

SECTION 13 21 26 CONTROLLED ENVIRONMENT FOR FOOD SERVICE WALK-IN FREEZERS

MINERAL INSULATED (MI) FREEZER FROST HEAVE PREVENTION SYSTEM

This specification is dated 03/01/2019 and supersedes all previous versions.

Any text in RED indicates a choice the user needs to decide upon to suit project requirements and deleted prior to incorporating into final contract documents. For detailed design information, please contact your local representative, our website “www.nventthermal.com” or nVent Thermal Technical Support 800-545-6258.

PART 1 GENERAL

1.1. SUMMARY

- A. Section includes a CSA Certified and FM Approved freezer frost heave heat tracing system that consists of a mineral insulated (MI) trace heater, accessories, and electronic controller.
- B. Related Requirements
 - 1. Section 11 41 26 – Walk-in Freezers
 - 2. Section 13 18 00 – Ice Rinks
 - 3. Section 03 06 00 – Schedules for Concrete
 - 4. Section 03 30 00 – Cast-In Place Concrete
 - 5. Section 25 12 16 – Direct-Protocol Integration Network Gateways
 - 6. Section 25 51 00 – Integrated Automation Control of Facility Equipment
 - 7. Section 26 00 00 – Electrical

1.2. REFERENCES

- A. Reference Standards
 - 1. UL515 – Electrical Resistance Heat Tracing for Commercial Applications
 - 2. IEEE 515.1-2012 Standard for the Testing, Design, Installation & Maintenance of Electric Resistance Trace Heating for Commercial Applications.
 - 3. CSA Standard C22.2 No. 130-03 Requirements for Electrical Resistance Heating Cables & Heating Device Sets
 - 4. NFPA 70 - National Electrical Code
 - 5. CSA Standard C22.1 – Canadian Electrical Code

1.3. SYSTEM DESCRIPTION

- A. System for preventing frost heave in freezers, cold rooms and ice arenas with temperature control, monitoring, integrated ground-fault circuit protection and BMS communication capabilities.
 - 1. nVent RAYCHEM Mineral Insulated (MI) Heating Cable (In Conduit) **[Select one]**
 - a. 120 V, 208 V, or 277 V nVent RAYCHEM mineral insulated (MI) heating cable with dual conductors surrounded by magnesium oxide insulation. The copper sheath material can either be copper with an extruded low smoke zero halogen (LSZH) jacket or Alloy 825. The heating cable shall be factory terminated and have a pulling eye and a reversed gland. The heating cable shall be part of a c-CSA-us Certified or FM Approved system.
 - 2. Mineral Insulated (MI) Heating Cable (Directly Embedded) **[Select one]**
 - a. 120 V, 208-277 V, or 347 V nVent RAYCHEM mineral insulated (MI) heating cable with a single conductor surrounded by magnesium oxide insulation and a copper sheath with an extruded low smoke zero halogen (LSZH) jacket. The heating cable shall be factory terminated and supplied with NPT gland connectors. The heating cable shall be part of a c-CSA-us Certified or FM Approved system.
 - 3. nVent RAYCHEM C910-485 multi-circuit group control panel **or** nVent RAYCHEM ACS-30 multi-circuit distributed group controller **[Select one]**

1.4. ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

- A. Product Data
 - 1. Heating cable data sheet
 - 2. CSA Certified or FM Approved certificates for freezer frost heave prevention
 - 3. Freezer frost heave design sheet
 - 4. System installation and operation instructions
 - 5. System installation details
 - 6. Controller/power panel data sheet
 - 7. Controller/power wiring diagram
- B. Shop Drawings
 - 1. Detail engineered isometric drawings showing layouts for freezer, indicating power connections, splice, end terminations, and circuit cable length.

1.5. QUALITY ASSURANCE

- A. Source Limitations: All system components [heating cable, accessories, and controller] shall be sourced from a single manufacturer, under no circumstances shall any components be installed other than those supplied by the cable manufacturer, to ensure system integrity and meet warranty requirements.
- B. Qualifications
 - 1. Manufacturers
 - a. Manufacturer to show minimum of forty (40) years of experience in manufacturing electric mineral insulated heating cables.
 - b. Manufacturer will be ISO-9001 registered.

- c. Manufacturer to provide heating cable consistent with IEEE 515.1 and CSA 22.2 No 130-03 requirements.
 - d. MI heating cable shall be qualified and tested to demonstrate a useful lifetime in excess of 20 years.
 - e. The manufacturer shall provide an extensive global reference list for this application, including installations that have been in operation for over 15 years.
2. Installers
 - a. System installer shall have complete understanding of product and product literature from manufacturer or authorized representative prior to installation. Electrical connections shall be performed by a licensed electrician.
 3. Electrical Components, Devices, and Accessories: Listed and labelled as defined in NFPA 70, Article 100, by a Nationally Recognized Testing Laboratory (NRTL), and marked for intended use.
- C. Certifications
1. The system (heating cable, connection kits, and controller) shall be CSA Certified and FM Approved for freezer frost heave prevention.

1.6. DELIVERY, STORAGE, AND HANDLING

- A. Delivery And Acceptance Requirements
1. Deliver, store and handle products to prevent their deterioration or damage due to moisture, temperature changes, contaminates or other causes.
 2. Deliver products to site in original, unopened containers or packages with intact and legible manufacturers' labels identifying the following:
 - a. Product and Manufacturer
 - b. Length/Quantity
 - c. Lot Number
 - d. Installation and Operation Manual
 - e. MSDS (if applicable)
- B. Storage And Handling Requirements
1. Store the heating cable in a clean, dry location with a temperature range not below -40°F (-40°C) or exceeding 140°F (60°C).
 2. Protect the heating cable from mechanical damage.

1.7. WARRANTY

- A. Manufacturer Warranty
1. nVent warrants all goods listed below for two (2) years from date of purchase against faulty workmanship and use of defective materials when such goods are properly installed, operated, and maintained according to product documentation. See Limited Product Warranty (H57396) at www.nventthermal.com.
 - a. Heating cables, connection kits and accessories
 - b. Thermostats, controllers, panels contactors, sensors and accessories
- B. Special Warranty –

1. Contractor shall provide the owner an extended product warranty for the heat tracing products listed below. The contractor must complete and forward to owner the Installation, Inspection or Commissioning Record(s), and complete the online warranty registration form within thirty (30) days from the date of installation, otherwise only standard limited warranty applies. See Limited Product Warranty Extension details (H57397) at www.nventthermal.com
 - a. Heating Cable and Components Warranty shall be Ten (10) Years from Date of Purchase
- C. Heating cables, connection kits and accessories not automatically offered with a 10 year manufacturer's warranty, as a standard matter of course, will not be allowed. Warranty information must be published on the manufacturer's website.

PART 2 PRODUCTS

2.1. HEAT TRACING SYSTEM

A. Manufacturers

1. Basis of Design Manufacturer: Subject to the compliance with requirements, provide nVent RAYCHEM heat tracing products of **nVent Thermal Management, LLC Redwood City 94063, 800-545-6258;**
Email: thermal.info@nvent.com Website: www.nventthermal.com

Specifier: Retain one of the two paragraphs below based upon Project requirements.

2. Submit comparable products of one of the following for approval by the specifier:
 - a. [Specifier: Insert name of manufacturer with comparable products]
 - b. Submit request for substitutions in accordance with Instructions to Bidders and Division 01 General Requirements.
 3. Provide specified product; Owner will not consider substitution requests.
- #### B. Materials
1. Heating Cable **[Select one option].**
 - a. [Option 1] **In Conduit** - LSZH Jacketed Copper Sheathed or Alloy 825 Sheathed Mineral Insulated Heating Cable
 - 1) Heating cable shall be MI heating cable manufactured by nVent.
 - 2) The heating cable shall consist of dual conductors surrounded by magnesium oxide insulation.
 - 3) The heating cable shall be factory terminated with a minimum 7-foot cold lead (unheated) length and an NPT gland connector to allow connection to a junction box.
 - 4) The heating cable shall have a pulling eye for ease of installation in conduit.
 - 5) Use only UL Listed or CSA Certified 3/4 in (2 cm) or larger diameter rigid galvanized steel or rigid aluminum electrical conduit.
 - 6) The heating cable shall be supplied with a reversed gland to make a liquid-tight/air-tight connection to the conduit.

- 7) The power supply end of the conduit should be terminated with suitably sized female NPT thread to allow connection of the reversed gland supplied on the heating cable.
 - 8) Only one run of heating cable shall be installed per conduit.
 - 9) If non-metallic junction boxes are used, a grounding kit is required (Catalog Number: MI-GROUND-KIT).
 - 10) The heating cable shall operate on line voltages of 120, 208, **or** 277 volts **[Select one]** without the use of transformers. [Custom MI heating cables can be designed to operate for any voltage up to 600 volts. Please contact your nVent sales representative for more information and pricing]
 - 11) The heating cable shall be part of a c-CSA-us Certified or FM Approved system.
 - 12) The MI heating cable tag shall have the following markings:
 - a) Complete heating cable model number
 - b) Agency listings
 - c) Serial Number
2. **[Option 2] Directly Embedded** - LSZH Jacketed Copper Sheathed Mineral Insulated Heating Cable.
- a. Heating cable shall be MI heating cable manufactured by nVent.
 - b. The heating cable shall consist of a single conductor surrounded by magnesium oxide insulation with a solid, seamless copper sheath.
 - c. The heating cable shall have a low smoke zero halogen (LSZH) jacket to protect the cable from corrosive elements that can exist in the concrete.
 - d. The heating cable shall be factory terminated with a minimum 7-foot cold lead (unheated) length.
 - e. The heating cable shall be supplied with NPT gland connectors for connection to a junction box.
 - f. If non-metallic junction boxes are used, a grounding kit is required (Catalog Number: MI-GROUND-KIT).
 - g. The heating cable shall operate on line voltages of 120, 208, 240, 277, **or** 347 volts **[Select one]** without the use of transformers. [Custom MI heating cables can be designed to operate for any voltage up to 600 volts. Please contact your nVent sales representative for more information and pricing]
 - h. The heating cable shall be part of a c-CSA-us Certified or FM Approved system.
 - i. The MI heating cable tag shall have the following markings
 - 1) Complete heating cable model number
 - 2) Agency listings
 - 3) Serial Number
3. Heating Cable Connection Kits
- a. Junction Box – The junction box is a cast aluminum junction box (Type 3) for installation in nonhazardous and C1D2 locations. There are three (3) ½" NPT entries on the bottom, provided with plugs, and includes a 4-pole terminal block. (Catalog Number: D1297TERM4)
4. Energy Efficient Control System **[Select One Option]**
- a. **[Option 1] Single Circuit Local Digital Control System**
 1. Local digital controller shall be C910-485.

2. Heating cable manufacturer shall provide a local digital controller with built-in GFPD compatible with selected heating cable.
 3. Digital controller shall be capable of supporting up to two (2) RTD temperature sensors per control point. Leads can be extended using 18 AWG, 3-wire, shielded cable.
 4. Enclosure type shall be Type 4X fiberglass reinforced plastic (FRP).
 5. Digital controller shall have an integrated adjustable GFPD (10 – 200 mA).
 6. Digital control system can be configured for line-sensing, ambient sensing and PASC modes. PASC control proportionally energizes the power to the heating cable to minimize energy based on ambient sensed conditions.
 7. Digital controller shall be capable of operating with supply voltages from 100 V to 277 V.
 8. Digital controller will have a built-in self-test feature to verify proper functionality of heating cable system.
 9. Digital controller will also be able to communicate with BMS by one of the following protocol. **[Select one]**
 - a. Modbus
 - b. BACnet® or Metasys® N2 **[Select RAYCHEM ProtoNode-RER multi-protocol gateway as accessory]**
 10. Digital controller will also supply an isolated triac alarm relay and a dry contact relay for alarm annunciation back to the BMS.
 11. The following variables will be monitored by the digital controller and reported back to the BMS:
 - a. Temperature
 - b. Ground-fault
 - c. Current draw
 - d. Power consumption
 - e. Associated alarms
 12. Digital controller shall have c-CSA-us approvals
- b. **[Option 2] Multi-Circuit, Distributed Digital Control System**
1. All freezer frost heave prevention circuits shall be controlled and monitored using a distributed digital control system, known as ACS-30, manufactured by nVent.
 2. Multi-application: Distributed digital control system shall have pre-programmed parameters to provide concurrent control for heating cables used for pipe freeze protection, flow maintenance, hot water temperature maintenance, surface snow melting, roof and gutter de-icing, freezer frost heave prevention and floor heating applications.
 3. All programming shall be done through the central User Interface Terminal (ACS-UIT2).
 4. The ACS-UIT2 shall be a color LCD touch-screen display with password protection to prevent unauthorized access to the system.
 5. The ACS-UIT2 shall communicate with up to fifty-two (52) ACS Power Control Panels (ACS-PCM2-5) where each panel can control up to five (5) circuits and accept up to five (5) temperature inputs. C910-485 controllers may also be added to the ACS-30 system for single circuit extensions.
 6. Digital control system shall be capable of assigning up to four (4) RTD temperature inputs per heat-tracing circuit.

7. The ACS-UIT2 shall communicate with up to sixteen (16) Remote Monitoring Modules (RMM2), where each module can accept up to eight (8) temperature inputs.
 8. The ACS-UIT2 shall have a USB port to allow for quick and easy software update.
 9. The ACS-UIT2 shall have three (3) programmable alarm contacts including an alarm light on the enclosure cover.
 10. A separate offline software tool shall be made available to allow users to pre-program the digital control system and transfer program via a USB drive or Ethernet.
 11. The ACS-UIT2 enclosure shall be NEMA 4 for indoor or outdoor locations.
 12. The ACS-PCM2-5 panel shall be in a NEMA 4/12 enclosure approved for nonhazardous indoor and outdoor locations.
 13. The ACS-PCM2-5 panel shall provide ground-fault and line current sensing alarming, switching and temperature inputs for five (5) heat tracing circuits.
 14. Each ACS-PCM2-5 panel shall have five (5) 3-pole, 30 A contactors (EMR type).
 15. The ACS-PCM2-5 panel shall be capable of operating at 120 V to 277 V.
[Custom ACS-PCM2-5 panel designs are available if standard configurations are not suitable. Please contact your nVent sales representative for more information and pricing].
 16. The ACS-PCM2-5 shall have an alarm contact including an alarm light on the panel cover.
 17. Digital controller shall have an integrated adjustable GFD (10 – 200 mA).
 18. Digital control system will have a built-in self-test feature to verify proper functionality of heating cable system.
 19. Digital control system will also be able to communicate with BMS by one of the following protocols. **[Select one]**
 - a. Modbus®
 - b. BACnet® or Metasys® N2 **[Select RAYCHEM ProtoNode-RER multi-protocol gateway as accessory]**
 20. The following variables will be monitored by the digital controller and reported back to the BMS:
 - c. Temperature
 - d. Ground-fault
 - e. Current draw
 - f. Power consumption
 - g. Associated alarms
 21. The ACS-UIT2 shall be c-CSA-us Certified. The ACS-PCM2-5 panel shall be c-UL-us Listed.
5. Approval
- a. The system (heating cable and controller) shall be c-CSA-us Certified or FM Approved for freezer frost heave prevention.
 - b. The freezer frost heave prevention system shall have a design, installation and operating manual.

PART 3 EXECUTION

3.1. EXAMINATION

A. Preinstalling Testing

1. Prior to installing heating cable, an insulation resistance test shall be performed by the installing contractor to ensure integrity of heating cable as described in the installation and maintenance manual.

3.2. PREPARATION

A. Protection Of In-Place Conditions

1. All heating cable ends shall be protected from moisture ingress until cable is terminated.

3.3. INSTALLERS

A. Acceptable Installers

1. Subject to compliance with requirements of Contract Documents, installer shall be familiar with installing heat-trace cable and equipment

3.4. INSTALLATION

- A. Comply with manufacturer's recommendations in the MI Floor Heating and Freezer Frost Heave Prevention Installation and Operation Manual (H58137).
- B. Install and secure the heating cable in accordance with the MI Floor Heating and Freezer Frost Heave Prevention Installation and Operation Manual (H58137).
- C. Install electric heating cable according to the drawings and the manufacturer's instructions. The installer shall be responsible for providing a complete functional system, installed in accordance with applicable national and local requirements.
- D. Grounding of controller shall be performed according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- E. Connection of all electrical wiring shall be according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables".

3.5. FIELD QUALITY CONTROL

- A. Initial start-up and field testing (commissioning) of the system shall be performed by factory technician or factory representative per the owner's requirements.
- B. Field Tests And Inspections
 1. The system shall be commissioned in accordance to the MI Floor Heating and Freezer Frost Heave Prevention Installation and Operation Manual.
 2. The heating cable circuit integrity shall be tested using a 1000 Vdc megohmmeter at the following intervals below. Minimum acceptable insulation resistance shall be 20 megohms. (100 megaohms upon receipt)
 - a. Before installing the heating cable

- b. After heating cable has been installed
 - c. After installing accessories
 - d. Prior to initial start-up (commissioning)
 - e. As part of the regular system maintenance
3. The technician shall verify that the controller parameters are set to the application requirements.
4. The technician shall verify that the ACS-30 and ProtoNode device server (if applicable) are configured correctly with the BMS.
5. All commissioning results will be recorded and presented to the owner.

C. Non-Conforming Work

1. Any heat tracing circuit which fails the any of the above tests must be corrected prior to commissioning or startup of the system.

D. Retain the services of nVent RAYCHEM Management to provide factory design build and inspection services to prepare submittals for complete design layouts, wiring diagrams, installation details for all heat trace equipment including heating cable, connection kits, controllers and sensors. nVent shall supply 11"x17" isometric drawings for every circuit for a complete heat tracing system.

E. Provide factory inspection report as part of a complete manufacturer approved installation that is compliant to Code.

F. Start-up – Start-up of system shall be performed by factory technician or factory representative per the owner's requirements.

3.6. SYSTEM STARTUP

1. Provide a factory-certified technician or manufacturer's representative for startup and commissioning of the heat tracing system and controller.
2. Coordinate all controller settings with engineer prior to programming the controller.
3. Provide commissioning report in submittals package to owner.

3.7. MAINTENANCE

A. Maintenance Service

1. Comply with manufacturer's recommendations in MI Floor Heating and Freezer Frost Heave Prevention Installation and Operation Manual (H58137).

END OF SECTION