

SECTION 15932 – ELECTRIC HEAT TRACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 WORK INCLUDED

- A. Acceptable manufacturers contingent upon compliance with the specifications.
 - 1. Raychem
 - 2. Pyrotenax
 - 3. Thermon
 - 4. Nelson
- B. This specification covers the requirements for the design, installation, and testing of an electrical heat tracing system for insulated pipes and vessels.
- C. The design, drawings, equipment and materials supplied shall be in conformance to this specification and the terms listed in the purchase order. It is the seller's responsibility to comply with this requirement.
- D. All heat tracing materials, components, and accessories shall be new, unused, undamaged and of a grade and quality specified in the manufacturer's literature.
- E. Design and installation shall be in strict compliance with the manufacturer's published recommendations and specifications.

1.3 RELATED SECTIONS

- A. Examine all drawings and criteria sheets and all other Sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.

1.4 REFERENCES

- A. The electric heat-tracing system shall conform to this specification. It shall be designed, manufactured, and tested in accordance with the applicable requirements of the latest edition of the following codes and standards.
1. ANSI American National Standards Institute
 2. NEC National Electrical Code
 3. CEC Canadian Electrical Code
 4. CSA CSA International
 5. FM FM Approvals
 6. IEC 216 International Electro-Mechanical Commission
 7. IEEE 515 Institute Of Electrical and Electronics Engineers
 8. ITS Intertek Testing Services (ETL)
 9. BS6351 British Standard for Electrical Surface Heating
 10. NEMA National Electrical Manufacturers Association
 11. NESC National Electrical Safety Code
 12. UL 746B, UL 508 Underwriters' Laboratories, Inc.
 13. National Fire Protection Association (NFPA)
 14. Local codes and requirements

1.5 SUBMITTALS

- A. See Section 15050 and General Conditions for additional requirements.
- B. Product Data: Provide data for each system component.
- C. Shop Drawings.
1. Include all calculations.
 2. Show system configuration with peripheral devices, batteries, power supplies, diagrams and interconnections.
 3. Indicate description and sequence of operation of operating, user and application software
- D. Manufacturer's Installation Instructions: Indicate manufacturer's installation instructions for all manufactured components.
- E. Operations and Maintenance Data:
1. Include interconnection wiring diagrams for complete field installed systems with identified and numbered, system components and devices.
 2. Include inspection period, cleaning methods, recommended cleaning materials and tolerances.
- F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

- A. Perform work in accordance with NFPA 70.

PART 2 - PRODUCT

2.1 GENERAL

- A. Heat loss calculations shall conform to the guidelines stated in IEEE Publication 515-1989.
- B. A 10% safety factor shall be used for all heat loss calculations.
- C. The following worst-case ambient conditions shall be used in the heat loss determination.
 - 1. Minimum Ambient Temperature = -12°F
 - 2. Maximum Wind Speed = 24 MPH

2.2 THERMAL INSULATION

- A. All heat traced pipes and vessels shall be insulated.
- B. See specification section 15081 Piping Insulation and 15082 Equipment Insulation.

2.3 ELECTRICAL CONDUIT

- A. Electrical conduit shall comply with project electrical specifications as well as referenced codes.
 - 1. Conduit shall be installed in a manner to prevent moisture entry or accumulation due to condensation. This should include bottom entry into enclosures where possible, low point conduit drains and drip loops on entry/exit wiring.
 - 2. Equipment enclosures, conduit fittings, connection boxes, etc. should be closed or temporarily protected from moisture (rain, snow, hosing) at the end of each day.
 - 3. Heater cable power connection points shall not be the low point in a conduit run. If at the end of a run, a low point drain should be installed below the power connection box and the conduit teed over and up to the power connection box.

2.4 ELECTRICAL HEAT TRACING SELECTION

- A. The selection of the appropriate heat tracing family shall be based on the maximum maintain temperature and maximum exposure temperature.

Selection of specific heaters within a family will be based on the heater power output being equal to or greater than the worst-case heat loss as calculated in Section 4.0. Additional factors such as required maintain temperature and maximum system design temperatures, i.e. maximum and minimum allowable product temperature and maximum allowable material temperature, must also be considered.

- B. All heat-tracing applications with continuous exposure (maintain) temperatures from 150°F (65°C) to 250°F (121°C) or intermittent exposure temperatures from 185°F (85°C) to 420°F (215°C) shall use self-regulating cables.
- C. Where heat tracing is required on lines that exceed the maximum exposure temperature of self-regulating cables, mineral insulated electric heat tracing shall be installed.

2.5 LOW TEMPERATURE, FREEZE PROTECTION

A. General

- 1. Maximum Maintain Temperature = 150°F
- 2. Maximum Exposure Temperature = 185°F

- B. The electric heating cable shall be a parallel, self-regulating heater such that it can be cut to length in the field without effecting power output per unit length. Initial design shall not exceed 75% of maximum rated circuit length, allowing for added field changes.
- C. Self-regulating heating cable shall vary its power output relative to the temperature of the surface of the pipe or the vessel. The cable shall be designed such that it can be crossed over itself and cut to length in the field.
- D. Self-regulating heating cable shall be designed for a useful life of 20 years or more with “power on” continuously, based on the following useful life criteria:
 - 1. Retention of at least 75 percent of rated power after 20 years of operation at the maximum published continuous exposure (maintain) temperature.
 - 2. Retention of at least 90 percent of rated power after 1000 hours of operation at the maximum published intermittent exposure temperature. The testing shall conform to UL 7468, IEC 216-1 Part 1.
- E. A warranty against manufacturing defects for a period of 10 years shall be available.
- F. All Self Regulating cables shall be capable of passing a 2500 VDC dielectric test for one minute (ASTM 2633) after undergoing a 0.5 kg-m impact (BS 6351, Part 1, 8.1.10).

2.6 DISTRIBUTION PANEL

- A. Provide power distribution panel.
- B. The power distribution panels shall be located close to the physical location of the heat trace cables as the branch circuit breakers shall serve as local disconnect means for each heat trace circuit. Wherever practical the panels shall be located in unclassified, non-corrosive areas.
- C. Critical process circuits shall be protected by a separate branch circuit breaker. No more than 2 circuits shall be grouped on a single branch circuit breaker for other circuits.
- D. Heat tracing circuit control shall be provided in accordance with the following guidelines.
 - 1. Freeze Protection, Group Control
 - a. For freeze protection or group control process-temperature maintenance systems, distribution panels shall consist of an enclosure, including a panelboard with ground-fault protection devices (30 mA trip level). The panels shall provide ground-fault alarm capabilities. If more than one circuit is required, a main contactor shall be used. The panels shall operate with ambient-sensing or proportional ambient-sensing controllers. The panel shall be the Tracer HTPG heat tracing panel as manufactured by Tyco Thermal Controls.
- E. Breakers shall be properly sized in accordance with manufacturer's recommendation.

2.7 TEMPERATURE CONTROL

- A. Freeze Protection
 - 1. Freeze protection circuits with maximum exposure temperatures 150°F or less shall be controlled with an ambient sensing thermostat and properly sized contactor for each power distribution panel. Circuits shall be energized when ambient temperature drops to 40°F.
- B. Temperature Maintenance
 - 1. Heat tracing circuits for pipes having maintained temperatures above 40°F and/or exposure temperatures above 150°F shall be individually controlled.
 - 2. Local temperature control shall be provided by mechanical, bulb and capillary thermostats or electronic controller approved for the area classification. Each heat tracing circuit shall be energized when pipe or vessel temperature drops below the desired maintain temperature as specified on the line list or vessel schedule. Thermostats shall be selected in accordance with electrical switching requirements provided in the heat tracing manufacturer's technical documentation.

3. Control of critical heat tracing circuits shall be accomplished with the use of a single or dual circuit digital controller. The controller shall conform to the following criteria:
 - a. The system shall be field-mounted and shall have FM or CSA approval for Class I, Division 2, Groups A, B, C, D when using a solid-state switching device.
 - b. The system shall provide the user with the option of line-sensing control with a user-selectable dead band, ambient sensing, proportional ambient sensing (PASC), and power limiting control modes.
 - c. The system shall provide an isolated triac alarm relay or a dry contact relay for alarm annunciation back to a Distributed Control System (DCS).
 - d. Electrical code-approved ground-fault detection equipment shall be integral to the controller to simplify installation and reduce total cost.
 - e. Enclosure type shall be NEMA 4X fiberglass reinforced plastic (FRP) or stainless steel for corrosion resistance and protection from moisture.
 - f. DigiTrace units may be network-ready to provide communication to a host PC running Windows™-based Supervisor software for central programming, status review, and alarm annunciation. DigiTrace units shall support the Modbus™ RTU or ASCII/HTCBus communications protocol and be supplied complete with RS-485 communications interface capability.
 - g. The system shall be DigiTrace 910 or DigiTrace 920 heat-tracing control systems, as manufactured by Tyco Thermal Controls.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Heater installation and electrical design shall conform to the manufacturer's published specifications and guidelines.
- B. All electrical heat tracing components, power connections, splices, tees and end seals shall be by the same manufacturer as the heat tracing cable and shall be approved by a Certifying Agency for installation in the designated areas.
- C. Heating cable shall be installed to allow easy removal in maintenance items such as pumps, valves, strainers and filters.
- D. Heater cables shall not be installed before completion of hydro tests and any piping rework to avert possible physical damage to the cables.
- E. All terminations and electrical connections shall be waterproofed to prevent moisture tracking electrical faults.

- F. Self-regulating heaters shall be attached to metal pipe with adhesive backed glass fiber tape at 1-foot intervals. Self-regulating heaters shall be attached to non-metallic pipe with adhesive backed aluminum tape applied linearly over the heating cable.
- G. MI cable shall be attached to the pipe with stainless steel tie wire at 1-foot intervals.
- H. Vessel heating panels shall be attached to the vessel wall with adhesive backed aluminum tape.
- I. NO HEAT TRANSFER CEMENT of any type shall be permitted.
- J. Caution signs shall be installed at 10-foot intervals along the pipe or around the vessel

3.2 START UP/CHECK OUT

- A. Upon completion of thermal insulation installation the heater cable shall be meggered to verify no damage has occurred. Tests on Polymer heating cables should use at least a 2,500 VDC megger and 500 VDC on mineral insulated cables. Do not use a megger with an excess of 2500 VDC for polymer heater cables and 1000 VDC for mineral insulated heater cables. Minimum acceptable readings should be 20 megohms per circuit, regardless of length.
- B. Each circuit shall be energized and voltage and current measured and documented to verify the installation is properly functioning.
- C. Temperature controls should be operated to verify functioning.

3.3 DOCUMENTATION

- A. The installed system documentation shall include cables/controls/accessories installed on each circuit, electrical parameters and panelboard (breaker, control, alarm) circuit assignments.
- B. Test documentation shall be maintained of installation and start up test values and turned over to plant maintenance upon completion of the project to assist in future maintenance.

END OF SECTION