

Quick Ship

• Same day shipment on stock units with orders received by 11:00 a.m. CST.

Flexible Heaters**Flexible Shapes and Geometries**

Flexible heaters from Watlow are just what the name implies: thin, bendable and shaped to fit your equipment. You can use your imagination to apply heat to the most complex shapes and geometries, without sacrificing efficiency or dependability. With Watlow's customization capabilities, you have the maximum amount of freedom when designing your equipment.

Excellent heat transfer results from the heater's thin design and its direct bonding to the application. Flexible heaters also 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 three material types and two element styles

- Allows for wider flexibility

Lightweight construction and low thermal mass

- Permits use in applications that have limited space or weight requirements

Close heating elements (as close as 0.003 inches (0.08 mm))

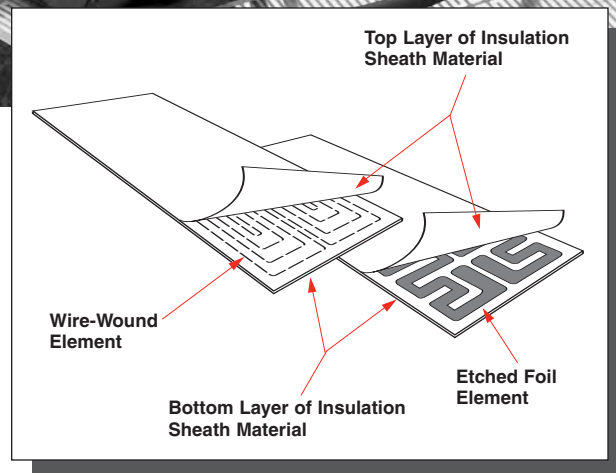
- Creates faster heat up and cool down time

Uniformly spaced element paths

- Distribute heat more evenly

Applications

- Medical equipment such as blood analyzers, respiratory therapy units and hydrotherapy baths
- Satellite and communication equipment
- Freeze protection for military hardware, aircraft instrumentation, hydraulic equipment, etc.



- Battery heating
- Semiconductor equipment
- Foodservice equipment
- Any application requiring a flexible shape or design

Flexible Heaters

Flexible Shapes and Geometries

Applications and Technical Data

Three Material Types

Silicone Rubber:

This rugged, moisture- and chemical-resistant material is easily bonded or adhered to parts. Watlow silicone rubber heaters can handle temperatures up to 260°C (500°F). Many styles of these heaters are available with UR®, cUR® and VDE recognition.

Polyimide:

Polyimide is a thin, lightweight transparent material and is designed for precise heating requirements ranging from -195° to 200°C (-319° to 392°F). 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.

HT Foil:

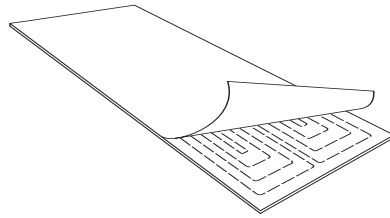
This mica-insulated, high temperature foil is a semi-rigid heater. Operating temperatures up to 595°C (1100°F) can be achieved.

Two Element Types

Watlow offers both wire-wound and etched foil resistance elements. These element types are available in

most insulating materials, and Watlow can recommend the type best suited to your application.

Wire-Wound Elements

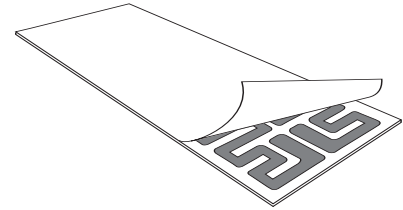


Available on silicone rubber heaters, this element style is created by spiraling fine resistance wires around a fiberglass cord. The element is then laid out in a pattern designed specifically for your application. The benefits of wire-wound elements include:

- Excellent physical strength and flexibility; repeated flexing of the heater has no harmful effects on its performance
- Conforms readily to curved surfaces, including small radius bends

Drum heaters and conduit bender heaters are typical examples of applications that use the wire-wound method. These heaters are flexed repeatedly during use, but due to their wiring, no internal damage will occur.

Etched Foil Elements



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

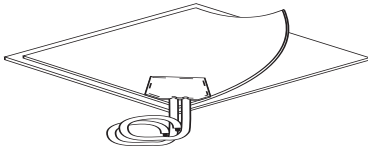
- Delivers more heat and up to twice the watt density of a wire-wound element, providing longer heater life
- Complex heat distribution patterns can be provided

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

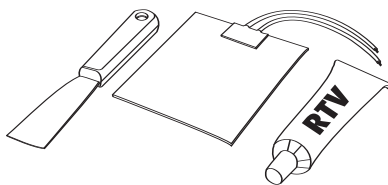
UR® and cUR® are registered trademarks of Underwriter's Laboratories, Inc.

Flexible Heaters

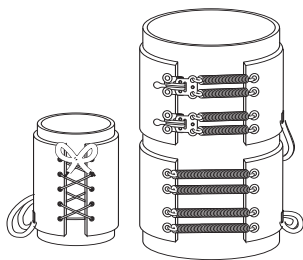
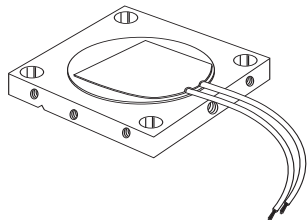
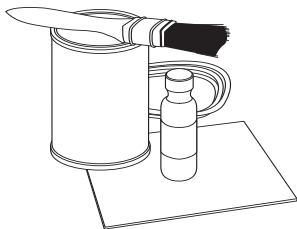
Flexible Shapes and Geometries Options



Note: PSAS minimum six months storage life before heater installation when stored at or below 30°C (86°F)



Note: Not recommended for polyimide heaters.



Mounting Methods

Watlow offers various attachment techniques, all designed for fast installation. These include: three

types of adhesives, Watlow's special factory vulcanization process and mechanical fasteners.

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.

Note: PSAS is not recommended for curved surfaces or for heaters rated above 10 W/in² (0.8 W/cm²). It should not be used for applications exceeding 205°C (400°F) on silicone rubber and 150°C (300°F) on polyimide.

Field Applied Adhesive (RTV)

For a stronger bond, or when long storage is probable, a **room temperature vulcanizing (RTV) silicone adhesive** is available from stock within two days. Watlow offers red RTV for temperatures up to 260°C (500°F). White RTV is available from adhesive suppliers for temperatures up to 205°C (400°F). 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 application of the adhesive.

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

from stock, the cement kit will handle temperatures to 175°C (350°F). The resin is available in pint or quart containers. To order, specify **silicone contact cement** and container size.

Factory Bonding

This attachment technique provides a strong, void-free bond for excellent heat transfer and extended heater life. Watlow's expertise in bonding heaters to customer parts has proven extremely successful.

Bonding is recommended for applications that reach maximum temperatures of 260°C (500°F) on silicone rubber and 150°C (300°F) on polyimide.

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 sheath material of Watlow flexible heaters. The most common types are latch fasteners, boot hooks and

grommets. Other styles include snap fasteners, springs, velcro style fastener strips and lacing cord. The grommets and boot hooks are commonly used with tension springs to compensate for slight variations in part size.

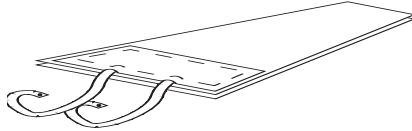
Flexible Heaters

Flexible Shapes and Geometries

Termination Styles

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

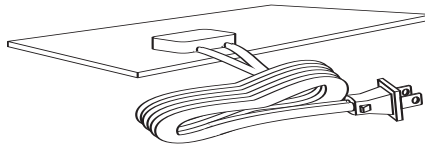
Standard Leads—Type E Teflon®



Leads shown exiting end of heater, centered on short side.

Watlow's standard leads are 12 inches (305 mm) long, white, Teflon® insulated, flexible, plated copper wire. They are rated for 200°C (392°F)/600 volts per MIL-W-16878, Type E. The lead connections on or at the heater are insulated with a cap of sheath material, vulcanized to the heater body. All custom flexible heaters except HT foil will be supplied with this lead type unless otherwise specified.

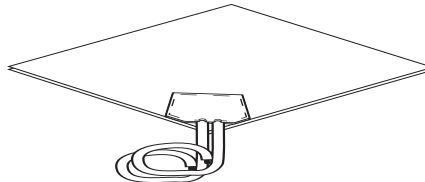
HPN Cord and Plug Set



Molded leads are shown exiting edge of heater. Capped leads are also available.

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

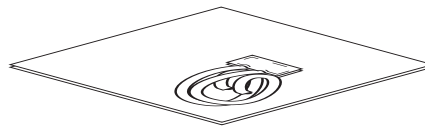
Silicone Insulated Leads



Leads shown exiting corner of heater.

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

Special Teflon® Leads

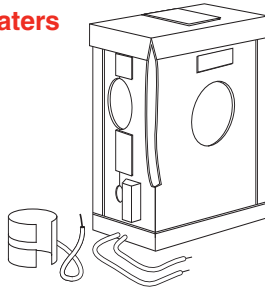


Leads shown exiting middle of heater.

Teflon® leads, UL® style 1180 and cUR® approved, are rated for 200°C (392°F)/300 volts. Any length is available. UL® Teflon® leads are standard on stock rectangles.

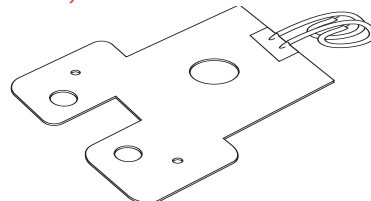
Construction

Formed Heaters



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

Holes, Cutouts and Notches



Watlow can provide 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 inch (3 mm) of all edges. Standard spacing is 1/4 inch (6 mm) from all edges.

Teflon® is a registered trademark of E.I. du Pont de Nemours & Company.

Quick Ship

• Same day shipment on stock units with orders received by 11:00 a.m.

Flexible Heaters

Silicone Rubber

Rugged, yet thin, lightweight and flexible ... the use of Watlow silicone rubber heaters is limited only by your imagination. With these heaters, you can put the heat where it is needed and, in the process, improve heat transfer, speed warm-ups and decrease wattage requirements.

Fiberglass-reinforced silicone rubber gives your heater dimensional stability without sacrificing flexibility. Because very little material separates the element from the part, heat transfer is rapid and efficient.

Performance Capabilities

- Operating temperatures to 260°C (500°F)
- Watt densities to 80 W/in² (12.5 W/cm²) dependent upon application temperature
- 0.055 inch (1.4 mm) thick with a wire-wound element; only 0.022 inch (0.56 mm) with an etched foil element

Features and Benefits

Designed in the exact shape and size needed

- Conforms to your equipment

More than 80 designs available immediately from stock

- Reduces downtime

UR®, cUR® and VDE recognitions

- Available on many designs up to 220°C (428°F)

Moisture and chemical-resistant silicone rubber material

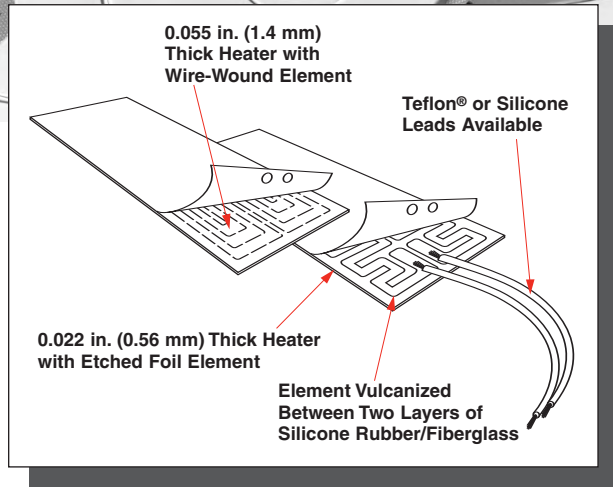
- Provides longer heater life

Vulcanizing adhesives or fasteners

- Easily bond heaters to your part

Applications

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



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Flexible Heaters

Flexible Heaters

Silicone Rubber

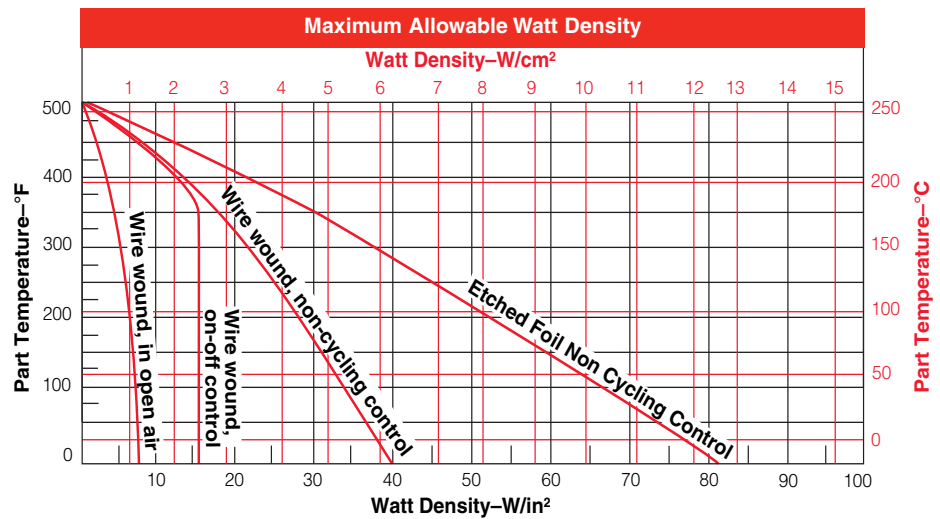
Applications and Technical Data

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 those calculations. When using this graph, remember:

- Part temperature is measured at the point where the heater contacts the metal part.
- Thermostats and on-off controls are typically bimetal or capillary bulb.
- Non-cycling controls are typically solid state, time-proportioning or SCR temperature controllers.
- Watt density values should be de-rated by one third if insulation is used.
- UL® recognition temperature limits are not detailed.
- Consult Watlow before doing any of the following: 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 non-cycling control at a part temperature of 120°C (250°F) can be rated at 24 W/in² (3.7 W/cm²) maximum. An etched foil heater under the same conditions can be rated at 45 W/in² (7 W/cm²) maximum.



Standard Silicone Rubber Specifications

Maximum width x maximum length:

- Wire wound: 36 x 120 inches (915 mm x 3050 mm)
- Etched foil: 20 x 30 inches (510 mm x 760 mm)

Thickness (standard):

- Wire wound: 0.055 inch (1.4 mm)
- Etched foil: 0.022 inch (0.56 mm)

Weight (standard):

- Wire wound: 8 oz./ft² (0.24 g/cm²)
- Etched foil: 3 oz./ft² (0.09 g/cm²)

Maximum operating temperature: 260°C (500°F)

Maximum temperature for UL® recognition: 220°C (428°F)

Minimum ambient temperature: -62°C (-80°F)

Maximum voltage: 600V~(ac)

Maximum wattage: See watt density graph

Lead size: Sized to load

Lead length: 12 + 1 ½ - ½ inches (305 mm + 40 mm - 15 mm)

Wattage tolerance:

- Wire: ±5 percent
- Foil: +5 percent -10 percent

Dimensional tolerances:

- 0 to 6 inches (0 to 150 mm): ±¹/₁₆ inch (1.6 mm)
- 6 to 18 inches (150 to 455 mm): ±¹/₈ inch (3.2 mm)
- 18 to 36 inches (455 mm to 915 mm): ±³/₁₆ inch (4.8 mm)
- Over 36 inches (915 mm): ±1 percent

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Flexible Heaters

Silicone Rubber

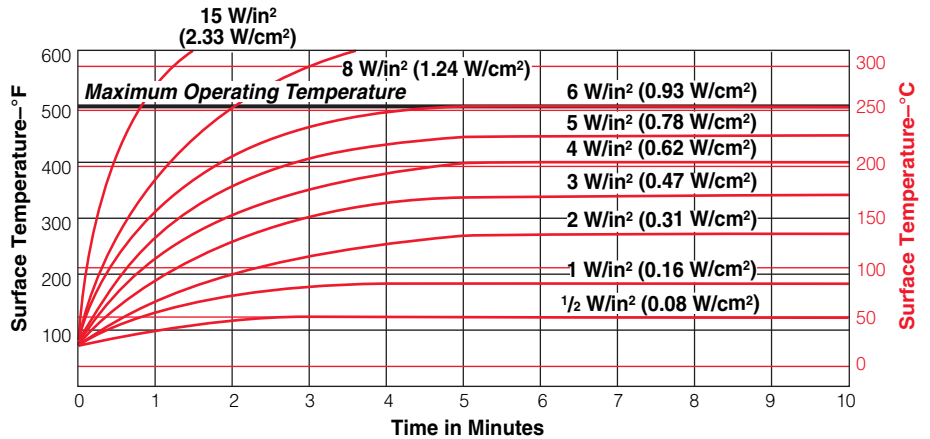
Applications and Technical Data

Continued

Surface Temperature vs. Time

This graph illustrates the surface temperature a silicone rubber heater will reach when the heater is uninsulated and is suspended

vertically in 20°C (70°F) still air. This data is based on 0.055 inch (1.4 mm) thick standard construction and is offered as a reference tool.



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

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

UL® Component Recognition (UR)

of factory-bonded heaters is available up to 200°C (392°F) and for customer installed heaters up to 220°C (428°F) (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~(ac) and 220°C (428°F) maximum surface temperature. Consult the factory for further information.

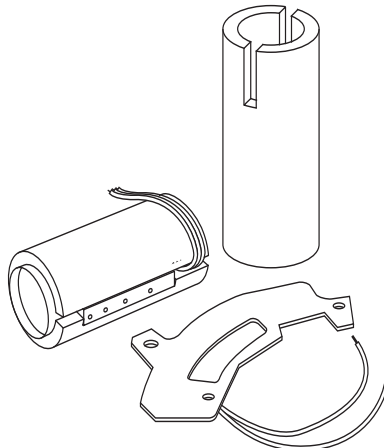
VDE Approval is available on several constructions of both wire-wound (File No. 62533) and etched foil (File No. 62535) silicone rubber heaters. The maximum ratings are 440V~(ac) and 220°C (428°F) surface temperature. Under VDE guidelines, minimum installed bend radius is 1/8 inch (3 mm) for etched foil and 1/4 inch (6 mm) for wire wound. VDE also states that the user is responsible for the safe application, installation and wiring of the heaters. Maximum working temperature must be maintained by an appropriate temperature control.

Flexible Heaters

Options

Watlow offers a variety of options such as attachment techniques, thermostats, special leads, holes and cutouts and three-dimensional shapes. These are all described in the introduction to flexible heaters section. In addition, the following option is available only on silicone rubber heaters.

Thermal Insulation



To increase the 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 inch (1.6, 3, 6, 10 or 13 mm). Heaters with thermal insulation are still quite flexible.

An aluminized surface can be added to the back of the heater to reduce radiated heat losses. This aluminized surface, called "Low Loss Treatment," adds very little to the unit thickness and maintains a very clean appearance.

Flexible Heaters

F.O.B.: Columbia, Missouri

Silicone Rubber/Wire-Wound

Wire-Wound Elements

Width in. (mm)	Length in. (mm)	Watts	120V~(ac) Code No.	120/240V~(ac) Code No.
1 (25)	2 (50)	10	010020C1*	
	3 (75)	15	010030C1*	
	4 (100)	20	010040C1*	
	5 (125)	25	010050C1*	
	5 (125)	6.25/25		010050C2*
	10 (255)	50	010100C1	
	10 (255)	12.5/50		010100C2*
	15 (380)	75	010150C1	
	15 (380)	18.75/75		010150C2
	20 (510)	100	010200C1	
	20 (510)	25/100		010200C2
	25 (635)	125	010250C1	
	30 (760)	150	010300C1	
	35 (890)	175	010350C1	
	40 (1015)	200	010400C1	
80 (2030)	400	010800C1		
120 (3050)	600	010F10C1		
2 (50)	2 (50)	20	020020C1*	
	5 (125)	50	020050C1	
	5 (125)	12.5/50		020050C2*
	10 (255)	100	020100C1	
	10 (255)	25/100		020100C2
	15 (380)	150	020150C1	
	15 (380)	37.5/150		020150C2
	20 (510)	200	020200C1	
	20 (510)	50/200		020200C2
	25 (635)	250	020250C1	
	30 (760)	300	020300C1	
	35 (890)	350	020350C1	
40 (1015)	400	020400C1		
3 (75)	3 (75)	45	030030C1	
	5 (125)	75	030050C1	
	5 (125)	18.75/75		030050C2
	10 (255)	150	030100C1	
	10 (255)	37.5/150		030100C2
	15 (380)	225	030150C1	
	15 (380)	56.25/225		030150C2
	20 (510)	300	030200C1	
	20 (510)	75/300		030200C2
	25 (635)	375	030250C1	
	30 (760)	450	030300C1	
	35 (890)	525	030350C1	
40 (1015)	600	030400C1		

CONTINUED

* These heaters are not recommended for curved or flexing applications - high resistance density.

Notes:

- Standard thickness 0.055 inch
- Stock heaters have standard lead length 12 inch UL® 1180 Teflon®
- UL® component recognition
- Silicone rubber wire-wound elements rated at 5 W/in²

Flexible Heaters

F.O.B.: Columbia, Missouri

Silicone Rubber/Wire-Wound Wire-Wound Elements (con't)

Width in. (mm)	Length in. (mm)	Watts	120V~(ac) Code No.	120/240V~(ac) Code No.
4 (100)	4 (100)	80	040040C1	
	5 (125)	100	040050C1	
	5 (125)	25/100		040050C2
	10 (255)	200	040100C1	
	10 (255)	50/200		040100C2
	15 (380)	300	040150C1	
	15 (380)	75/300		040150C2
	20 (510)	400	040200C1	
	20 (510)	100/400		040200C2
	25 (635)	500	040250C1	
	30 (760)	600	040300C1	
	35 (890)	700	040350C1	
40 (1015)	800	040400C1		
5 (125)	5 (125)	125	050050C1	
	5 (125)	31.25/125		050050C2
	10 (255)	250	050100C1	
	10 (255)	62.5/250		050100C2
	15 (380)	375	050150C1	
	15 (380)	9.375/375		050150C2
	20 (510)	500	050200C1	
	20 (510)	125/500		050200C2
	25 (635)	625	050250C1	
	30 (760)	750	050300C1	
	35 (890)	875	050350C1	
	40 (1015)	1000	050400C1	
6 (150)	5 (125)	150	060050C1	
	5 (125)	37.5/150		060050C2
	10 (255)	300	060100C1	
	10 (255)	75/300		060100C2
	15 (380)	450	060150C1	
	15 (380)	112.5/450		060150C2
	20 (510)	600	060200C1	
	20 (510)	150/600		060200C2
	25 (635)	750	060250C1	
	30 (760)	900	060300C1	
	35 (889)	1050	060350C1	
	40 (1016)	1200	060400C1	

Notes:

- Standard thickness 0.055 inch
- Stock heaters have standard lead length 12 inch UL® 1180 Teflon®
- UL® component recognition
- Silicone rubber wire-wound elements rated at 5 W/in²

Flexible Heaters

Flexible Heaters

Silicone Rubber/Wire-Wound

Wire-Wound Stock Heater Coding Configured Options

How to order

To order, complete the code 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 inch Sponge
- S = 1/8 inch Sponge
- T = 1/4 inch Sponge
- U = 3/8 inch Sponge
- V = 1/2 inch Sponge
- W = PSAS + 1/16 inch Sponge
- Y = PSAS + 1/8 inch Sponge
- 1 = PSAS + 1/4 inch Sponge
- 2 = PSAS + 3/8 inch Sponge
- 3 = PSAS + 1/2 inch 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
Y = B200	STD	STD
1 = B200	STD	ALT
2 = B200	ALT	STD
3 = B200	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 series with the heater; alternate location is rotated parallel with heater width; alternate wiring is separate leads for pilot control.

•For thermocouples, "J" standard is Teflon® insulation; "J" alternate is fiberglass insulation; "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

B200 Set °F

- 0 = None
- 2 = 100-500
- 3 = 25-330

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 foot HPN Set
- 9 = Type E Teflon®
- A = 1180VDE*
- B = 1199VDE*
- C = Silicone Leads W/Waterproof Cap
- E = SJO Cord
- F = 6 foot 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.

How to Order

To order stock silicone rubber heaters, specify the Watlow code number and the quantity. To order a heater with options, specify the code number, quantity and options desired. Consult Watlow before combining options.

Made-to-Order: Consult factory.

For **made-to-order** units, Watlow will need the following application information from you:

- Size (dimensions)
- Voltage
- Wattage/watt density
- Operating temperature
- Options (leads, thermostats, attachment techniques, etc.)
- Will heater be subject to flexing?
- Element type, if you have a preference
- Agency approvals
- Quantity

Availability:

Stock: Same day shipment of orders (with part number configuration -0001B) if received by 11:00 a.m. CST. All other modifications (other than -0001B) are modified stock and ship within five working days.

Flexible Heaters

F.O.B.: Columbia, Missouri

Silicone Rubber/Etched Foil

Etched Foil Elements

Width in. (mm)	Length in. (mm)	Watts	W/in ²	W/cm ²	120V~(ac) Code No.	120/240V~(ac) Code No.
1 (25)	5 (125)	25	5	(0.8)	F010050C3	F010050C8
	5 (125)	50	10	(1.6)	F010050C7	
	5 (125)	12.5/50	2.5/10	(0.4/1.6)		
	10 (255)	100	10	(1.6)	F010100C7	F010100C8
	10 (255)	25/100	2.5/10	(0.4/1.6)		
	15 (380)	150	10	(1.6)	F010150C7	
2 (50)	5 (125)	100	10	(1.6)	F020050C7	F020050C8
	5 (125)	25/100	2.5/10	(0.4/1.6)		
	10 (255)	200	10	(1.6)	F020100C7	
	10 (255)	50/200	2.5/10	(0.4/1.6)		F020100C8
	15 (380)	300	10	(1.6)	F020150C7	
	15 (380)	75/300	2.5/10	(0.4/1.6)		
3 (75)	20 (510)	400	10	(1.6)	F020200C7	F020200C8
	20 (510)	100/400	2.5/10	(0.4/1.6)		
	5 (125)	75	5	(0.8)	F030050C3	
	5 (125)	150	10	(1.6)	F030050C7	
	5 (125)	37.5/150	2.5/10	(0.4/1.6)		
	4 (100)	10 (255)	300	10	(1.6)	F030100C7
10 (255)		75/300	2.5/10	(0.4/1.6)		
15 (380)		450	10	(1.6)	F030150C7	
15 (380)		112/450	2.5/10	(0.4/1.6)		F030150C8
20 (510)		600	10	(1.6)	F030200C7	
20 (510)		150/600	2.5/10	(0.4/1.6)		
5 (125)	5 (125)	200	10	(1.6)	F040050C7	F040050C8
	5 (125)	50/200	2.5/10	(0.4/1.6)		
	10 (255)	400	10	(1.6)	F040100C7	
	10 (255)	100/400	2.5/10	(0.4/1.6)		F040100C8
	15 (380)	600	10	(1.6)	F040150C7	
	15 (380)	150/600	2.5/10	(0.4/1.6)		
6 (150)	20 (510)	800	10	(1.6)	F040200C7	F040200C8
	20 (510)	200/800	2.5/10	(0.4/1.6)		
	5 (125)	125	5	(0.8)	F050050C3	
	5 (125)	250	10	(1.6)	F050050C7	
	5 (125)	62.5/250	2.5/10	(0.4/1.6)		
	7 (175)	10 (255)	500	10	(1.6)	F050100C7
10 (255)		125/500	2.5/10	(0.4/1.6)		
15 (380)		750	10	(1.6)	F050150C7	
15 (380)		187/750	2.5/10	(0.4/1.6)		F050150C8
20 (510)		1000	10	(1.6)	F050200C7	
20 (510)		250/1000	2.5/10	(0.4/1.6)		
8 (200)	5 (125)	300	10	(1.6)	F060050C7	F060050C8
	5 (125)	75/300	2.5/10	(0.4/1.6)		
	10 (255)	600	10	(1.6)	F060100C7	
	10 (255)	150/600	2.5/10	(0.4/1.6)		F060100C8
	15 (380)	900	10	(1.6)	F060150C7	
	15 (380)	225/900	2.5/10	(0.4/1.6)		
9 (225)	20 (510)	1200	10	(1.6)	F060200C7	F060150C8
	20 (510)	300/1200	2.5/10	(0.4/1.6)		
	5 (125)	300	5	(0.8)	F060200C3	
	5 (125)	600	10	(1.6)	F060200C7	
	5 (125)	150/600	2.5/10	(0.4/1.6)		

Flexible Heaters

Notes:

- Silicone rubber etched foil elements 0.018 inch thick
- Stock heaters have standard lead length 12 inch UL® 1180 Teflon®
- UL® Component Recognition

Flexible Heaters

Silicone Rubber/Etched Foil

Etched Foil Stock Heater Coding Configured Options

How to order

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

Etched Foil
FO _____ -

Options
0 = None
A = PSAS Bottom
B = PSAS Top
K = PSAS and Low Loss
L = Low Loss
R = 1/16 inch Sponge
S = 1/8 inch Sponge
T = 1/4 inch Sponge
U = 3/8 inch Sponge
V = 1/2 inch Sponge
W = PSAS + 1/16 inch Sponge
Y = PSAS + 1/8 inch Sponge
1 = PSAS + 1/4 inch Sponge
2 = PSAS + 3/8 inch Sponge
3 = PSAS + 1/2 inch 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 series with the heater; alternate location is rotated parallel with heater width; alternate wiring is separate leads for pilot control.

- For thermocouples, "J" standard is Teflon® insulation; "J" alternate is fiberglass insulation; "K" standard is fiberglass insulation.

- Etched foil heaters 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 Foot HPN Set
9 = Type E Teflon®
A = 1180VDE*
B = 1199VDE*
C = Silicone Leads W/Waterproof Cap
E = SJO Cord
F = 6 foot 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

How to Order

To order stock silicone rubber heaters, specify the Watlow code number and the quantity. To order a heater with options, specify the code number, quantity and options desired. Consult Watlow before combining options.

Made-to-Order: Consult factory.

For **made-to-order** units, Watlow will need the following application information from you:

- Size (dimensions)
- Voltage
- Wattage/watt density
- Operating temperature
- Options (leads, thermostats, attachment techniques, etc.)
- Will heater be subject to flexing?
- Element type, if you have a preference
- Agency approvals
- Quantity

Availability:

Stock: Same day shipment of orders (with part number configuration - 0001B) if received by 11:00 a.m. CST. All other modifications (other than -0001B) are modified stock and ship within five working days.

Flexible Heaters

Silicone Rubber

Stock Product Offering

Composite Flexible Stock Heaters

The composite bonding industry is a large field that is expanding into a variety of areas. One of the primary fields that utilize flexible heaters for curing is the aerospace industry. Watlow offers a stock list of heaters commonly used for composite bonding and curing. The design includes equal length circuits and a no-heat tab for temperature uniformity. Also, the contact surface is made of a smooth silicone to prevent composite surface imperfections. The heaters are fiberglass reinforced to provide lasting field service durability and life.

Features and Benefits

Standard 5 W/in² (0.8 W/cm²)

- Meets composite industry specifications

120V~(ac) standard / 240V~(ac) (option) single phase

- Matches standard composite industry equipment

Customized leads

- Up to 40 feet of lead length

Field service ease

- Makes on-site repairs possible

Equal length circuits - minimum two-inch by two-inch tab with radius

- Creates temperature uniformity

Smooth contact surface

- Prevents composite surface imperfections

UL® recognized

- Available on many custom designs



Applications

- Aerospace industry
 - Repair
 - Fabrication
- Composite bonding processes

Flexible Heaters

F.O.B.: Columbia, Missouri

Silicone Rubber/Composite Heaters “L”

Wire-Wound Elements

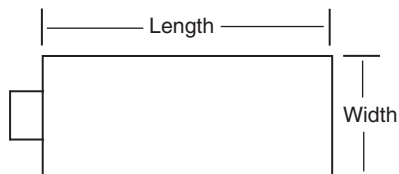
Width in. (mm)	Length in. (mm)	Watts	120V~(ac) Code No.	120/240V~(ac) Code No.
6 (150)	6 (152)	180	L060080C1	L060080C2
	6 (152)	180		
	10 (254)	300	L060120C1	L060120C2
	10 (254)	300		
8 (203)	8 (203)	320	L080100C1	L080100C2
	8 (203)	320		
	12 (305)	480	L080140C1	L080140C2
	12 (305)	480		
10 (255)	10 (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		

* Thermostat option is not available for this heater.

** Only T207 thermostat option is available.

Notes:

- Standard thickness 0.055 inch
- Standard lead length 12 inch UL® 1180 Teflon®
- UL® component recognition
- Silicone rubber wire-wound elements rated at 5 W/in²
- Length does not include two inch tab for leads
- Material A2
- For modification options use same options as foil heaters.



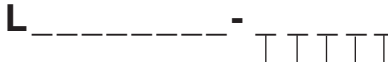
Flexible Heaters

Silicone Rubber/Composite Heaters "L"

Wire-Wound Elements

How to order
To order, complete the code number with the information below:

Composite Flexible Stock Heaters



Modification Options
0 = None
A = PSAS Bottom
B = PSAS Top
K = PSAS and Low Loss
L = Low Loss
R = 1/16 inch Sponge
S = 1/8 inch Sponge
T = 1/4 inch Sponge
U = 3/8 inch Sponge
V = 1/2 inch Sponge
W = PSAS + 1/16 inch Sponge
Y = PSAS + 1/8 inch Sponge
1 = PSAS + 1/4 inch Sponge
2 = PSAS + 3/8 inch Sponge
3 = PSAS + 1/2 inch 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 series with the heater; alternate location is rotated parallel with heater width; alternate wiring is separate leads for pilot control.

- For thermocouples, J standard is Teflon® insulation; J alternate is fiberglass insulation; K standard is fiberglass insulation.

- Etched foil heaters 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 foot HPN Set
9 = Type E Teflon®
A = 1180VDE*
B = 1199VDE*
C = Silicone Leads W/Waterproof Cap
E = SJO Cord
F = 6 foot 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.

Availability:

Stock: Same day shipment of orders (with part number configuration - 0001B) if received by 11:00 a.m. CST. All other modifications (other than -0001B) are modified stock and ship within five working days.

How to Order

To order stock silicone rubber heaters, specify the Watlow code number and the quantity. To order a heater with options, specify the code number, quantity and options desired. Consult Watlow before combining options.

Made-to-Order: Consult factory.

For **made-to-order** units, Watlow will need the following application information from you:

- Size (dimensions)
- Voltage
- Wattage/watt density
- Operating temperature
- Options (leads, thermostats, attachment techniques, etc.)
- Will heater be subject to flexing?
- Element type, if you have a preference
- Agency approvals
- Quantity

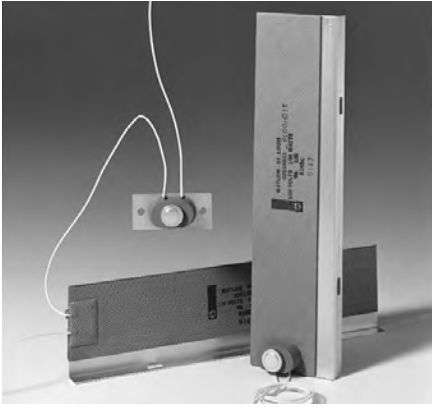
Flexible Heaters

Silicone Rubber

Enclosure Heaters

Stock Product Offering

Enclosure Heaters— Wire-Wound Only



Designed for freeze and condensation protection, Watlow's enclosure heaters are rugged, reliable and safe to operate. These rectangular-shaped, wire-wound silicone rubber heaters can be ordered by themselves with adhesive or vulcanized to an aluminum mounting plate. A thermostat can be attached to the heater or mounted separately. Pictured are units with thermostat on heater in foreground and heater with remote thermostat in background.

Performance Capabilities

- Watt density rating of 5 W/in² (0.8 W/cm²)
- Temperatures to 150°F (66°C)

Features and Benefits

Pressure sensitive adhesive, mounting to aluminum plate or customer cementing

- Reduces installation time
- Creates easy installation

Quick delivery on more than 72 variations

- Simplifies operation

No exposed electrical connections

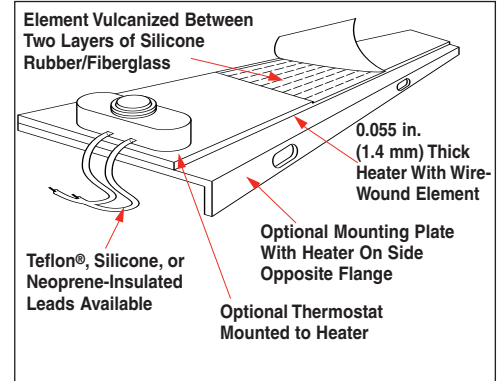
- Creates a safe and reliable operation

Custom leads

- Available in any length

Horizontal and vertical mounting

- Simplifies operation



Applications

Freeze or condensation prevention in housings containing electronic equipment. Examples include:

- Traffic signal boxes
- Automatic teller machines
- Temperature control panels
- Gas or liquid control valve housings

Applications and Technical Data

Determining Minimum Wattage Requirements for Enclosures

This chart is an excellent guide for determining total wattage requirements for both insulated

and uninsulated enclosures, assuming the box is relatively airtight. For windy conditions, add an additional 50 percent to the wattage requirement listed.

		Total Enclosure Surface Area*—Square Feet (Square Meters)													
		2 (0.2)	3 (0.3)	4 (0.4)	5 (0.5)	6 (0.6)	7.5 (0.7)	9 (0.8)	10 (0.9)	15 (1.4)	20 (1.9)	25 (2.3)	30 (2.8)	40 (3.7)	50 (4.7)
Temperature Rise from Ambient °F (°C)	20 (11)	30 10	40 10	55 15	70 20	80 20	100 25	120 30	135 35	205 50	270 65	335 80	405 100	540 130	670 160
	40 (22)	55 15	80 20	110 30	135 35	160 40	200 50	245 60	270 65	405 100	540 130	670 160	805 195	1075 260	1340 320
		90 20	120 30	160 55	205 50	245 60	300 75	365 90	405 100	605 145	805 195	1005 240	1210 290	1610 385	2010 480
	80 (44)	110 30	160 40	215 55	270 65	325 80	400 100	485 115	540 130	805 195	1075 260	1340 320	1610 385	2145 515	2680 640
		135 35	200 50	270 65	335 80	405 100	500 125	605 145	670 160	1005 240	1340 320	1675 400	2010 480	2680 640	3350 800
	120 (67)	165 40	240 60	320 80	405 100	485 115	600 150	725 175	805 195	1210 290	1610 385	2010 480	2415 580	3220 770	4020 960
		190 45	280 70	375 90	470 115	565 135	700 175	845 205	940 225	1410 340	1880 450	2345 560	2815 675	3755 900	4690 1120

□ Uninsulated boxes □ Insulated boxes

*Note: Area = 2 X (L X W + L X H + W X H); Square feet = (square inch) divided by 144.

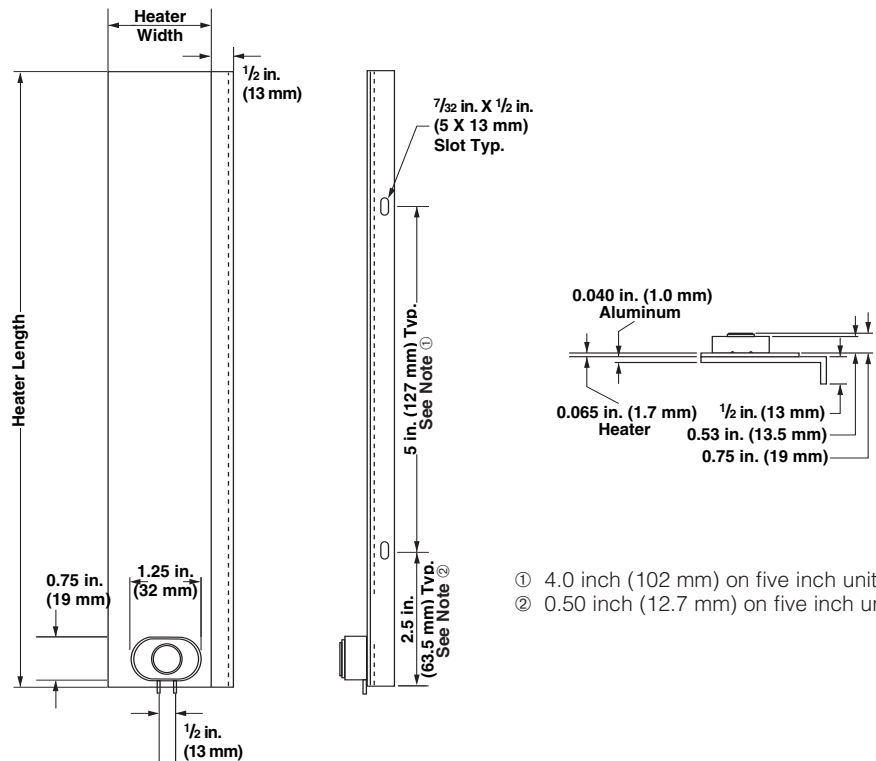
Flexible Heaters

Silicone Rubber Enclosure Heaters Stock Product Offering *Enclosure Heaters* Options

Aluminum Mounting Plate

Both vertical and horizontal mounting can be accomplished with enclosure heaters. The mounting plates are 0.040 inch (1 mm) thick, specified as #3003 H14 aluminum. The preferred orientation is vertical, with a thermostat attached at the lower end (as shown in the drawing).

For horizontal mounting, a remote thermostat is recommended. An enclosure heater can be ordered by itself, with PSAS or vulcanized to an aluminum mounting plate. See *Thermostats* below for more information.



- ① 4.0 inch (102 mm) on five inch unit.
- ② 0.50 inch (12.7 mm) on five inch unit.

Thermostats

Mounted on Heater

Built-in snap action thermostats from Watlow are designed to sense air temperature. See the ordering chart on the following page for available settings.

Remote From Heater

For an air sensing thermostat separate from the heater, the ST-207E is ideal. This is a modified ST-207 mounted on a 1/32 inch (0.8 mm) thick G-10 circuit board with the thermostat's metal cap exposed to sense air temperature. The thermostat is placed at the

midpoint of the lead length. The sensor can be preset at the temperatures listed for integral sensors.

Notes:

- On both integral and remote sensors, the thermostat's exposed metal cap is vulnerable to impact. This could defeat the thermostat's switching action and cause heater malfunction.
- T-10 thermostats are not recommended for enclosure heating applications.

Flexible Heaters

Silicone Rubber

Drum Heaters

Stock Product Offering

Drum Heaters

Performance Capabilities

- Available with fixed or adjustable thermostats for temperatures up to 165°C (330°F)
- Watt density of 6 W/in² (1 W/cm²)

Features and Benefits

Protects fluids stored in drums

- Prevents fluids from freezing

Quick delivery on 28 styles from stock

- Simplifies operation

Includes six-foot cord and plug set

- Allows for application convenience

Custom heaters

- Available for non-standard sizes

Applications

- Freeze protection
- Viscosity control

Application Hints

- Allow a three-inch (76 mm) gap between heater ends when clamped around a drum.
- Heaters with thermostat settings of 4°C and 16°C (40°F and 60°F) will have open circuit readings if room temperature exceeds the thermostat settings.
- Heaters cannot be bench tested since the thermostat is located over a no-heat section of the heater. Accurate testing of the heater requires it to be placed over the drum which is to be heated.
- When a single heater is used, place the heater at the bottom of the drum to minimize stratification.

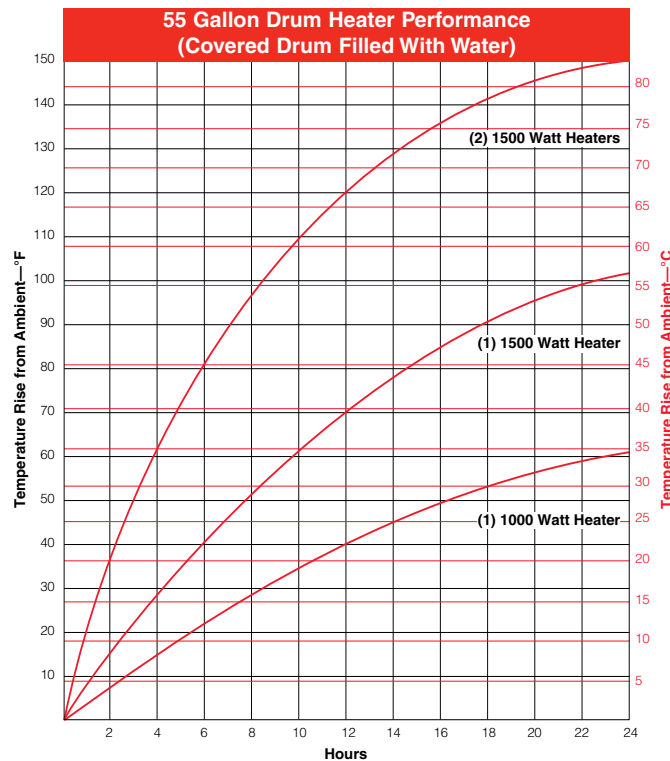


Standard Features

Watlow flexible drum heaters are designed for use on 5-, 30-, and 55-gallon metal drums. They come with the following standard features:

- Six-foot (1.8 m) cord and plug set
- Latch fasteners and springs

- Two styles of thermostats:
 - T-207 snap action, available on all sizes
 - B-200-3 adjustable, available only on four-inch (100 mm) wide units, and mounted in a silicone rubber boot to protect it from contamination



Determining Temperature Rise From Ambient

The total wattage (number of heaters and the material being heated) must be considered when estimating the

actual temperature the contents of the drum will reach. The graph above shows the temperature rise from ambient conditions, not drum content temperature.

Flexible Heaters

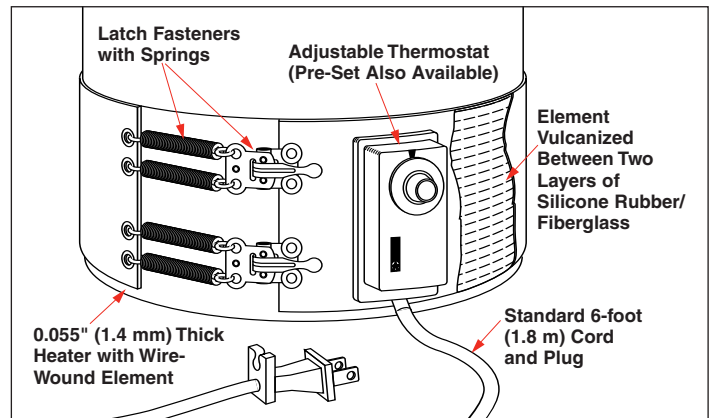
F.O.B.: Columbia, Missouri

Silicone Rubber

Drum Heaters

Stock Product Offering

Drum Heaters



Drum Size	Volts	Watts	Width in. (mm)	Thermostat	Availability	Code No.
5 gal. (20 L) 11 1/2 in. (290 mm) nom. diameter	120	650	4 (100)	(no thermostat)	Stock	04031500A
				66°C (150°F)	Modified Stock	04031500BT
				38°C (100°F)	Modified Stock	04031500CT
				4°C (40°F)	Modified Stock	04031500DT
				16°C (60°F)	Modified Stock	04031500HT
				Adj. -5°-165°C (25°-330°F)	Stock	04031510
30 gal. (115 L) 18 1/2 in. (470 mm) nom. diameter	120	750	2 1/16 (70)	(no thermostat)	Stock	02655080A
				66°C (150°F)	Modified Stock	02655080BT
				38°C (100°F)	Modified Stock	02655080CT
				4°C (40°F)	Modified Stock	02655080DT
				16°C (60°F)	Modified Stock	02655080ET
55 gal. (210 L) 22 1/2 in. (570 mm) nom. diameter	120	1000	2 1/16 (70)	(no thermostat)	Stock	02667700A
				66°C (150°F)	Modified Stock	02667700BT
				38°C (100°F)	Modified Stock	02667700CT
				4°C (40°F)	Modified Stock	02667700DT
				16°C (60°F)	Modified Stock	02667700ET
55 gal. (210 L) 22 1/2 in. (570 mm) nom. diameter	120	1500	4 (100)	(no thermostat)	Stock	04067700A
				66°C (150°F)	Modified Stock	04067700BT
				38°C (100°F)	Modified Stock	04067700CT
				4°C (40°F)	Modified Stock	04067700DT
				16°C (60°F)	Modified Stock	04067700GT
				Adj. -5°-165°C (25°-330°F)	Stock	04067710
55 gal. (210 L) 22 1/2 in. (570 mm) nom. diameter	240	1500	4 (100)	(no thermostat)	Stock	04067701A
				66°C (150°F)	Modified Stock	04067701BT
				38°C (100°F)	Modified Stock	04067701CT
				4°C (40°F)	Modified Stock	04067701DT
				16°C (60°F)	Modified Stock	04067701ET
				Adj. -5°-165°C (25°-330°F)	Stock	04067711

① Supplied with 6-foot (1.8 m) cord—no plug.

How to Order

After determining the drum size, volts, watts and temperature sensing requirements, specify the corresponding Watlow code number and quantity desired.

Availability

Stock: Drum heaters without thermostats and those with adjustable thermostats are available for same day shipment if order is received by 11:00 a.m. CST.

Modified Stock: Drum heaters with pre-set thermostats require two to three days lead time before being shipped.

Made-to-Order: Consult factory

Flexible Heaters

Silicone Rubber

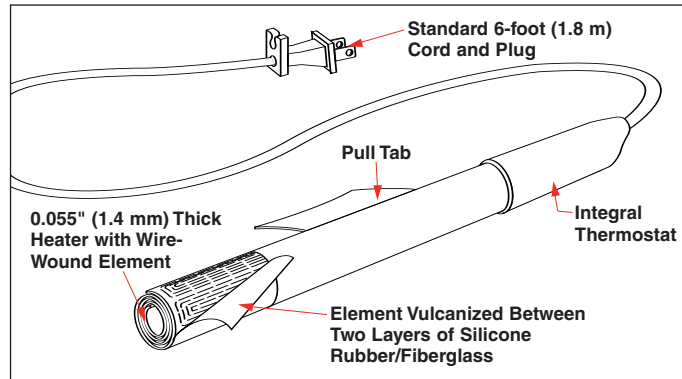
Conduit Heaters

Stock Product Offering

PVC Wire-Wound Conduit Heaters

Watlow's conduit heater simplifies bending PVC plastic conduit to the desired shape right on the job site. Just plug it in and within four to 18 minutes—depending upon heater size—the conduit is ready to be formed by hand into the shape or radius you need.

This lightweight silicone rubber heater is easily wrapped around the conduit because of its flexible, self-conforming construction.



Performance Capabilities

- Operating temperatures to 121°C (250°F)
- Handles plastic conduits as large as four inches (100 mm) in diameter

Features and Benefits

Self-conforms to cylindrical shapes

- Fits snugly around the conduit

Portable design

- Makes it easy to use in the field

Included thermostat

- Prevents overheating

Pull tab

- Allows for easy removal or positioning when heater is hot

Immediate delivery

- Simplifies operation

F.O.B.: Columbia, Missouri

Conduit Diameter in. (mm)	Length in. (mm)	Watts	Volts	Temp. Limit °F (°C)	Warm-up Time	Code No.
½ to 1 ½ (15-40)	12 (300)	180	120	250 (121)	4-10 minutes	05712082
2 to 4 (50-100)	25 (635)	950	120	250 (121)	7-18 minutes	14825081

How To Order

Choose between the two sizes available. Specify the Watlow code number and quantity desired.

Availability

Stock: Both sizes are available for immediate delivery from stock.

Made-to-Order: Consult factory