
100	2" x 10"	3" x 10"	1/2" x 10"	STS-SRH3017
200	4" x 10"	5" x 10"	1/2" x 10"	STS-SRH3018
250	5" x 10"	6" x 10"	1/2" x 10"	STS-SRH3019

Southeast Thermal Systems LLC **Flexible Heaters**

Temperature Controls



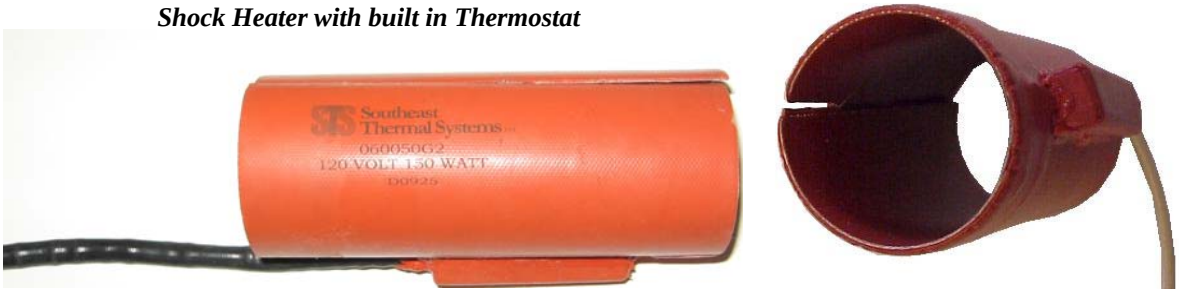
Heaters can be fabricated with thermostats, thermal fuses, temperature sensors, thermocouples and resistance temperature detectors (RTD) as an integral part of the heater.



Temperature Sensors:

Sensors can be located to monitor either heater surface or part temperature. Small sensors are held in place with a protective cover of silicone rubber/fiberglass vulcanized to the heater body. Larger sensors and thermostats have a protective cover (overmold) that is bonded to the heater body.

Shock Heater with built in Thermostat



Mechanical Thermostats:

There are two basic types of Mechanical Thermostats:

- **Creep Action Thermostat:**

The creep action units are constructed with a bimetal strip that curves with the temperature excursions to provide the mechanical action of make and break for the contacts. This provides a close differential between on/off, but can cause radio frequency interference in enclosures that have sensitive electronics. The temperature setting is factory preset and has the range of between 40°F and 300°F, +/- 5°F. Maximum amperage of these units is 8 amps at 120 volts. These small thermostats are commonly used as motor protectors or over temperature protectors in appliance applications.

- **Snap Action**

The snap action units are round in construction (approx 5/8” dia.) due to the bimetal disk that provides the snap action. The disk is shaped similar to a contact lens and snaps back and forth at pre-set temperature to make and break the contact points. The pros and cons of these types of units are:

Due to the energy required to snap the disk over center, the temperature differential between on and off is 20° to 30°F. When used as a high limit over 300°F this differential can be as large as 75°F. Maximum temperature for high limit is 500°F. The wide differential does not provide narrow band temperature control but also does not generate any radio frequency interference due to the positive make/break action. The most common use for these units is freeze protection and enclosure control with a setting of On at 40°F / Off at 60°F. These units must be covered with an over mold that is bonded to the heater.

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Thermocouples and Resistance Temperature Devices (RTD):

These devices are most commonly very small and can be attached to the heater with a patch of silicone rubber/fiberglass. Almost any type thermocouple can be used. Type ”J” is most commonly employed. RTDs are either 100 Ohm or 1000 Ohm two conductor type. Special sensors can be provided to your specifications and we can mount customer-supplied sensors.

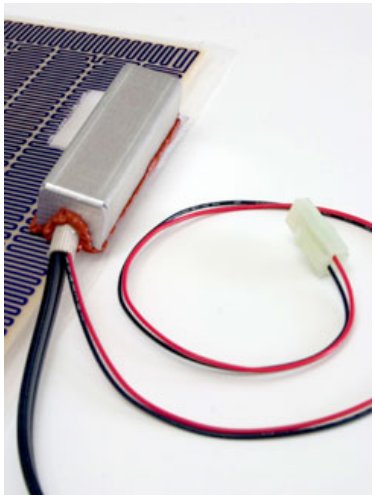
Thermal Fuses:

Thermal fuses open the circuit if the heater exceeds the selected fuse temperature. They are a one time over temperature protection device that can prevent heater runaway in the event that a control device has frozen in the on position. Testing is suggested to select the location and temperature setting of the fuse to protect your product most effectively. Fuses are preset with a range of 150°F to 460°F. Electrical ratings are 120/250 VAC and 15 amp maximum. They must be covered or enclosed because the outer case of the fuse is electrically live.

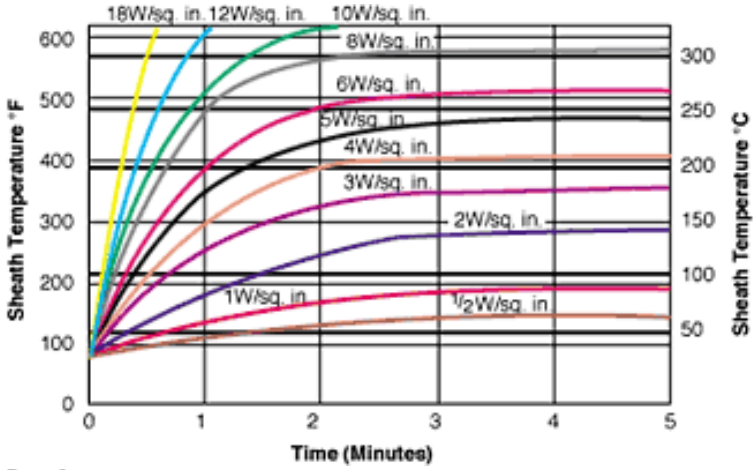
Catalog Heaters:

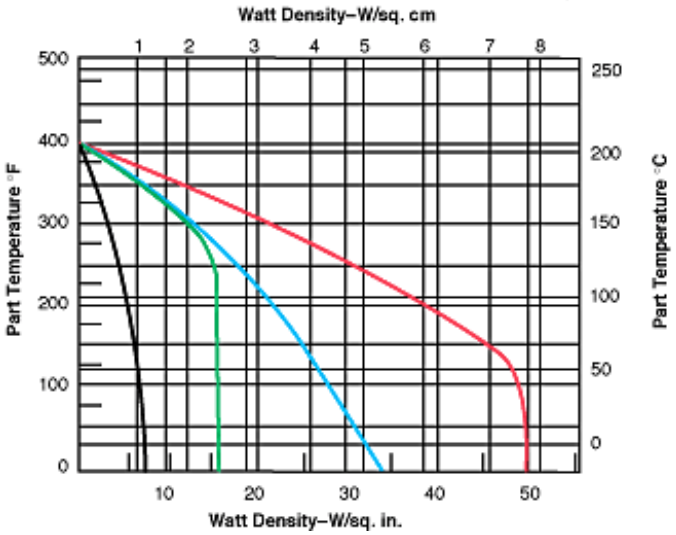
In addition to custom-designed industrial heaters, Hi-Heat Industries manufactures standard sizes of silicone rubber heaters. These flat, flexible heaters range from 25 to 1500 watts. Pre-set or adjustable thermostats are optional. Contact us to discuss the electrical heating element that will work for you.

Design Variations

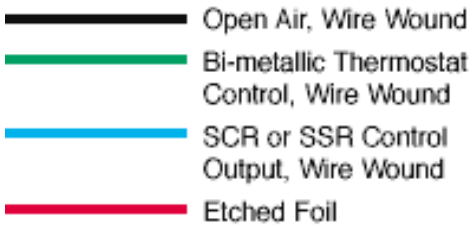


Surface Temperature versus Time for Silicone Rubber Heaters
Illustrated is the surface temperature of a standard Silicone Rubber Heater, .055" thick without insulation at several watt densities. The heater is suspended vertically in 70° F (20°C) still air.





Maximum Watt Density
Etched foil elements can be designed at higher watt densities based upon application considerations. Consult STS.



The area where leads are attached adds additional thickness depending upon gauge wire used and type.

12" leads are standard. Gauge of wire to be determined based on amperage or other considerations.

Composite Bonding Processes and other applications may require special heat pattern or uniformity. Heat Mapping Certification is available as an option. Underwriter's Laboratory and CSA recognition or listing apply to most configurations

	SILICONE RUBBER		KAPTON®
	Wire Wound	Etched Foil	
Maximum Width	36" (915mm)	12" (305mm)	12" (305mm)
Maximum Length	120" (3050mm)	30" (760mm)	25" (635mm)
Thickness	0.055" (1.4mm)	0.031 (0.64mm)	.007" (.2mm)
Resistance Tolerance	-5 + 10%		
Wattage Tolerance	-10 + 5%		
Minimum Ambient Temperature	-80°F (-62°C)		-319°F(-195°C)
Maximum Operation Temperature	390°F (200°C)		
Maximum Voltage	600		1000VAC Dielectric

Thickness of Optional Silicone Sponge Insulation: 1/8", 1/4", or 1/2"
Thickness of Optional Foil Backing: 0.005" (0.13mm).
Dimension Tolerances:
Less than 6 " (150mm); ±.03" (± .8mm);
6 - 12 " (150mm - 305mm); ±.06" (±1.5mm);
12 - 36 " (305mm - 915mm); ±.12" (±3.5mm);
Over 36 " (915mm); ±1% **T**he area where leads are attached adds additional thickness depending upon gauge wire used and type.