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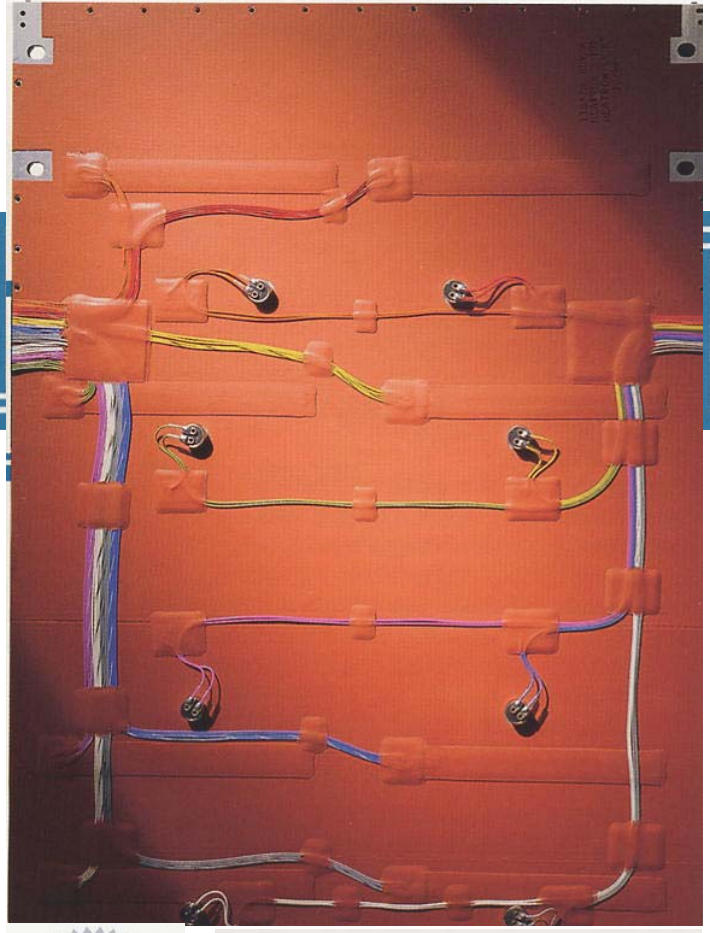
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HEATFLEX
Silicone Rubber Heaters



Application Advantages

-UL and CSA component recognition
-Continuous operation from –90°F to 450°F
-Infinite number of shapes and sizes
-Efficient heat transfer to all types of parts
-Minimal mass resulting in easy controllability
-High dielectric strength
-Low current leakage
-Factory vulcanization to metal heat sinks or other parts
-Vibration resistant
-High strength fiberglass reinforced material

Insulation Characteristics

HEATFLEX silicone rubber heaters are manufactured by placing a wire wound or etched circuit element between two or more layers of fiberglass reinforced silicone rubber. These layers can be a variety of thicknesses depending upon the design requirements. Basic design thickness selections are as follows:

.020"-For etched circuit elements where extremely efficient heat transfer is necessary. This is the thinnest construction available.

.030"- Standard thickness for silicone rubber heaters containing etched circuit elements. This thickness may also be used for economically priced silicone rubber wire round heaters.

.040"-Standard thickness for silicone rubber wire wound heaters when they will be permanently attached. This is a construction with .015" between the element and the part to be heated and .025" on the top side to provide insulation and added protection.

.055"-Thickest standard silicone rubber wire wound heater constructed. This construction is most suitable for heaters that are not permanently attached. .028" silicone rubber is used on either side of the element. This is a common construction for drum heaters and flexing applications.

Agency Approvals

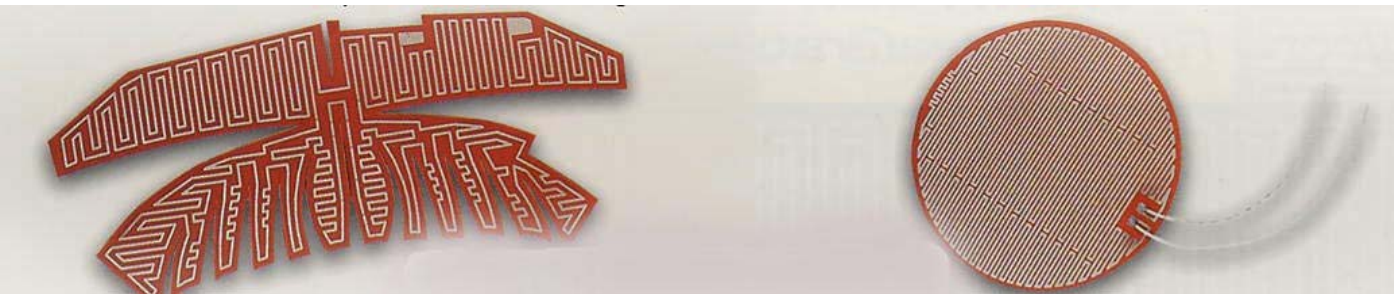
Heatron's HEATFLEX silicone rubber heaters are Underwriters Laboratories (UL) recognized components under File #E91597. **Heatron** has the most extensive UL option list in the heater industry. Consult with **Heatron** technical staff to discuss your particular requirements. Because **Heatron** has been though the UL approval process numerous times, early involvement by **Heatron** can save your company time and money.

Heatron has **TUV** approval under test specification EN605192-2 (certificate number B 99 01 17816 002 report number D1008108401). This approval gives **Heatron** the option of CE marking its heating elements.

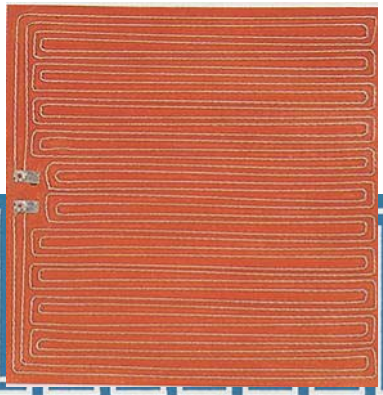
Heatron's HEATFLEX silicone rubber heaters are certified by the Canadian Standards Association (CSA) under file #LR66355-1. Please consult **Heatron** for further information.

Element Selection

Heatron's HEATFLEX silicone rubber heaters may contain either an etched foil element or a wire wound element. In both cases the heater's element pattern is laid out using CAD. Basic element selection criteria are as follows:



Silicone rubber heaters with etched foil circuit elements begin as sheets of a metallic foil and silicone rubber laminate. These sheets are then printed with a pattern of the designed circuit. Next, the sheets are chemically etched with the printed portion remaining. After cutting individual circuits apart, the top layer of silicone rubber is laminated over the top of the circuit. The foil thickness can range from .0005" to .004" depending on the required resistance of the designed **HEATFLEX** heater element. Several different material types can be utilized again depending on the heater resistance. Because the etched circuit element is flat foil, the element itself can cover up to 80% of the heater area.



Selection Criteria

-Better choice for high watt density heaters (those over 6 watts per sq. inch). Can also be used for watt densities less than 6.
-Excellent choice for heaters that require multi-zoned wattages or heaters that have many holes and/or cutouts.
-May provide an economic advantage for high volume applications.
-Offers excellent circuit repeatability.
-Relatively expensive for single short run orders due to initial one time artwork and steel rule cutting die charges.
-May not be suitable for some high resistance heaters.

Specifications

-Size: up to 22" by 28"
-Standard Thickness: .30"
-Maximum Watts Density: 60 watts per sq. inch (under Heatron approved conditions)
-Standard Maximum Resistance Density: 115 ohms per sq. inch
-Maximum Operating Temp: 450°F
-Minimum Operating Temp: -70°F
-Maximum Voltage: 600 volts
-Wattage Tolerance: +5%-10% for UL & CSA heaters
-Standard Dimensional Tolerances: + or– .063". Tolerances of + or –.015" can be held as specified

Wire wound silicone heaters begin with one to five strands of resistance wire that are machine wound, in most cases, on a fiber glass core for strength. Combinations chosen are based on the desired resistance and flexibility requirements of the final heater. The element is then wound around dedicated tooling and transferred to a layer of silicone rubber. Another layer of silicone rubber is then placed over the element to complete this heater.

Selection Criteria

-Provides excellent repeatability for short run orders.
-Better choice for flexing applications.
-Adapts to contoured surfaces with relative ease.
-Advantages in high resistance applications and heater sizes not lending themselves to the etching process.
-Prototypes can be delivered quickly at minimal cost.

Specifications

-Size: 36" by 70" (consult Heatron for other sizes)
-Standard Thickness: .40" for permanently attached heaters; .055" for removable heaters
-Maximum Watt Density: 12 watts Per sq. inch (Heatron approval required for densities over 6)
-Standard Maximum Resistance Density: 1000 ohms per sq. inch
-Maximum Operating Temp: 450°F
-Minimum Operating Temp:-70°F
-Maximum Voltage: 600 Volts
-Wattage Tolerance: + or –5% for UL & CSA heaters
-Standard Dimensional Tolerances: 0 to 12" + or - .0625"; 12 to 24" +or -.1875"; over 36" + or –.75"
Tighter tolerances can be held if requested.

Attachment Methods

As with any heater, proper attachment to the part being heated is one of the most critical elements for long heater life. Except for low watt density heaters, a flexible heater must make intimate contact over the entire surface area for a successful application. The following sections explain some of the more common attachment methods.

Silicone RTV

Silicone RTV is liquid silicone adhesives that cures at room temperature. Different formulations with varied performance specifications are available from many sources including Heatron. In general, two-part RTV's are necessary for large heaters that are over 16" by 16". One-part RTV's are sufficient for attaching smaller heaters. In both cases clean oil-free surfaces are critical. For more specific information contact Heatron, and ask for Instruction Sheet SR31.

Pressure Sensitive Adhesive

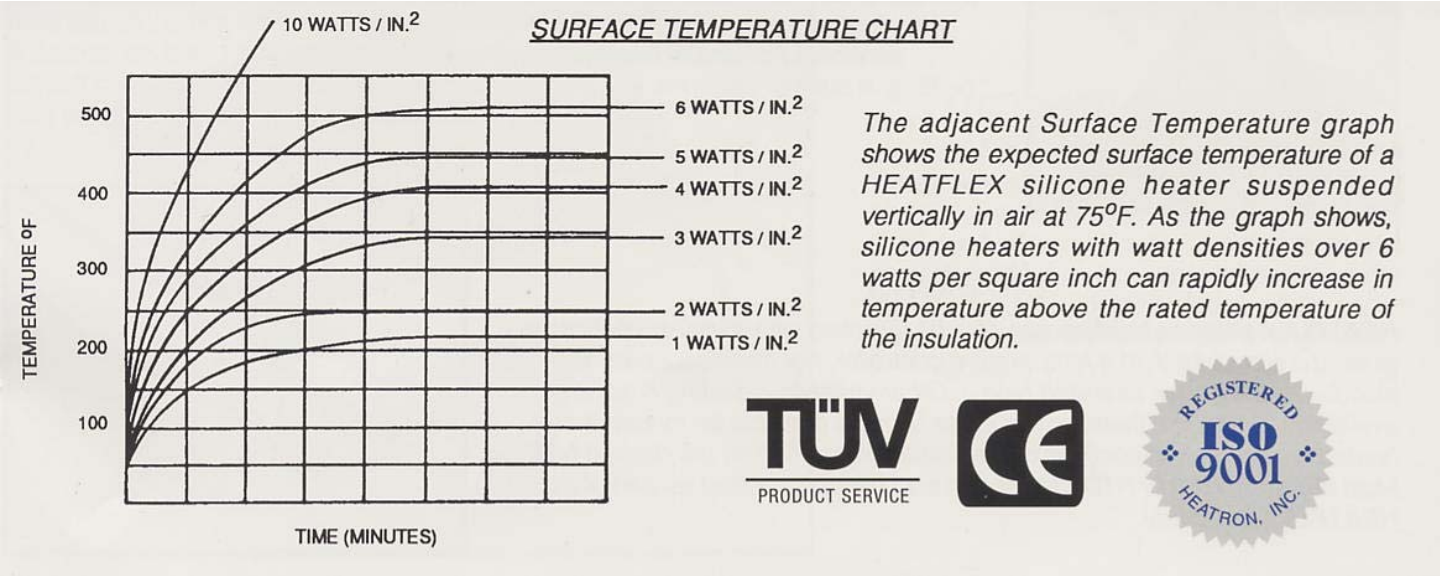
HEATFLEX silicone rubber heaters can be supplied with several varieties of pressure sensitive adhesive. Installation is made easy by simply peeling off the protective liner and rolling the heater in place on a clean surface. Heatron's standard adhesive is a product that is silicone based. This chemistry delivers a superior product with a continuous operating temperature range of –300°F to +500°F. This adhesive also stands up well to deep thermal cycling without becoming brittle, as is common with other inferior pressure sensitive adhesives. This product provides a one year shelf life.

Factory Vulcanization

The best method for attachment of HEATFLEX silicone rubber heaters is factory vulcanization of the heater to a surface part. With special production processes, Heatron can bond the silicone heater directly to metal and other surfaces without the use of an additional adhesive layer. The heat and pressure of this process allows the silicone rubber to fill the micro structure of the surface. This allows the silicone heater to operate safely at higher watt densities and temperatures than would be possible with other attachment methods. To investigate the suitability of this method for your application contact Heatron.

Mechanical Fasteners

For HEATFLEX silicone heaters that need to be removable, Heatron has available a wide assortment of mechanical fastening straps. These include lacing eyelets, spring and eyelet combinations, boot hooks, boot type fasteners, and hook and loop type fabric straps. In addition, Heatron has sewing capabilities that can provide heaters with high strength fabric fastening straps.



Silicone Rubber Heater Options

Voltage Options

HEATFLEX silicone rubber heaters can be designed to operate from 2 to 600 volts. Because they are resistive elements, **HEATFLEX** heaters function with either AC or DC voltage sources. Dual voltage heaters are also possible. Dual voltage heaters allow the usage of the same heater for 110 and 220 volt equipment. These heaters incorporate two circuits that are wired in series for the high voltage and parallel for the low voltage. These three lead wire heaters commonly use different colored wires depending on customer preference. Three phase wye or three delta can be specified for high amperage heaters. For more information please contact **Heatron**.

Distributed Wattage

More effective with etched foil elements, but also possible with wire wound elements, are distributed wattage **HEATFLEX** heaters. **Heatron** designers can design different sections of the flexible heaters to have different watt densities. This can be done to compensate for edge loss on the outside perimeter of a part to supply more wattage to a given section of the part. **HEATFLEX** heaters can also be designed as dual wattage heaters with independent zones. This allows the delivery of more heat for the initial heat-up of the part, but less heat to maintain the part at a given temperature.



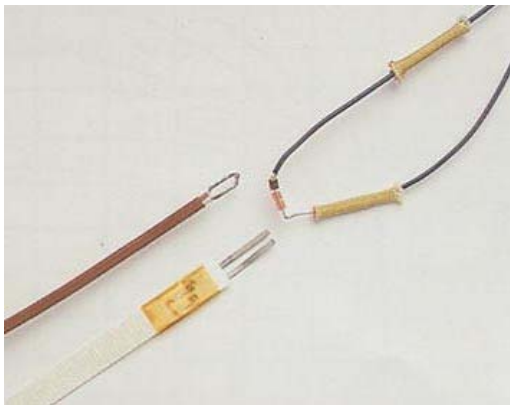


Thermostats

HEATFLEX silicone rubber heaters can be supplied with a variety of bi-metallic thermostats to perform different control or safety functions. These thermostats are limited to 240 volts and 15 amps. For controlling or sensing part temperature, **HEATFLEX** heaters can be manufactured with a hole in them allowing the sensing face of the thermostat to make contact with the part. Indirect sensing of the part can be accomplished by placing the thermostat over a non-heated section of the heater. By placing the thermostat over a heated section, the thermostat will limit the temperature of the heating element itself. This is beneficial as a back-up to primary temperature controller. For flexible heaters that are used to prevent freezing and condensation build-up in outdoor electronic enclosures, **Heatron** can mount the thermostat so that the sensing side is exposed to the ambient air in the box.

Sensors

HEATFLEX silicone heaters can also be supplied with a variety of sensors to send a signal back to a temperature controller. For thermocouples, the standard is 24 gauge standard type J. Other varieties including K are also available. As with the thermostats, these sensors can also be mounted over heated or non-heated sections of the heater depending on the desired results. Most any thermistor or RTD sensor can also be incorporated as part of the **HEATFLEX** assembly.



Connecting Leads

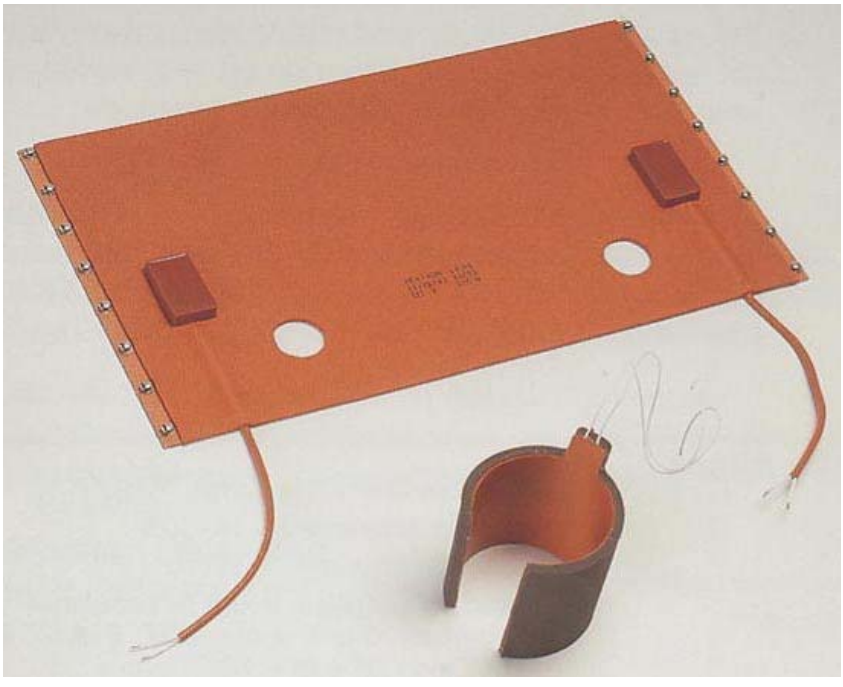
HEATFLEX silicone rubber heaters can be supplied with a variety of connecting leads. Standard leads are 200°C, 300 volt, Teflon TM (TFE) insulated, 19 strand silver plated copper conductor. For a moisture resistant connection, 18 gauge silicone rubber insulated leads are the best choice. Most all other types of lead wires can be incorporated into silicone rubber heaters. HEATFLEX silicone rubber heaters can also accommodate rubber cords or cord sets (cord with a molded plug already attached , usually three or six feet in length). These come in HPN style (also referred to as lamp cord or zip cord) or SJO style. It is possible to design a heater using three-conductor HPN or SJO. The third conductor is used as a ground that can be left unattached at the heater or be connected to the metal surface. It can also be attached to an internal ground plane built into the silicone heater. Another option is to sleeve the leads in silicone coated fiberglass, heat shrink, or stainless steel overpaid. This can offer the advantages of a clean bundle, additional moisture protection, or added strain relief.

Formed Silicone Heaters

HEATFLEX silicone rubber heaters can be vulcanized to conform to the contours of many different shaped parts. This is particularly useful for heaters that need to fit over columns or pipes. Heatron has also developed methods that allow silicone rubber heaters to be formed to follow compound curves. Special tooling or forms may be required for this process. For more information contact Heatron.



TÜV PRODUCT SERVICE CE



Thermal Insulation

HEATFLEX silicone heaters can also be supplied with a variety of insulation types on one side. Normally this insulation is one eighth to one half inch silicone rubber sponge of a medium density. For applications where the heater and sponge combination will be under pressure, Heatron has access to engineered sponges that resist compression setting.

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