**PART 1 – GENERAL**

* 1. **SUMMARY**
		1. This Section includes a UL Listed and CSA Certified pipe freeze protection system that consists of a self-regulating heating cable, connection kits, controller, monitor and accessories.
		2. Related Sections
			1. Section 22 07 19 – Plumbing Piping Insulation
			2. Section 22 08 00 – Commissioning of Plumbing
			3. Section 22 09 00 – Instrumentation & Control for Plumbing
			4. Section 22 11 00 – Facility Fuel Piping
			5. Section 22 13 00 – Facility Sanitary Sewerage
			6. Section 22 10 00 – Plumbing Piping
			7. Section 23 07 19 – HVAC Piping Insulation
			8. Section 23 08 00 – Commissioning of Plumbing
			9. Section 23 09 00 – Instrumentation & Control for HVAC
			10. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables
			11. Section 26 05 26 – Grounding and Bonding for Electrical Systems
	2. **REFERENCES**
		1. Underwriter’s Laboratories (UL)
		2. Canadian Standards Association (CSA)
		3. National Electric Code (NEC)
	3. **SYSTEM DESCRIPTION**
		1. System for complete underground water pipe freeze.
		2. System consists of a self-regulating heating cable, connection kits, controller, monitor, and accessories. **[Select all that apply]**
		3. The heating cable shall have a modified polyolefin (-JT) jacket or fluoropolymer (-J) jacket. **[Select one]**
	4. **ACTION SUBMITTALS**
		1. Product Data
			1. Heating cable data sheet
			2. UL, CSA approval certificates for freeze protection of underground water piping.
			3. Heating Cable Installation and Maintenance Instructions
			4. Connection Kit, Controller, Monitor and Thermostat Instructions. **[Select all that apply]**
			5. Electrical Wiring Diagram of System
	5. **QUALITY ASSURANCE**
		1. Manufacturers’ Qualifications
			1. Manufacturer to show minimum of thirty (30) years of experience in manufacturing self-regulating heating cables.
			2. Manufacturer to provide products consistent with IEEE 515.1 and CSA 22.2 No 130-03 requirements.
		2. Installer Qualifications
			1. System installer shall have complete understanding of product and product literature from manufacturer or authorized representative prior to installation.
			2. Electrical connections shall be performed by a licensed electrician.
		3. Regulatory Requirements and Approvals
			1. The heat tracing system shall be UL Listed/CSA Certified
			2. Electrical Components, Devices, and Accessories: Listed and labelled as defined in NFPA 70 and marked for intended use.
	6. **DELIVERY, STORAGE AND HANDLING**
		1. General Requirements: Deliver, store and handle products to prevent their deterioration or damage due to moisture, temperature changes, contaminates or other causes.
		2. Delivery and Acceptance Requirements: Deliver products to site in original, unopened containers or packages with intact and legible manufacturers’ labels identifying the following:
			1. Product and Manufacturer
			2. Length/Quantity
			3. Lot Number
			4. Installation and Maintenance Instructions
		3. Storage and Handling Requirements
			1. Store the heating cable in a clean, dry location with a temperature range -40°F to 140°F (-40°C to 60°C).
			2. Protect products from mechanical damage and water ingress.
	7. **WARRANTY**
		1. Extended Warranty
			1. Manufacturer shall make available a minimum two (2) year warranty for heating cable and connection kits. Provide one (1) year warranty for all heat trace controllers, monitors, and thermostats.
			2. Contractor shall submit to owner the results of all installation tests required by the manufacturer.

**PART 2 – PRODUCTS**

* 1. **MANUFACTURER**
		1. Contract Documents are based on manufacturer and products named below to establish a standard of quality.
		2. Manufacturer
			1. Manufacturer shall be Emerson – Nelson
			2. Manufacturer to show minimum of thirty (30) years of experience in manufacturing self-regulating heating cables.
			3. Manufacturer shall provide UL and CSA approval certificates.
	2. **MATERIALS**
		1. Heating Cables – Nelson CLT and/or LT **[Select all that apply]**

|  |
| --- |
| **Heating Cables** |
|  | **CLT** | **LT** |
| Catalogue No.  | Over Jacket | Polyolefin (-JT) | Polyolefin (-JT) | Fluoropolymer (-J) |
| 120 VAC – 3 W/ft @ 50°F | CLT3-JT | LT3-JT | LT3-J |
| 120 VAC – 5 W/ft @ 50°F | CLT5-JT | LT5-JT | LT5-J |
| 120 VAC – 8 W/ft @ 50°F | CLT8-JT | LT8-JT | LT8-J |
| 120 VAC – 10 W/ft @ 50°F | Unavailable | LT10-JT | LT10-J |
| 240 VAC – 3 W/ft @ 50°F | CLT23-JT | LT23-JT | LT23-J |
| 240 VAC – 5 W/ft @ 50°F | CLT25-JT | LT25-JT | LT25-J |
| 240 VAC – 8 W/ft @ 50°F | CLT28-JT | LT28-JT | LT28-J |
| 240 VAC – 10 W/ft @ 50°F | Unavailable | LT210-JT | LT210-J |
| Max. Rated Voltage | 277 VAC | 277 VAC |
| Max. Exposure Temperature | 85°C (185°F) | 85°C (185°F) |
| Bus Wire Size | 18 Gauge | 16 Gauge |

* + - 1. CLT Heating Cable
				1. Shall be a self-regulating heater cable with a parallel circuit electric heater strip.
				2. Shall feature an irradiation cross-linked conductive polymer core material that is extruded over the multi-stranded, tin-plated, 18-gauge copper bus wires.
				3. The conductive core material shall increase or decrease its heat output in response to temperature changes.
				4. Max. rated service voltage shall be 277 VAC.
				5. Shall feature a thermoplastic elastomer inner jacket extruded over the conductive core material that provides dielectric strength, moisture resistance, and protection from impact and abrasion damage.
				6. A stranded copper braid shall be installed over the inner jacket, providing a continuous ground path.
				7. A modified polyolefin over jacket shall cover the braid for added dielectric strength, moisture resistance, and protection from impact and abrasion damage.
			2. LT Heating Cable
				1. Shall be a self-regulating heater cable with a parallel circuit electric heater strip.
				2. Shall feature an irradiation cross-linked conductive polymer core material that is extruded over the multi-stranded, tin-plated, 16-gauge copper bus wires.
				3. The conductive core material shall increase or decrease its heat output in response to temperature changes.
				4. Max. rated service voltage shall be 277 VAC.
				5. Two inner thermoplastic jackets shall be extruded over and bonded to the core material for extra dielectric strength, moisture resistance, and protection from impact and abrasion damage.
				6. A modified polyolefin or fluoropolymer **[select one]** over jacket shall cover the braid for added dielectric strength, moisture resistance, and protection from impact and abrasion damage.
		1. Connection Kits – Nelson PLT-BC, PLT-BS, PLT-BY, or PLT-L **[Select all that apply]**
			1. PLT-BC Power Connection Kit
				1. Shall be suitable for connecting up to two heating cables to customer supplied power wiring.
			2. PLT-BS Splice Connection Kit
				1. Shall be suitable for connecting two heating cables in an in-line splice configuration.
			3. PLT-BY Tee Connection Kit
				1. Shall be suitable for connecting three heating cables in a tee splice configuration.
			4. PLT-L Lighted Connection Kit
				1. Shall feature an end-of circuit indicating light assembly utilizing a low-temperature LED lamp.
				2. Shall operate in 120-277 VAC service voltage.
1. Thermostats – Nelson TA4X140, TH4X325 and/or TF4X40 **[Select all that apply]**
	1. TA4X140 Thermostat
		1. Shall be used for ambient temperature control and offers the following features:

Enclosure: Die Cast Aluminum

Classifications: NEMA Type 4X IP66

Temperature Range: -9°C to +60°C (+15°F to +140°F)

Exposure: -40°C to +71°C (-40 to +160°F )

Capillary:

Material: Stainless Steel

Maximum Bulb Temperature: +71°C (+160°F)

Electrical Data:

CSA Rating: 22 amp resistance 480 Vac

UL Rating: 22 amp resistance 480 Vac

Calibration Accuracy: +1.1°C (+2°F)

Switch Type: Single Pole Double Throw

* 1. TH4X325 Thermostat
		1. Shall be used for controlling heat tracing systems and offers the following features:

Enclosure: Die Cast Aluminum

Classifications: NEMA Type 4X IP66

Temperature Range: -4°C to +163°C (+25°F to +325°F)

Exposure: -40°C to +71°C (-40 to +160°F )

Capillary:

Length: 3 m (10 ft)

Material: Stainless Steel

Maximum Bulb Temperature: +215°C (+420°F)

Electrical Data:

CSA Rating: 22 amp resistance 480 Vac

UL Rating: 22 amp resistance 480 Vac

Calibration Accuracy: +1.6°C (+3°F)

Switch Type: Single Pole Double Throw

* 1. TF4X40 Thermostat
		1. Shall be used for controlling heat tracing systems and offers the following features:

Enclosure: Molded Fiberglass Polyester

Classifications: NEMA Type 4X IP66

Temperature Range: Fixed Range, 4.4°C (+40°F)

Exposure: -40°C to +71°C (-40 to +160°F )

Capillary:

Length: 0.9 m (3 ft)

Material: Tin Plated Copper

Maximum Bulb Temperature: +71°C (+160°F)

Electrical Data:

CSA Rating: 22 amp resistance 480 Vac

UL Rating: 22 amp resistance 480 Vac

Calibration Accuracy: +2.2°C (+4°F)

Switch Type: Single Pole Single Throw

1. Controller – Nelson CM-GP **[Select if applicable]**
	* 1. Shall be a micro-processor based digital controller specifically designed for wall mounted electric heat tracing applications.
		2. Shall provide temperature control of an individual heater segment with sensor monitoring, remote alarm contacts, and ground fault leakage detection.
		3. Shall offer the following features:
			1. Ground Fault Trip function

A fixed 30mA trip level is provided for circuit integrity eliminating the need for separate EPD branch circuit breakers.

* + - 1. Temperature Input:

Range: 0°C to +218°C (32°F to +425°F)

Accuracy: +/- 1°C

Repeatability: +/- 1°C

RTD: 100-ohm platinum, 3-wire, (lead compensated up to 20 ohms)

* + - 1. Voltage Range: 100 Vac to 277 Vac
			2. Heater Switching

Configuration: Two-pole, EMR

Ratings: 100-277 Vac, 30A continuous (resistive load only)

Line Frequency: 50 or 60 Hz

* + - 1. Control Power

Power Requirement: Control power from heater voltage, 110-277 VAc, 12 VA max

* + - 1. User Interface

Display: 4-character LCD Alphanumeric display

Panel Indicators:

Actual Temp LED

Setpoint Temp LED

Alarm LED

Keypad:

4 buttons, glass-reinforced epoxy laminate faceplate

Next, Up, Down, Menu

* + - 1. Environment

Ambient Temperature: -40°C to +55°C Starting at -20°C (-4°F)

Conformal Coating: Boards conformal coated for hostile environments

* + - 1. Enclosure

Type: NEMA Type 4X Fiberglass reinforced, carbon impregnated, UV resistant polymer

Size: 6.5”H x 6.5” W x 4.0” D

Features: Captive cover screws

* + - 1. Alarm Output

Alarm: EMR Form C

Alarm Rating: EMR Version 24-277 Vac @ 2.0A Max, 12-30Vdc

Alarm Output: LED Indication

* + - 1. Alarm Function

High Temperature Alarm

Low Temperature Alarm

Sensor Failure

Ground Fault Trip

* + - 1. User-Definable Options

Deadband: Adjustable 1°C to 6°C (2°F to 10°F)

Alarm Contacts: NO or NC operation

1. Monitor – Nelson CM-1 **[Select if applicable]**
	1. Monitoring system shall continually monitor the status of both series and parallel styles of electric heat tracing cables and panels.
	2. Shall offer the following features:
		* 1. Ambient Temperature: -40° to +55°C (-40° to +130°F)
			2. Relative Humidity: 0-95% maximum, non-condensing, PC boards are conformal coated and special connectors are used.
			3. Enclosures **[Select one]**:

NEMA 4, powder coated steel

NEMA 4X, Stainless Steel

* + - 1. Display: Single line numeric LED circuit indication. LED bar indicators for Alarm status
			2. Power Input: 120Vac, 1.0A
			3. Voltage Range: 85 to 300Vac
			4. Current Range: 0.05 to 30.0A
			5. Continuity: Requires additional CMD device for each monitored circuit
			6. Alarm Output Rating: AC/DC Contact, 12-120V @ 0.1A maximum
			7. Control Input: Requires Dry Contact from control device(s) or -V Control Input Option
			8. Communications: RS-485, Modbus® Protocol

**PART 3 – EXECUTION**

* 1. **EXAMINATION**
		1. Verification of Conditions
			1. Prior to installation of heating cable system, verify that all piping which will be heat trace has passed all hydrostatic/pressure test and is signed off by plumbing inspector.
		2. Preinstalling Testing
			1. Prior to installing heating cable on the piping an insulation resistance test shall be performed by the installing contractor to ensure integrity of heating cable as describe in the installation & maintenance manual.
	2. **INSTALLATION**
		1. Acceptable Installers
			1. Subject to compliance with requirements of Contract Documents, installer shall be familiar with installing pipe trace cables and equipment.
		2. The process pipe freeze protection installation shall conform to all local building codes including but limited to NFPA70, IEEE 515 industrial Heat Tracing Applications.
		3. The installer shall layout heating cable per approved shop drawings.
		4. Grounding of the Process Pipe Freeze Protection System shall be in accordance with section 26 05 26 “Grounding & Bonding for Electrical Systems”
		5. Connections of all electrical wiring shall be in accordance with section 26 05 19 “Low-Voltage Electrical Systems”
		6. Comply with the following manufacturer’s recommendations:
			1. Self-Regulating Heating Cable Installation & Maintenance Instructions (GA-1765).
			2. PLT-BC Power Connection Kit Instructions (GA-1859).
			3. PLT-BS Splice Connection Kit Instructions (GA-1860). **[Select if applicable]**
			4. PLT-BY Tee Connection Kit Instructions (GA-1861). **[Select if applicable]**
			5. PLT-L Series End of Circuit Light Kit Instructions (GA-2028). **[Select if applicable]**
			6. TA4X140/TH4X325 Thermostat Installation and Maintenance Manual (Bulletin No. 27277-Z). **[Select if applicable]**
			7. TF4X40 Thermostat Installation and Maintenance Manual (Bulletin No. 272137-B). **[Select if applicable]**
			8. CM-GP Installation and Operating Instructions (14251-001). **[Select if applicable]**
			9. CM-1 Installation and Maintenance Manual (GA-2129). **[Select if applicable]**
	3. **FIELD QUALITY CONTROL**
		1. Initial start‐up and field testing (commissioning) of the system shall be performed by factory technician or factory representative per the owner’s requirements.
		2. Field Tests and Inspections in accordance with the Self-Regulating Heating Cable Installation & Maintenance Instructions (GA-1765), recorded and included in submittals to owner:
			1. The following test shall be performed before the heat cable has been installed:
				1. Continuity test on reel
				2. Insulation resistance on reel – 2500 VDC
			2. The following test shall be performed after the heat cable has been installed but before the insulation and after insulating the piping:
				1. Continuity test
				2. Insulation resistance – 2500 VDC, 5 megaohm minimum
			3. The technician shall verify that the TA4X140, TH4X325, TF4X40, CM-GP, and/or CM-1 **[Select all that apply]** parameters are set to the application requirements.
	4. **MAINTENANCE**
		1. Maintenance Service
			1. Comply with manufacturer’s recommendations in the applicable Installation and Maintenance Instructions.

**END OF SECTION**