

SECTION 32 17 43 PAVEMENT SNOW MELTING SYSTEMS

MINERAL INSULATED (MI) SURFACE SNOW MELTING SYSTEMS

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 UL Listed, CSA Certified snow melting heat tracing systems that consists of a mineral insulated (MI) trace heater, accessories, and electronic controller.
- B. Related Requirements
 - 1. Section 23 83 13 – Radiant-Heating Electric Cables
 - 2. Section 25 56 00 – Integrated Automation of Electrical Systems
 - 3. Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables
 - 4. Section 26 05 26 – Grounding and Bonding for Electrical Systems
 - 5. Section 26 05 33 – Raceway and Boxes for Electrical Systems
 - 6. Section 26 06 20 – Schedules for Low-Voltage Electrical Distribution

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 snow melting of concrete, asphalt, and under pavers with temperature and moisture sensing control, monitoring, integrated ground-fault circuit protection and BMS communication capabilities.

System spacing requirements based on supply voltage, application, and location. Generally,

the required watt density for a snow melting application in the Northeast US will be 35 – 45 Watts per square foot. This system will operate on voltages 120 – 600 V.

1.4. ACTION SUBMITTALS / INFORMATIONAL SUBMITTALS

A. Product Data

1. Heating cable data sheet
2. UL Listed and CSA Certified certificates for surface snow melting
3. Snow melting design sheet
4. System installation and operation instructions
5. System installation details
6. Connection kits and accessories data sheet
7. Controller wiring diagram

B. Shop Drawings

1. Project-Specific Heating Cable System Installation Details
2. Project-Specific System Power Wiring Schematic
3. Project-Specific System Control Wiring Schematic
4. OPTIONAL BUT RECOMMENDED: Project-Specific Heating Cable Layout Drawing

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 to 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. The 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 UL Listed and CSA Certified for snow melting of concrete surfaces and pavers.

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, contaminants 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 0°F (-18°C) to 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 the 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 cables shall be RAYCHEM LSZH Jacketed, Copper Sheathed MI heating cables specifically designed for snow melting in concrete, asphalt, and pavers, tested and approved to UL 515, CSA 22.2 No 130-03 and IEEE 515.1 requirements.
 - a. The construction of the MI heating cable shall consist of a single conductor surrounded by magnesium oxide insulation with a solid, seamless copper sheath.
 - b. The heating cable shall have an extruded low-smoke zero halogen (LSZH) jacket to protect the cable from corrosive elements that can exist in the concrete. The heating cable shall be supplied with an identification tag that contains the heating cable catalog number, length, power output, operating voltage, agency listings, serial number and temperature code.
 - c. Heating cable core materials shall be inorganic and not deteriorate with age.
 - d. Heating cables shall be factory-fabricated to the length required and shall not be altered at site. Heated-section shall be joined to cold-lead section with factory-made joint. Cold-lead length shall be ordered as per site requirements.
 - e. Heating cables shall be selected to deliver sufficient heat to melt snow under regional or site-specific conditions (refer to construction documentation) and circuit zoning shall comply with construction documentation.
 - f. The heating cable shall operate on line voltages of 120, 208, 240, 277, 347, 480 **or** 600 volts without the use of transformers. **[Select one]**
 - g. The heating cable shall be part of a UL Listed and CSA Certified system.
2. Heating Cable Accessories
 - a. Fasteners - depending on slab construction, use one of the following:
 - 1) For single-pour concrete installations, fasten cable to reinforcing steel mesh at prescribed spacing, using nylon (or other nonmetallic) tie-wraps.
 - 2) For slab constructions where topping is applied over cables on a set surface (e.g. two-pour concrete slabs or stairs, road asphalt, or mastic asphalt), fasten cables at prescribed spacing, using pre-punched galvanized steel strapping, type HARD-SPACER-GALV-25MM-25M.

- b. Snow-Melt Caution Sign
- c. Mark each snow-melting area with a brass identification plate embedded in the slab, type SMCS
- 3. Snow and Slab Sensors
- 4. Energy Efficient Control System **[Select One Option]**
 - a. **[Option 1] Single Circuit Local Digital Control System**
 - a. Single circuit snow/ice melting controller shall be APS-3C **or** APS-4C **[Select one]**.
 - b. Heating cable manufacturer shall provide a single circuit snow/ice melting controller with built-in GFPD compatible with selected heating cable. **(APS-4C only)**
 - c. Electronic snow/ice melting controller shall have a GFPD with adjustable trip levels of 30, 60, 120 mA. **(APS-4C only)**
 - d. Electronic snow/ice melting controller shall have 24-A (APS-3C) **or** 50-A (APS-4C 208 240 V) **or** 40-A (APS-4C 277 V) **[Select one]** switching capacity rating.
 - e. Electronic snow/ice melting controller shall be capable of operating with supply voltages of 120 V, 208 – 240 V (APS-3C) **or** 208 – 240 V, 277 V (APS-4C) **[Select one]**.
 - f. Electronic snow/ice melting controller shall be capable of supporting up to six (6) type CIT-1 aerial and/or type SIT-6E slab mounted temperature and moisture sensors.
 - g. Enclosure type shall be NEMA 3R polycarbonate.
 - h. Electronic snow/ice melting controller shall have an adjustable hold-on timer (0 – 10 hours).
 - i. Electronic snow/ice melting controller shall have an integrated high-limit temperature sensor.
 - j. Electronic snow/ice melting controller shall have contacts (10mA dry switch contact) to interface with an Energy Management Computer (EMC).
 - k. Inputs: Override On, Override Off
 - l. Outputs: Supply, Snow, Heat, High Temp, Alarm
 - m. Digital controller shall have c-UL-us approvals.
 - b. **[Option 2] Multi-Circuit, Group Control System – Single Phase**
 - 1. Group controller shall be RAYCHEM SMPG1 snow melting and de-icing power distribution and control panel.
 - 2. Heating cable manufacturer shall provide a group snow/ice melting controller with built-in GFPD compatible with selected heating cable.
 - 3. Group snow/ice melting controller shall have an integrated 30-mA ground-fault circuit breaker.
 - 4. Group snow/ice melting controller shall have 6, 12, or 18 [Select one] ground-fault circuit breakers rated up to 50 A. [Custom SMPG panel designs are available if standard configurations are not suitable. Please contact your nVent sales representative for more information and pricing].
 - 5. Group snow/ice melting controller shall have a main circuit breaker **[Select if applicable]**
 - 6. Group snow/ice melting controller shall be capable of operating with supply voltages of 208 V **or** 277 V **[Select one]**.

7. Group snow/ice melting controller shall be capable of supporting up to six (6) aerial or gutter mounted temperature/moisture sensors.
8. Group snow/ice melting controller enclosure shall be NEMA 1/12 **or** NEMA 3R/4 **[Select one]**.
9. Group snow/ice melting controller shall have an adjustable hold-on timer (0 – 10 hours).
10. Group snow/ice melting controller shall have an integrated high-limit temperature sensor.
11. Electronic snow/ice melting controller shall have contacts to interface with an Energy Management Computer (EMC).
 - a. Inputs: Override On, Override Off
 - b. Outputs: Supply, Snow, Heat, High Temp, Alarm
12. Digital controller shall have c-UL-us approvals
- c. **[Option 3] Multi-Circuit, Group Control System – 3 Phase**
 13. Group controller shall be RAYCHEM SMPG3 snow melting and de-icing power distribution and control panel.
 14. Heating cable manufacturer shall provide a group snow/ice melting controller with built-in GFPD compatible with selected heating cable.
 15. Group snow/ice melting controller shall have an integrated 30-mA ground-fault circuit breaker.
 16. Group snow/ice melting controller shall have 1, 2, or 3 [Select one] 3-pole, Shunt trip circuit breakers with external ground-fault sensors. [Custom SMPG panel designs are available if standard configurations are not suitable. Please contact your nVent sales representative for more information and pricing].
 17. Group snow/ice melting controller shall have a main circuit breaker **[Select if applicable]**
 18. Group snow/ice melting controller shall be capable of operating with 3 phase supply voltages of 208 V, 480 V, **or** 600 V **[Select one]**.
 19. Group snow/ice melting controller shall be capable of supporting up to six (6) aerial or gutter mounted temperature/moisture sensors.
 20. Group snow/ice melting controller enclosure shall be NEMA 1/12 **or** NEMA 3R/4 **[Select one]**.
 21. Group snow/ice melting controller shall have an adjustable hold-on timer (0 – 10 hours).
 22. Group snow/ice melting controller shall have an integrated high-limit temperature sensor.
 23. Electronic snow/ice melting controller shall have contacts to interface with an Energy Management Computer (EMC).
 - a. Inputs: Override On, Override Off
 - b. Outputs: Supply, Snow, Heat, High Temp, Alarm
 24. Digital controller shall have c-UL-us approvals
- d. **[Option 4] Multi-Circuit, Distributed Digital Control System**
 1. All surface snow melting 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 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-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, connection kits, and controller) shall be UL Listed, CSA Certified for surface snow melting of concrete and asphalt, and under pavers.
- b. The snow melting system shall have a design, installation and operating manual specific to surface snow melting.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verification Of Conditions

- 1. Prior to installation of heating cables, the installation area shall be swept clear of construction equipment and other debris, and passage through the area of unrelated personnel or equipment shall be halted for the duration of the installation. If applicable, trench Drain cutting shall be complete, and electrical service holes shall be in place prior to installation of heating cable.

B. Pre-installation Testing

- 1. Upon receipt of the heating cables, continuity (conductor resistance) and "megger" (insulation resistance) tests shall be performed. Records shall be kept for each cable in the test results table provided at the back of the installation manual. Detailed test instructions shall be included in the heating cable installation manual.
- 2. Continuity Test
 - a. Using a standard multimeter, resistance from one end of the heating conductor to the other shall be measured and recorded. Expected resistance for each heating cable reference shall be indicated on manufacturer's data sheet and noted on said report.
- 3. "Megger" Test
 - a. Using a megohmmeter, Insulation Resistance between the heating conductor and copper cable sheath shall be measured and recorded. It is recommended that the test be performed at 1000 VDC, however 500 VDC is acceptable in the absence of capable equipment. Upon receipt, minimum acceptable insulation resistance shall be 100 MΩTest

3.2. PREPARATION

A. Protection Of In-Place Conditions

- 1. If there is any delay between installation of the heating cables and placement of the topping course, take the following precautions to protect the installation:
 - a. Record post-installation test results immediately
 - b. Do not energize the cables

- c. Mechanically protect the cables so that they cannot be damaged by pedestrian or vehicular traffic, paint, welding, falling objects, inclement weather, or other inappropriate exposure

3.3. INSTALLATION

A. Cable:

1. Heating cable shall be installed according to national and local electrical codes, manufacturer's recommendations, and the instructions supplied with heating cable and components.
2. Cables shall be laid such that sheaths shall not touch or cross one another. Concrete expansion and/or crack-control joints shall be crossed in accordance with specific procedures provided by the manufacturer.
3. Cables shall be laid at the spacing specified in construction documentation. As a general rule, spacing shall be wider than 3" (75 mm) and must not exceed 10" (250 mm) in concrete or 6" (150 mm) in asphalt, to promote equal heat distribution at the surface.
4. All junction boxes shall be located in accessible areas, above grade (unless indoors). Junction boxes shall not be located in the heated slab. Covers shall be kept on enclosures at all times when not working therein.
5. All terminations shall be protected from the weather and from mechanical damage. The gland assembly shall be bonded to the system ground. When fishing cable cold-leads through conduit, cold-lead tails shall not be pulled.
6. Field-alterations or deviations shall proceed only after authorization has been issued by the project engineering team. All changes shall be accurately recorded by the contractor and shall be provided to engineering upon completion of that phase of work.
7. After the heating cable is laid, the same tests outlined in section 3.1.B shall be performed and results recorded in the same Results table. Continuity test reading should be the same; Insulation Resistance test reading should exceed 20 MΩ. In the event that test results are unsatisfactory, the construction team shall be notified, and work in the area stopped, until the issue is rectified. The cable manufacturer shall be capable of assisting with troubleshooting.

B. Sensors and Controller

1. Sensor shall be mounted securely in upright position in an area clear of overhead trees, wires, eaves, and the like, and not at risk from falling debris. Exposure to artificial heat sources and shock or vibration shall be avoided.
2. Location shall be selected so as to be representative of anticipated precipitation conditions in the area(s) where snow-melting system has been installed.
3. Sensor shall be powered in accordance with Electrical Codes and standards.

C. Slab Temperature Sensor **[Select One Option]**

1. **[Option 1] For Group Control and Power Distribution Panel**
 - a. Metallic conduit for accommodation of the slab thermistor (min. ¾" nominal) shall be installed between runs of heating cable prior to topping course pour. The conduit shall not cross runs of heating cable, and shall end no less than 18" (450mm) within the heated section of the slab. The conduit shall be sealed at its extent to prevent ingress of paving material during pour and moisture after.
 - b. After topping course work is complete, the slab temperature sensor (thermistor) shall be inserted to the end of the previously-installed conduit. It is recommended that

fish-tape (or similar) be used to push the thermistor in, and abandoned in place, for the dual purpose of ensuring it gets to the end and allowing future retrieval.

2. **[Option 2] Distributed Control Network**

- a. Metallic conduit for accommodation of the slab-sensing RTD (min. 3/4" nominal) shall be installed between runs of heating cable prior to topping course pour. The conduit shall not cross runs of heating cable, and shall end no less than 18" (450mm) within the heated section of the slab. The conduit shall be sealed at its extent to prevent ingress of paving material during pour and moisture after.
- b. After topping course work is complete, the slab temperature sensor (RTD) shall be inserted to the end of the previously-installed conduit. It is recommended that fish-tape (or similar) be used to push the RTD in, and abandoned in place, for the dual purpose of ensuring it gets to the end and allowing future retrieval without undue tension on the sensor assembly itself.

D. Energy Efficient Control System **[Select One Option]**

1. **[Option 1] Group Control and Power Distribution Panel**

- a. Panel shall be mounted in accordance with manufacturer's installation and operating manuals applicable codes and standards.
- b. All power and control wiring connections shall be made safe prior to energizing the panel.

2. **[Option 2] Distributed Control Network**

- a. Panels shall be mounted in accordance with Manufacturer's installation and operating manuals (H58661, H58672), and applicable codes and standards.
- b. Control Module addresses shall be set prior to energizing the system, avoiding duplication of addresses.
- c. All power and control wiring connections shall be made safe prior to energizing the system. Circuits shall be energized in the order specified in the installation and operating manuals to ensure network connectivity.

3.4. 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 System Installation and Operation manual. (H57754)
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 or greater. (100 megaohms upon receipt)
 - a. Before installing the heating cable
 - b. After heating cable has been installed
 - c. After installing accessories
 - d. Before the concrete is poured
 - e. During the concrete pour
 - f. Prior to initial start-up (commissioning)
 - g. As part of the regular system maintenance

3. If a fault is indicated during the pour, the affected area shall be immediately identified, cleaned, and protected for the duration of the pour so that a repair can be made before it is encased in concrete.
4. The technician shall verify that the controller parameters are set to the application requirements.
5. The technician shall verify that the ACS-30 and ProtoNode device server (if applicable) are configured correctly with the BMS.
6. 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.

3.5. 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.

3.6. MAINTENANCE

A. Maintenance Service

1. Comply with manufacturer's recommendations in MI System Installation and Operation Manual. (H57754)

END OF SECTION