

# Flexible Heaters

## Flexible Shapes and Geometries

Flexible heaters are thin, bendable and shaped to fit almost any type of equipment. Heat can be applied to complex shapes and geometries without sacrificing efficiency or dependability.

Excellent heat transfer results from the heater's thin design and direct bonding to an application. Flexible heaters provide fast heat-up and cool-down rates, uniform heat distribution and high watt densities.

### Features and Benefits

#### Flat geometry

- Permits holes, notches and unusual shapes

#### Option of two material types and two element styles

- Allow wider flexibility

#### Lightweight construction and low thermal mass

- Permit use in applications with limited space or weight requirements

#### Heating elements as close as 0.003 in. (0.08 mm)

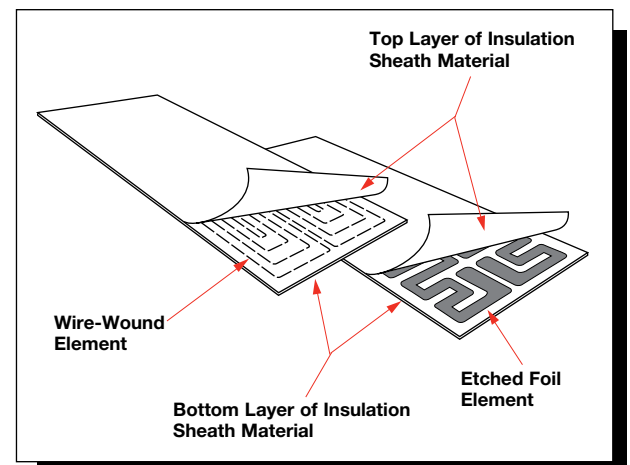
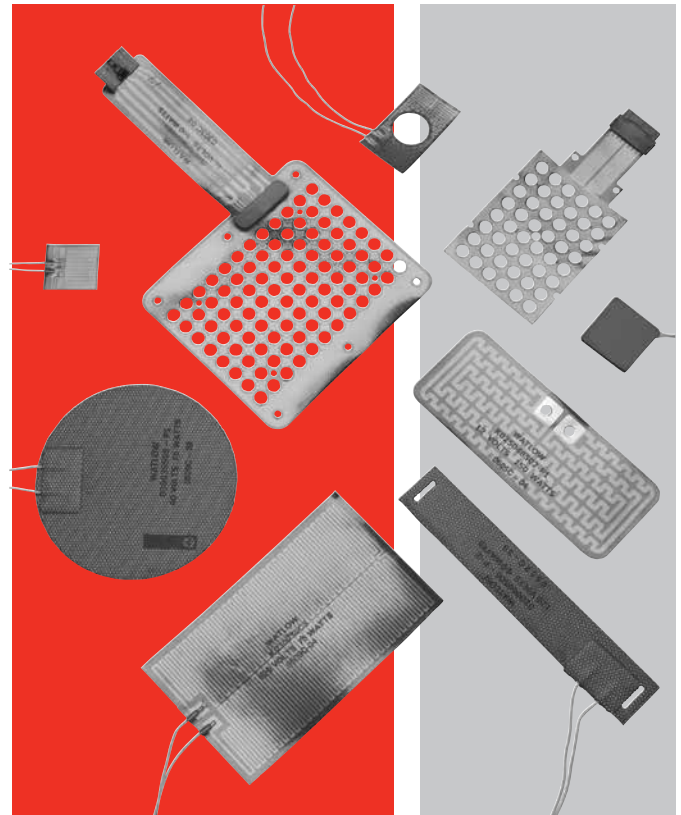
- Creates faster heat-up and cool-down time

#### Uniformly spaced element paths

- Distributes heat more evenly

### Typical Applications

- Medical equipment including blood analyzers, respiratory therapy units and hydrotherapy baths
- Semiconductor equipment, including vacuum and gas delivery lines and wafer processing equipment
- Foodservice equipment, including food holding and warming cabinets
- Battery heating
- Satellite and communication equipment
- Freeze protection for military hardware, aircraft instrumentation, hydraulic equipment, etc.
- Any application requiring a flexible shape or design



# Flexible Heaters

## Flexible Shapes and Geometries

### Applications and Technical Data

#### Two Material Types

##### Silicone Rubber

Rugged, moisture- and chemical-resistant material easily can be bonded to parts for effective heat transfer. Watlow silicone rubber heaters handle temperatures up to 500°F (260°C). Many heater styles are available with UR®, cUR®, VDE and CE recognition.

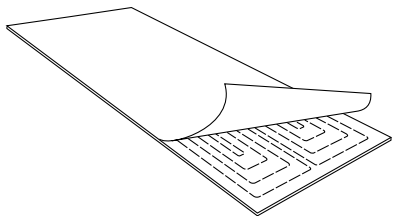
##### Polyimide

Polyimide is a thin, lightweight transparent material designed for precise heating requirements ranging from -319 to 392°F (-195 to 200°C). It is ideal for applications requiring low outgassing in a vacuum or resistance to radiation, fungus and chemicals. Many custom heaters can be UR® and cUR® recognized.

#### Two Element Types

Watlow offers wire-wound and etched foil resistance elements for silicone rubber heaters. Watlow can recommend the type best suited to your application.

##### Wire-Wound Elements

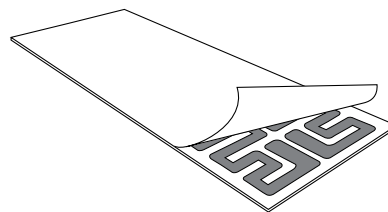


This element style is created by spiraling fine resistance wires around a fiberglass cord. The element is laid out in a pattern designed for a specific application. The benefits of wire-wound elements include:

- Excellent physical strength and flexibility. Repeated heater flexing has no harmful effects on its performance
- The ability to conform easily to curved surfaces, including small radius bends

Semiconductor pump/line heaters are typical examples of applications that use the wire-wound method. These heaters are flexed repeatedly during removal and installation, but due to their wiring, no internal damage occurs.

##### Etched Foil Elements



This element type is created by acid etching a circuit in nickel alloy resistance foil. It is available in silicone rubber and polyimide heater types. The etched foil element is known for its excellent circuit pattern repeatability and superior heat transfer, which results from greater coverage of the element. Other benefits include:

- Delivery of more heat and up to twice the watt density of a wire-wound element provides longer heater life
- Complex heat distribution patterns

The etched foil element style is usually recommended for applications requiring high temperatures, watt densities, or multiple zoning.

# Flexible Heaters

## Silicone Rubber Heaters

Rugged, yet thin, lightweight and flexible — use of Watlow® silicone rubber heaters is limited only by the imagination. Heat can be put exactly where it is needed to improve heat transfer, speed warm ups and decrease wattage requirements in an application process.

Fiberglass-reinforced silicone rubber provides dimensional stability without sacrificing flexibility. Because very little material separates the element from the part, heat transfer is rapid and efficient. Heaters are constructed with a wire-wound element or with an etched foil element. Its thin construction allows it to fit into applications where space is limited.

### Performance Capabilities

- Operating temperatures up to 500°F (260°C)
- Watt densities up to 80 W/in<sup>2</sup> (12.5 W/cm<sup>2</sup>), dependent upon application temperature
- Wire-wound element thickness — 0.055 in. (1.4 mm)
- Etched foil element — 0.022 in. (0.56 mm)
- UR®, cUR®, VDE and CE recognitions are available on many designs up to 428°F (220°C)

### Features and Benefits

#### Designed to the exact shape and size needed

- Conforms to component and/or equipment

#### More than 80 designs available immediately from stock

- Reduces downtime

#### Constructed with wire-wound or etched foil elements

- Enables a thin, lightweight heater
- Provides the desired flexibility for many dynamic applications
- Delivers low mass and easily repeatable distributed watt densities

#### Moisture and chemical-resistant silicone rubber material

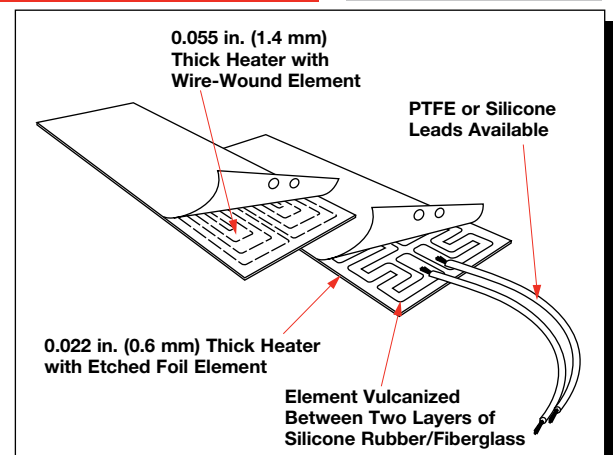
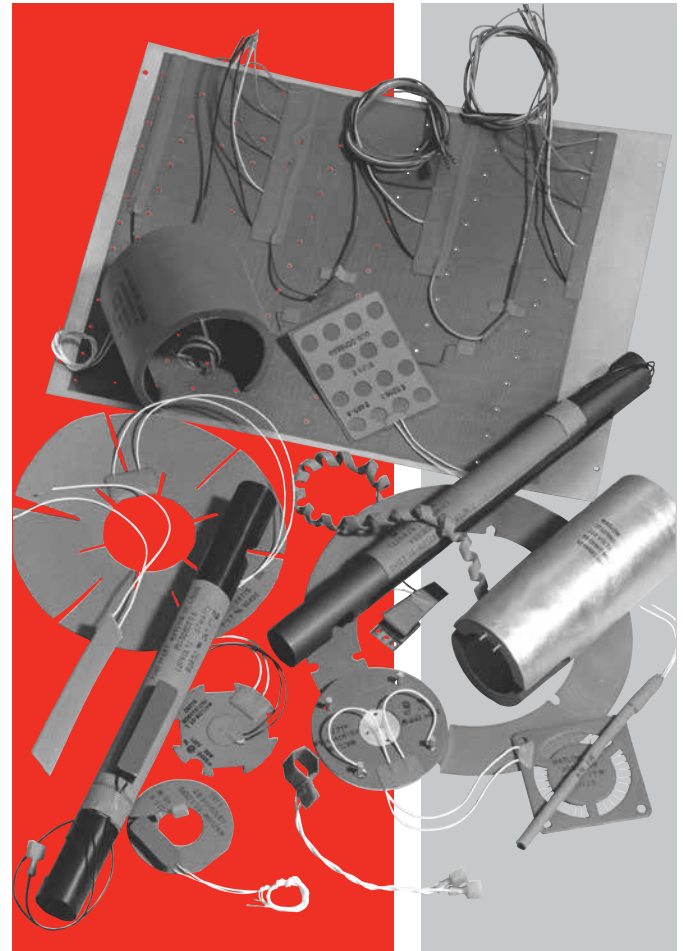
- Provides longer heater life

#### Vulcanizing adhesives or fasteners

- Allows heaters to be easily bonded to parts

### Typical Applications

- Semiconductor processing equipment
- Freeze protection and condensation prevention for many types of instrumentation and equipment
- Medical equipment such as blood analyzers and test tube heaters
- Computer peripherals such as laser printers
- Curing of plastic laminates
- Photo processing equipment



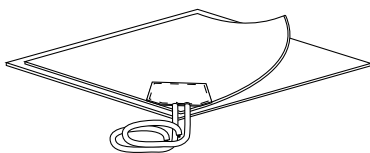
# Flexible Heaters

## Silicone Rubber Heaters

### Mounting Methods

Watlow offers various attachment techniques designed for fast installation.

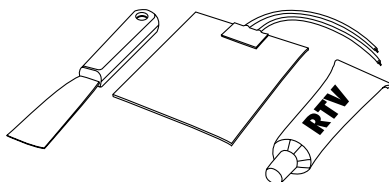
#### Pressure Sensitive Adhesive Surface (PSAS)



For speed, convenience and economy of installation, specify PSAS. Simply peel off the protective backing and roll the heater in place for an even bond to a clean, smooth surface. PSAS is not recommended for curved surfaces or for heaters rated above 10 W/in<sup>2</sup> (1.5 W/cm<sup>2</sup>). It should not be used for applications exceeding 400°F (205°C) on silicone rubber and 300°F (150°C) on polyimide.

**Note:** PSAS has a maximum six-month storage life at or below 86°F (30°C) before heater installation.

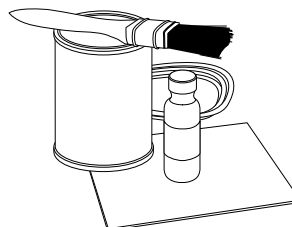
#### Field Applied Adhesive



For a stronger bond or when long storage is probable, room temperature vulcanizing (RTV) silicone adhesive works well. Watlow offers red RTV for temperatures up to 500°F (260°C). White RTV is available from adhesive suppliers for temperatures up to 400°F (205°C). Watlow's one-part RTV is self-priming and can be ordered in either 3 oz (90 ml) or 12 oz (355 ml) tubes. For larger heaters requiring longer adhesive working time, two-part RTV kits can be purchased from adhesive suppliers. These kits require primer on the surface prior to adhesive application.

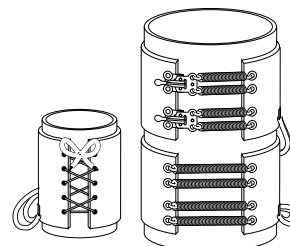
**Note:** Not recommended for polyimide heaters.

#### Silicone Contact Cement Kit



This two-part adhesive consists of a resin and catalyst that are easily mixed together and applied with a paintbrush. Recommended usage is for field cementing of silicone rubber heaters to customer parts. Available for immediate delivery, the cement kit handles temperatures up to 350°F (175°C). The resin is available in pint or quart containers. To order, specify **silicone contact cement** and the container size.

#### Mechanical Fasteners



When a wire-wound flexible heater must be detachable, any type of fastener normally used with fabrics can usually be built into the flexible heater's sheath material. The most common types are latch fasteners, boot hooks and grommets. Other styles include snap fasteners, springs and lacing cord. (Hook and loop style fastener strips are only available as part of the extended capabilities offering.) Grommets and boot hooks are commonly used with tension springs to compensate for slight variations in part size.

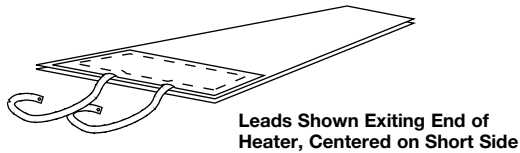
# Flexible Heaters

## Silicone Rubber Heaters

### Termination Styles

Watlow offers many types of leads and terminations. Leads can project from any position along the perimeter of the unit. **They are centered on the short side width of rectangular heaters unless specified.**

#### PTFE UL® 1180 CSA



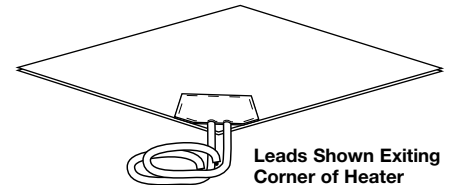
Watlow's leads are 12 in. (305 mm) long, white, PTFE insulated, flexible, plated copper UL® 1180 CSA wire. Leads are rated for 392°F (200°C)/300V. Lead connections on or at the heater are insulated with a cap of sheath material vulcanized to the heater body.

#### PTFE Leads



PTFE Type E (MIL-W-16878) and PTFE UL® 1199 leads rated for 392°F (200°C)/600V are also available.

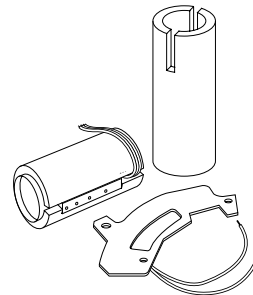
#### Silicone Insulated Leads



For a better moisture seal, specify UL® silicone insulated lead wires. This lead type is rated for 302°F (150°C)/600V. Any lead length is available. **Note:** Silicone rubber heaters are not designed to be waterproof. Excess exposure to moisture may facilitate premature heater failure.

### Option

#### Thermal Insulation



To increase heating efficiency of your application, silicone rubber heaters can be thermally insulated with silicone sponge rubber bonded to one side in the following thicknesses: 1/16, 1/8, 1/4, 3/8 or 1/2 in. (1.6, 3.2, 6, 9.5 or 13 mm).

An aluminized surface can be added to the back side of the heater to reduce radiated heat losses. This aluminized surface, called "low loss treatment," adds very little to the unit thickness or mass and maintains a very clean appearance.

# Flexible Heaters

## Silicone Rubber Heaters

### Applications and Technical Data

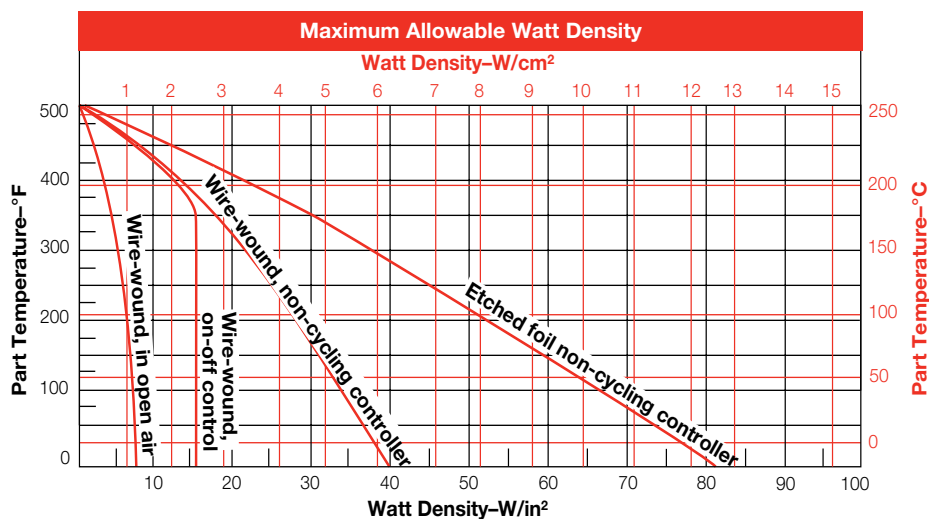
#### Determining Watt Density

The *Maximum Allowable Watt Density* graph illustrates the maximum recommended heater watt density at various metal parts or ambient air temperatures. However, it does not indicate the watt density necessary to achieve a given part temperature. See the *Surface Temperature vs. Time* graph on the next page for assistance with these calculations. When using this graph, consider:

- Part temperature is measured at the point where the heater contacts the metal part.
- Thermostats and on-off controllers are typically bimetal or capillary bulb.
- Non-cycling controllers are typically solid state, time-proportioning or silicone controlled rectifier (SCR) temperature controllers.

- Watt density values should be de-rated by one third if insulation is used.
- UL® recognition temperature limits are not detailed.
- Contact your Watlow representative prior to selecting high watt density etched-foil elements, or operating heaters with back side insulation or non-metallic parts which are poor thermal conductors.

**Example:** A wire-wound heater with a non-cycling controller at a part temperature of 250°F (120°C) can be rated at 24 W/in<sup>2</sup> (3.7 W/cm<sup>2</sup>) maximum. An etched foil heater operating under the same conditions can be rated at 45 W/in<sup>2</sup> (7 W/cm<sup>2</sup>) maximum.



#### Silicone Rubber Specifications

##### Max. width x max. length

- Wire wound: 36 x 120 in. (914 mm x 3048 mm)
- Etched foil: 18 x 34 in. (457 mm x 863 mm)

##### Thickness

- Wire wound: 0.055 in. (1.4 mm)
- Etched foil: 0.022 in. (0.6 mm)

##### Weight

- Wire wound: 8 oz/ft<sup>2</sup> (0.24 g/cm<sup>2</sup>)
- Etched foil: 3 oz/ft<sup>2</sup> (0.09 g/cm<sup>2</sup>)

**Max. operating temperature:** 500°F (260°C)

**Max. temperature for UL® recognition:** 428°F (220°C)

**Min. ambient temperature:** -80°F (-62°C)

**Max. voltage:** 600V

**Max. wattage:** see watt density graph

**Lead size:** sized to load

**Lead length:** 12 +1½ -1½ in. (305 mm +38 mm -13 mm)

##### Wattage tolerance

- Wire: ±5%
- Foil: +5% -10%

##### Dimensional tolerances

- 0 to 6 in. (0 to 152 mm): ±1/16 in. (1.59 mm)
- 6 to 18 in. (152 to 457 mm): ±1/8 in. (3.18 mm)
- 18 to 36 in. (457 mm to 914 mm): ±3/16 in. (4.76 mm)
- Over 36 in. (914 mm): ±1%

# Flexible Heaters

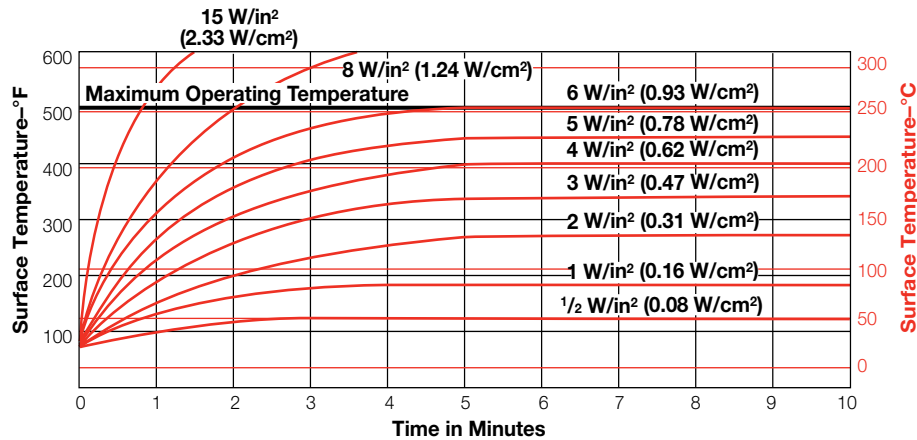
## Silicone Rubber Heaters

### Applications and Technical Data (Continued)

#### Surface Temperature vs. Time

This graph illustrates the surface temperature a silicone rubber heater will reach when uninsulated and suspended vertically in 70°F (20°C) still air.

Data is based on 0.055 in. (1.4 mm) thick construction and is offered as a reference tool.



#### UR®, cUR®, VDE and CE Recognition for Silicone Rubber Heaters

Watlow frequently works with customers requiring agency approvals such as UR®, cUR®, VDE and CE. Many silicone rubber heaters are available with one or more certifications.



**UL® Component Recognition (UR®)** of factory-bonded heaters is available up to 392°F (200°C) and for customer installed heaters up to 428°F (220°C) (UL® File No. E52951).

For Canadian recognition, Watlow offers **cUR® Recognized** silicone rubber heaters under UL® File #E52951. Several constructions are available with ratings to 600V and 428°F (220°C) maximum surface temperature. Contact your Watlow representative for further information.

**VDE Approval** is available on several constructions of both wire-wound (File No. 62533) and etched foil (File No. 62535) silicone rubber heaters. Maximum ratings are 440V and 428°F (220°C) surface temperature. Under VDE guidelines, minimum installed bend radius is 1/8 in. (3.2 mm) for etched foil and 1/4 in. (6 mm) for wire wound. VDE states that the user is responsible for the safe application, installation and wiring of heaters. Maximum working temperature must be maintained by an appropriate temperature controller.

The **CE mark** is available on UR® and/or VDE recognized heaters.

#### Options

Watlow offers options including attachment techniques, thermostats, special leads, holes and cutouts and three-dimensional shapes as described in the introduction to flexible heaters section.

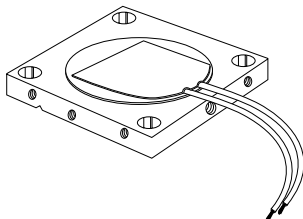
# Flexible Heaters

EXTENDED  
CAPABILITY

## Extended Capabilities For Silicone Rubber Heaters

### Mounting Methods

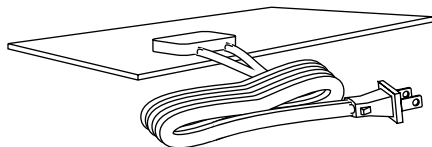
#### Factory Bonding



This attachment technique provides a strong, void-free bond for excellent heat transfer and extended heater life that has proven to be successful. Bonding is recommended for applications that reach maximum temperatures of 500°F (260°C) on silicone rubber and 300°F (150°C) on polyimide.

### Termination Styles

#### HPN Cord and Plug Set

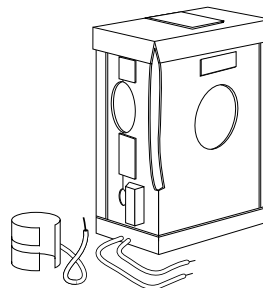


**Molded Leads are Shown Exiting Edge of Heater;  
Capped Leads are also Available.**

For removable heaters, a 6 ft (1.8 m) HPN cord and plug set provides convenience. It is rated for 194°F (90°C)/300V. An HPN cord without a plug is also available in any length.

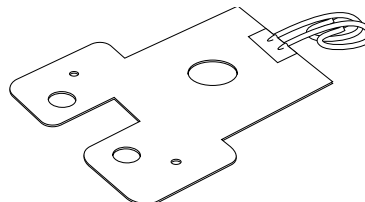
### Construction

#### Formed Heaters



Many three-dimensional shapes, such as cylinders, cones and boxes, can be factory formed. Semi-rigid shapes can self-grip to the part. Special tooling may be required for some designs.

### Holes, Cutouts and Notches



Watlow provides flexible heaters with special holes, cutouts and notches in nearly any position required for your design. The resistance element can be brought to within 1/8 in. (3.2 mm) of all edges. Standard spacing is 1/4 in. (6 mm) from all edges.

# Flexible Heaters

## Silicone Rubber Heaters

### Wire-Wound Elements — RAPID SHIP Offering

| Width<br>in. (mm) | Length<br>in. (mm) | Watts     | 120VAC<br>Part Number | 120/240VAC<br>Part Number |
|-------------------|--------------------|-----------|-----------------------|---------------------------|
| 1 (25)            | 2 (51)             | 10        | 010020C1*             |                           |
|                   | 3 (76)             | 15        | 010030C1*             |                           |
|                   | 4 (102)            | 20        | 010040C1*             |                           |
|                   | 5 (127)            | 25        | 010050C1*             |                           |
|                   | 5 (127)            | 6.25/25   |                       | 010050C2*                 |
|                   | 10 (254)           | 50        | 010100C1              |                           |
|                   | 10 (254)           | 12.50/50  |                       | 010100C2*                 |
|                   | 15 (381)           | 75        | 010150C1              |                           |
|                   | 15 (381)           | 18.75/75  |                       | 010150C2                  |
|                   | 20 (508)           | 100       | 010200C1              |                           |
|                   | 20 (508)           | 25/100    |                       | 010200C2                  |
|                   | 25 (635)           | 125       | 010250C1              |                           |
|                   | 30 (762)           | 150       | 010300C1              |                           |
|                   | 35 (889)           | 175       | 010350C1              |                           |
|                   | 40 (1016)          | 200       | 010400C1              |                           |
|                   | 80 (2032)          | 400       | 010800C1              |                           |
|                   | 120 (3048)         | 600       | 010F10C1              |                           |
| 2 (51)            | 2 (51)             | 20        | 020020C1*             |                           |
|                   | 5 (127)            | 50        | 020050C1              |                           |
|                   | 5 (127)            | 12.50/50  |                       | 020050C2*                 |
|                   | 10 (254)           | 100       | 020100C1              |                           |
|                   | 10 (254)           | 25/100    |                       | 020100C2                  |
|                   | 15 (381)           | 150       | 020150C1              |                           |
|                   | 15 (381)           | 37.50/150 |                       | 020150C2                  |
|                   | 20 (508)           | 200       | 020200C1              |                           |
|                   | 20 (508)           | 50/200    |                       | 020200C2                  |
|                   | 25 (635)           | 250       | 020250C1              |                           |
|                   | 30 (762)           | 300       | 020300C1              |                           |
|                   | 35 (889)           | 350       | 020350C1              |                           |
|                   | 40 (1016)          | 400       | 020400C1              |                           |
| 3 (76)            | 3 (76)             | 45        | 030030C1              |                           |
|                   | 5 (127)            | 75        | 030050C1              |                           |
|                   | 5 (127)            | 18.75/75  |                       | 030050C2                  |
|                   | 10 (254)           | 150       | 030100C1              |                           |
|                   | 10 (254)           | 37.50/150 |                       | 030100C2                  |
|                   | 15 (381)           | 225       | 030150C1              |                           |
|                   | 15 (381)           | 56.25/225 |                       | 030150C2                  |
|                   | 20 (508)           | 300       | 030200C1              |                           |
|                   | 20 (508)           | 75/300    |                       | 030200C2                  |
|                   | 25 (635)           | 375       | 030250C1              |                           |
|                   | 30 (762)           | 450       | 030300C1              |                           |
|                   | 35 (889)           | 525       | 030350C1              |                           |
|                   | 40 (1016)          | 600       | 030400C1              |                           |

CONTINUED

**RAPID SHIP**

- **RS** - Next day shipment up to 10 pieces for orders with part number configuration -0001B.

\* Due to their high resistance, these heaters are not recommended for curved or flexing applications.

**Notes:**

- Thickness 0.055 in. (1.4 mm)
- Heaters have lead length of 12 in. (305 mm) UL® 1180 PTFE
- UL® component recognition
- Silicone rubber wire-wound elements rated at 5 W/in<sup>2</sup> (0.78 W/cm<sup>2</sup>)

# Flexible Heaters

## Silicone Rubber Heaters

### Wire-Wound Elements — RAPID SHIP Offering (Continued)

| Width<br>in. (mm) |       | Length<br>in. (mm) |        | Watts      | 120VAC<br>Part Number | 120/240VAC<br>Part Number |
|-------------------|-------|--------------------|--------|------------|-----------------------|---------------------------|
| 4                 | (102) | 4                  | (102)  | 80         | 040040C1              |                           |
|                   |       | 5                  | (127)  | 100        | 040050C1              |                           |
|                   |       | 5                  | (127)  | 25/100     |                       | 040050C2                  |
|                   |       | 10                 | (254)  | 200        | 040100C1              |                           |
|                   |       | 10                 | (254)  | 50/200     |                       | 040100C2                  |
|                   |       | 15                 | (381)  | 300        | 040150C1              |                           |
|                   |       | 15                 | (381)  | 75/300     |                       | 040150C2                  |
|                   |       | 20                 | (508)  | 400        | 040200C1              |                           |
|                   |       | 20                 | (508)  | 100/400    |                       | 040200C2                  |
|                   |       | 25                 | (635)  | 500        | 040250C1              |                           |
|                   |       | 30                 | (762)  | 600        | 040300C1              |                           |
| 5                 | (127) | 35                 | (889)  | 700        | 040350C1              |                           |
|                   |       | 40                 | (1016) | 800        | 040400C1              |                           |
|                   |       | 5                  | (127)  | 125        | 050050C1              |                           |
|                   |       | 5                  | (127)  | 31.25/125  |                       | 050050C2                  |
|                   |       | 10                 | (254)  | 250        | 050100C1              |                           |
|                   |       | 10                 | (254)  | 62.50/250  |                       | 050100C2                  |
|                   |       | 15                 | (381)  | 375        | 050150C1              |                           |
|                   |       | 15                 | (381)  | 9.38/375   |                       | 050150C2                  |
|                   |       | 20                 | (508)  | 500        | 050200C1              |                           |
|                   |       | 20                 | (508)  | 125/500    |                       | 050200C2                  |
|                   |       | 25                 | (635)  | 625        | 050250C1              |                           |
| 6                 | (152) | 30                 | (762)  | 750        | 050300C1              |                           |
|                   |       | 35                 | (889)  | 875        | 050350C1              |                           |
|                   |       | 40                 | (1016) | 1000       | 050400C1              |                           |
|                   |       | 5                  | (127)  | 150        | 060050C1              |                           |
|                   |       | 5                  | (127)  | 37.50/150  |                       | 060050C2                  |
|                   |       | 10                 | (254)  | 300        | 060100C1              |                           |
|                   |       | 10                 | (254)  | 75/300     |                       | 060100C2                  |
|                   |       | 15                 | (381)  | 450        | 060150C1              |                           |
|                   |       | 15                 | (381)  | 112.50/450 |                       | 060150C2                  |
|                   |       | 20                 | (508)  | 600        | 060200C1              |                           |
|                   |       | 20                 | (508)  | 150/600    |                       | 060200C2                  |
|                   |       | 25                 | (635)  | 750        | 060250C1              |                           |
|                   |       | 30                 | (762)  | 900        | 060300C1              |                           |
|                   |       | 35                 | (889)  | 1050       | 060350C1              |                           |
|                   |       | 40                 | (1016) | 1200       | 060400C1              |                           |

**RAPID SHIP**

- **RS** - Next day shipment up to 10 pieces for orders with part number configuration -0001B.

\* Due to their high resistance, these heaters are not recommended for curved or flexing applications.

**Notes:**

- Thickness 0.055 in. (1.4 mm)
- Heaters have lead length of 12 in. (305 mm) UL® 1180 PTFE
- UL® component recognition
- Silicone rubber wire-wound elements rated at 5 W/in<sup>2</sup> (0.78 W/cm<sup>2</sup>)

# Flexible Heaters

## Silicone Rubber Heaters

### Wire-Wound Elements — RAPID SHIP Offering Coding Configured Options

To order, complete the part number with the information below:

Wire Wound

0 - - - - -

#### Modification Options

0 = None  
 A = PSAS bottom  
 B = PSAS top  
 E = With plate, heater on side opposite flange  
 F = With plate, heater on flange side  
 G = Flaps + grommets  
 H = Flaps + boot hooks  
 J = Flaps + latch fasteners  
 K = PSAS and low loss  
 L = Low loss  
 M = Low loss + flaps + grommets  
 N = Low loss + flaps + boot hooks  
 P = Low loss + flaps + latch fasteners  
 R = 1/16 in. sponge  
 S = 1/8 in. sponge  
 T = 1/4 in. sponge  
 U = 3/8 in. sponge  
 V = 1/2 in. sponge  
 W = PSAS + 1/16 in. sponge  
 Y = PSAS + 1/8 in. sponge  
 1 = PSAS + 1/4 in. sponge  
 2 = PSAS + 3/8 in. sponge  
 3 = PSAS + 1/2 in. sponge

#### Sensors

| Type      | LOC       | WIR |
|-----------|-----------|-----|
| 0 = None  |           |     |
| L = T10   | STD       | STD |
| M = T10   | STD       | ALT |
| N = T10   | ALT       | STD |
| P = T10   | ALT       | ALT |
| R = T207  | STD       | STD |
| S = T207  | STD       | ALT |
| T = T207  | ALT       | STD |
| U = T207  | ALT       | ALT |
| V = T207E | On heater | STD |
| W = T207E | Remote    | STD |
| 4 = JSTD  | STD       | STD |
| 6 = JALT  | STD       | STD |
| 7 = KSTD  | STD       | STD |

•For thermostats, standard location is as shown in catalog; standard wiring is integral or in series with the heater, alternate location is rotated parallel with heater width, alternate wiring is separate leads for pilot control.

•For thermocouples, Type J standard is PFA insulation, Type J alternate is fiberglass insulation, Type K standard is fiberglass insulation.

#### T10 Set °F\*

0 = None  
 A = 125  
 B = 150  
 E = 175  
 F = 200  
 G = 225  
 H = 250  
 J = 275  
 K = 300

#### T207 Set °F\*

0 = None  
 1 = 40/55  
 2 = 60/75  
 3 = 95/110  
 4 = 145/160

#### T/C Length

0 = None  
 A = 8 in.  
 B = 12 in.  
 E = 18 in.  
 F = 24 in.  
 G = 30 in.  
 H = 36 in.  
 J = 40 in.  
 K = 4 ft  
 L = 5 ft  
 M = 6 ft  
 N = 7 ft  
 P = 8 ft  
 R = 9 ft  
 S = 10 ft  
 T = 12 ft  
 U = 15 ft  
 V = 18 ft  
 W = 20 ft  
 Y = 22 ft  
 1 = 25 ft  
 2 = 30 ft

\* For all thermostats the heater must be a 2 in. (51 mm) min. width and 5 in. (127 mm) min. length.

#### Lead Insulation

0 = None  
 1 = 1180 UL® R/C  
 2 = 1180 C-UL® R/C  
 3 = 3133 22 Ga.  
 6 = 1199 CSA  
 7 = HPN  
 8 = 6 ft HPN set  
 9 = Type E PTFE  
 A = 1180VDE\*  
 B = 1199VDE\*  
 C = Silicone leads w/waterproof cap  
 E = SJO cord  
 F = 6 ft SJO set

\* 1180VDE denotes a C-UL® heater plus a VDE stamp.

#### Lead Length\*

A = 8 in.  
 B = 12 in.  
 E = 18 in.  
 F = 24 in.  
 G = 30 in.  
 H = 36 in.  
 J = 40 in.  
 K = 4 ft  
 L = 5 ft  
 M = 6 ft  
 N = 7 ft  
 P = 8 ft  
 R = 9 ft  
 S = 10 ft  
 T = 12 ft  
 U = 15 ft  
 V = 18 ft  
 W = 20 ft  
 Y = 22 ft  
 1 = 25 ft  
 2 = 30 ft

\* Customer specified length must be noted in inches when ordering.

# Flexible Heaters

## Silicone Rubber Heaters

### Etched Foil Elements — RAPID SHIP Offering

| Width<br>in. (mm) | Length<br>in. (mm) | Watts    | W/in <sup>2</sup> (W/cm <sup>2</sup> ) | 120VAC<br>Part Number | 120/240VAC<br>Part Number |
|-------------------|--------------------|----------|----------------------------------------|-----------------------|---------------------------|
| 1 (25)            | 5 (127)            | 25       | 5 (0.8)                                | <b>F010050C3</b>      | <b>F010050C8</b>          |
|                   | 5 (127)            | 50       | 10 (1.6)                               | <b>F010050C7</b>      |                           |
|                   | 5 (127)            | 12.5/50  | 2.5/10 (0.4/1.6)                       |                       |                           |
|                   | 10 (254)           | 100      | 10 (1.6)                               | <b>F010100C7</b>      | <b>F010100C8</b>          |
|                   | 10 (254)           | 25/100   | 2.5/10 (0.4/1.6)                       |                       |                           |
|                   | 15 (381)           | 150      | 10 (1.6)                               | <b>F010150C7</b>      | <b>F010150C8</b>          |
|                   | 15 (381)           | 37.5/150 | 2.5/10 (0.4/1.6)                       |                       |                           |
|                   | 20 (508)           | 200      | 10 (1.6)                               | <b>F010200C7</b>      | <b>F010200C8</b>          |
|                   | 20 (508)           | 50/200   | 2.5/10 (0.4/1.6)                       |                       |                           |
| 2 (51)            | 5 (127)            | 100      | 10 (1.6)                               | <b>F020050C7</b>      | <b>F020050C8</b>          |
|                   | 5 (127)            | 25/100   | 2.5 /10 (0.4/1.6)                      |                       |                           |
|                   | 10 (254)           | 200      | 10 (1.6)                               | <b>F020100C7</b>      | <b>F020100C8</b>          |
|                   | 10 (254)           | 50/200   | 2.5 /10 (0.4/1.6)                      |                       |                           |
|                   | 15 (381)           | 300      | 10 (1.6)                               | <b>F020150C7</b>      | <b>F020150C8</b>          |
|                   | 15 (381)           | 75/300   | 2.5/10 (0.4/1.6)                       |                       |                           |
|                   | 20 (508)           | 400      | 10 (1.6)                               | <b>F020200C7</b>      | <b>F020200C8</b>          |
|                   | 20 (508)           | 100/400  | 2.5/10 (0.4/1.6)                       |                       |                           |
| 3 (76)            | 5 (127)            | 75       | 5 (0.8)                                | <b>F030050C3</b>      | <b>F030050C8</b>          |
|                   | 5 (127)            | 150      | 10 (1.6)                               | <b>F030050C7</b>      |                           |
|                   | 5 (127))           | 37.5/150 | 2.5 /10 (0.4/1.6)                      |                       |                           |
|                   | 10 (254)           | 300      | 10 (1.6)                               | <b>F030100C7</b>      | <b>F030100C8</b>          |
|                   | 10 (254)           | 75/300   | 2.5 /10 (0.4/1.6)                      |                       |                           |
|                   | 15 (381)           | 450      | 10 (1.6)                               | <b>F030150C7</b>      | <b>F030150C8</b>          |
|                   | 15 (381)           | 112/450  | 2.5 /10 (0.4/1.6)                      |                       |                           |
|                   | 20 (508)           | 600      | 10 (1.6)                               | <b>F030200C7</b>      | <b>F030200C8</b>          |
|                   | 20 (508)           | 150/600  | 2.5 /10 (0.4/1.6)                      |                       |                           |
| 4 (102)           | 5 (127)            | 200      | 10 (1.6)                               | <b>F040050C7</b>      | <b>F040050C8</b>          |
|                   | 5 (127)            | 50/200   | 2.5 /10 (0.4/1.6)                      |                       |                           |
|                   | 10 (254)           | 400      | 10 (1.6)                               | <b>F040100C7</b>      | <b>F040100C8</b>          |
|                   | 10 (254)           | 100/400  | 2.5 /10 (0.4/1.6)                      |                       |                           |
|                   | 15 (381)           | 600      | 10 (1.6)                               | <b>F040150C7</b>      | <b>F040150C8</b>          |
|                   | 15 (381)           | 150/600  | 2.5/10 (0.4/1.6)                       |                       |                           |
|                   | 20 (508)           | 800      | 10 (1.6)                               | <b>F040200C7</b>      | <b>F040200C8</b>          |
|                   | 20 (508)           | 200/800  | 2.5/10 (0.4/1.6)                       |                       |                           |
| 5 (127)           | 5 (127)            | 250      | 10 (1.6)                               | <b>F050050C7</b>      | <b>F050050C8</b>          |
|                   | 5 (127)            | 62.5/250 | 2.5/10 (0.4/1.6)                       |                       |                           |
|                   | 10 (254)           | 500      | 10 (1.6)                               | <b>F050100C7</b>      | <b>F050100C8</b>          |
|                   | 10 (254)           | 125/500  | 2.5/10 (0.4/1.6)                       |                       |                           |
|                   | 15 (381)           | 750      | 10 (1.6)                               | <b>F050150C7</b>      | <b>F050150C8</b>          |
|                   | 15 (381)           | 187/750  | 2.5/10 (0.4/1.6)                       |                       |                           |
|                   | 20 (508)           | 1000     | 10 (1.6)                               | <b>F050200C7</b>      | <b>F050200C8</b>          |
|                   | 20 (508)           | 250/1000 | 2.5/10 (0.4/1.6)                       |                       |                           |
| 6 (152)           | 5 (127)            | 300      | 10 (1.6)                               | <b>F060050C7</b>      | <b>F060050C8</b>          |
|                   | 5 (127)            | 75/300   | 2.5/10 (0.4/1.6)                       |                       |                           |
|                   | 10 (254)           | 600      | 10 (1.6)                               | <b>F060100C7</b>      | <b>F060100C8</b>          |
|                   | 10 (254)           | 150/600  | 2.5 /10 (0.4/1.6)                      |                       |                           |
|                   | 15 (381)           | 900      | 10 (1.6)                               | <b>F060150C7</b>      | <b>F060150C8</b>          |
|                   | 15 (381)           | 225/900  | 2.5/10 (0.4/1.6)                       |                       |                           |
|                   | 20 (508)           | 1200     | 10 (1.6)                               | <b>F060200C7</b>      | <b>F060200C8</b>          |
|                   | 20 (508)           | 300/1200 | 2.5/10 (0.4/1.6)                       |                       |                           |

**RAPID SHIP**

• **RS** - Next day shipment up to 10 pieces  
for orders with part number configuration 0001B.

#### Notes:

- Silicone rubber etched foil elements 0.022 in. (0.56 mm) thick
- Heaters have standard lead length of 12 in. (305 mm) UL® 1180 PTFE
- UL® component recognition

# Flexible Heaters

## Silicone Rubber Heaters

### Etched Foil Elements — RAPID SHIP Offering Coding Configured Options

To order, complete the part number with the information below:

Etched Foil  
F0-----

#### Options

0 = None  
A = PSAS bottom  
B = PSAS top  
K = PSAS and low loss  
L = Low loss  
R = 1/16 in. sponge  
S = 1/8 in. sponge  
T = 1/4 in. sponge  
U = 3/8 in. sponge  
V = 1/2 in. sponge  
W = PSAS + 1/16 in. sponge  
Y = PSAS + 1/8 in. sponge  
1 = PSAS + 1/4 in. sponge  
2 = PSAS + 3/8 in. sponge  
3 = PSAS + 1/2 in. sponge

#### Sensors

| Type     | LOC | WIR |
|----------|-----|-----|
| 0 = None |     |     |
| L = T10  | STD | STD |
| M = T10  | STD | ALT |
| N = T10  | ALT | STD |
| P = T10  | ALT | ALT |
| R = T207 | STD | STD |
| S = T207 | STD | ALT |
| T = T207 | ALT | STD |
| U = T207 | ALT | ALT |
| 4 = JSTD | STD | STD |
| 6 = JALT | STD | STD |
| 7 = KSTD | STD | STD |

•For thermostats, standard location is as shown in catalog; standard wiring is integral or in series with the heater, alternate location is rotated parallel with heater width, alternate wiring is separate leads for pilot control.

•For thermocouples, Type J offering is PFA insulation, Type J alternate is fiberglass insulation, Type K offering is fiberglass insulation.

•Etched foil heaters are not recommended for enclosure heaters.

#### T10 Set °F\*

0 = None  
A = 125  
B = 150  
E = 175  
F = 200  
G = 225  
H = 250  
J = 275  
K = 300

#### T207 Set °F\*

0 = None  
1 = 40/55  
2 = 60/75  
3 = 95/110  
4 = 145/160

#### T/C Length

0 = None  
A = 8 in.  
B = 12 in.  
E = 18 in.  
F = 24 in.  
G = 30 in.  
H = 36 in.  
J = 40 in.  
K = 4 ft  
L = 5 ft  
M = 6 ft  
N = 7 ft  
P = 8 ft  
R = 9 ft  
S = 10 ft  
T = 12 ft  
U = 15 ft  
V = 18 ft  
W = 20 ft  
Y = 22 ft  
1 = 25 ft  
2 = 30 ft

\* For all thermostats, the heater must be a 2 in. min. width and a 5 in. min. length.

#### Lead Insulation

0 = None  
1 = 1180 UL®R/C  
2 = 1180 C-UL®R/C  
3 = 3133 22 Ga.\*\*  
6 = 1199 CSA  
7 = HPN  
8 = 6 ft HPN set  
9 = Type E PTFE  
A = 1180VDE\*  
B = 1199VDE\*  
C = Silicone leads w/waterproof cap  
E = SJO cord  
F = 6 ft SJO set

\*1180VDE denotes a C-UL® heater plus a VDE stamp.

\*\*Not available on composite heaters due to amperage.

#### Lead Length\*

A = 8 in.  
B = 12 in.  
E = 18 in.  
F = 24 in.  
G = 30 in.  
H = 36 in.  
J = 40 in.  
K = 4 ft  
L = 5 ft  
M = 6 ft  
N = 7 ft  
P = 8 ft  
R = 9 ft  
S = 10 ft  
T = 12 ft  
U = 15 ft  
V = 18 ft  
W = 20 ft  
Y = 22 ft  
1 = 25 ft  
2 = 30 ft

\*Customer specified length must be noted in inches when ordering.

# Flexible Heaters

## Silicone Rubber Heaters

### Composite Bonding Applications

Watlow offers silicone rubber heaters commonly used for composite bonding and curing. The design includes equal length circuits and a no-heat tab for temperature uniformity. The contact surface is made using smooth silicone to prevent composite surface imperfections. The heaters are fiberglass reinforced to provide lasting field service durability and life.

### Performance Capabilities

- Watt density up to 5 W/in<sup>2</sup> (0.8 W/cm<sup>2</sup>)
- Voltage of 120VAC/240VAC (option) single phase
- UL® recognized

### Features and Benefits

#### Customized leads

- Allows up to 30 feet of lead length

#### Field service ease

- Enables on-site repairs

#### Equal length circuits — min. 2 x 2 in. (51 x 51 mm) tab with radius

- Creates temperature uniformity

#### Smooth contact surface

- Prevents composite surface imperfections

### Typical Applications

- Aerospace industry
  - Repair
  - Fabrication
- Composite bonding processes



# Flexible Heaters

## Silicone Rubber Heaters

### Wire-Wound Elements — Composite Bonding Applications

#### Composite Heaters “L”

| Width<br>in. (mm) | Length<br>in. (mm) | Watts | 120VAC<br>Part Number | 120/240VAC<br>Part Number |
|-------------------|--------------------|-------|-----------------------|---------------------------|
| 6 (152)           | 6 (152)            | 180   | L060080C1             | L060080C2                 |
|                   | 6 (152)            | 180   |                       |                           |
|                   | 10 (254)           | 300   | L060120C1             | L060120C2                 |
|                   | 10 (254)           | 300   |                       |                           |
| 8 (203)           | 8 (203)            | 320   | L080100C1             | L080100C2                 |
|                   | 8 (203)            | 320   |                       |                           |
|                   | 12 (305)           | 480   | L080140C1             | L080140C2                 |
|                   | 12 (305)           | 480   |                       |                           |
| 10 (254)          | 10 (254)           | 500   | L100120C1             | L100120C2                 |
|                   | 10 (254)           | 500   |                       |                           |
|                   | 12 (305)           | 600   | L100140C1             | L100140C2                 |
|                   | 12 (305)           | 600   |                       |                           |
|                   | 18 (457)           | 900   | L100200C1**           | L100200C2                 |
|                   | 18 (457)           | 900   |                       |                           |
| 12 (305)          | 12 (305)           | 720   | L120140C1**           | L120140C2                 |
|                   | 12 (305)           | 720   |                       |                           |
|                   | 18 (457)           | 1080  | L120200C1**           | L120200C2**               |
|                   | 18 (457)           | 1080  |                       |                           |
|                   | 24 (610)           | 1440  | L120260C1**           | L120260C2**               |
|                   | 24 (610)           | 1440  |                       |                           |
| 16 (406)          | 16 (406)           | 1280  | L160180C1**           | L160180C2**               |
|                   | 16 (406)           | 1280  |                       |                           |
| 18 (457)          | 18 (457)           | 1620  | L180200C1**           | L180200C2**               |
|                   | 18 (457)           | 1620  |                       |                           |
| 20 (508)          | 20 (508)           | 2000  | L200220C1*            | L200220C2**               |
|                   | 20 (508)           | 2000  |                       |                           |

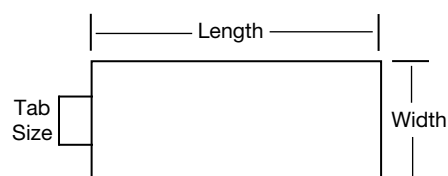
- M - Manufacturing lead times

#### Notes:

- Thickness 0.055 in. (1.4 mm)
- Lead length 12 in. (305 mm) UL® 1180 PTFE
- UL® component recognition
- Silicone rubber wire-wound elements rated at 5 W/in<sup>2</sup>
- Length does not include 2 in. (51 mm) tab for leads
- Smooth surface

\* Thermostat option is not available for this heater.

\*\* Only T207 thermostat option is available.



# Flexible Heaters

## Silicone Rubber Heaters

### Etched Foil Elements — Coding Configured Options Composite Heaters “L”

To order, complete the part number with the information below:

#### Composite Flexible Stock Heaters

L \_\_\_\_\_ -

#### Modification Options

0 = None  
A = PSAS bottom  
B = PSAS top  
K = PSAS and low loss  
L = Low loss  
R = 1/16 in. sponge  
S = 1/8 in. sponge  
T = 1/4 in. sponge  
U = 3/8 in. sponge  
V = 1/2 in. sponge  
W = PSAS + 1/16 in. sponge  
Y = PSAS + 1/8 in. sponge  
1 = PSAS + 1/4 in. sponge  
2 = PSAS + 3/8 in. sponge  
3 = PSAS + 1/2 in. sponge

#### Sensors

| Type     | LOC | WIR |
|----------|-----|-----|
| 0 = None |     |     |
| L = T10  | STD | STD |
| M = T10  | STD | ALT |
| N = T10  | ALT | STD |
| P = T10  | ALT | ALT |
| R = T207 | STD | STD |
| S = T207 | STD | ALT |
| T = T207 | ALT | STD |
| U = T207 | ALT | ALT |
| 4 = JSTD | STD | STD |
| 6 = JALT | STD | STD |
| 7 = KSTD | STD | ST  |

•For thermostats, standard location is as shown in catalog; standard wiring is integral or in series with the heater, alternate location is rotated parallel with heater width, alternate wiring is separate leads for pilot control.

•For thermocouples, Type J offering is PFA insulation, Type J alternate is fiberglass insulation, Type K offering is fiberglass insulation.

•Etched foil heaters are not recommended for enclosure heaters.

#### T10 Set °F\*

0 = None  
A = 125  
B = 150  
E = 175  
F = 200  
G = 225  
H = 250  
J = 275  
K = 300

#### T207 Set °F\*

0 = None  
1 = 40/55  
2 = 60/75  
3 = 95/110  
4 = 145/160

#### T/C Length

0 = None  
A = 8 in.  
B = 12 in.  
E = 18 in.  
F = 24 in.  
G = 30 in.  
H = 36 in.  
J = 40 in.  
K = 4 ft  
L = 5 ft  
M = 6 ft  
N = 7 ft  
P = 8 ft  
R = 9 ft  
S = 10 ft  
T = 12 ft  
U = 15 ft  
V = 18 ft  
W = 20 ft  
Y = 22 ft  
1 = 25 ft  
2 = 30 ft

#### Lead Insulation

0 = None  
1 = 1180 UL®R/C  
2 = 1180 C-UL®R/C  
3 = 3133 22 Ga.\*\*  
6 = 1199 CSA  
7 = HPN  
8 = 6 ft HPN set  
9 = Type E PTFE  
A = 1180VDE\*  
B = 1199VDE\*  
C = Silicone leads w/waterproof cap  
E = SJO cord  
F = 6 ft SJO set

\*1180VDE denotes a cUR® heater plus a VDE stamp.

\*\*Not available on composite heaters due to amperage.

#### Lead Length\*

A = 8 in.  
B = 12 in.  
E = 18 in.  
F = 24 in.  
G = 30 in.  
H = 36 in.  
J = 40 in.  
K = 4 ft  
L = 5 ft  
M = 6 ft  
N = 7 ft  
P = 8 ft  
R = 9 ft  
S = 10 ft  
T = 12 ft  
U = 15 ft  
V = 18 ft  
W = 20 ft  
Y = 22 ft  
1 = 25 ft  
2 = 30 ft

\* Customer specified length must be noted in inches when ordering.