SECTION 220533 - HEAT TRACING FOR PLUMBING PIPING

Revise this Section by deleting and inserting text to meet Project-specific requirements.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

1. GENERAL
	* + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			1. SUMMARY
				1. Section includes plumbing piping heat tracing for freeze prevention, and domestic hot-water-temperature maintenance, and snow and ice melting on roofs and in gutters and downspouts with the following electric heating cables:

Plastic insulated, series resistance.

Self-regulating, parallel resistance.

Constant wattage.

Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

* + - * 1. Section 210533 "Heat Tracing for Fire-Suppression Piping."
				2. Section 230533 "Heat Tracing for HVAC Piping."
			1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: For each type of product.

Include rated capacities, operating characteristics, and furnished specialties and accessories.

Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.

* + - * 1. Shop Drawings: For electric heating cable.

Include plans, elevations, sections, and attachment details.

Include diagrams for power, signal, and control wiring.

Retain "Field quality-control reports" paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
				2. Sample Warranty: For special warranty.
			1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.
			2. WARRANTY

When warranties are required, verify with Director’s Representative's that warranties stated in this article are not less than remedies available to Director’s Representative under prevailing local laws.

* + - * 1. Special Warranty: Manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within specified warranty period.

Verify available warranties and warranty periods for electric heating cable. Special warranties often exclude labor.

Warranty Period: [**Three**] [**Five**] <**Insert number**> years from date of Substantial Completion.

1. PRODUCTS

See Editing Instruction No. 1 in the Evaluations for cautions about named manufacturers and products.

* + - 1. PLASTIC-INSULATED, SERIES-RESISTANCE HEATING CABLES

Retain this article for pipe-mounted freeze protection or for snow and ice melting on roofs and in gutters and downspouts. Some manufacturers limit use of this product to stone, ceramic tile, or concrete floors.

* + - * 1. Comply with IEEE 515.1 “Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications”.
				2. Heating Element: Single- or dual-stranded resistor wire. Terminate with waterproof, factory-assembled, nonheating leads with connectors at both ends.
				3. Electrical Insulating Jacket: Minimum 4.0-mil Kapton with silicone, Tefzel, or polyolefin.

Outer jacket in "Cable Cover" paragraph below is optional feature and is required for waterproof applications; verify availability with manufacturer.

* + - * 1. Cable Cover: Aluminum braid[ and silicone or Hylar outer jacket].
				2. Maximum Operating Temperature (Power On): [300 deg F (150 deg C)] <Insert temperature>.
				3. Maximum Exposure Temperature (Power Off): [185 deg F (85 deg C)] <Insert temperature>.
				4. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 “Standard for Electrical Safety in the Workplace”, by a qualified testing agency, and marked for intended location and application.

If Project has more than one type or configuration of electric heating cable, delete "Capacities and Characteristics" paragraph below and schedule on Drawings. See Evaluations for a sample schedule.

* + - * 1. Capacities and Characteristics:

Maximum Heat Output: [**6 W/ft.**  [**7.5 W/ft.**] <Insert value>.

Piping Diameter: <**Insert NPS** >.

Number of Parallel Cables: <**Insert number**>.

Spiral Wrap Pitch: <**Insert inches** >.

Electrical Characteristics for Single-Circuit Connection:

Verify available voltages and heat-output ratings with manufacturer.

Volts: [120] [208] [240] [277] [480] <Insert value>.

Phase: <Insert value>.

Hertz: <Insert value>.

Full-Load Amperes: <**Insert value**>.

Minimum Circuit Ampacity: <**Insert value**>.

Maximum Overcurrent Protection: <**Insert amperage**>.

* + - 1. SELF-REGULATING, PARALLEL-RESISTANCE HEATING CABLES

Retain this article for pipe-mounted freeze protection, domestic hot-water-temperature maintenance, or snow and ice melting on roofs and in gutters and downspouts.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=5862) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Delta-Therm Corporation](http://www.specagent.com/Lookup?uid=123457218590).

[Nelson; Emerson Electric Co., Automation Solutions](http://www.specagent.com/Lookup?uid=123457218587).

[RAYCHEM; brand of nVent Electrical plc](http://www.specagent.com/Lookup?uid=123457218586).

Or equal.

* + - * 1. Comply with IEEE 515.1 “Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications”.
				2. Heating Element: Pair of parallel [**No. 16**] [**No. 18**] AWG, [**tinned**] [**nickel-coated**], stranded copper bus wires embedded in crosslinked conductive polymer core, which varies heat output in response to temperature along its length. Terminate with waterproof, factory-assembled, nonheating leads with connectors at one end, and seal the opposite end watertight. Cable shall be capable of crossing over itself once without overheating.
				3. Electrical Insulating Jacket: Flame-retardant polyolefin.

Outer jacket in "Cable Cover" paragraph below is optional feature and is required for waterproof applications; verify availability with manufacturer.

* + - * 1. Cable Cover: [Tinned-copper] [Stainless-steel] braid[ and polyolefin outer jacket with ultraviolet inhibitor].
				2. Maximum Operating Temperature (Power On): [**150 deg F**] <**Insert temperature**>.

Verify temperature of circulated media in freeze-protected piping in "Maximum Exposure Temperature (Power Off)" paragraph below.

* + - * 1. Maximum Exposure Temperature (Power Off): [**185 deg F**] <**Insert temperature**>.
				2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 “Standard for Electrical Safety in the Workplace”, by a qualified testing agency, and marked for intended location and application.

If Project has more than one type or configuration of electric heating cable, delete "Capacities and Characteristics" paragraph below and schedule on Drawings. See Evaluations for a sample schedule.

* + - * 1. Capacities and Characteristics:

Maximum Heat Output: [**3 W/ft.**] [**5 W/ft.**] [**8 W/ft.**] [**10 W/ft.**] [**12 W/ft.** ] <Insert value>.

Piping Diameter: <**Insert NPS** >.

Number of Parallel Cables: <**Insert number**>.

Spiral Wrap Pitch: <**Insert inches** >.

Electrical Characteristics for Single-Circuit Connection:

Verify available voltages and heat-output ratings with manufacturer.

Volts: [120] [208] [240] [277] [480] <Insert value>.

Phase: <Insert value>.

Hertz: <Insert value>.

Full-Load Amperes: <**Insert value**>.

Minimum Circuit Ampacity: <**Insert value**>.

Maximum Overcurrent Protection: <**Insert amperage**>.

* + - 1. CONSTANT-WATTAGE HEATING CABLES

Retain this article for snow and ice melting on roofs and in gutters and downspouts.

* + - * 1. Comply with IEEE 515.1 “Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications”.
				2. Heating Element: Pair of parallel [**No. 12**] <**Insert gage**> AWG, [**tinned**] [**nickel-coated**], stranded copper bus wires with single-stranded resistor wire connected between bus wires. Terminate with waterproof, factory-assembled, nonheating leads with connectors at one end, and seal the opposite end watertight.
				3. Electrical Insulating Jacket: Flame-retardant fluoropolymer.

Outer jacket in "Cable Cover" paragraph below is optional feature and is required for waterproof applications; verify availability with manufacturer.

* + - * 1. Cable Cover: [Tinned-copper] [Stainless-steel] braid[ and polyolefin outer jacket with ultraviolet inhibitor].
				2. Maximum Operating Temperature (Power On): [**392 deg F**] <**Insert temperature**>.

Verify temperature of circulated media in freeze-protected piping in "Maximum Exposure Temperature (Power Off)" paragraph below.

* + - * 1. Maximum Exposure Temperature (Power Off): [**185 deg F**] <**Insert temperature**>.
				2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 “Standard for Electrical Safety in the Workplace”, by a qualified testing agency, and marked for intended location and application.

If Project has more than one type or configuration of electric heating cable, delete "Capacities and Characteristics" paragraph below and schedule on Drawings. See Evaluations for a sample schedule.

* + - * 1. Capacities and Characteristics:

Maximum Heat Output: [**4 W/ft.**] [**8 W/ft.**] [**12 W/ft.**] <Insert value>.

Electrical Characteristics for Single-Circuit Connection:

Verify available voltages and heat-output ratings with manufacturer.

Volts: [120] [208] [240] [277] [480] <Insert value>.

Phase: <Insert value>.

Hertz: <Insert value>.

Full-Load Amperes: <**Insert value**>.

Minimum Circuit Ampacity: <**Insert value**>.

Maximum Overcurrent Protection: <**Insert amperage**>.

* + - 1. CONTROLS

Retain "Pipe-Mounted Thermostats for Freeze Protection" paragraph below to control electric heating cable for pipe-mounted freeze protection.

* + - * 1. Pipe-Mounted Thermostats for Freeze Protection:

Remote bulb unit with adjustable temperature range from [**30 to 50 deg F**] <Insert temperature range>.

Snap action; open-on-rise, single-pole switch with minimum current rating adequate for connected cable.

Remote bulb on capillary, resistance temperature device, or thermistor for directly sensing pipe-wall temperature.

Corrosion-resistant, waterproof control enclosure.

Retain "Precipitation and Temperature Sensor for Snow Melting on Roofs and in Gutters" paragraph below to operate electric heating cable for snow melting on roofs and in gutters.

* + - * 1. Precipitation and Temperature Sensor for Snow Melting on Roofs and in Gutters:

[**Microprocessor-based**] [**Automatic**] control with manual on, automatic, and standby/reset switch.

Precipitation and temperature sensors shall sense the surface conditions of roof and gutters and shall be programmed to energize the cable as follows:

Retain and revise features in "Temperature Span," "Adjustable Delay-Off Span," "Energize Cables," and "De-Energize Cables" subparagraphs below to suit Project. Verify available features with manufacturer.

Temperature Span: [**34 to 44 deg F**] <Insert temperature range>.

Adjustable Delay-Off Span: [**30 to 90**] <**Insert time**> minutes.

Energize Cables: Following [**two**] <**Insert time**>-minute delay if ambient temperature is below set point and precipitation is detected.

De-Energize Cables: On detection of a dry surface plus time delay.

Corrosion-proof and waterproof enclosure suitable for outdoor mounting, for controls and precipitation and temperature sensors.

Minimum 30-A contactor to energize cable or close other contactors.

Freestanding sensor can be used for snow and ice melting on roofs and in gutters.

Precipitation sensor shall be freestanding.

Provide relay with contacts to indicate operational status, on or off, for interface with central HVAC control-system workstation.

Programmable timer operates domestic hot-water-temperature-maintenance cable during occupied periods.

* + - * 1. Programmable Timer for Domestic Hot-Water-Temperature Maintenance:

Microprocessor based.

Minimum of four separate schedules.

Minimum 24-hour battery carryover.

On-off-auto switch.

365-day calendar with 20 programmable holidays.

Relays with contacts to indicate operational status, on or off, and for interface with central HVAC control-system workstation.

* + - 1. ACCESSORIES
				1. 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.

Retain "Warning Labels" or "Warning Tape" paragraph below.

* + - * 1. Warning Labels: Refer to Section 220553 "Identification for Plumbing Piping and Equipment."
				2. Warning Tape: Continuously printed "Electrical Tracing"; vinyl, at least 3 mils thick, and with pressure-sensitive, permanent, waterproof, self-adhesive back.

Width for Markers on Pipes with OD, Including Insulation, Less Than 6 inches : 3/4 inch minimum.

Width for Markers on Pipes with OD, Including Insulation, 6 inches or Larger: 1-1/2 inches minimum.

1. EXECUTION
	* + 1. EXAMINATION
				1. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.

Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.

* + - * 1. Proceed with installation only after unsatisfactory conditions have been corrected.
			1. APPLICATIONS

Applications in this article are typical uses for each type of electric heating cable. Consult manufacturers for other applications and for applications of other electric heating cables.

* + - * 1. Install the following types of electric heating cable for the applications described:

Snow and Ice Melting on Roofs and in Gutters and Downspouts: [Plastic-insulated, series-resistance] [Self-regulating, parallel-resistance] [Constant-wattage] heating cable.

Temperature Maintenance for Domestic Hot Water: Self-regulating, parallel-resistance heating cable.

* + - 1. INSTALLATION

Indicate location of controls on Drawings.

* + - * 1. Install electric heating cable across expansion, construction, and control joints according to manufacturer's written instructions; use cable-protection conduit and slack cable to allow movement without damage to cable.
				2. Electric Heating-Cable Installation for Snow and Ice Melting on Roofs and in Gutters and Downspouts: Install on roof and in gutters and downspouts with clips furnished by manufacturer that are compatible with roof, gutters, and downspouts.
				3. Electric Heating-Cable Installation for Freeze Protection for Piping:

Install electric heating cables after piping has been tested and before insulation is installed.

Install electric heating cables according to IEEE 515.1 “Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications”.

Install insulation over piping with electric cables according to Section 220719 "Plumbing Piping Insulation."

Install warning tape on piping insulation where piping is equipped with electric heating cables.

* + - * 1. Electric Heating-Cable Installation for Temperature Maintenance for Domestic Hot Water:

Install electric heating cables after piping has been tested and before insulation is installed.

Install insulation over piping with electric heating cables according to Section 220719 "Plumbing Piping Insulation."

Install warning tape on piping insulation where piping is equipped with electric heating cables.

* + - * 1. Set field-adjustable switches and circuit-breaker trip ranges.
			1. CONNECTIONS
				1. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
				2. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
			2. FIELD QUALITY CONTROL

Retain "Testing Agency," "Manufacturer's Field Service," and "Perform the following tests and inspections" paragraphs below to identify who shall perform tests and inspections. If retaining second option in "Testing Agency" paragraph or if retaining "Manufacturer's Field Service" or "Perform the following tests and inspections" paragraph, retain "Field quality-control reports" paragraph in "Informational Submittals" Article.

* + - * 1. Testing Agency: [Director’s Representative will engage ] [**Engage**] a qualified testing agency to perform tests and inspections.

Retain "Manufacturer's Field Service" paragraph below to require a factory-authorized service representative to perform tests and inspections.

* + - * 1. Manufacturer's Field Service: Engage a Company Field Advisor per OGS Spec Section 014216 factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

Retain "Perform the following tests and inspections" paragraph below to require Contractor to perform tests and inspections.

* + - * 1. Perform the following tests and inspections [ with the assistance of a Company Field Advisor per OGS Spec Section 014216]:

Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.

Test cables for electrical continuity and insulation integrity before energizing.

Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.

Retain first paragraph below for pipe-mounted freeze protection and for domestic hot-water-temperature maintenance.

* + - * 1. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.
				2. Cables will be considered defective if they do not pass tests and inspections.
				3. Prepare test and inspection reports.
			1. PROTECTION
				1. Protect installed heating cables, including nonheating leads, from damage during construction.
				2. Remove and replace damaged heat-tracing cables.

END OF SECTION 220533