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# Heat Trace (Heat Tracing)

## Introduction

Heat trace is most commonly seen with the use of electric heating to protect surfaces and piping from freezing, thus preventing fluid flow due to surrounding low ambient air temperatures. When the heat trace systems are not continuously monitored, their failure can create unpleasant surprises that may negatively impact the systems they serve.

## Brief History and Facts

The principle of heat tracing dates back from the early 1900's, when steam and fluid heat tracing techniques, were used to ensure the flow of petroleum (viscosity control) through pipelines. Although very rudimentary during the 1930's, electric heat tracing began to appear without dedicated equipment, controls or adequate materials. After World War II ended, the oil and derivatives industries grew and needed more effective ways to keep up with the demand. In the early 1950's the latest non-electric heat transfer compounds were designed to increase the heat transfer rate, as the industry was looking to maintain lower temperatures with better controls and reliability. Although overwhelmed with problems due to the enlargement and shrinkage of the material and high installation costs, fluid heat tracing (bare tracers), a sort of capillary tubing located above the pipeline, were implemented to lower the amount of heat supplied. During the 1950's durable electric heat tracing was being developed, leading to needed improvements, such as adding temperature controls. This improvement made this technology a serious competitor to the fluid/steam tracer methods.

## Equipment Compliance and Types

The steam and fluid heat tracing methods do not have specific guidelines for their implementation; however, all work shall comply with applicable federal, state and local codes as well as industry standards such as ANSI, ASTM, ASME, MSS, UL and API.

The Institute of Electrical and Electronic Engineers, Inc. (IEEE) developed two (2) guidelines for the testing, design, installation and maintenance of electrical resistance heat tracing:

- **IEEE 515**, Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Heat Tracing for Industrial Applications
- **IEEE 515.1**, Recommended Practice for the Testing, Design, Installation, and Maintenance of Electrical Resistance Heat Tracing for Commercial Applications

Commercial applications of electrical resistance heat tracing for deicing of roof, gutters, pavement, freeze protection of sprinkler piping and standpipe of fire suppression systems in commonplaces are intended for their installation in accordance with the installation guidelines of the NEC, ANSI/NFPA 70 and the IEEE 515.1.

The most common types of electric heat tracing are:

- Heat Tape (for high density and temperature heating)
- Self-Regulating, Low Temperature
- Constant Wattage, Medium Temperature
- Mineral Insulating (for High Temperature)
- Series Resistance and Skin Tracing

## Heat Tracing Pros and Cons

<u>Steam heat tracing</u> can utilize waste steam, environmentally safe with high heat transfer rates and practical, if steam source is nearby. However, it is expensive to install if no steam is readily available, has limited operational temperature and has rather unstable temperature control.

<u>Fluid heat tracing</u> can work in a wide temperature range with modest temperature control. It is relatively expensive, requiring a source to heat the fluid, possibly multiple circuits and circulating pump(s) for fluids that can be rather hazardous, if a leak were to occur.

<u>Electric heat tracing</u> can work at almost any location that has electrical power available. It can be installed on short and long metal and non-metal pipes due to the broad range of temperature control and works well on components that require precision temperature control. On the other hand, the electric heat tracing cannot provide quick heat up and could lead to sparking that may lead to fire or explosion, if flammable materials are present, especially when the electrical heat tracing was not properly installed.

## Other Applications and Considerations

Heat tracing can also be used in laboratory and industrial applications where necessary for safe and reliable operation of the systems.

In a laboratory environment, heat tracing may be required for pipes and vents exposed to the weather from areas that are considered clean or sterile, such as clean rooms and food processing areas, where some these vents may be equipped with high efficiency particulate air (HEPA) filters. Heat tracing operation should be monitored and alarmed, and powered from an emergency power source.

Heat tracing may be required for control tubing, especially whenever it is exposed to below-freezing outdoor temperatures. Heat tracing is required for extended underground piping for remotely installed grease interceptors, when other options are not available. Piping insulation is also recommended.

Other applications for electric heat tracing (with insulation) include caustic lines in reagent piping systems, hydronic piping, exposed pipe traps, and garage wash-down systems.

For fire protection applications, NFPA 13 allows the use of heat tracing for sprinkler piping in specific areas and conditions, as long as the heat trace is supervised and reliable, unless otherwise not permitted by the authority having jurisdiction.

It is important to again mention that the installation of electric heat tracing follows the IEEE 515 and 515.1 as applicable to ensure reliable and safe operation of the system. Understanding the temperature requirements and the selected product rating, number of circuits required, avoiding cable overlaps, providing proper insulation, grounding, monitoring and controls is very important.

Heat tracing systems can be an asset or a painful nuisance; therefore, understanding the types, options, coordinating with process engineers and plant operators and selecting a good system can maximize the benefits, reduce associated operating cost and improve system reliability.

At NIH, heat trace is certainly the endmost alternative when piped utilities cannot be located within building envelopes and below the frost line (when buried) and should be avoided. Even when supplied from emergency power, heat trace needs to be monitored and alarmed as it is subject to failure from damage, shorting and loss of electrical supply.

Reference:

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