

**SECTION 22 05 33
HEAT TRACING FOR PLUMBING PIPING**

SPEC WRITER NOTES:

1. Delete between // // if not applicable to project. Also delete any other item or paragraph not applicable in the Section and renumber the paragraphs.
2. Coordinate electrical requirements with Electrical Engineer. Electrical power requirements shall be as shown on the drawings.
3. Heat tracing shall not be used in lieu of hot water circulation systems for domestic hot water.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes the requirement for supplying, installing, and testing of the electric heat tracing system of the plumbing piping. Freeze protection shall be utilized for domestic water piping in areas subject to freezing temperatures. Ice and snow melting shall be utilized for gutters, downspouts, roof drain bodies and roof drain leaders exposed to snow and ice accumulation.
- B. A complete listing of common acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- D. //Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.//
- E. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- F. Section 22 07 11, PLUMBING INSULATION.
- G. //Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.//
- H. Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

1.3 APPLICABLE PUBLICATIONS

SPEC WRITER NOTE: Make material requirements agree with requirements specified in the referenced Applicable Publications. Verify and update the publication list to that which applies to the project, unless the reference applies to all plumbing systems. Publications that apply to all plumbing systems may not be specifically referenced in the

body of the specification but shall form a part of this specification.

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standard will govern.
- B. The Institute of Electrical and Electronic Engineers (IEEE):
515.1-2012.....Testing, Design, Installation, and Maintenance
of Electrical Resistance Trace Heating for
Commercial Applications
- C. International Code Council, (ICC):
IPC-2018.....International Plumbing Code
- D. National Fire Protection Association (NFPA):
70-2020.....National Electrical Code (NEC)
- E. Underwriters' Laboratories, Inc. (UL):
508-2018.....Industrial Control Equipment

1.4 SUBMITTALS

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 05 33, HEAT TRACING FOR PLUMBING PIPING", with applicable paragraph identification.
- C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
 - 1. Rated capacity.
 - 2. Length of cable.
 - 3. Cable spacing.
 - 4. Electrical power requirements.
 - 5. Controls.
 - 6. Enclosures.
 - 7. Accessories.
- D. The shop drawings shall include plans, sections, details, wiring diagrams, and attachments to other work. The wiring diagrams shall include power, signal, and control wiring.
- E. Field quality control test reports shall be submitted.

- F. Complete operating and maintenance manuals including wiring diagram, technical data sheets, information for ordering replaceable parts, and troubleshoot guide:
 1. Include complete list indicating all components of the systems.
 2. Include complete diagrams of the internal wiring for each item of equipment.
 3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.
- G. //Completed System Readiness Checklist provided by the CxA and completed by the Contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.//
- H. //Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.//

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Ten years' experience in design, engineering, manufacture and support of specified system and components.
- B. Product Requirements:
 1. Pipe or tank tracing cable assembly shall be factory assembled, immersed in water for a minimum of 12 hours, and then tested for insulation resistance, high potential breakdown and continuity before leaving the factory.
 2. Factory Mutual approved heating cable that has the same wattage per lineal foot (power output), throughout its entire length.
 3. UL Listed, thermostat and contactor panel.
 4. UL Listed Control/Monitor Panel.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Bio-Based Materials: For products designated by the USDA's bio-based Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit <http://www.biopreferred.gov>.

- E. Refer to Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS for additional sustainable design requirements.

1.6 AS-BUILT DOCUMENTATION

- A. Comply with requirements in Paragraph "AS-BUILT DOCUMENTATION of Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

PART 2 - PRODUCTS

SPEC WRITER NOTE: Coordinate and assure that the electrical characteristics specified below are clearly shown on appropriate drawings. Coordinate with Electrical Engineer.

2.1 PLASTIC INSULATED SERIES RESISTANCE HEATING CABLES

- A. The plastic insulated series resistance heating cables shall comply with IEEE 515.1.
- B. The heating element shall be a single or dual strained resistor wire. Terminations shall be made with waterproof, factory assembled non heating leads with connectors at both ends.
- C. The electrical insulated jacket shall be a minimum 0.10 mm (4.0 mil) polymeric with silicone jacket, ETFE or polyolefin. The cable cover shall be aluminum braid //and silicone or high melt viscosity PVDE (Polyvinylidene Fluoride) outer jacket//.
- D. The maximum operating temperature shall be 150 degrees C (302 degrees F).
- E. Maximum exposure temperature shall be 85 degrees C (185 degrees F).
- F. The capacities and characteristics shall be:
 1. Maximum heat output //19.7 W/m (6 W/foot// //24.6 W/m (7.5 W/foot)//.
 2. Pipe Diameter: //INSERT Nominal Pipe Size VALUE//.
 3. Number of parallel cables: //INSERT VALUE//.
 4. Spiral wrap pitch: //INSERT VALUE//.
 5. See electrical drawings for electrical characteristics.

2.2 SELF-REGULATING PARALLEL RESISTANCE HEATING CABLES

- A. Self-regulating parallel resistance heating cables shall comply with IEEE 515.1.
- B. The heating element shall be a pair of parallel No. 16 AWG //tinned// //nickel coated// stranded copper bus wires embedded in cross linked conductive polymer core, which varies heat output in response to temperature along its length. Cables shall be terminated with waterproof, factory assembled non heating leads with connects at one

and seal the opposite end watertight. The cable shall be capable of crossing over itself without overheating.

- C. The electrical insulating jacket shall be flame-retardant polyolefin.
- D. The cable cover shall be //tinned copper// //stainless steel// braid and polyolefin outer jacket with UV inhibitor.
- E. The maximum power on operating temperature shall be 65 degrees C (150 degrees F).
- F. The maximum power off exposure temperature shall be 85 degrees C (185 degrees F).
- G. The capacities and characteristics shall be:
 1. Maximum heat output //9.8 W/m (3.0 W/foot)// //16.4 W/m (5.0 W/foot)// //26.0 W/m (8.0 W/foot)// //32.8 W/m (10.0 W/foot)// //39.4 W/m (12.0 W/foot)//.
 2. Pipe Diameter: //INSERT Nominal Pipe Size VALUE//.
 3. Number of parallel cables: //INSERT VALUE//.
 4. Spiral wrap pitch: //INSERT VALUE//.
 5. See electrical drawings for electrical characteristics.

2.3 CONSTANT WATTAGE RESISTANCE HEATING CABLES

- A. Constant Wattage Resistance Heating Cables shall comply with IEEE 515.1.
- B. The heating element shall be a pair of parallel No. 12 AWG, //tinned// //nickel-coated// stranded copper bus wires with single stranded resistor wire connected between bus wires. The heating element shall be terminated with waterproof, factory assembled non-heating leads with connectors at one end and seal the opposite end watertight.
- C. The electrical insulating jacket shall be flame retardant fluoropolymer.
- D. The cable cover shall be //tinned copper// //stainless steel// braid and polyolefin outer jacket with UV inhibitor.
- E. The maximum operating temperature shall be 200 degrees C (392 degrees F).
- F. The maximum exposure temperature shall be 200 degrees C (392 degrees F).
- G. The capacities and characteristics shall be:
 1. Maximum heat output //13.1 W/m (4.0 W/foot)// //26 W/m (8.0 W/foot)// //39.4 W/m (12.0 W/foot)// //32.8 W/m (10.0 W/foot)// //39.4 W/m (12.0 W/foot)//.
 2. Pipe Diameter: //INSERT Nominal Pipe Size VALUE//.

3. Number of parallel cables: //INSERT VALUE//.
4. Spiral wrap pitch: //INSERT VALUE//.
5. See electrical drawings for electrical characteristics.

2.4 CONTROLS

- A. Pipe mounting thermostats for Freeze protection shall have be a remote bulb unit with adjustable temperature range from minus 1 to 10 degrees C (34 to 50 degrees F). The thermostat shall be snap action, open-on-rise, single pole switch with minimum current rating adequate for the connected cable. The thermostat shall be remote bulb on capillary, resistance temperature device, or thermistor for direct sensing of pipe wall temperature. The control enclosure shall be corrosion resistant and waterproof.
- B. The precipitation and temperature sensor for snow melting on roofs and in gutters shall be //automatic// //microprocessor// based control with manual on, automatic, and standby/reset switches. The precipitation and temperature sensors shall sense the surface conditions of roof and/or gutters and shall be programmed to energize the cable as follows:
 1. Temperature span between 1 to 7 degrees C (34 to 44 degrees F).
 2. Adjustable delay off span between 30 and 90 minutes.
 3. Following a two minute delay, the cables shall be energized if ambient temperature is below set-point and precipitation is detected.
 4. The cables shall be de-energized upon detection of a dry surface plus a time delay of 15 minutes.
- C. The enclosure shall be the NEMA 4X type.
- D. A minimum 30 amp contactor shall be provided to energize cable or close other contactors. Provide relay with contacts to indicate operational status, on/off, and for interface with central energy management and control system.

2.5 ACCESSORIES

- A. Cable Installation Accessories: Fiberglass tape, heat-conductive putty, cable ties, silicone end seals and splice kits, and installation clips all furnished by manufacturer, or as recommended in writing by manufacturer.
- B. Warning Labels: Shall comply with NFPA 70.
- C. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 0.08 mm (3 mils) thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.

1. Width for Warning Tape on Pipes with Outside Dimension, Including Insulation, Less Than 150 mm (6 inches): 19 mm (3/4 inch) minimum.
2. Width for Warning Tape on Pipes with Outside Dimension, Including Insulation, 150 mm (6 inches) or Greater: 38 mm (1-1/2 inches) minimum.

PART 3 - EXECUTION

3.1 GENERAL

- A. Inspect surfaces and substrates of electric heating cables for compliance with requirements of this specification. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.
- B. Notify COR if the existing substrate conditions are unsuitable for application of heating cables in accordance with manufacturer's recommendations.
- C. If the installation of the heat tracing is unsatisfactory, then the Contractor shall correct the installation at no additional cost or time to the Government.

3.2 INSTALLATION

SPEC WRITER NOTE: Evaluate the need to place heat tracing cables on emergency power on any service supporting acute patient care.

- A. Electric heating cable shall be installed for the following applications:
 1. Snow and ice melting on roofs, in gutters and downspouts, roof drain bodies, and roof drain leaders: //Plastic-insulated series-resistance// //Self-regulating parallel-resistance// //Constant-wattage resistance// heating cable.
 2. Freeze protection of plumbing piping: //Plastic-insulated series-resistance// //Self-regulating parallel-resistance// //Constant-wattage resistance// heating cable.
- B. Electric heating cable shall be installed across expansion, construction, and control joints according to the manufacturer's recommendations using cable protection conduit and slack cable to allow for movement without damage to cable.
- C. The installation of electric heating cable for snow and ice melting on roofs, gutters and downspouts, and roof drain leaders shall be provided with clips furnished by the manufacturer that are compatible with roof, gutters and downspouts and roof drain leaders.

- D. Electric heating cable for pipe freeze protection shall be installed according to the following:
 - 1. Electric heating cables shall be installed after piping has been tested and before insulation is installed.
 - 2. Electric heat cables shall be installed according to IEEE 515.1
 - 3. Insulation shall be installed or applied over piping with electric cables. Refer to Section 22 07 11, PLUMBING INSULATION.
 - 4. Warning tape shall be installed on pipe insulation where piping is equipped with electric heating cables.
 - 5. Provide current transducer to monitor power in heating tape and monitor and alarm from BAS.
- E. Field adjustable switches and circuit breaker trip ranges shall be set.
- F. Heating cables including leads shall be protected from damage.
- G. Equipment shall be grounded according to Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
- H. Wiring shall be connected according to Section 26 05 19, LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

3.3 TESTS

SPEC WRITER NOTE: Coordinate testing and commissioning with Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS and 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections //with the assistance of a factory-authorized service representative//:
 - 1. Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
 - 2. Test cables for electrical continuity and insulation integrity before energizing.
 - 3. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.
- C. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.
- D. If deficiency is found, Contractor shall correct all deficiencies at no addition cost or time to the Government.

E. Prepare test and inspection reports.

3.4 //COMMISSIONING

A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.//

3.5 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer's technical representative for //4//
// // hour//s// to instruct each VA personnel responsible in operation and maintenance of the system.

B. //Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.//

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