SECTION 404113.13 - PROCESS PIPING ELECTRICAL RESISTANCE HEAT TRACING

Note that this section has only been edited for NYSOGS standardization and has not been technically edited. The designer shall make all technical edits specific to the project for this section.

This Section specifies electrical heat-tracing systems for freeze protection of process piping, fittings, valves, and accessories. Thermal fluids heat tracing for process piping is specified in Section 404113.26, heat tracing for equipment is specified in Section 404123.26, process piping insulation is specified in Section 404213, and process equipment insulation is specified in Section 404223.

1. GENERAL
	* + 1. SUMMARY
				1. Section Includes:

Self-regulating cables.

Heat-tracing controls.

* + - * 1. Related Requirements:

List other Sections directly related to or affecting Work of this Section. Include Sections specifying information expected to be found in this Section as well as Sections required to describe complete system or assembly requirements.

Section 404113.26 - Process Piping Thermal Fluids Heat Tracing: Piping heat tracing using heated glycol.

Section 404123.26 - Process Equipment Thermal Fluids Heat Tracing: Equipment heat tracing using heated glycol.

Section 404213 - Process Piping Insulation: Insulation and jacketing of process piping.

Section 404223 - Process Equipment Insulation: Insulation of equipment.

* + - 1. DEFINITIONS

Limit list of definitions to terms unique to this Section and not provided elsewhere.

* + - * 1. Self-Regulating Index (SRI): The rate of change of power output in Watts per degree F, as measured between the temperatures of 50 and 100 degrees F.
			1. REFERENCE STANDARDS

List reference standards included within text of this Section, with designations, numbers, and complete document titles.

* + - * 1. ASTM International:

ASTM B193 - Standard Test Method for Resistivity of Electrical Conductor Materials.

ASTM D2633 - Standard Test Methods for Thermoplastic Insulations and Jackets for Wire and Cable.

* + - * 1. FM Global:

FM Approval Guide.

* + - * 1. National Electrical Manufacturers Association:

NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

* + - * 1. NFPA:

NFPA 70 - National Electrical Code (NEC).

* + - 1. COORDINATION
				1. Coordinate Work of this Section with [**installation of process piping**] [**, installation of piping insulation**] [**, and**] <**\_\_\_\_\_\_\_\_**>.
			2. PREINSTALLATION MEETINGS
				1. Convene minimum [**one week**] [**<\_\_\_\_\_\_\_\_> weeks**] prior to commencing Work of this Section.
			3. SUBMITTALS

Only request submittals needed to verify compliance with Project requirements.

* + - * 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: Submit manufacturer information for system materials and component equipment, including thermal properties, electrical characteristics, and connection requirements.
				5. Shop Drawings:

Indicate system materials and component equipment.

Submit wiring and control diagrams, installation and anchoring requirements, fasteners, and other details.

* + - * 1. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

Include separate Paragraphs for additional certifications.

* + - * 1. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
				2. Source Quality-Control Submittals: Indicate results of [**shop**] [**factory**] tests and inspections.
				3. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
				4. Manufacturer Reports: Certify that equipment has been installed according to manufacturer instructions.
				5. Qualifications Statement:

Coordinate following Subparagraph with requirements specified in QUALIFICATIONS Article.

Submit qualifications for manufacturer.

* + - 1. CLOSEOUT SUBMITTALS
				1. Project Record Documents: Record actual locations of piping and appurtenances receiving heat tracing, and locations of source power and controls.
			2. QUALITY ASSURANCE

Include this Article to specify compliance with overall reference standards affecting products and installation included in this Section.

In following Paragraph insert "State of New York Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate.

* + - * 1. Perform Work according to <**\_\_\_\_\_\_\_\_**> standards.

Include following Paragraph only when cost of acquiring specified standards is justified.

* + - * 1. Maintain <**\_\_\_\_\_\_\_\_**> [**copy**] [**copies**] of each standard affecting Work of this Section on Site.
			1. QUALIFICATIONS

Coordinate following Paragraph with requirements specified in SUBMITTALS Article.

* + - * 1. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years' [**documented**] experience.
			1. DELIVERY, STORAGE, AND HANDLING
				1. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
				2. Store materials according to manufacturer instructions.
				3. Protection:

Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.

Provide additional protection according to manufacturer instructions.

* + - 1. EXISTING CONDITIONS
				1. Field Measurements:

Verify field measurements prior to fabrication.

Indicate field measurements on Shop Drawings.

* + - 1. WARRANTY

This Article extends warranty period beyond one year. Extended warranties may increase construction costs and State enforcement responsibilities. Specify warranties with caution.

* + - * 1. Furnish [**five**] [**10**] <**\_\_\_\_\_\_\_\_**>-year manufacturer's warranty for heat tracing and components.
1. PRODUCTS
	* + 1. SELF-REGULATING CABLE
				1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=9602&mf=04&src=wd):

designer to provide two manufacturers and approved equivalent for all listed products.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

In following Subparagraph insert "State of New York Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate.

Furnish materials according to <**\_\_\_\_\_\_\_\_**> standards.

Insert descriptive specifications below to identify Project requirements and to eliminate conflicts with products specified above.

* + - * 1. Description:

Bus Wires:

Quantity: Two.

Orientation: Parallel.

Material: Nickel-coated copper.

Minimum Size: [**16**] <**\_\_\_\_\_\_\_\_**> gage

Heating Element: Self-regulating polymeric core.

Jacketing:

Description: Tinned copper braid with resistance less than cable bus wire resistance.

Comply with ASTM B193.

Insulating Jacket: [**Polyolefin**] [**Fluoropolymer**] <**\_\_\_\_\_\_\_\_**>.

Cable Temperature Identification Number (T-Rating):

T6, without use of thermostats.

Comply with NEC.

Output:

As indicated on Drawings.

Minimum 3 W/ft.

* + - * 1. Performance and Design Criteria:

Power Output: Vary relative to temperature of surface of pipe or appurtenance.

Cable can be cut to length on Site.

Minimum SRI:

Cable Rating 3 W/ft. 0.038 W/degrees F

Cable Rating 5 W/ft. 0.060 W/degrees F

Cable Rating 8 W/ft. 0.074 W/degrees F

Cable Rating 10 W/ft. 0.100 W/degrees F

* + - * 1. Operation:

Electrical Characteristics:

[**<\_\_\_\_\_\_\_\_> hp ]**[**<\_\_\_\_\_\_\_\_> RLA**].

Voltage: <**\_\_\_\_\_\_\_\_**> V, [**single**] [**three**] phase, 60 Hz.

Maximum [**Fuse Size**] [**Circuit Breaker Size**] [**Overcurrent Protection**]: <**\_\_\_\_\_\_\_\_**> A.

Minimum Circuit Ampacity: <**\_\_\_\_\_\_\_\_**>.

Ground-Fault Protection Device: Set at 30 mA, with nominal 100-ms response time, to protect each circuit.

Disconnect Switch: Factory mounted in control panel.

* + - * 1. Accessories:

Splicing connectors.

End terminations.

T-connectors.

Power termination kits.

* + - 1. HEAT-TRACING CONTROLS
				1. Control and Monitoring Panel:

Materials: Nonmetallic.

Rating: NEMA 250 Type [**4X**] <**\_\_\_\_\_\_\_\_**>.

Configuration: [**Wall mounted**] [**Pedestal mounted**] <**\_\_\_\_\_\_\_\_**>.

Temperature Controller:

Microprocessor based.

Diagnostic self-testing capability.

Communications Port: [**Modbus ASCII via RS 485**] <**\_\_\_\_\_\_\_\_**>.

ON-OFF Control: Soft start.

Real-Time Data Indication:

Temperature.

Heater current.

Ground leakage current.

<**\_\_\_\_\_\_\_\_**>.

Stored Data:

[**Highest**] [**and**] [**lowest**] temperature encountered.

<**\_\_\_\_\_\_\_\_**>.

Alarms:

LOW TEMPERATURE.

HIGH TEMPERATURE.

LOW HEATER CURRENT.

HIGH HEATER CURRENT.

GROUND LEAKAGE CURRENT.

DAMAGED RTD SENSOR.

<**\_\_\_\_\_\_\_\_**>.

Consider single thermostat for non-hazardous locations and explosion-proof thermostats for hazardous locations.

* + - * 1. Single Thermostat:

Description: Stainless-steel remote bulb with 6-foot capillary encased in flexible stainless-steel armor.

Housing:

FM approved.

Rating: NEMA 250 Type [**4X**] <**\_\_\_\_\_\_\_\_**>.

Set-Point Range: 35 to 235 degrees F

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Explosion-Proof Thermostat:

Description: 6-foot capillary bulb encased in armored sheathing.

Housing:

Material: Cast aluminum.

Comply with NEC hazardous location requirements based on Site conditions.

Set-Point Range: 35 to 235 degrees F

* + - 1. SOURCE QUALITY CONTROL
				1. Testing:

Retain at least 75 percent of rated power after 20 years of operation at maximum published continuous exposure temperature.

Retain at least 90 percent of rated power after 1,000 hours of operation at maximum published intermittent exposure temperature.

Cable Dielectric Test: Passing 2.5 kV dielectric test for one minute according to ASTM D2633 after undergoing a 0.5 kg-m impact.

Before shipment, demonstrate cable insulation resistance of 20 megohms minimum bus to braid using a 2,500-V dc megger, and demonstrate tolerance for one minute at voltage equal to twice rated plus 1,000 V applied bus to braid.

Thermal Runaway:

Ensure that cable produces less than 0.5 W/ft. when energized and heated to 350 degrees F for 30 minutes.

After testing and reenergizing, demonstrate that cable does not have an increasing power output leading to thermal runaway.

Include one or both of following Paragraphs to require Director's inspection or witnessing of test at factory.

* + - * 1. Director’s Inspection:

Make completed heat-tracing assembly available for inspection at manufacturer's factory prior to packaging for shipment.

Notify Director’s Representative at least [**seven**] <**\_\_\_\_\_\_\_\_**> days before inspection is allowed.

* + - * 1. Director’s Witnessing:

Allow witnessing of factory inspections and tests at manufacturer's test facility.

Notify Director’s Representative at least [**seven**] <**\_\_\_\_\_\_\_\_**> days before inspections and tests are scheduled.

Include following Paragraph if reliance on manufacturer's approved quality-control program is sufficient for Project requirements.

* + - * 1. Certificate of Compliance:

If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.

Specified shop tests are not required for Work performed by approved manufacturer.

1. EXECUTION
	* + 1. EXAMINATION
				1. Verify that surfaces of pipes, valves, and fittings are clean and dry.
				2. Verify that piping has been inspected and is ready for insulation.
			2. INSTALLATION
				1. Install heat tracing before insulation is installed.
				2. Install equipment according to manufacturer instructions.
				3. If required, spiral heat-trace cable around piping to obtain proper heating per length of piping.
				4. Do not overlay cable over cable.
				5. Cover installed heating cable with thermal insulation and waterproof jacketing as soon as possible.
				6. Affix following label to exterior of thermal insulation every 15 feet and readily visible from ground level: CAUTION: ELECTRIC HEAT TRACING.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

In following Paragraph insert "State of New York Department of Transportation," "Municipality of \_\_\_\_\_\_\_\_ Department of Public Works," or other agency as appropriate.

* + - * 1. Installation Standards: Install Work according to <**\_\_\_\_\_\_\_\_**> standards.
			1. FIELD QUALITY CONTROL
				1. After installation, inspect for proper operation.
				2. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than <**\_\_\_\_\_\_\_\_**> [**days**] [**hours**] on Site for installation, inspection, startup, field testing, and instructing Director’s Representative in operation and maintenance of equipment.
				3. Equipment Acceptance:

Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.

Make final adjustments to equipment under direction of manufacturer's representative.

* + - * 1. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.
			1. ADJUSTING
				1. Check control functions and adjust as required.
			2. DEMONSTRATION
				1. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Director’s Representative.

END OF SECTION 404113.13