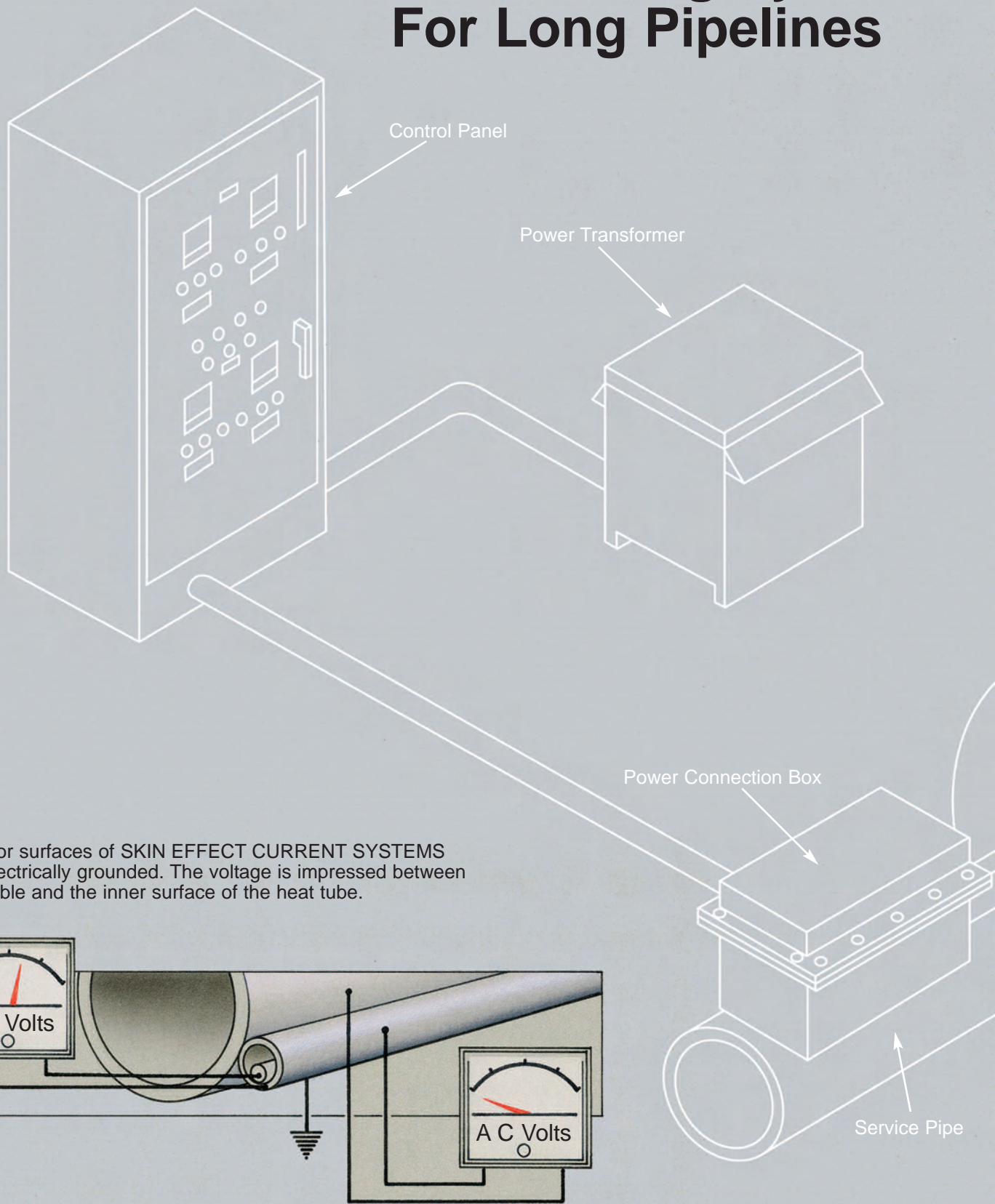


SKIN EFFECT CURRENT TRACING

PERMA-PIPE®

RICWIL SKIN EFFECT CURRENT TRACED SYSTEMS

The Most Reliable Cost-Effective Heat Tracing System For Long Pipelines



Exterior surfaces of SKIN EFFECT CURRENT SYSTEMS are electrically grounded. The voltage is impressed between the cable and the inner surface of the heat tube.

Electric **SKIN EFFECT CURRENT TRACING** combines the engineering principles of skin effect and proximity effect. Skin effect is an alternating current phenomena whereby AC current flows in the outer surface of a carbon steel conductor. Proximity effect is an electromagnetic force whereby equal currents in opposite directions attract. By placing the electric cable inside the heat tube, the current is drawn to a thin section of the heat tube inner wall. Heat generated from the current is dispatched through the heat tube wall and into the service pipe by conduction.

Custom Designed and Supplied in accordance with ANSI/IEEE 844, NEC 426, 427 and your specific application requirements.

Factory Fabricated Tracing System packaged with prefabricated preinsulated piping ensures the physical, thermal and electrical integrity of the system.

Factory Mutual Approved for hazardous environments.

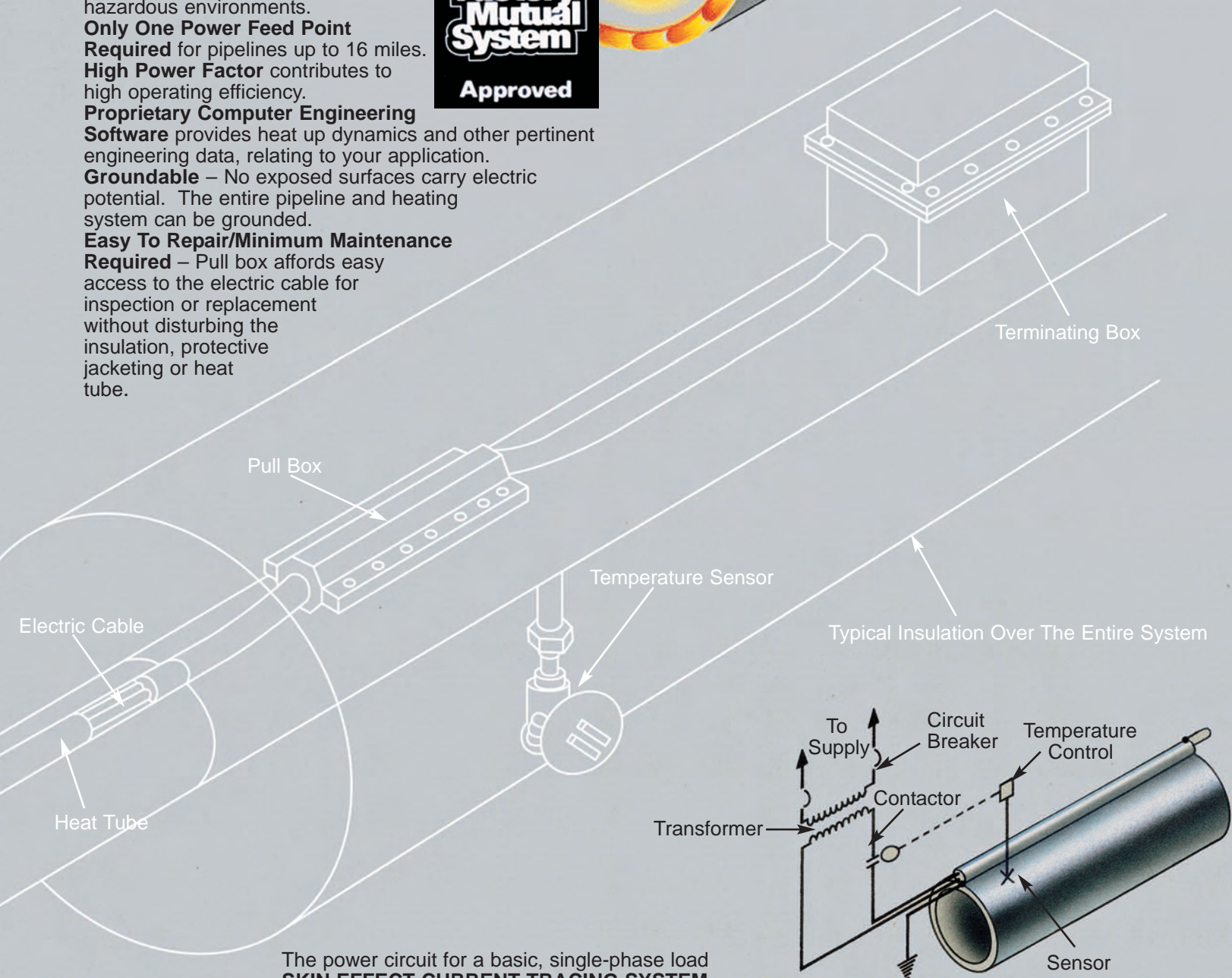
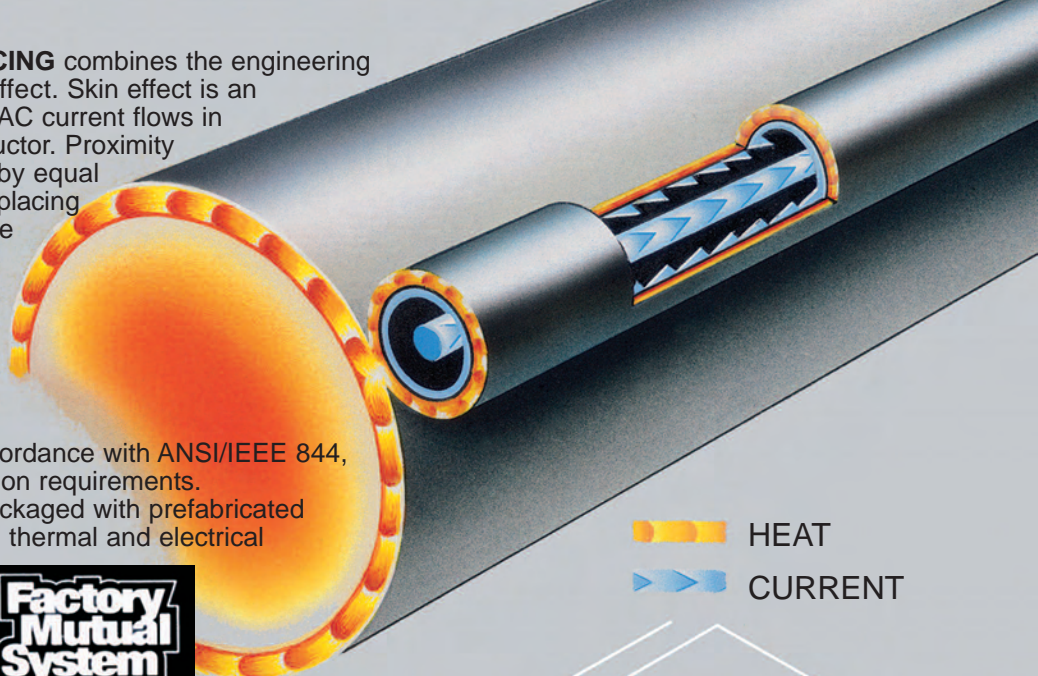
Only One Power Feed Point Required for pipelines up to 16 miles.

High Power Factor contributes to high operating efficiency.

Proprietary Computer Engineering Software provides heat up dynamics and other pertinent engineering data, relating to your application.

Groundable – No exposed surfaces carry electric potential. The entire pipeline and heating system can be grounded.

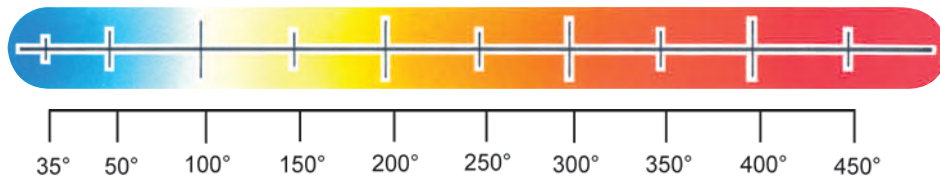
Easy To Repair/Minimum Maintenance Required – Pull box affords easy access to the electric cable for inspection or replacement without disturbing the insulation, protective jacketing or heat tube.



The power circuit for a basic, single-phase load **SKIN EFFECT CURRENT TRACING SYSTEM** consists of a transformer for isolation and specific voltage, primary and secondary current protection, an operating contactor and a temperature control device. Additional tubes on a single pipe, if required, are usually fed from multi-phase transformers to provide balance on a three-phase source. All thermal and electrical characteristics are designed to ensure optimal performance based upon your requirements.

Applications

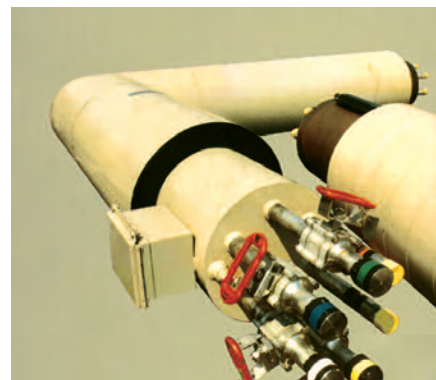
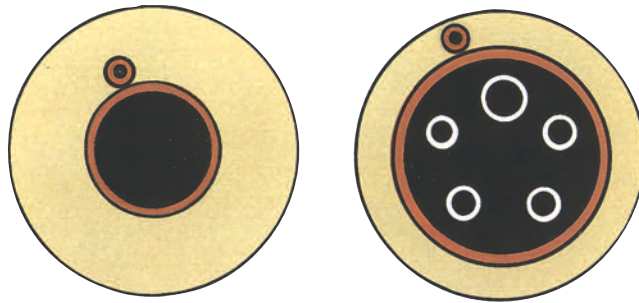
The effective maintenance temperature range for SKIN EFFECT CURRENT TRACING is +35°F to +350°F. (will withstand -80°F to +450°F)



Typical SKIN EFFECT CURRENT TRACING applications include:

- WATER
- FOODS
- GASES
- CHEMICALS
- RESINS
- ACIDS
- OILS
- BASES
- HYDROCARBONS PRODUCTS

RICWIL SKIN EFFECT CURRENT TRACING SYSTEMS are custom designed for both single and multiple pipe applications. The multiple pipe configuration enables non-metallic pipes to be efficiently heat traced and also provides secondary containment for the pipeline.



SKIN EFFECT CURRENT TRACING SYSTEMS can be applied to aboveground, underground and underwater piping systems.

Typical applications include:

1. **Freeze protection** for keeping fluids above their freeze point (water)
 2. **Temperature maintenance** for maintaining the viscosity for efficient fluid flow (processing lines - sulfur)
 3. **Heat/reheat** for intermittent flow of fluids (unloading lines - crude oil)
- Systems can also be retrofitted to existing lines.

Heat Tracing is the use of an externally applied heat source on a pipeline to compensate for heat losses through the thermal insulation.

Heat tracing evolved from the need to maintain the flow of low, medium and high temperature liquids through a pipeline, regardless of the surrounding environment.

The primary applications for heat tracing are: 1) freeze protection, 2) temperature maintenance and 3) heat/reheat.

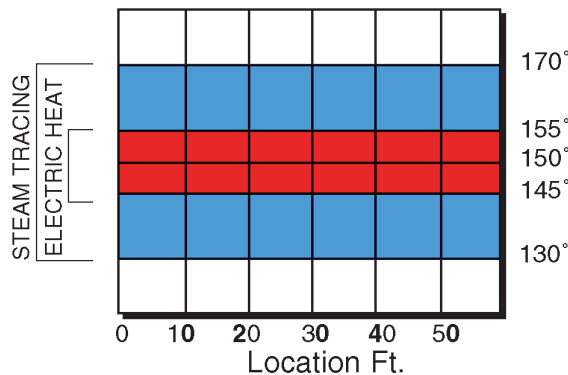
Early heat tracing methods, utilizing steam or hot fluids, were inefficient in their use of thermal energy and their ability to maintain a uniform temperature along the pipeline. Frequent inspection and care was required for these systems.

Electric heat tracing has significant advantages over other methods:

Reliable, Uniform, Controllable Heat

Electric heat tracing *supplies only the heat necessary* for the efficient flow of product through the pipeline, *and only when required*. Because electric tracing is easily controllable, temperature variance is minimized and operating costs are significantly reduced. Time-consuming, costly purging of the lines is also eliminated.

Temperature Control
Steam Vs. Electric



Optimum Tracing For Any Temperature And Pipeline Length

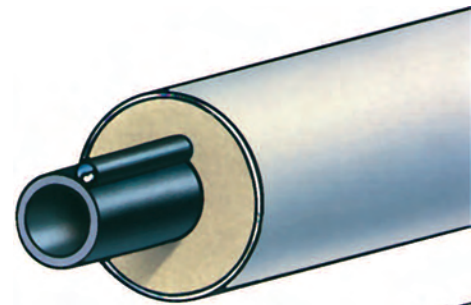
Several electric heat tracing methods are available for use, depending upon the application. Each tracing method had distinctive characteristics relating to pipeline length, configuration, product temperature requirements and type of application. All of this data directly affects the operating cost efficiency of a given type of heat tracing. Most applications require a custom system in order to achieve optimal performance.

As a pioneer in pipeline heat tracing, we design, manufacture and install custom, high quality, prefabricated, preinsulated heat traced piping systems utilizing steam, hot liquids or electric methods.

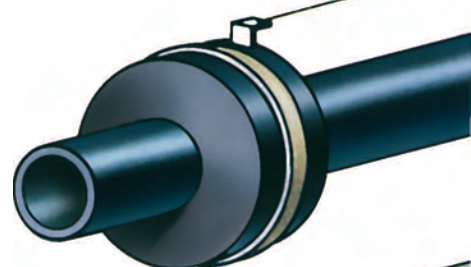
We know electric heat tracing. We offer complete system packages, including pipe and insulation, for SKIN EFFECT, IMPEDANCE and HEAT TAPE TRACING SYSTEMS.

We accomplish this using proprietary, computer aided engineering software, skilled personnel and more than 75 years of custom, prefabricated, preinsulated piping system expertise.

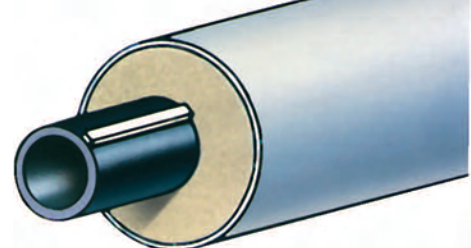
For example, we have custom designed more than 200 SKIN EFFECT CURRENT TRACING SYSTEMS, representing 1 million feet of pipeline and more than 25,000 KVA.



SKIN EFFECT



IMPEDANCE



HEAT TAPE



RICWIL SKIN EFFECT CURRENT TRACING

SPECIFICATION GUIDE

GENERAL

The design of the electrical heat tracing system shall provide the most energy efficient and cost effective system in accordance with the operating, maintenance and ambient temperature parameters of the traced system. The system shall not be limited to the tracing elements, but rather, shall include factory preinsulated service pipe and protective outer jacket. The supplier of the system shall provide complete thermal designs as well as mechanical designs of pipe supports, anchors and expansion loops. Only vendors capable of supplying complete system designs and total package equipment to include field service, installation instructions and system start-up shall be considered. The heat tracing system shall be RICWIL SKIN EFFECT CURRENT TRACING as manufactured by PERMA-PIPE. The system manufacturer shall have at least five years experience in the design and manufacture of skin effect current tracing systems.

ELECTRICAL DESIGN

The SKIN EFFECT CURRENT TRACING SYSTEM shall consist of an electrical cable inside a carbon steel heat tube. The system shall be capable of uniformly providing heat along its entire length without hot/cold spots on the pipe.

The electrical design shall provide 25% greater power than the maximum heat loss at minimum ambient and maximum maintenance temperature conditions for maintenance temperature 100°F and below. For maintenance temperature above 100°F the input power shall be at least 40% greater than the heat loss. Where specified heat up times demand greater input power capability, the greater power input shall be supplied.

Electrical cable shall be designed for a minimum 20 year life with insulation temperatures on the cable not exceeding 90% of the manufacturer's recommended temperature rating. Cable operating voltage, likewise, shall not be greater than 90% of the manufacturer's rating.

CONTROLS

The pipe temperature shall be continuously monitored and controlled via a closed loop, temperature control system. Proper controls shall be provided to protect the power transformer and heating power cable.

Temperature sensors shall be resistance temperature detectors or thermocouples positively seated with constant pressure on the pipe. Sensors shall be protected from environmental conditions and laminated in weatherproof fittings.

Status indication lights shall be provided for the following functions: Power on, heating on, high temperature and low temperature.

TRANSFORMERS

The power transformer shall be isolating type (autotransformers are not permitted). Power transformers shall be dry-type with primary voltage percentage taps to match the supply voltage. Transformers shall be designed for continuous self-cooled operation at the maximum design KVA rating.

PERMA-PIPE[®]

PERMA-PIPE, Inc.

A Subsidiary of MFRI, Inc.

7720 North Lehigh Avenue

Niles, Illinois 60714-3491

Phone (847) 966-2235

Fax (847) 470-1204

www.permapipe.com

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