



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/in² (12.5 W/cm²), 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

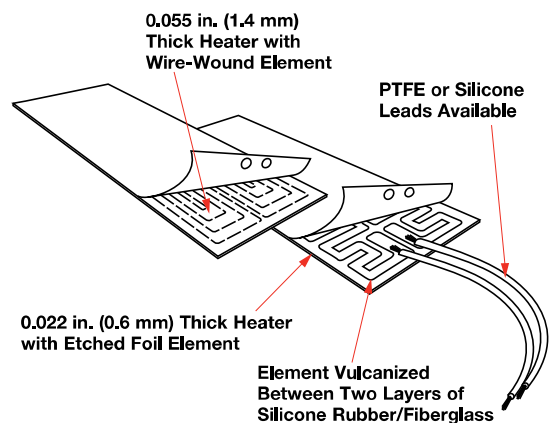
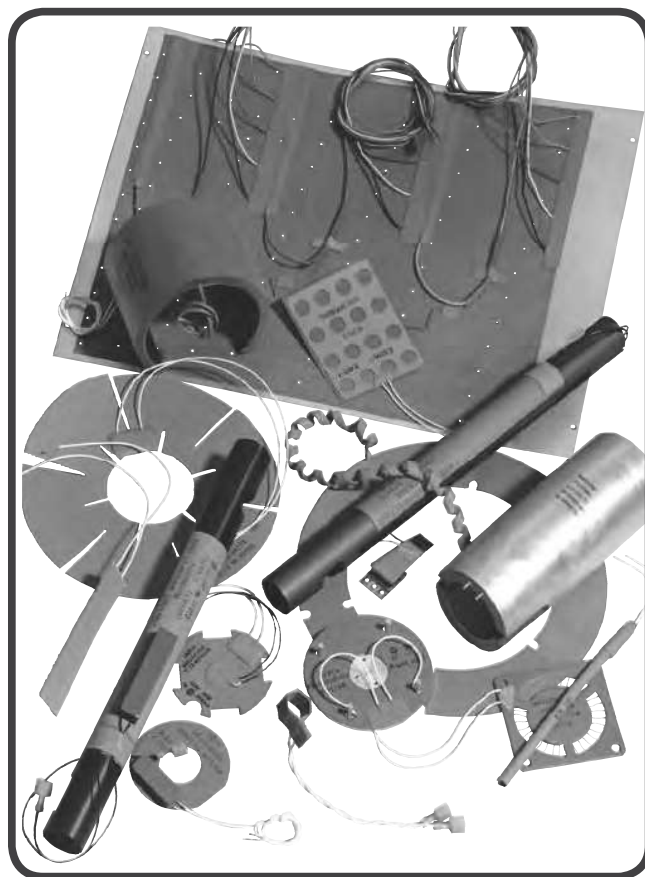
- Provides longer heater life

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





Silicone Rubber Heaters

Applications and Technical Data

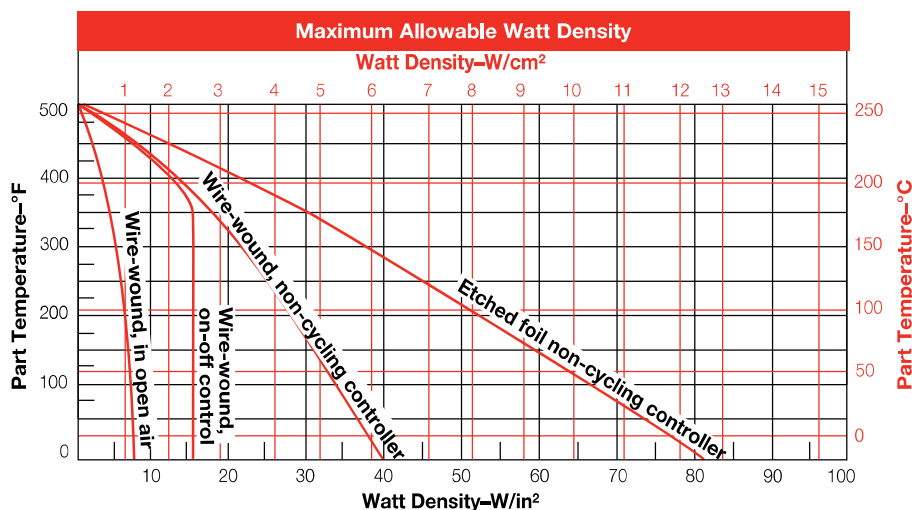
Determining Watt Density

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/in² (3.7 W/cm²) maximum. An etched foil heater operating under the same conditions can be rated at 45 W/in² (7 W/cm²) maximum.



Silicone Rubber Specifications

Max. width x max. length

- Wire wound: 36 x 95 in. (914 mm x 2413 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/ft² (0.24 g/cm²)
- Etched foil: 3 oz/ft² (0.09 g/cm²)

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%



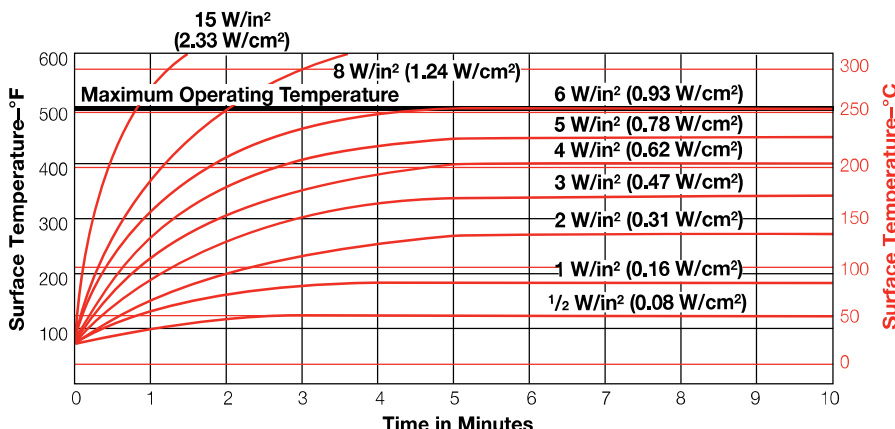
Silicone Rubber Heaters

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, integrated controls, thermostats, special leads, holes and cutouts and three-dimensional shapes as described in the introduction to flexible heaters section.

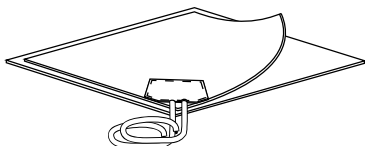


Silicone Rubber Heaters

Mounting Methods

Watlow offers various attachment techniques designed for fast installation.

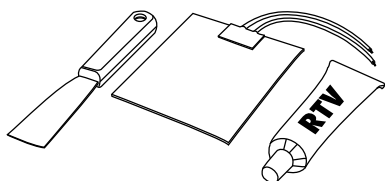
Pressure Sensitive Adhesive Surface (PSAS)



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/in² (1.5 W/cm²). 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.

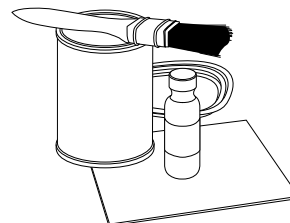
Field Applied Adhesive



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.

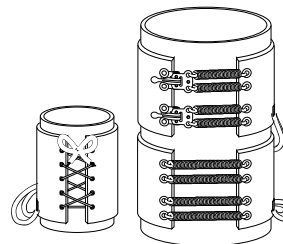
Note: Not recommended for polyimide heaters.

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

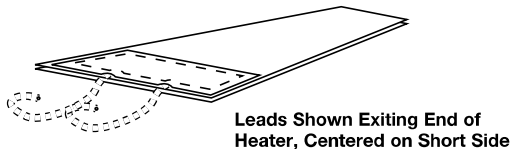


Silicone Rubber Heaters

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



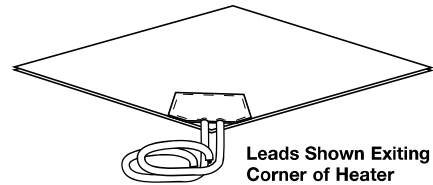
Watlow's leads are 12 in. (305 mm) long, white, PTFE insulated, flexible, plated copper UL® 1180 CSA wire. Leads are rated for 392°F (200°C)/300V. Lead connections on or at the heater are insulated with a cap of sheath material vulcanized to the heater body.

PTFE Leads



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

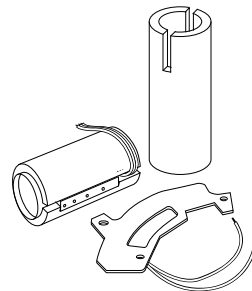
Silicone Insulated Leads



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

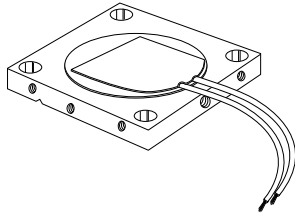
**EXTENDED
CAPABILITY**



Extended Capabilities for Silicone Rubber Heaters

Mounting Methods

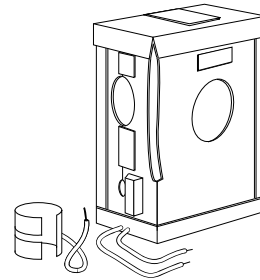
Factory Bonding



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.

Construction

Formed Heaters



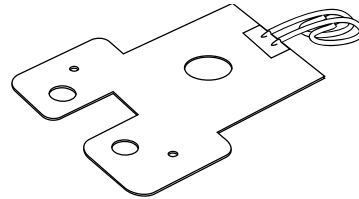
Many three-dimensional shapes, such as cylinders, cones and boxes, can be factory formed. Semi-rigid shapes can self-grip to the part. Special tooling may be required for some designs.

Integrated Control



The SERIES EHG® is an integrated multi-function controller that is a key component in a powerful system that integrates a heater, an adjustable set point temperature controller, a high/low temperature alert, a power switching device and a high temperature safety limit. The agency recognized controller/safety limit meets UL® and CE requirements.

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.



Silicone Rubber Heaters

Wire-Wound Elements

Width in. (mm)	Length in. (mm)	Watts	120VAC Part Number	120/240VAC 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

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

Notes:

- Thickness 0.055 in. (1.4 mm)
- UL® component recognition available
- Silicone rubber wire-wound elements rated at 5 W/in² (0.78 W/cm²)



Silicone Rubber Heaters

Wire-Wound Elements (Continued)

Width in. (mm)	Length in. (mm)	Watts	120VAC Part Number	120/240VAC 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	
	35 (889)	700	040350C1	
	40 (1016)	800	040400C1	
5 (127)	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	
	30 (762)	750	050300C1	
	35 (889)	875	050350C1	
	40 (1016)	1000	050400C1	
6 (152)	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	



Silicone Rubber Heaters

Wire-Wound Elements 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.