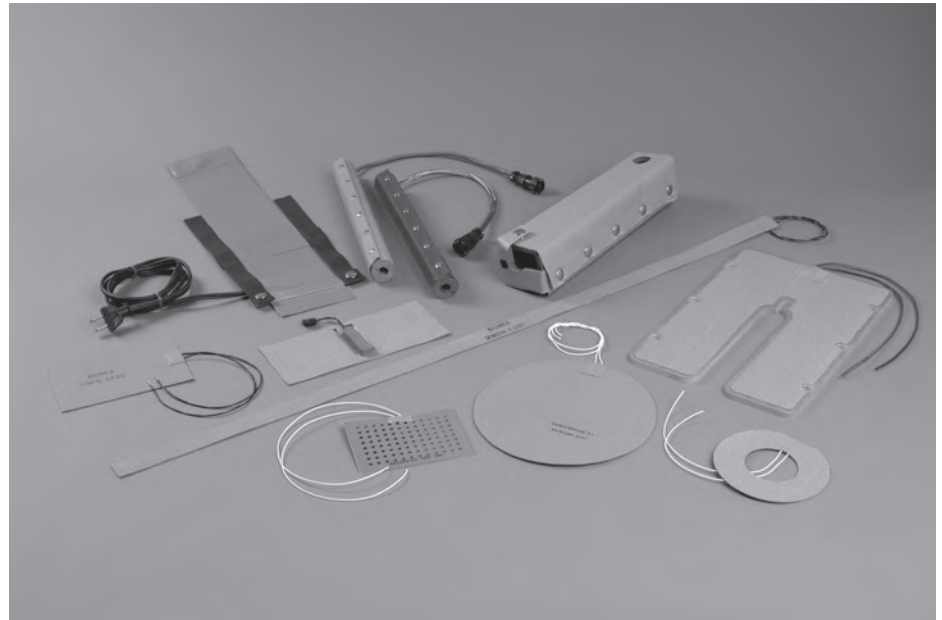




SILICONE RUBBER HEATERS

Silicone rubber heaters permit composite bonding and curing, as well as freeze protection, condensation prevention, and various repair and fabrication operations in many industries. Equal length circuits and a “cool tab” are provided, while a fiberglass reinforced heater cover means long service life and superior durability. Silicone rubber heaters can be easily bonded to heat sinks and other parts.



FEATURES:

- Standard watt density: 5 W/in²
- UL recognition available
- Many stock sizes, contact Sales for details
- Chemical, moisture, oil, and solvent resistance
- Available with wire wound or etched foil elements
- Operate in temperatures from -60°F to +450°F (-50°C to +230°C)
- Conform to almost any shape

TYPICAL APPLICATIONS:

- Food Service
- Medical Imaging
- Image Setting
- Photo Developing
- Photocopiers
- Composite Bonding
- Glue Curing
- Aerospace Instrumentation
- Fluid Line Freeze Protection
- Motor Dehumidification



SILICONE RUBBER HEATERS

ETCHED FOIL HEATERS

Creating etched foil silicone rubber heaters is a five step process.

1. The heaters start as sheets of metallic foil and silicone rubber laminate.
2. The designed circuit is photo imaged on the sheets.
3. The sheets are chemically etched until only the designed portion remains.
4. Individual heaters are cut from the sheets.
5. A top layer of silicone rubber laminate is applied to each circuit, followed by the termination.

Etched foil heaters are very economical for small, complex circuits that would be costly to create with wound wire.

SPECIFICATIONS

- **Sizes:** up to 12" x 60"
- **Standard Thicknesses:** .030" or .043"
- **Maximum Operating Temperature:** 450°F (230°C)
- **Minimum Operating Temperature:** -60°F (-50°C)
- **Standard Maximum Resistance Density:** 75 ohms/in²
- **Standard Dimensional Tolerances:** Less than 12" ± .062 , Greater than 12" ± .125
- **Maximum Watt Density:** 60 W/in² (depending on application)
- **Maximum Voltage:** 600 volts
- **Wattage Tolerance:** ±10% standard

WIRE WOUND HEATERS

Wire wound silicone heaters feature multiple strands of resistance wire that have been wound together. Selections are made to determine the resistance and flexibility of the heater. Then, the wound element is transferred to one layer of silicone rubber, while a second layer is positioned over the element to complete the heater. Larger heaters are more economical when wire wound since no material is wasted. Because of their size, large silicone rubber heaters are costly and wasteful to etch.

SPECIFICATIONS

- **Sizes:** up to 36" wide x (consult factory)
- **Standard Thicknesses:** .030", .043", or .056"
- **Max. Operating Temp:** 500°F (260°C) intermittent
- **Minimum Operating Temperature:** -60°F (-50°C)
- **Standard Maximum Resistance Density:** 55 ohms/in²
- **Standard Dimensional Tolerances:** Less than 12" ± .062 , Greater than 12" ± .125
- **Maximum Watt Density:** 5 watts/in² (depending on application) Consult Factory for higher densities
- **Maximum Voltage:** 600 volts
- **Wattage Tolerance:** ±10% standard



SILICONE RUBBER HEATERS

MOUNTING OPTIONS

Vulcanizing:

Silicone rubber heaters are most effectively attached to factory surface parts through vulcanization. Using a heat and pressure process, Durex Industries' silicone rubber heaters can be bonded to a metal surface with no adhesive. The resulting bond is not only strong, but it also allows excellent heat transfer. This method permits higher watt densities and temperatures than other methods while still operating safely.

Silicone RTV:

Silicone RTV is a liquid silicone adhesive that can be used to bond silicone rubber heaters to a surface. It is important that the surface is clean and free from any bumps or grooves to ensure an even bond. Without an even bond, heat can not be evenly transferred and overheating can occur. RTV cures at room temperature and requires humidity to cure properly. To guarantee moisture, place a humidifier near the heater or a moist towel over it if the environment is dry.

Pressure Sensitive Adhesive:

Silicone rubber heaters can also be applied with a pressure sensitive adhesive. First, ensure that the heater is being applied to a clean surface. The heater should then be rolled in place to eliminate any air bubbles that would compromise the bond. Large, heavy heaters may not effectively bond with PSA as their weight can pull them off the surface as temperatures rise. PSA does have a limited shelf life.

Mechanical Bonding:

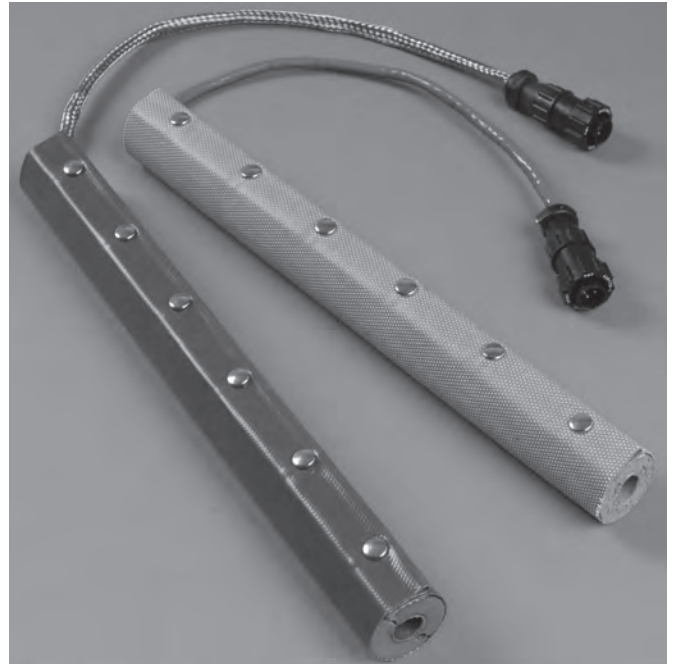
If heaters need to be removable, mechanical bonding options may be ideal. These include lacing eyelets, spring and eyelet combinations, boot hooks, boot type fasteners, snaps, and hook and loop velcro type fabric straps. Clamps can also be used. The surface must be free of dirt and any chemicals that might harm the silicone. The surface should also be examined for sharp protrusions that could pierce the heater. Insulation can be used to direct heat towards the surface and cushion the heater during compression.



INSULATED GAS LINE HEATERS

Uniform gas temperature in delivery lines is critical to eliminate condensation and contamination of the wafer process.

Durex Industries introduces improved gas line heater designs to maximize heat profile uniformity and prevent unwanted thermal gradients that lead to reduced yields and tool downtime.

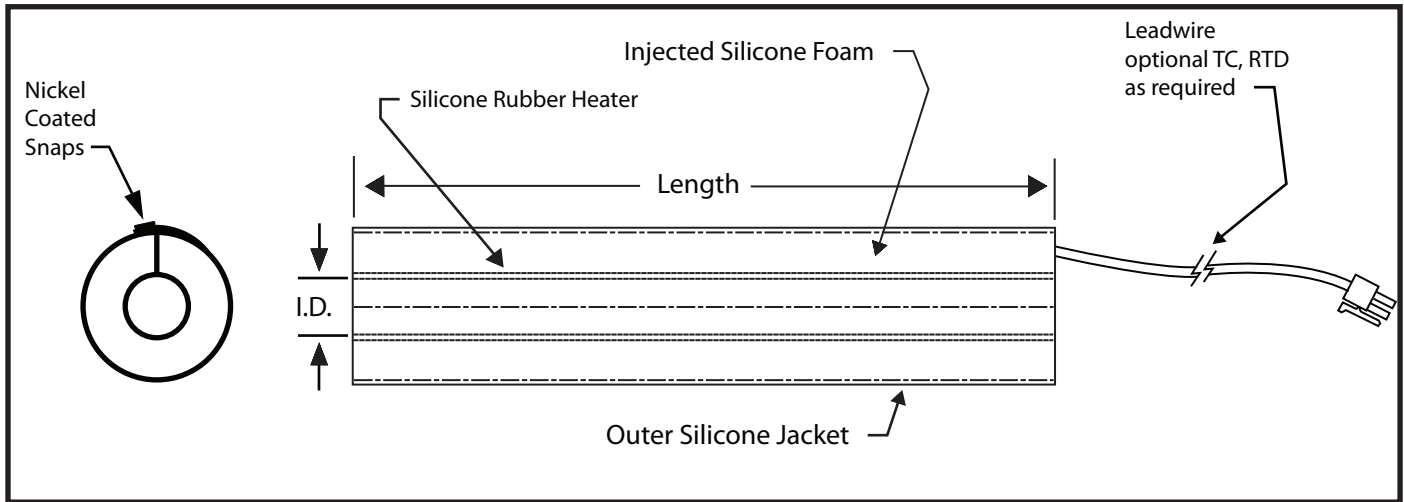


FEATURES:

- Uniform or profiled heat throughout or in discrete zones.
- Integral temperature control with embedded thermocouples, thermostats, RTD's, and/or thermistors.
- Surface temperature isolated by insulation provides operator safety.
- Nickel coated snaps for clean room compatibility.
- Post cured to eliminate outgassing.
- Termination area engineered to assure temperature uniformity.
- Foam molded parts for precision fit.
- Molded foam creating faster ramp and more uniform soak.
- Series or parallel wiring for ease of installation.



INSULATED GAS LINE HEATERS



PHYSICAL SPECIFICATIONS

- Maximum operating temperature 475°F (246°C).
- Insulation thickness of .250", .375", or .500".
- Designed to fit lines from 0.250" O.D. to 4.0" O.D.
- Leadwire insulation and configuration designed to suit the application.
- Heater jacket constructed of fiberglass reinforced silicone sheet material.
- Available in orange and gray.

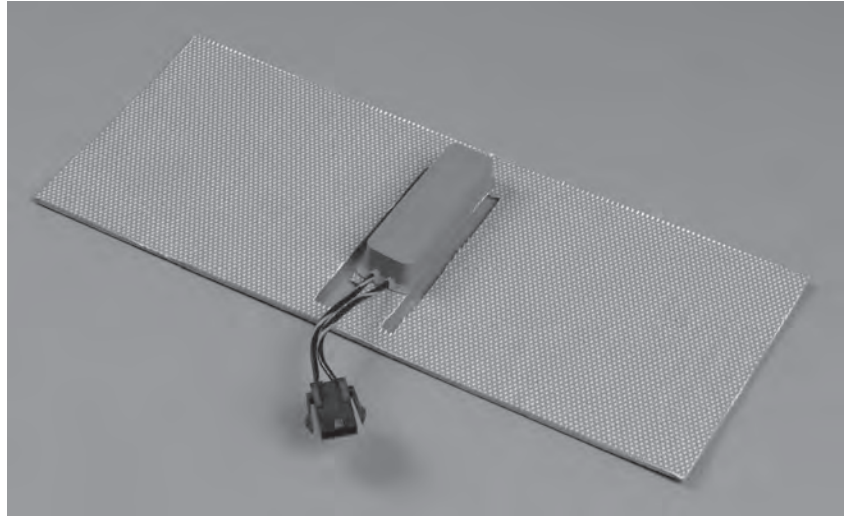
ELECTRICAL SPECIFICATIONS

- Watt density from 1-5 watts/in².
- Heaters can be designed with input voltages from 12 V to 240 V based on amperage.
- Typical electrical terminations are Amp connectors rated up to 10 amps.
- Integral temperature control utilizing thermocouple, RTD, or thermostat.
- Interconnect sections up to 10 amps.



SILICONE RUBBER TEMPERATURE CONTROL OPTIONS

One way of providing temperature control of surface heaters is a built-in thermostat. Wired to the heater, the thermostat can be mounted over a heated section to sense the heater's temperature or over a cold section to indirectly sense the temperature of the part.



When mounted over a cold section,

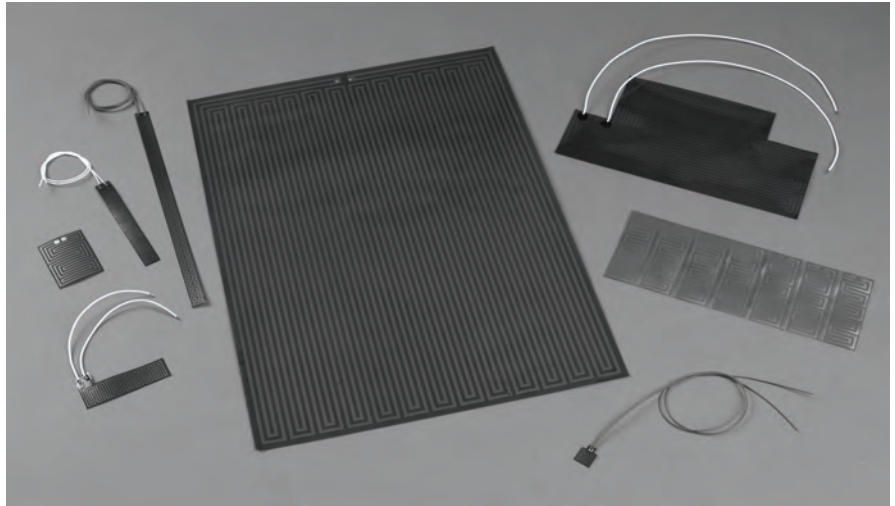
the thermostat avoids limiting the temperature of the heating element. Thermostats can be preset with a wide variety of ranges. Silicone Rubber heaters can also feature a thermal switch or an adjustable thermostat. If chosen, the temperature should be increased slowly over time to determine the proper thermostat setting.

SENSORS

Other temperature control options include thermocouples, RTD's, and thermistors. Multiple thermocouple types are available and can be mounted over heated or cold sections. Specify when ordering. RTD's provide accuracy and stability since their resistance increases as the temperature of the heater rises. Thermistors are also resistance-based, but are ideal for limited temperature ranges or a specific single temperature.

KAPTON® FLEX HEATERS

Kapton® flexible heaters offer superior tensile strength and tear resistance with precision heat distribution. They are ideal for extreme temperature environments. Kapton® is an organic polymer with very high dielectric capabilities, while providing



superior resistance to most solvents, oils, even radiation. For temperature control on Kapton® heaters, Durex recommends an RTD or thermocouple. Sensors are mounted to the surface of the heater and send a resistance measurement to an external controller that cycles the heater at a set temperature.

FEATURES:

- Operate in extreme temperatures: -319°F to +500°F (-195°C to +260°C)
- Thickness can range from 0.006" to 0.012" (.0002 to .0004mm), and up to 16" x 29" (475 mm x 660 mm)
- Watt density of 5 W/in² (0.8 W/cm²) standard with units available up to 50 W/in² (7.8 W/cm²)
- Transparent Kapton® film allows easy visual inspection on the internal structures
- Etched foil heating elements
- Kapton®, Teflon®, or Silicone leads are available

TYPICAL APPLICATIONS:

- Vacuum Chambers
- Incubators
- Shrink Film Packaging
- Semiconductor Processing
- Telcom Packaging
- ATM's
- Platen Heating
- Laser Printing
- Autoclaves



KAPTON® FLEX HEATERS

MOUNTING OPTIONS

Pressure Sensitive Adhesive:

PSA is the most common option for mounting Kapton® heaters. By selecting proper materials, including the release agent, you can promote a strong bond and effective heat transfer.

Clamping:

Kapton® heaters can also be clamped to their heating surface. A pressure plate is then fastened in place. To ensure even distribution of heat, and to protect the heater, a pressure pad or insulation layer is advised. The work surface should be free of any debris, dirt, chemicals, bumps, or grooves. This will protect the heater as well as prevent overheating.

Self-Fusing Tape:

When mounting to a smooth cylindrical surface, Kapton® heaters can be mounted with self-fusing tape. This will provide a safe operation and even transfer of heat.

SPECIFICATIONS

- **Sizes:** up to 16" x 29"
- **Standard Thickness:** .007" in
- **Maximum Watt Density:** 50 W/in²
(depending on application)
- **Standard Maximum Resistance Density:** 100 ohms/in²
- **Standard Dimensional Tolerances:** Less than 12" ± .062 , Greater than 12" ± .125
- **Maximum Operating Temperature:** 500°F (260°C)
- **Minimum Operating Temperature:** -319°F (-195°C)
- **Wattage Tolerance:** ±10%
- **Dielectric Strength:** 1000 VAC