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Flexible Electric Heating System Design

Heating Cables

NPH Heating Cables, both Constant-Wattage and Self-Limiting, are designed for freeze protection and process temperature maintenance anywhere temperature has to be maintained under changing ambient conditions.

Self-Limiting Heating Cables

Heating Tapes

NPH flexible heating tapes, both Fiberglass and Extruded Silicone Rubber, can be used on any surface or body requiring fast and efficient direct contact heat. They are used extensively in high-temperature applications and in laboratories for special vessel and liquid transfer systems.

Heating Tapes

Heating Blankets

NPH Silicone Rubber Laminated (SRL) and Molded Silicone Rubber (SRE) heating blankets are designed for freeze protection and process temperature control on large surfaces where low watt density heat is desired.

Heating/Insulating Jackets

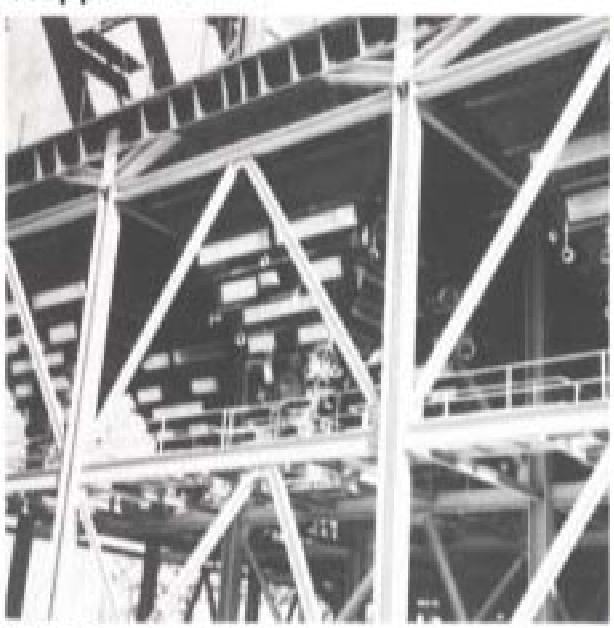
NPH fiberglass and Samox® Heating and Insulating jackets provide high thermal efficiency with exposure temperatures up to 900° F and 1,400° F, respectively, and are adaptable to any complex surface. These conforming jackets provide intimate contact with the surface of the vessel, eliminating air pockets to provide even, efficient heating and insulation. BriskHeat Insulating Jackets are also available for applications where the addition of heat is not required.

Drum Heaters

Hopper Heaters

NPH Hopper Heaters are designed specifically for pollution-control applications, particularly the prevention of moisture buildup that causes fly ash plugging, and the buildup of corrosive acids in hopper systems.

Hopper Heaters



Temperature Control Systems

The accuracy of any heating system depends on the sensitivity of its controls to detect precise operating temperatures. BriskHeat's electrical engineers will custom-design control systems that provide the most efficient and effective monitoring and control of your system.

Heating and Insulating Jackets

Drum Heaters

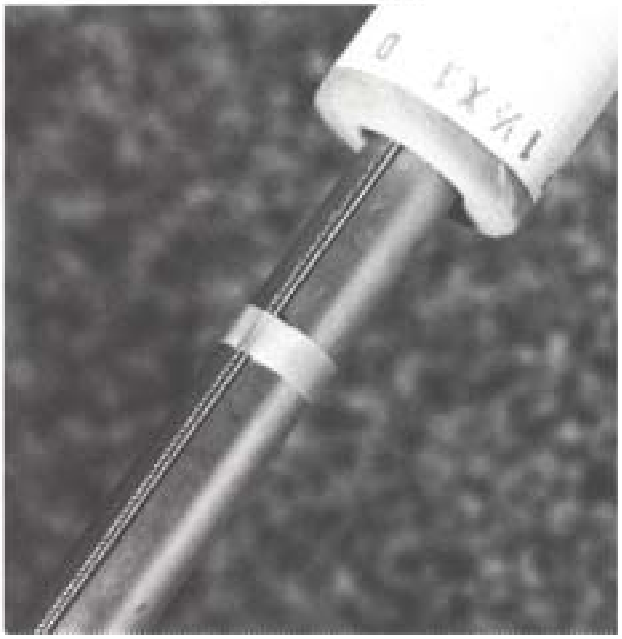
NPH (SRL) and Silicone Rubber Hazardous Area (SRH) drum heaters are electrical resistance heaters in blanket form, designed to provide a means of freeze protection and viscosity control. The NPH "thin-line" design lets you use a standard drum and cradle without modifying either.

Temperature Controllers and Control Systems

High Temperature Wire

NPH high-temperature lead and hookup wires KGT/KGS© are designed to withstand continuous operating temperatures of 250° C.

Constant Wattage Heating Cables



System Design

Pipe and Valve Temperature Maintenance: The Basic Steps

Definition of Heat Loss and Inherent Factors

Heat Loss is the amount of heat given up to the surrounding atmosphere through a combination of conduction, convection, and radiation. Required parameters to determine total heat losses on a given pipe or vessel include several of the following:

1. The temperature to be maintained
2. The lowest expected ambient temperature
3. Type, size and run length of tubing
4. The type and thickness of thermal insulation to be used
5. Heat loss from the surface of the material or vessel
6. Losses through the vessel wall and insulation
7. Specific heat of the material being heated
8. Flow rate
9. Dimensions and weight of the vessel and the material being heated
10. Heat carried away by products being processed through the heated area
11. Specified heat-up time
12. Type and number of valves and supports

Pipe Temperature Maintenance

To determine the actual heat loss from piping valves, supports, etc. that must be replaced by the heating cables, simply include the following steps in your calculation:

1. Determine the ΔT (the difference between low ambient and operating temperature)

2. Using ΔT and the insulation thickness to be used, determine the heat loss in watts per lineal foot of pipe using the Heat Loss Chart for Pipes (Table 2 Series) (Watts per Linear Foot).
3. Multiply the result obtained in step 2 by the appropriate factor from the Insulation Factor Chart (Table 3.a). The resulting number is the heat loss expressed in watts per lineal foot of pipe to be made up by the heat tracer.
4. Determine the cable most appropriate for your system based on the temperature to be maintained, environment, length of the run, and the voltages available; using the BriskHeat CAB Heating Cable Specifications and Ratings Comparison Charts (Table 14 Series).
5. If the watts-per-foot rating of the cable selected is more than the heat loss per foot, a straight run may be used. If it is less, you should:
   a. use a higher wattage cable, or
   b. use multiple straight runs, or
   c. spiral-wrap the cable on the pipe, or
   d. use insulation with a higher insulation factor, or
   e. use thicker insulation
      i. *(Multiple straight runs are preferred over spiraling in most applications because fewer power points along the pipe are required and insulating is easier.)*
6. If spiraling is used, determine the wrapping factor by dividing the watts per lineal foot of heat loss from Step 3 by the wattage rating of the selected heat tracer. A wrap factor of less than 1.0 indicates that a straight run of cable will provide adequate heat. For ease of installation, it is also recommended that multiple straight runs be used for wrapping factors of more than 2.0.
7. Using the wrapping factor from Step 7, determine the pitch distance for the pipe size being used from the Spiral Pitch Table (Table 7 Series).

It is also necessary to determine the valve and pipe support heat loss by following the steps below:

8. Determine the heat-loss multiplication factor for valves for the corresponding pipe size using Heat Loss Multiplication Factors for Valves (Table 3.b). Multiply this factor by the heat loss value determined in Step 3. This heat loss figure is based on a typical gate valve with insulation coverage to include the body, flange, and bonnet of the valve. If pipe supports are part of the system, the heat loss calculation for each support should be made in the same manner as for a valve.

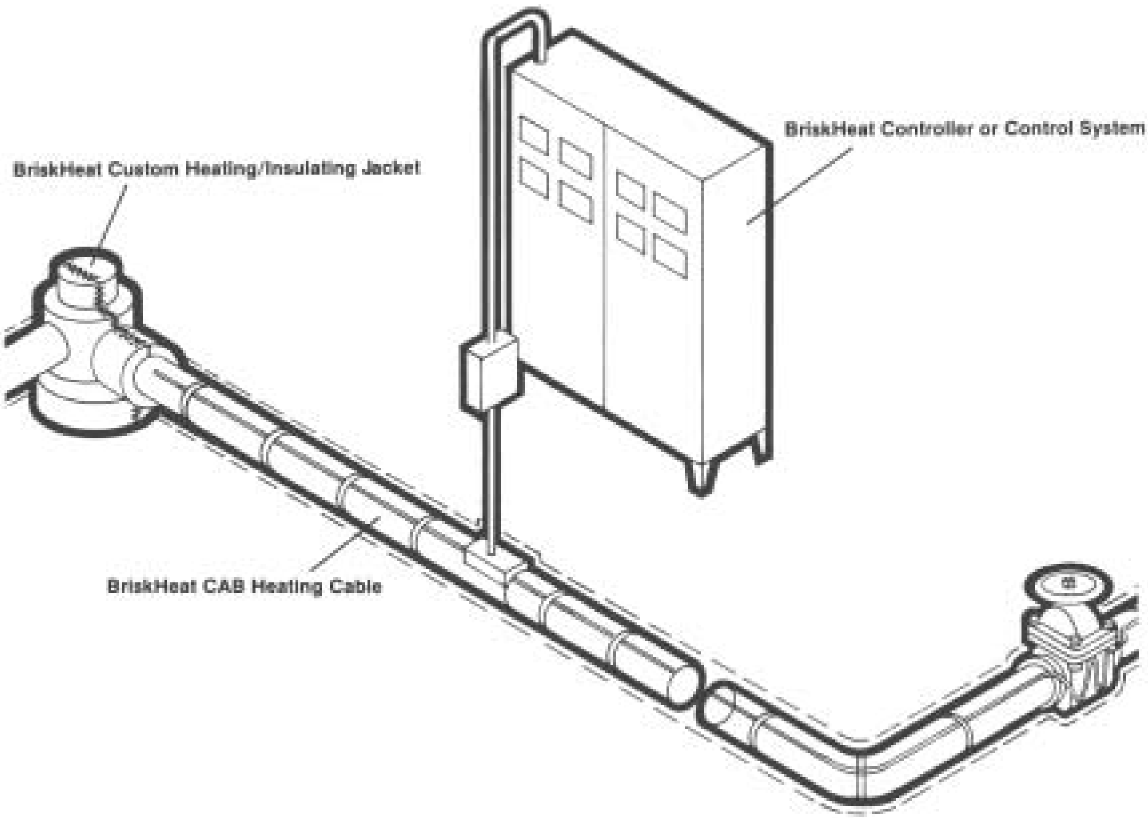
9. To determine adjusted multiplication factor for other types of valves and supports, use the following conversion factors:

a.	Gate valve	1.0
b.	Ball valve	.7
c.	Globe valve	.95
d.	Butterfly valve	.60
e.	Pipe supports	.50

10. Determine the length of cable required for each valve and / or support by dividing the heat loss in watts per foot by the wattage rating of the selected cable.
11. Next, add the length of cable required for each valve and support to the length of cable required for the total pipe within your system.
12. Using this figure, round up to the nearest whole number divisible by the module length (usually four feet). Add four feet four cold lead. This is the final amount of cable required for your system.

Attaching the Cable:

Pressure Sensitive Adhesive Tape (PSAT) is recommended in lieu of metallic clamps for securing the heating cables to the pipes and valves. The PSAT should be applied over the cable and around the pipe every 12 inches. If plastic or fiberglass pipe is part of your system, or if process temperature maintenance is involved requiring improved heat transfer, we recommend the use of AAT260 Tape. On plastic and fiberglass pipe, the AAT 260 Tape should be placed between the pipe and cable. The tape may be placed over the cable or between the cable and pipe for process temperature maintenance.
To determine the amount of heat-transfer tape and / or pressure-sensitive tape within your system, refer to the Tracing Adhesive Tape Requirement Table (PSAT) (Table 8 Series).



Tank Temperature Maintenance: The Basic Steps

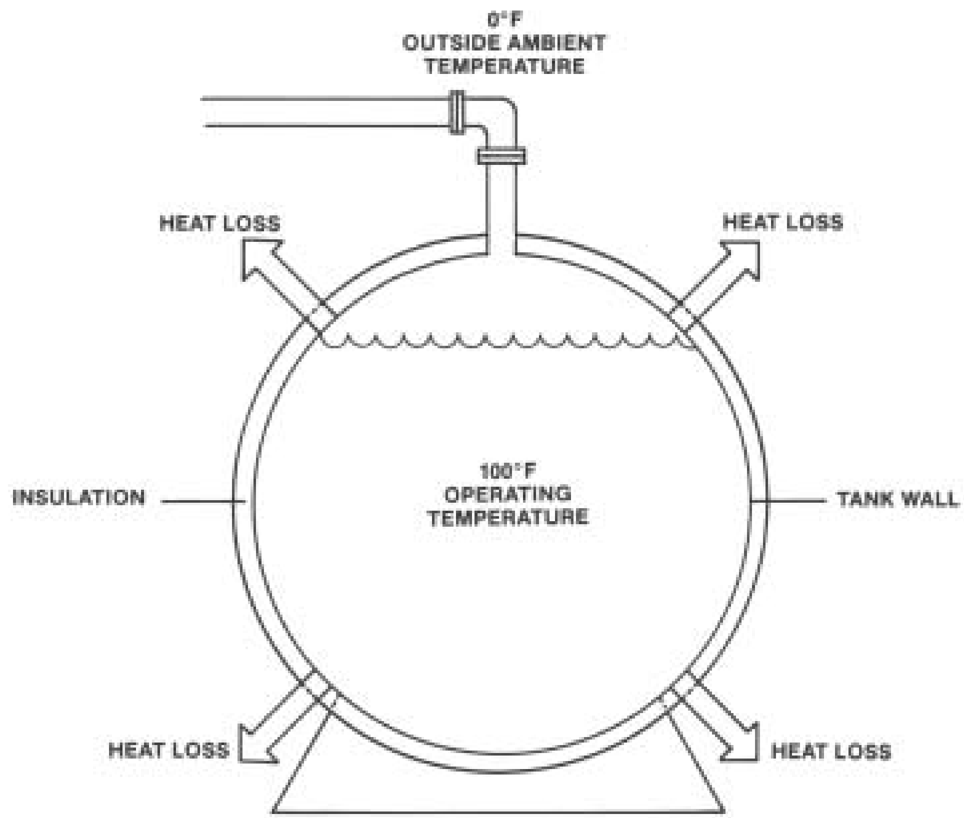
Factors of Heat Loss From Tanks
Required parameters for calculating the heat losses through tank wall and insulation:

1. Type and size of tank
2. Operating temperature to be maintained
3. The low ambient temperature
4. The type and thickness of insulation to be used
5. The location of the tank
6. The available voltage

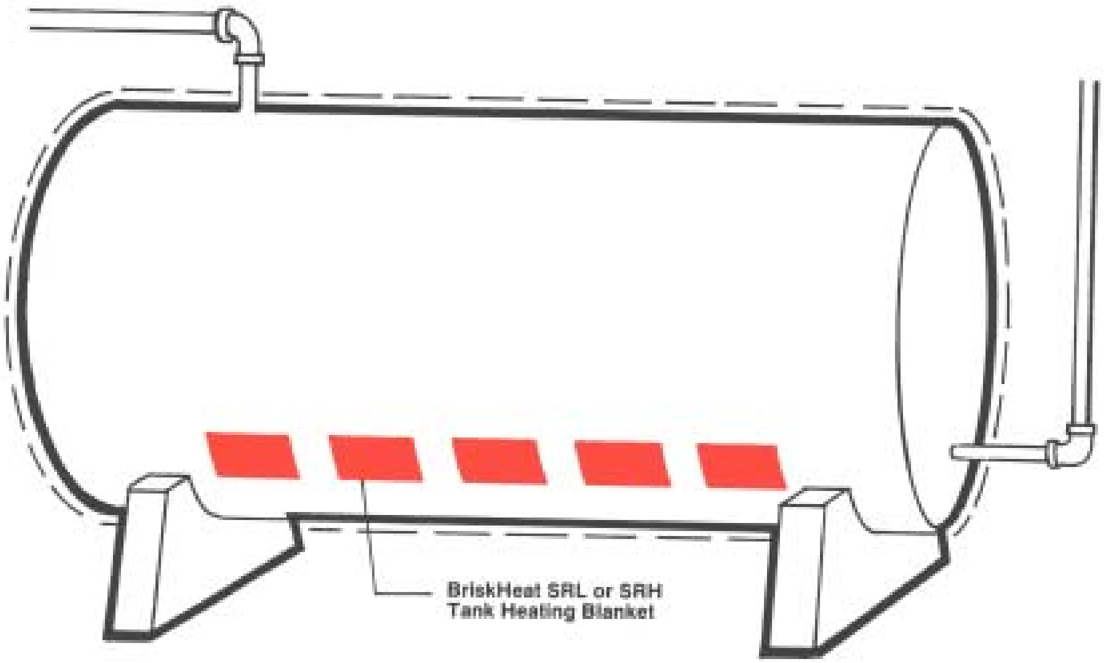
Tank Temperature Maintenance

1. Determine the heat required to replace heat losses (include all exposed surfaces: insulated, un-insulated, material, etc.) by calculating the area of the entire tank surface. Use The Tank Surface Areas (ft2) (Table 5 Series).
2. Determine ΔT between the low ambient temperature and the maintain temperature.
3. Using the ΔT, determine the heat loss factor using the Heat Loss Chart for Tanks (and Other Large Vessels - W/ft3) (Table 3.c).
4. Determine any adjustment factor needed for the type of insulation using the Insulation Factor Chart (Table 3.a), and multiply to the result from Step 3.
5. Multiply the result from Step 4 by the area determined in Step 1 to find total heat losses.
6. Adjust for 20% heat loss contingency by multiplying Step 5 by 120%.
7. To select heating blankets (SRL or SRH blankets are preferred over heating cable for ease of installation), divide the total wattage requirement by the standard wattage ratings of BriskHeat SRL or SRH blankets (see Standard SRL and SRH blanket sizes and standard wattages), and determine the number of blankets required.

NOTE: If the tank were installed in a hazardous area (Class I, Division 2, see Hazardous Locations (Table 16 Series)), an SRH blanket would be used instead of an SRL. If the tank is non-metallic and temperature sensitive, consideration should be given to using heating cable for overall coverage of the tank or custom-designed blankets. Contact BriskHeat for sizing and assistance if required.



PRINCIPLE OF HEAT LOSS



Tank Heat-up: The Basic Steps

Initial Heat-up Wattage Requirement
If initial heat-up is required or material is being added to the process, include the following steps *for each material heated, to include the tank itself***:**

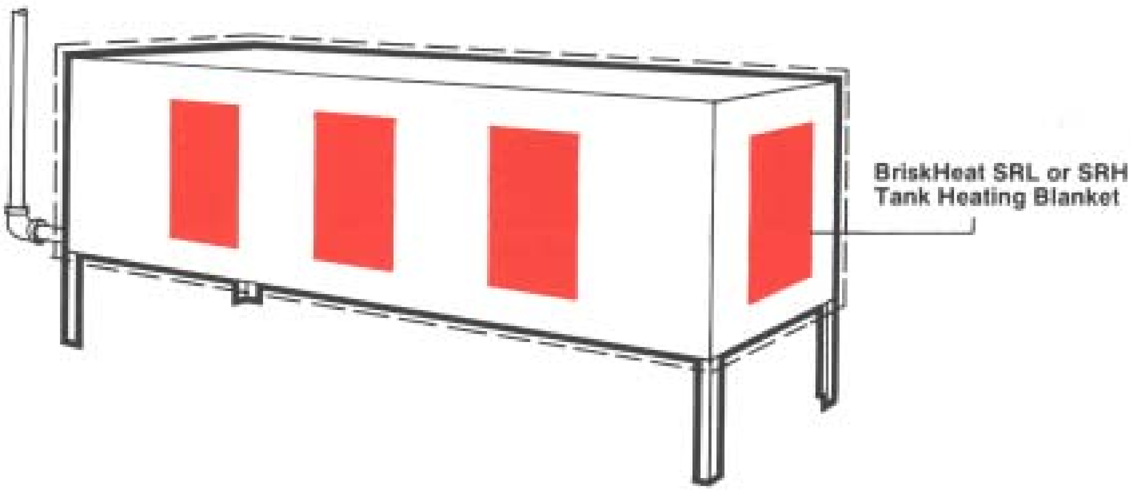
1. Determine the amount of heat that will be absorbed by all material to include the tank using the Average Specific Heat column in the Properties of Solids (Table 4.a). For each, multiply the weight of the material x the specific heat of the material x the ΔT (final minus initial).
2. Determine the amount of heat required for fusion or vaporization using the Heat of Fusion or Vaporization column in the Properties of Liquids (Table 4.b). Multiply the weight of the material x heat of fusion or vaporization.
3. Determine the heat required to replace heat losses during heat-up (include all exposed surfaces: insulated, un-insulated, material, etc.) using the "Surface Heat Loss Graphs". Multiply the exposed surface area x heat loss at final temperature x time allowed for heat-up x .5 (average loss).
4. Add the total kWh required for heat-up and add a 20% contingency, by multiplying by 120%.
5. Divide the total kWh by the total time required for heat-up to get wattage requirement.

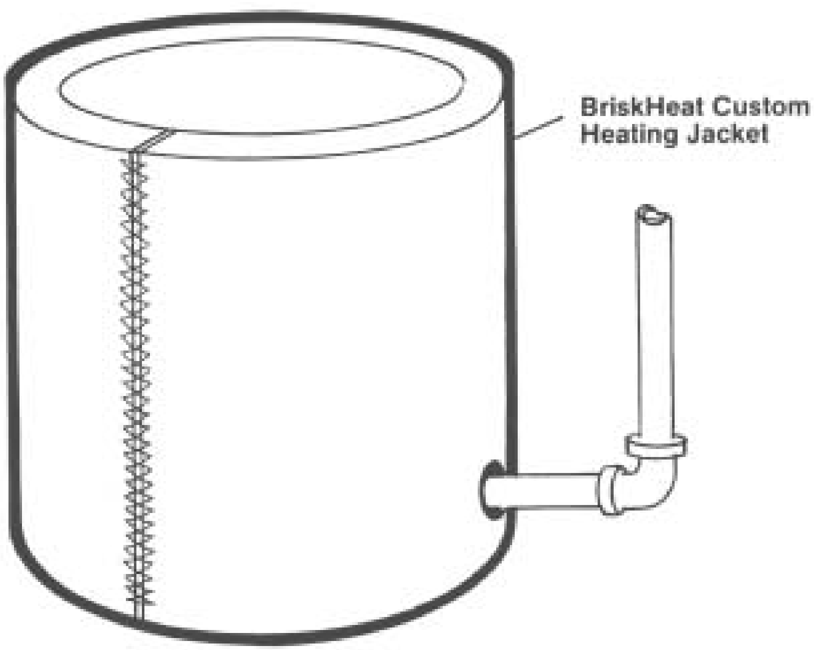
Blanket Requirement for Temperature Maintenance

1. Determine the amount of heat that will be absorbed by all material to include the tank using the Average Specific Heat column in the Properties of Solids (Table 4.a). For each, multiply the weight of the material x the specific heat of the material x the ΔT (final minus initial).
2. Determine the amount of heat required for fusion or vaporization using the Heat of Fusion or Vaporization column in the Properties of Liquids (Table 4.b). Multiply the weight of the material x heat of fusion or vaporization.
3. Determine the heat required to replace heat losses during heat-up (include all exposed surfaces: insulated, un-insulated, material, etc.) using the "Surface Heat Loss Graphs".

Multiply the exposed surface area x heat loss at final temperature x time allowed for heat up x .5 (average loss).

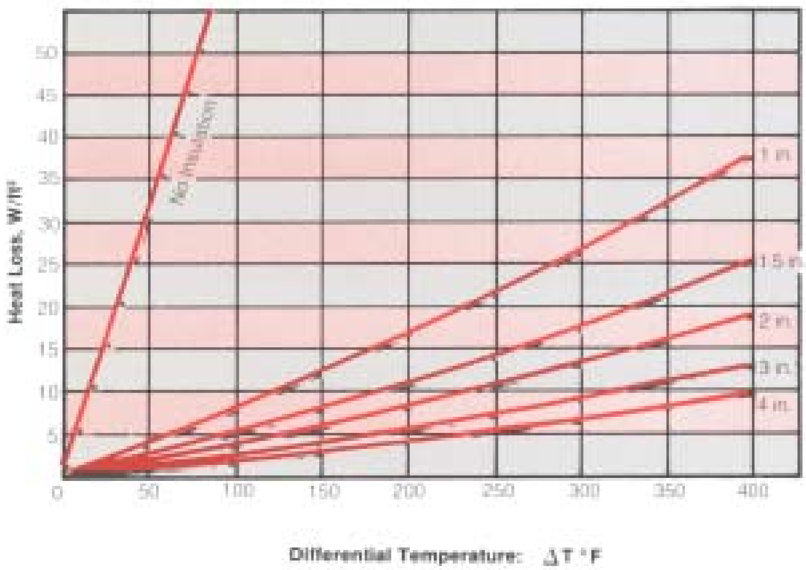
4. Add the total kWh required for heat-up and add a 20% contingency, by multiplying by 120%.
5. Determine the number of heating blankets required using the Standard SRL and SRH blanket sizes and standard wattages. Divide the total kW required x 1000W by the blanket wattage.





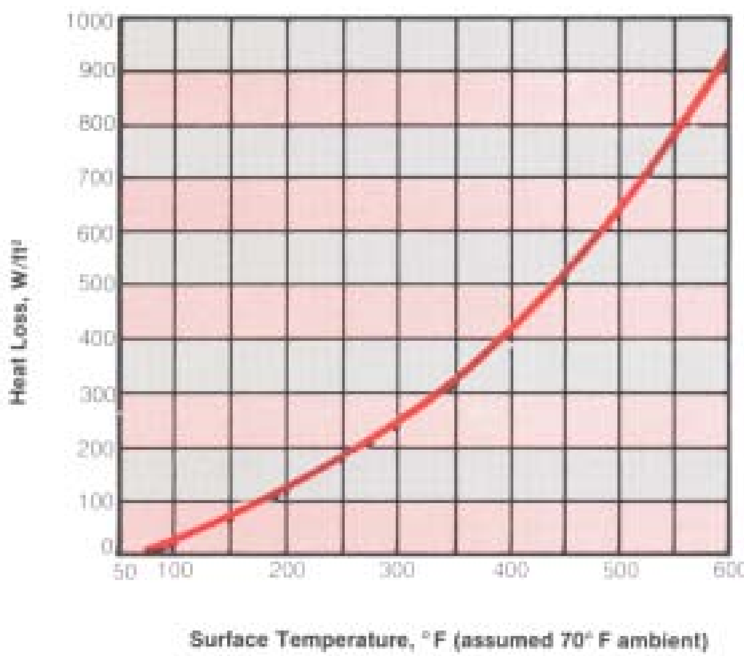
Heat Loss Graphs

Surface Heat Loss (Insulated Tank)

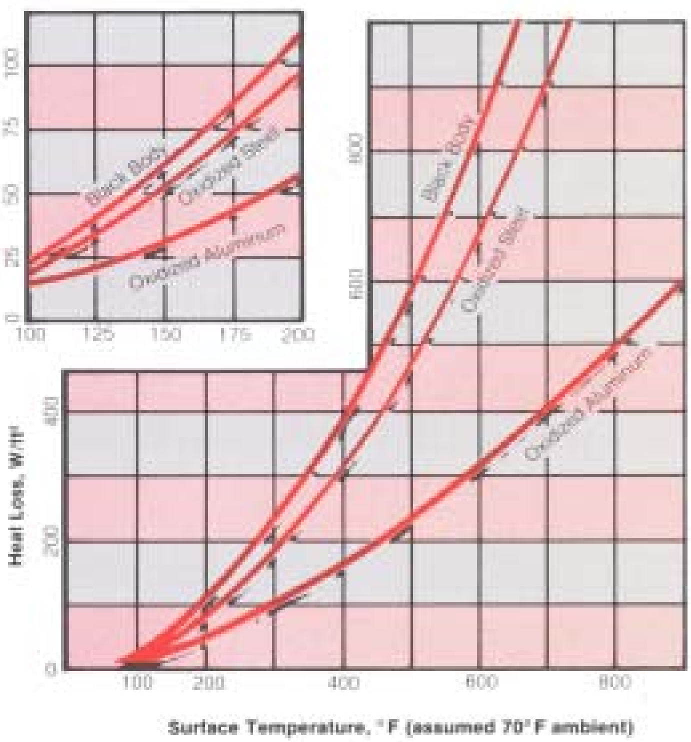


NOTE: Based on thermal insulation of fiberglass, 6 lb/ft³ density. Ambient temperature: 70°F.

Surface Heat Loss from Oil or Paraffin

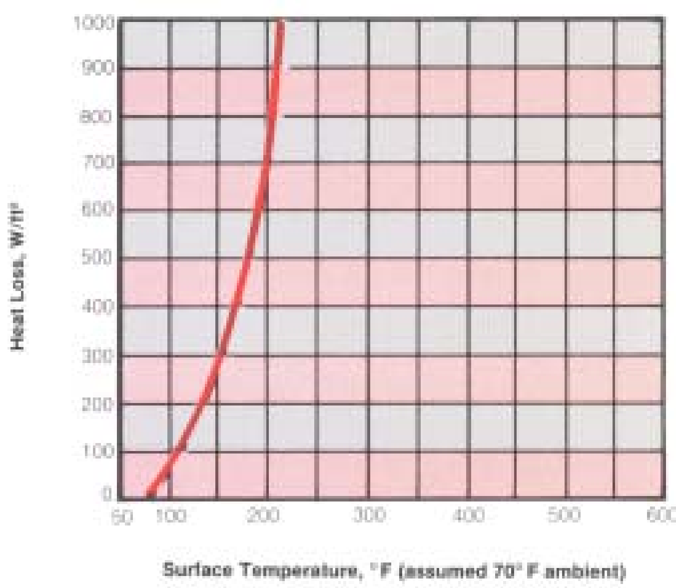


Surface Heat Loss (Uninsulated Tank)



NOTE: Values are for vertical surfaces. For top of horizontal surface, multiply value obtained by 1.1. For bottom of horizontal surface, multiply value obtained by 0.55.

Surface Heat Loss from Water



Selecting The Proper Temperature Controller

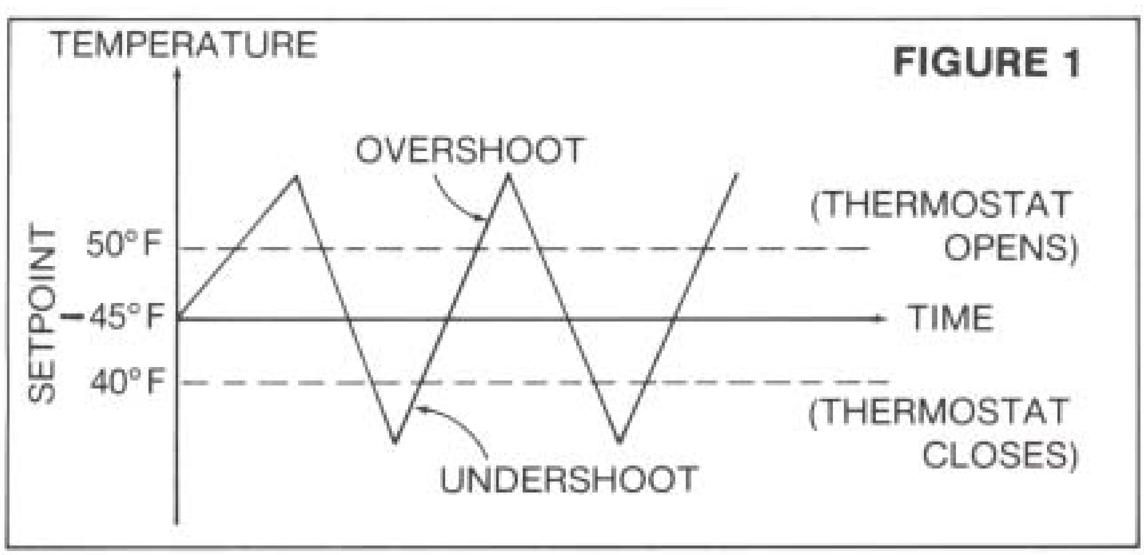
Introduction
There are many types of controls available on the market today. Some are very simple mechanical devices, and the spectrum is filled with complicated varieties, extending through micro-processor-based units. Each type of control is best suited to a particular set of conditions within a system. The best start for selecting a control for your system is with Selecting the Proper Temperature Controller (Table 1 Series).

A balanced heating system is one in which, after the process has stabilized, the duty cycle is 50%. However, even if the heater is at rest as much as it is active for a given period in practical applications, a balanced system is not obtainable since many variables may affect the system. The most common variable which affects freeze protection and maintenance-type heating applications is the "initial heat-up" requirement. The "initial heat-up" parameters usually require many times the amount of watt density required to "maintain" a system, thereby "working" the controller due to the increased power requirement for heat-up.

Controller Types (Modes)
While there are many combinations of control modes available, three are the most popular:

- ON/OFF
- PROPORTIONAL
- P.I.D. (Proportional, Integral Derivative or Proportional, Reset, Rate)

On/Off
This type of control has two modes, "On" and "Off". During "On" periods, full power is applied to the heater until the controller senses the pre-selected set point. Due to its design, a certain amount of overshoot and undershoot is present in the system. *See Figure 1.*



Proportional
This type of control proportions the amount of power to the system over a given range of error from set point. The larger the error becomes, the greater the applied power. As the error approaches 0%, power applied decreases. At the set point, the power applied is usually 50% to allow equal swing above and below the set point. A proportional controller will minimize the overshoot associated with On/Off-type controls, allowing for better regulation. *See Figure 2.*

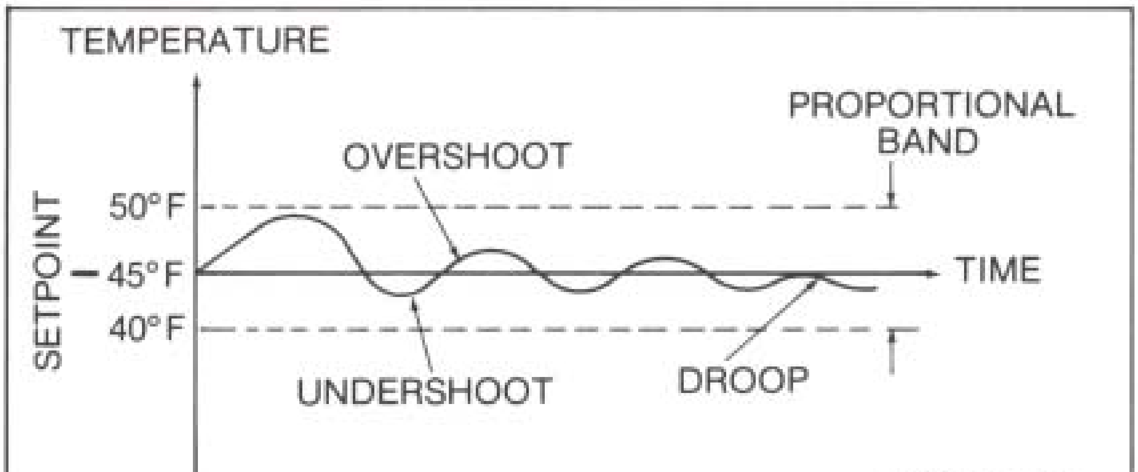


FIGURE 2

A problem which frequently arises on large heating systems which are very stable is "excessive cycling" due to the proportional action of the controller. In most cases, this is merely a nuisance, but may cause premature failure of load contactors. Remedies might be to use solid-state load switching or On/Off control.

P.I.D.
P.I.D. or three-mode control, offers proportional control with automatic reset and rate features. It will eliminate overshoot, cancel the offset or droop associated with proportional control, and will minimize oscillations due to integral action. It is the most expensive mode of control and generally is used for processes, which undergo many variable changes in a system.

Types of Controls
Choosing the proper control depends first on the system requirements and second, features desired and cost. Since BriskHeat products are primarily used for freeze protection and to offset heat losses in a system, P.I.D. controls are usually not required. The most economical control is the BriskHeat TD100N Series. It is an On/Off type utilizing a bimetallic disk, which responds to a preset temperature. These units are preset, nonadjustable, with generally small range spans. They are ideal for freeze protection applications and process systems under 200 ºF where variables change slowly and very precise control is not required.

Where greater accuracy, faster response, and larger ranges with adjustment capability are needed, the BriskHeat TB4100 Series or the TB250N temperature controllers would be a logical choice.

These models incorporate a liquid-filled thermal system with a bulb and capillary assembly, allowing the control head (set point dial) to be located away from the sensing bulb. By utilizing a fluid that is very responsive to temperature, to actuate a bellows assembly in conjunction with close differential switches, good response can be achieved. Different materials available for construction of the thermal assembly and control enclosure offer the desired flexibility for many types of environments such as outdoors, food processing plants, and corrosive atmospheres. The bulb-and-capillary-type control offers great flexibility with respect to available ranges and suitability for many different environments. It is a very popular, cost-effective, On/Off-type controllers for pipe tracing freeze protection and process applications. The many combinations available in the TB4100 Model line allow nearly all control applications to be accomplished with one of the available modes.

For applications that may preclude using a bulb and capillary control, the BriskHeat TC6100 Series offers thermocouple type control with solid-state proportional action. Typical applications would be where the controller needs to be located long distances from the sensing point, proportional control is required, faster response is needed, or in applications where vibration may be a problem. In those systems where electronic control is desired, but proportional control causes excessive cycling, the control may be adjusted on an On/Off mode.

General Guidelines
Pipelines are well suited to bulb-and-capillary-type controls, however, if a corrosive element is present, or additional control functions such as alarms, limits, and indicating lights are needed, the TB 4100 Series would be the correct choice.

For process control where control that is more accurate is desired along with additional features, as mentioned above, the electronic TC Series using a thermocouple sensor is the correct choice. The TC Series is also the best choice for BriskHeat fiberglass and Samox® jackets since the sensor may be built into the jacket.

Final Selection
Nearly all BriskHeat controls are capable of switching relatively large loads. Final selection depends on determining several parameters about the heating system (see Selecting the Proper Temperature Controller (Table 1 Series)):

1. What type of environment will be encountered? This will determine what type of enclosure is necessary and what type of material and sensor portion of the control needs to be.

2. What are the load conditions? This will determine which type of control, On/Off or Proportional, is required to provide adequate control response to changing conditions.

3. What is the load size and voltage? This will determine the voltage and amperage that is required to be switched.

4. What is the operating temperature? This will determine the range span necessary.

5. What other conditions might the control be subject to? This will determine final suitability of application. Some of the conditions might be vibrations, periodic steam out of pipelines, unusual atmosphere, or in applications where a control failure could cause injury to personnel or loss of expensive product, thereby requiring backup controls or safety-limit-type controls.

NEMA ENCLOSURE STANDARDS

Control devices which are used with electric heating equipment can be located in an enclosure that is mounted either in the hazardous area with the electric heater or in a remote non-hazardous area. The electric heater terminal box or control enclosure is usually specified per NEMA (National Electrical Manufacturers Association) standards. The NEMA standards are summarized below:

Pertaining to Non-hazardous Locations

Type 1 enclosures are intended for indoor use primarily to provide a degree of protection against contact with the enclosed equipment.

Type 2 enclosures are intended for indoor use primarily to provide a degree of protection against limited amounts of falling water and dirt.

Type 3 enclosures are intended for outdoor use primarily to provide a degree of protection against windblown dust, rain, sleet, and external ice formation.

Type 3R enclosures are intended for outdoor use primarily to provide a degree of protection against falling rain, sleet, and external ice formation.

Type 3S enclosures are intended for outdoor use primarily to provide a degree of protection against windblown dust, rain, sleet, and provide for operation of external mechanisms when ice laden.

Type 4 enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against windblown dust and rain, splashing water, and hose-directed water.

Type 4X enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against corrosion, windblown dust and rain, splashing water, and hose-directed water.

Type 5 enclosures are intended for indoor use primarily to provide a degree of protection against dust and falling dire.

Type 6 enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against the entry of water during occasional temporary submersion at a limited depth.

Type 6P enclosures are intended for indoor or outdoor use primarily to provide a degree of protection against the entry of water during prolonged submersion at a limited depth.

Type 11 enclosures are intended for indoor use primarily to provide, by oil immersion, a degree of protection to enclosed equipment against the corrosive effects of liquids and gases.

Type 12 enclosures are intended for indoor use primarily to provide a degree of protection against dust, falling dirt, and dripping non-corrosive liquids.

Type 12K enclosures with knockouts are intended for indoor use primarily to provide a degree of protection against dust, falling dirt, and dripping non-corrosive liquids other than at knockouts.

Type 13 enclosures are intended for indoor use primarily to provide a degree of protection against dust, spraying of water, oil, and non-corrosive coolant.

Pertaining To Hazardous (Classified) Locations

Type 7 enclosures are for use indoors in locations classified as Class 1, Groups, A, B, C, or D, as defined in the *National Electrical Code*.

Type 8 enclosures are for indoors or outdoors use in locations classified at Class 1, Groups A, B, C, or D, as defined in the *National Electrical Code*.

Type 9 enclosures are for use in indoor locations classified as Class 11, Groups E, F, or G, as defined in the *National Electrical Code.*

Type 10 enclosures are constructed to meet the applicable requirements of the Mine Safety and Health Administration.

HAZARDOUS LOCATIONS

Introduction
Hazardous locations are those areas where a potential for explosion and fire exist due to the presence of flammable gases, vapors, pulverized dusts, or ignitable fibers in the atmosphere. Hazardous locations are created from the normal processing of volatile chemicals, gases, coal, grains, etc., or from the accidental failure of storage systems for these materials.

National Electrical Code Classifications
Articles 500 through 516 of the National Electrical Code deal with the definition of hazardous areas and the use or design of electrical equipment used in these locations. Electric heating equipment for hazardous areas is specified based on the NEC Class Division, Group, and ignition Temperature.

Auto-ignition Temperature
The minimum temperature required to initiate or cause self-sustained combustion of a solid, liquid, or gas independently of the heating or heated element (See NFPA 325M, Fire Hazard Properties of Flammable Liquids, Gases and Volatile Solids.)

Class 1, Division 1
Locations (1) in which ignitable concentrations of flammable gases or vapors exist under normal operating conditions; or (2) in which ignitable concentrations of such gases or vapors may exist frequently because of repair or maintenance operations or because of leakage; or (3) in which breakdown or faulty operation of equipment or processes might release ignitable concentrations of flammable gases or vapors and might also cause simultaneous failure of electrical equipment. (See Section 500-4(a) of NFPA 70, National Electrical Code.)

Class I, Division 2
Locations (1) in which volatile flammable liquids or flammable gases are handled processed or used, but in which the liquids, vapors or gases will normally be confined within closed containers or closed systems from which they can escape only in case of accidental rupture or breakdown of such containers or systems, or in case of abnormal operation of equipment; or (2) in which ignitable concentrations of gases or vapors are normally prevented by positive mechanical ventilation, and which might become hazardous through failure or abnormal operation of the ventilating equipment; or (3) that is adjacent to a Class l, Division l location, and to which ignitable concentrations of gases or vapors might occasionally be communicated unless such communication is prevented by adequate positive pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided. (See Section 500-4(b) of NFPA 70, National Electrical Code.)

Class II, Division 1
Locations (1) in which combustible dust is in the air under normal operating conditions in quantities sufficient to produce explosive or ignitable mixtures, or (2) where mechanical failure or abnormal operation of machinery or equipment might cause such explosive or ignitable mixtures to be produced and might also provide a source of ignition through simultaneous failure of electrical equipment, operation of protection devices, or from other causes, or (3) in which combustible dusts of an electrically conductive nature may be present. (See Section 500-5(a) of NFPA 70, National Electrical Code.)

Class II, Division 2
Locations in which (1) combustible dust will not normally be in suspension in the air in quantities sufficient to produce explosive or ignitable mixtures and dust accumulations are normally insufficient to interfere with the normal operation of electrical equipment or other apparatus, or (2)

dust may be in suspension in the air as a result of infrequent malfunctioning of handling or processing equipment and dust accumulations resulting therewith may be ignitable by abnormal operation or failure of electrical equipment or other apparatus. (See Section 500-5(b) of NFPA 70, National Electrical Code.)

Class III Locations
Locations are those that are hazardous because of the presence of easily ignitable fibers or filings, but in which such fibers or filings are not likely to be in suspension in the air in quantities sufficient to produce ignitable mixtures. Class III locations shall include those specified below. (See Section 500-6 of NFPA 70, National Electrical Code.)

Class III, Division 1
Locations in which easily ignitable fibers or materials producing combustible filings are handled, manufactured, or used. (See Section 500-6(a) or (b) of NFPA National Electrical Code.)

Class III, Division 2
Locations in which easily ignitable fibers are stored or handled (See Section 500-6(b) of NFPA 70, National Electrical Code).

Special Requirements for Electric Heating Equipment Used in Hazardous Areas
Electric heating equipment can be economically designed and safely used in hazardous areas if the following special requirements are kept in mind:

The exposed surface temperature of the electric heating equipment cannot exceed the ignition temperature of the hazardous atmosphere. To insure that the proper heater has been selected for the application, it is essential that the correct NEC identification number be specified (see Hazardous Locations (Table 16 Series)). If too high a temperature has been selected, the electric heating system may operate above the ignition point of the application, creating a potentially hazardous condition. If too low a temperature is selected, you will probably be paying a considerable penalty for the system since the electric heater size and price go up as the maximum ignition temperature goes down.
The arc-and-spark producing control devices must be isolated from the hazardous atmosphere. If it is not economically feasible to locate the control devices in the non-hazardous area, they must be housed in an enclosure that will withstand the pressure of a potential explosion from within the enclosure. Use NEMA standards to specify the type of enclosure required.
All electrical supply connections must be made according to the latest NEC requirements for hazardous locations. This includes the requirement that conduits entering the enclosures must be provided with seals at the enclosure.

Ignition Temperature
All electrical equipment is designed not to exceed the ignition temperature of the hazardous atmosphere. The NEC, for each class, defines the maximum surface temperature for electric heaters as follows:

Class I Locations (Groups A, B, C, D)
NEC Ignition Temperature I.D. Number

The T1 through T6 identification numbers represent a recent change to the NEC. Formerly, the temperature limit of each group in Class I was assumed the lowest ignition temperature of any material in the group as summarized below:

Groups A, B, and D	– 280º C (536º F)
Group C	– 180º C (356º F)

BriskHeat Heating Blankets and Jackets – Features and Specifications

SRL Heating Blankets and SRH Explosion-Proof Heating Blankets

BriskHeat SRL Heating Blankets
BriskHeat silicone rubber laminated heating blankets offer a number of advantages over immersion heaters, rigid heaters, steam jackets, and other types of high watt density heaters. Unlike other types of heaters, BriskHeat SRL blankets can be fabricated in an unlimited number of configurations to fit almost any size and shape of part. Their extreme flexibility affords maximum ease of application, and their lightweight, rigged; thin-line design makes them ideally suited for countless uses in both industrial and military applications.

BriskHeat SRL heating blankets are low-watt density (watts per square inch) electrical resistance heaters in blanket form. They are designed to provide evenly distributed low watt density heat for freeze protection and / or process temperature control on tanks, vessels, pumps, conveyors, hoppers, and valves, as well as custom applications.

BriskHeat SRL heating blankets provide a continuous operating capability of 450^{o} F, yet their evenly distributed low watt density makes them ideal for sensitive applications. The use of multi-strand braided and knitted heating element, laminated between multiple layers of fiberglass reinforced silicone cloth, provides the most rugged assembly available in blanket form.

BriskHeat's factory applied pressure sensitive adhesive allows simple and easy installation. The semi-cured pressure sensitive silicone rubber adhesive is protected by a quick release paper, which is removed just before installation. Heat from the blanket itself completes the cure, creating a permanent bond between the blanket and vessel.

SRL Heating Blankets

- Available in all common voltages, 6 to 600 AC or DC
- Standard and custom sizes available
- Moisture and chemical resistant
- Reduces installation time
- Forms to fit most surfaces
- Eliminates hot spots
- Remains stable at temperatures up to 450^{o} F
- Low cost evenly distributed heat
- Direct heat transfer

BriskHeat SRH Explosion-Proof Heating Blankets
Surprisingly, few people are aware that both people and equipment can be heated safely and economically with electric heat. Electric heating is typically much less expensive to install and maintain than comparable remote oil or gas fired heating systems.

BriskHeat SRH heating blankets are low-watt density (watts per square inch) electrical resistance heaters in blanket form. They are designed to offset heat losses while maintaining a constant product temperature in storage tanks, vessels, pumps, conveyors, hoppers, or similar equipment containing heat sensitive products in hazardous (classified) areas.

BriskHeat SRH heating blankets feature built-in high limit thermal cutout protection which, in the event of a primary temperature control failure, maintains blanket sheath temperature below the minimum safe auto-ignition temperature of the material being heated or materials in the area ("T Rating" in the National Electric Code, Section 500).

BriskHeat SRH heating blankets are flexible and ready to conform to most plane and simple curved surfaces. Factory applied heat conductive pressure sensitive adhesive allows simple and easy installation, reduces installation time by eliminating the messy process of applying adhesives in the field.

BriskHeat SRH heating blankets are compatible with most chemical fluids and oils commonly encountered in field service. They are exceptionally resistant to weather, moisture, and effects of sunlight, ozone gases and are acceptable in areas of high radioactivity.

SRH Heating Blankets

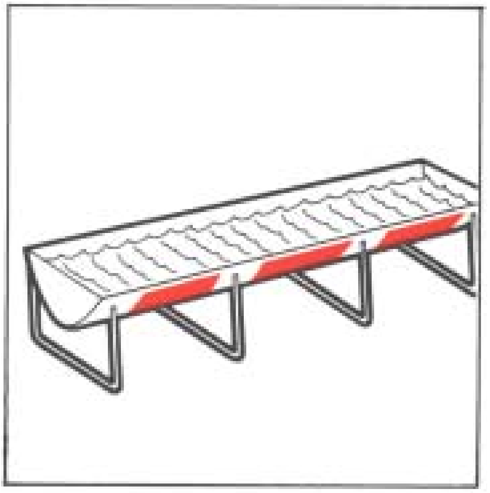
- F.M. approved for use in hazardous (classified) areas.
- Integral built-in high limit thermal cutout prevents temperature run-away
- Moisture and chemical resistant
- Reduces installation time
- Mechanically and electrically rugged
- Evenly distributed constant watt density
- Heat up to 2 ½ watts per square inch
- Forms to fit most surfaces
- Remains stable at temperatures up to 450^{o} F
- Inherently safe

Standard SRL and SRH blanket sizes and standard wattages

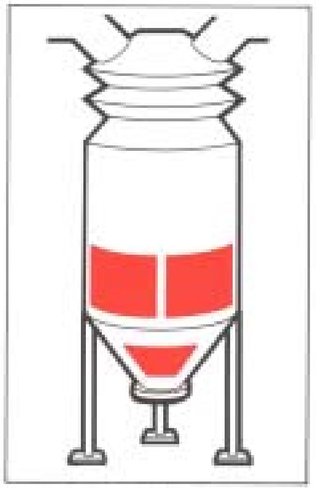
- 6" x 12" 180W
- 12" x 12" 360W
- 6" x 24" 360W
- 12" x 24" 720W
- 24" x 24" 1440W

Typical Tank Heating Blanket Applications

Illustrated here are only a few of the potential applications for SRL/SRH heating blankets.



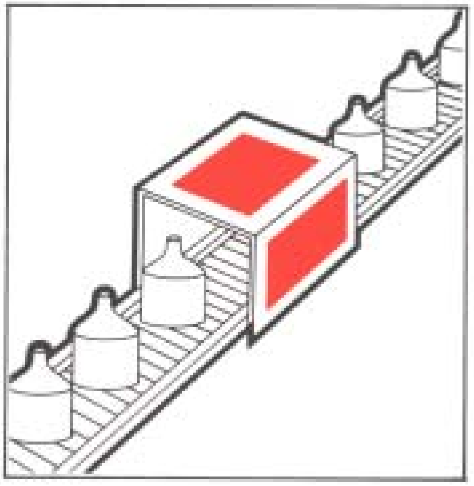
Water and Feed Troughs
Freeze protection for water
livestock feeds.



Dust Collectors
Condensation control for and
sawdust, sands, grains, and
particulates.

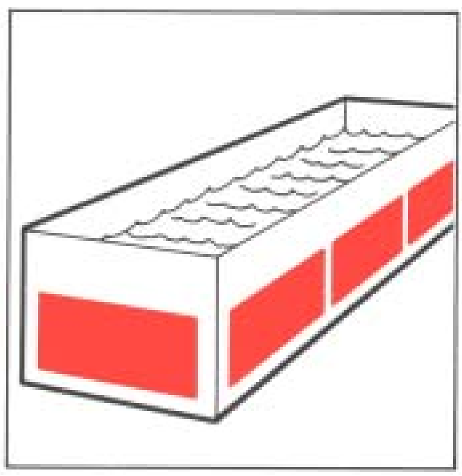
Storage Tanks
Viscosity control and freeze protection for
petroleum products, caustic liquids, water,
molasses, and most stored liquids.

Conveyors
Freeze protection for coal,
ash and gravel.

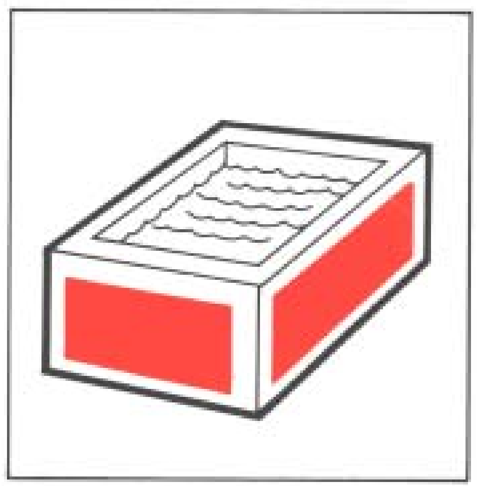


Low Temperature Ovens
Process temperature control for curing, shrinking, and baking.

Tank Trucks
Freeze protection and viscosity control for milks, asphalts, molasses, and and most transported liquids.



Process Vats and Dip Tanks
Heat raising and maintenance for plating, degreasing, and rinsing.



Melt Pots
Viscosity and temperature control for waxes, adhesives, coatings, and gums.

Heating Jackets and Insulating Jackets

BriskHeat Heating Jackets
Many industrial and laboratory applications require the addition of heat to valves, tubular piping, laboratory and scientific vessels, processing and vacuum bake-out equipment. Unfortunately, in many instances, due to the physical size of the vessel, configuration, operating temperature, watt density, etc., heating cables, steam jackets, and strip heaters are not practical. For these applications, BriskHeat fiberglass and Samox® heating jackets offer a convenient, low-cost method of applying heat to an unlimited variety of shapes, sizes, and complex vessels. Unlike

cables, jackets, and strip heaters, BriskHeat heating jackets cover all surfaces of the vessel providing evenly distributed, low-watt density heat.

BriskHeat heating jackets are available with continuous operating temperature capability of up to 1400^{o} F, yet their evenly distributed, low-watt density makes them ideal for sensitive applications. BriskHeat heating jackets utilize a totally integrated, parallel circuit, heater design. The durable, multi-strand heating element of nickel-chromium is insulated with several applications of high temperature fiberglass or Samox® yarn, then knitted into a tape form. Several tapes are then wired in parallel and sewn between a layer of high-density fiberglass insulation and a layer of fiberglass cloth. The built-in high-density thermal insulation provides cost efficient, high temperature operation, while maintaining overall flexibility for easy installation and removal.

Fabrication of each jacket uses full size patterns to ensure proper fit and correct location of openings, ports, panels, and closures. This unique manufacturing technique assures intimate direct contact and heat transfer between the surface of the vessel and the heating jacket. This custom design feature eliminates hot spots, air pockets, and voids; providing cost-efficient, evenly distributed heat.

Two types of heating systems are available:

High Temperature Samox® Heating Jackets

- 1400^{o} F exposure temperature
- Evenly distributed, low-watt density heat
- Can be designed to fit any size and configuration
- Vibration resistant
- Reusable
- Easily installed and removed
- Voltage 6 to 600 AC or DC

Fiberglass Heating Jackets

- 900^{o} F exposure temperature
- Evenly distributed, low-watt density heat
- Can be designed to fit any size and configuration
- Vibration resistant
- Reusable
- Easily installed and removed
- Voltage 6 to 600 AC or DC

BriskHeat Insulating Jackets

Often highly maintained devices such as valves, pumps, pipe connections, and instrumentation are left un-insulated for convenience or permanently insulated, thus making repairs difficult. BriskHeat Heating Jackets eliminate this problem.

BriskHeat fiberglass and Samox® reusable flexible insulating jackets are available for practically any application. No matter how large or complex the vessel, a BriskHeat insulating jacket can be designed to provide even, efficient insulation across the entire surface. BriskHeat insulating jackets are ideal for insulating existing equipment and / or new installations. Its flexible construction enables the installer to quickly fit the jacket around existing pipe, pumps, valves, instrumentation, and accessory equipment.

Since the BriskHeat insulating jacket is provided with hooks and lacing (although ties, zippers, or Velcro® strips may be specified), it can be easily removed without damage to jacket or equipment. It can be re-used indefinitely because of the high quality of construction and the durable materials employed.

Although fiberglass and Samox® are the standard insulating materials used, a wide range of insulating and facing materials can be specified. Various thicknesses of insulation can be used based on the requirement.

Two types of insulating systems are available:

High Temperature Samox® Insulating Jackets

- 1400^{o} F exposure temperature
- Lightweight
- Can be designed to fit any size and configuration
- Saves energy and is cost efficient
- Reusable
- Easily installed and removed

Fiberglass Insulating Jackets

- 900^{o} F exposure temperature
- Lightweight
- Can be designed to fit any size and configuration
- Saves energy and is cost efficient
- Reusable
- Easily installed and removed

Typical Heating/Insulating Jacket Applications

BriskHeat Fiberglass/Samox® Jackets are constructed to the exact dimensions of the vessel to be heated providing evenly distributed heat across the entire surface. The conforming design allows for intimate heater contact with the surface of the vessel assuring efficient heat transfer and the elimination of hot spots.

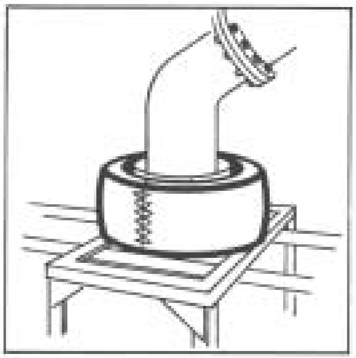
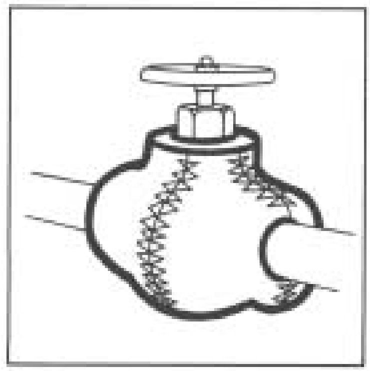
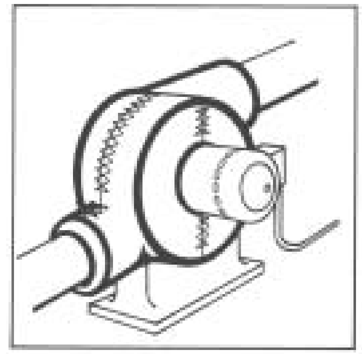
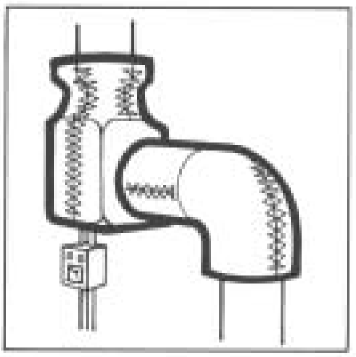
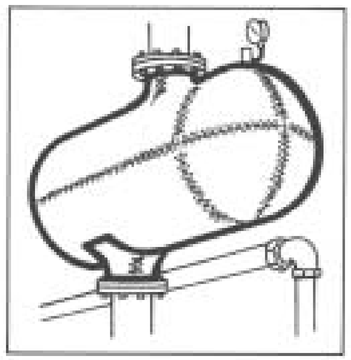
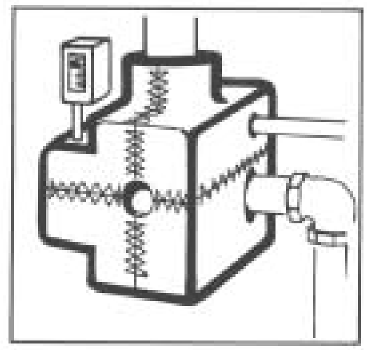
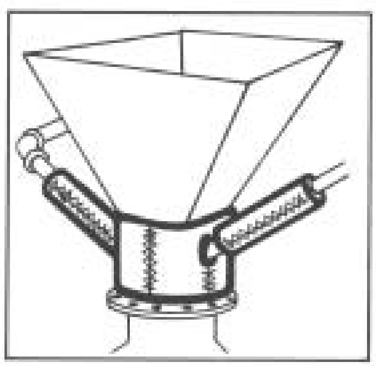
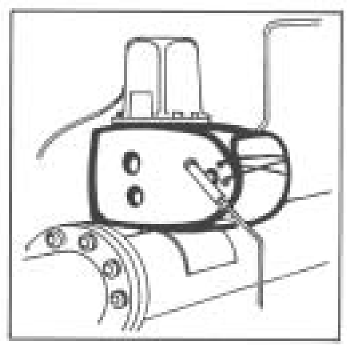
Illustrated here are only a few of the potential applications for Fiberglass/Samox® Heating/Insulating Jackets.

Scientific Instruments
Precise temperature control of gases, liquids, and vapors entering analytical instrumentation.

Process Lines
Resin and Asphalt processing

High Temperature Vessel Heating
Vats, tanks, and vessels that require even heat distribution, high process temperatures or watt density not achievable with other heating products.

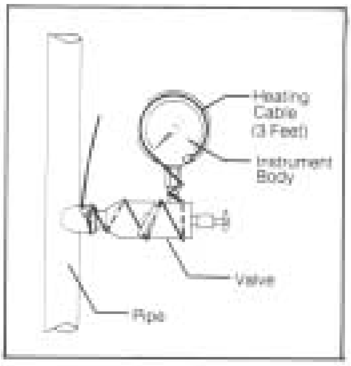
Valves
Freeze protection and process control of liquids.

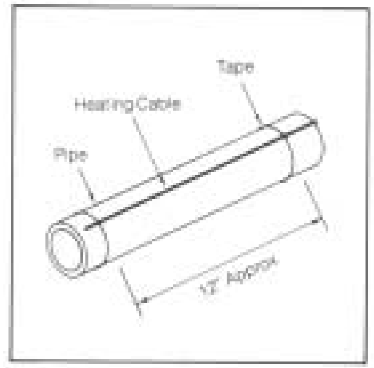
System Details

Typical Installation Details

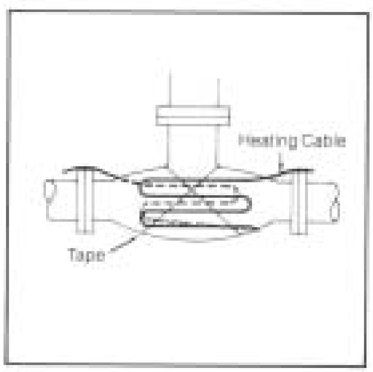
The following details show how heating cable is typically installed on the various common components of a piping system. For exact length of heating cable required, please refer to BriskHeat's project engineering drawings.



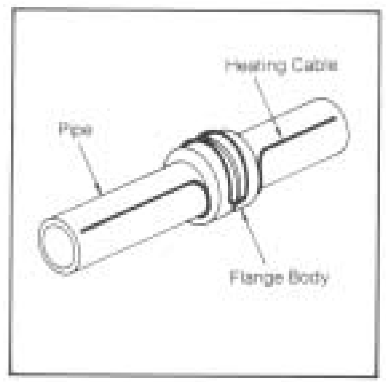
Installation of Heating Cable on a Pressure Indicator



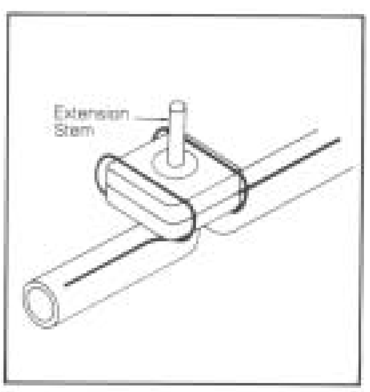
Installation of Heating Cable on a Straight Pipe Run



Installation of Heating Cable at a Blind Tee

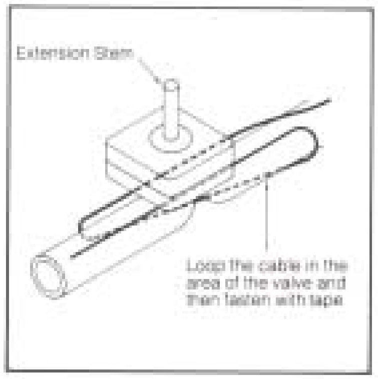


Installation of Heating Cable on a Flange Body

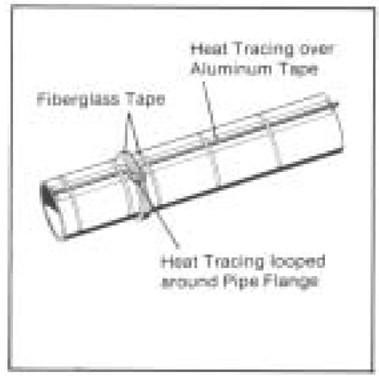


Installation of Heater on a Diaphragm Valve

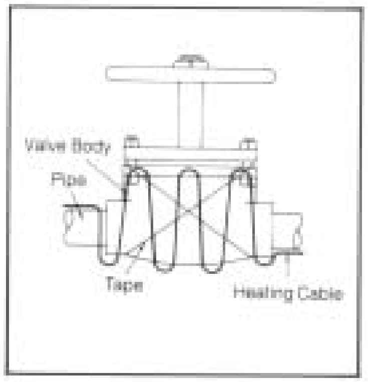
Installation of AAT Aluminum Tape over Heating Cable



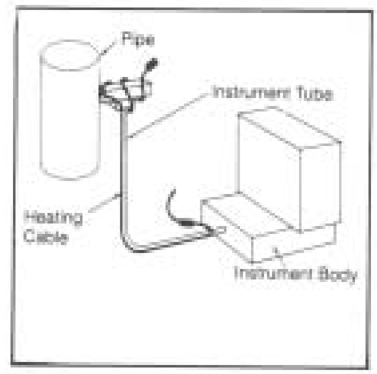
Installation of Heating Cable on
a Diaphragm Valve



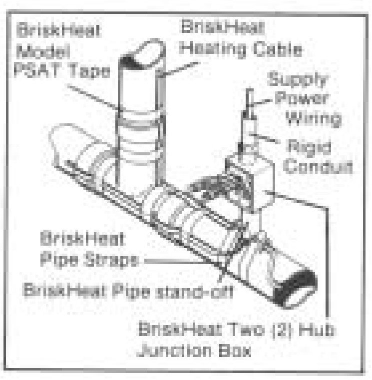
Installation of AAT Aluminum
Tape on Plastic or Fiberglass Pipe



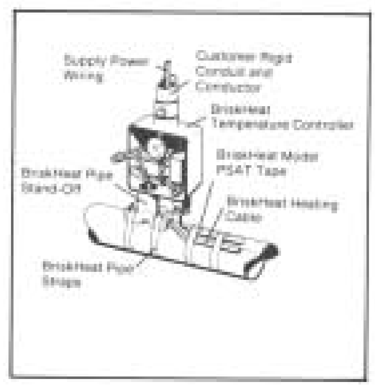
Installation of Heating Cable on
a Valve Body



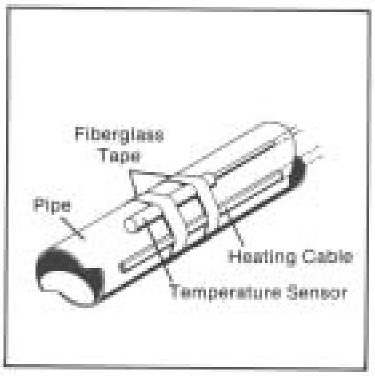
Installation of Heating Cable
On A pressure transmitter



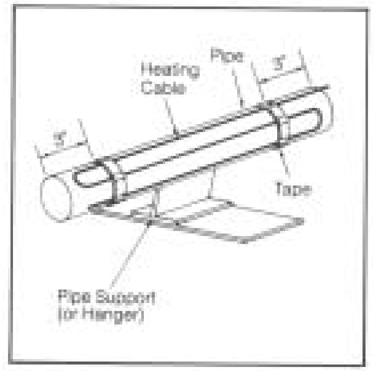
Installation of Single Run Tee Splice
or Power Input



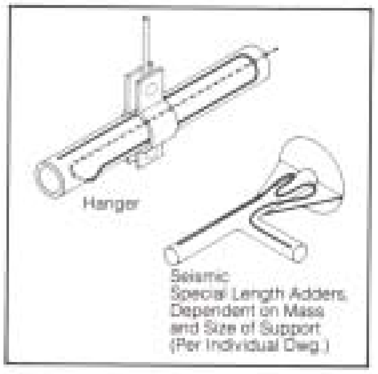
Installation of Heating Cable System
in Non-Hazardous Area



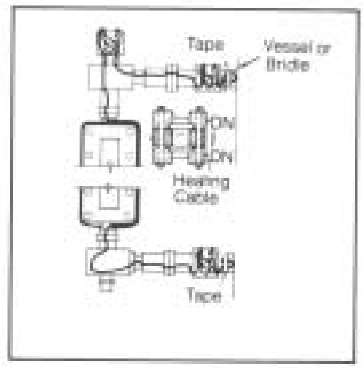
Installation of Temperature
Sensor, Thermistor



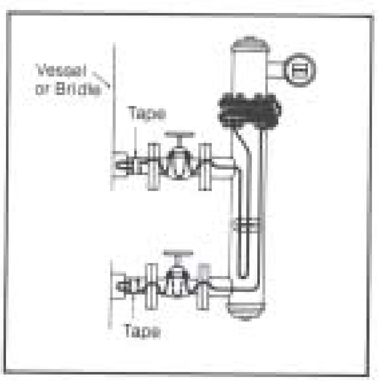
Installation of Heating Cable
on a Pipe Support



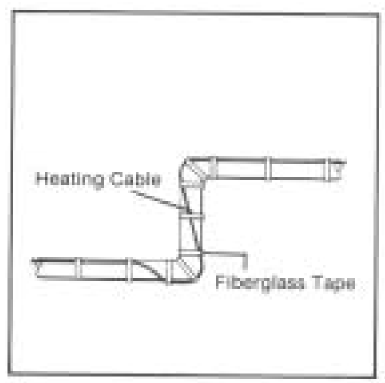
Installation of Heating Cable
for Supports



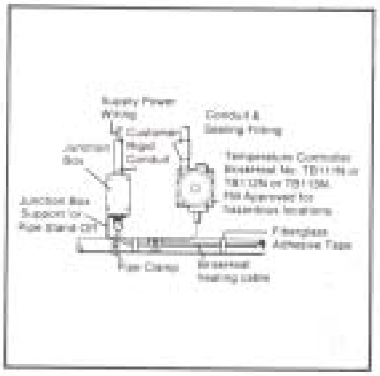
Installation of Heating Cable
on a Level Gauge



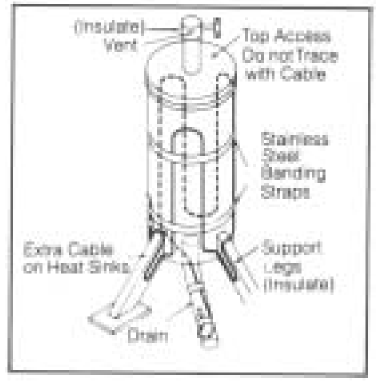
Installation of Heating Cable
on a Level Controller



Installation of Heating Cable
at Elbows



Installation of Heating Cable
System Located in Hazardous Area



Installation of Heating Cable
on Filter or Strainer

Glossary

Ampere – Unit of current flow (I), I=V/R

AC – Alternating Current

Ampacity – The current carrying capacity of the conductor under stated thermal conditions*

Conductor – The current carrying, non-heat producing component of the heating element*

Conduction – The transfer of conduction within or between two bodies in physical contact

Convection – The movement of a mass with its associated energy (liquid or gas) from one location to another

DC – Direct Current

Dielectric Strength – The ability of the electrical insulation to withstand an applied voltage*

Dielectric Breakdown – The voltage at which the dielectric strength of the insulating material falls below the acceptable level*

Element – A resistor encased in an acceptable insulating material covered with a protective sheath*

Ground – A conducting connection between an electrical circuit or equipment and the earth, or to some conducting body that serves in place of the earth*

Hazardous Locations – Locations are classified depending on the properties of the flammable vapors, liquids, or gases, or combustible dusts, or fibers that may be present and the likelihood that a flammable or combustible concentration or quantity may be present*

Heat – Energy in transition from one body to another by virtue of temperature difference between the bodies

Heat of Fusion – Heat necessary to change a solid to a liquid

Heat of Vaporization – Heat necessary to change liquid to gas

Hertz – Unit of frequency for the charge reversal in alternating current

Hi-Pot – A high-voltage quality assurance test performed on electrical components and systems

Impedance Heat – A system in which heat is generated in a pipeline or vessel wall by causing current to flow through the pipeline or vessel wall by direct connection to an AC voltage source from a dual winding transformer

Specific Gravity (Gas) – The ratio of the density of a gas to the density of air at 60^{o} F and 14.7 psia

Specific Gravity (Liquid) – The ratio of the density of a liquid to the density of water at 60^{o} F and 14.7 psia

Specific Heat – the energy in Btu's required to change the temperature of a substance by 1^{o} F

Heater – A completed, usable assembly containing one or more elements

Insulation – The dielectric material surrounding the resistor and / or conductor in order to electrically isolate the current carrying components from ground or other components (e.g., thermal insulation is any material that retards the transfer of heat to the environment or other components)*

Insulation Resistance – The ability of the insulation to resist the passage of current

Leakage – The undesirable passage of current flow through or over the surface of an insulator

Leakage Current – The total electrical current flow from the resistor through or around the insulation to a point external to the resistor when the element is energized*

OHM – The electrical unit of resistance (R), R=V/I

Parallel Circuit – A circuit in which the identical voltage is presented to all components, and the current divides among the components according to the resistance or the impedance of the components

Radiation – The transfer of energy from one body to another through space by electromagnetic wave phenomena
Rating – The performance characteristic of an element or heater normally expressed in power output (watts) for a specific input voltage

Resistor – The heat-producing component of an element*

Series Circuit – A circuit in which the components are arranged end-to-end to form a single path for the circuit

Single Phase – A system energized from a single alternating voltage wave

Thermal Resistance – The property that opposes the flow of heat (energy) through the material

Terminal – The device or point at which external power is connected

Three Phase – A system energized from three substantially equal voltages, which differ in phase by one third of a cycle or 120^{o}

Volt – Unit of electrical pressure (V). One volt is the amount of pressure that will cause one ampere of current in one ohm of resistance. V=IR

Watt – Unit of electrical power (W). One watt is equivalent to the power represented by one ampere of current under a pressure of one volt. W=VI

Watt Density – The output of the element or resistor in watts per square inch of surface area. On heating cable elements, watt density is expressed in watts per foot of cable*

Wattage Rating Tolerance – Wattage Output Tolerance is the acceptable manufacturer's wattage variation allowed from rated wattage at rated voltage*

*NEMA Standard