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

FOR FREEZER FROST HEAVE PREVENTION - RAYSOL

This is an nVent RAYCHEM specification. A qualified design professional should review and edit the document to suit project requirements.

For more information, contact RAYCHEM, a brand of nVent, 899 Broadway St., Redwood City, CA 94025-1146; Phone: 800-545-6258; Website: www.nvent.com/RAYCHEM

PART 1 GENERAL

1.1. SUMMARY

A. Section includes a UL Listed and CSA Certified freezer frost heave heat tracing system that consists of a self-regulating trace heater, connection kits, 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. 130-16 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 RaySol Heating Cable

a. 120 and 208 - 277 V, RAYCHEM RaySol self-regulating heating cable with a fluoropolymer outer jacket. The heating cable shall be part of a UL Listed and CSA Certified system.

2. nVent RAYCHEM FTC connection kits and accessories
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. UL Listed and CSA Certified 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. Provide detailed engineered isometric drawings showing layouts for freezer, indicating power connections, splice, end seals, and circuit cable length.

1.5. QUALITY ASSURANCE

A. Source Limitations: All system components [heating cable, connection kits, 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 to meet warranty requirements.

B. Qualifications
1. Manufacturers
a. Manufacturer to show minimum of forty (40) years of experience in manufacturing electric self-regulating 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 130-16 requirements.
d. Self-regulating 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 UL Listed and CSA Certified 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 Warranty Information | nVent RAYCHEM.
   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 the standard limited warranty applies. See Limited Product Warranty Extension details (H57397) at nVent RAYCHEM Warranty Registration | nVent RAYCHEM
   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: Electrical Heat Tracing | Heat Tracing | nVent RAYCHEM

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
   a. Heating cable shall be RAYCHEM RaySol self-regulating heating cable manufactured by nVent. **[Select one]** RaySol-1 (120 V) **or** RaySol-2 (208 – 277 V)
   b. The heating cable shall consist of a continuous core of conductive polymer that is radiation cross-linked, extruded between two (2) 16 AWG nickel-plated copper bus wires, that varies its power output in response to temperature changes.
   c. The heating cable shall have a FLUOROPOLYMER outer jacket for dielectric integrity and long life expectancy.
   d. The heating cable shall operate on line voltages of 120, 208, 240, **or** 277 volts **[Select one]** without the use of transformers.
   e. The heating cable shall be part of a UL Listed and CSA Certified system.
   f. The outer jacket of the heating cable shall have the following markings:
      a) Heating cable model number
      b) Agency listings
      c) Meter mark
      d) Lot/Batch ID
2. Heating Cable Connection Kits
   a. Heating cable connection kits shall be RAYCHEM FTC connection kits.
   b. Manufacturer shall provide power connection and end seal kits compatible with selected heating cable.
   c. Connection kits shall be UL Listed and CSA Certified.
3. 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 protocols. [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-UIT3).
4. The ACS-UIT3 shall be a color LCD touch-screen display with password protection to prevent unauthorized access to the system.
5. The ACS-UIT3 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-UIT3 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-UIT3 shall have a USB port to allow for quick and easy software update.
9. The ACS-UIT3 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-UIT3 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 GFPD (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-UIT3 shall be c-CSA-us Certified. The ACS-PCM2-5 panel shall be c-UL-us Listed.

4. Approval
   a. The system (heating cable and controller) shall be UL Listed and CSA Certified 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 RaySol Floor Heating and Freezer Frost Heave Prevention Installation and Operation Manual (H58138).

B. Install and secure the heating cable in accordance with the RaySol Floor Heating and Freezer Frost Heave Prevention Installation and Operation Manual (H58138).

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 RaySol Floor Heating and Freezer Frost Heave Prevention Installation and Operation Manual.
2. The heating cable circuit integrity shall be tested using a 2500 Vdc megohmmeter at the following intervals below. Minimum acceptable insulation resistance shall be 1000 megohms.
    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 RaySol Floor Heating and Freezer Frost Heave Prevention Installation and Operation Manual (H58138).

END OF SECTION