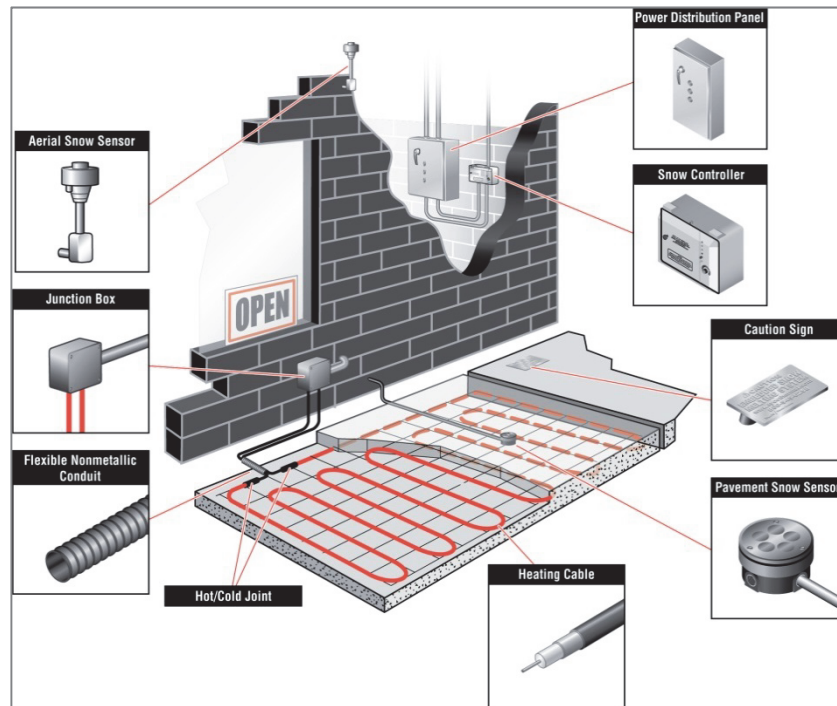


# Raychem CSI MASTER FORMAT 2004 GUIDE SPECIFICATION FOR: SNOW MELTING (MINERAL INSULATED)



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

## Scope

This specification describes an energy efficient snow melting system for pavers and concrete and asphalt surfaces and control systems. Depending on the system design and the size of application, one of the three control options listed should be selected.

This page gives a general overview of the system and the CSI formatted specification begins on page 4. The specification can be modified to better suit individual projects.

## System Description

### Mineral Insulated (MI) Heating Cable

120 V, 208-277 V, 347 V, 480 V, or 600 V Pyrotenax mineral insulated (MI) heating cable with a single conductor surrounded by magnesium oxide insulation, a solid copper sheath, and an extruded high density polyethylene (HDPE) jacket. The heating cable shall be part of a UL Listed and CSA Certified system.

### Accessories

SPACERGALV: Galvanized steel prepunched strapping  
 SMCS: Snow melting caution sign  
 D1297TERM4: Cast aluminium junction box (NEMA 3)

## Controller

### Single Circuit Control

APS-3C or APS-4C automatic snow/ice melting controller with:

Individual circuit control

- Up to six (6) temperature and moisture sensor inputs.
- Integrated ground-fault (APS-4C only)
- Adjustable hold-on timer (0 – 10 hours)
- Integrated high-limit temperature sensor
- Operating Voltages
  - APS-3C: 120 V, 208 – 240 V, single phase
  - APS-4C: 277 V single phase; 208 – 240 V, 277/480 V, or 600 V, three phase
- Switching Capacity
  - APS-3C: 24 A
  - APS-4C: 40 A (277 V single phase); 50 A (all other voltages)
- NEMA 3R enclosure

### Group Control

Raychem SMPG1 or SMPG3 snow melting and de-icing power distribution and control panel

Single controller, multiple circuits, group contactor

- Integrated EUR-5A snow/ice controller
- Up to six (6) temperature and moisture sensor inputs
- Adjustable hold-on timer (0 – 10 hours)
- Integrated high-limit temperature sensor
- Operating Voltages: 208 V or 277 V, single phase (for SMPG1) or 208 V, 480 V, or 600 V three phase (for SMPG3)
- 6, 12, or 18 ground-fault circuit breakers up to 50 A
- Optional main circuit breaker
- Multiple configurations available

### Distributed Group Control

Raychem ACS-30 Multi-circuit digital control system plus external snow/ice melting controller:

Single controller, multiple circuits, individual circuit contactors

- Pre-programmed application based heat-tracing controller.
- Touch-screen user interface (ACS-UIT2) communicates with up to 52 ACS-PCM2-5 modular control panels. The Raychem C910-485 digital controller may be added to the ACS-30 Network for single circuit extensions.
- BMS interface.
- Controls up to 260 heat-tracing circuits with up to 388 temperature inputs (RTDs).
- Proportional Ambient Sensing Control (PASC).
- 30 A switching capacity rating.
- Enclosure:
  - ACS-UIT2: NEMA 4
  - ACS-PCM2-5: NEMA 4/12

Snow/Ice Melting Controller (required) Features:

- Type LCD-7A or approved equivalent

## Device Server

Raychem ProtoNode: A multi-protocol device server to interface the ACS-30 with a building management system (BMS).

## Designer Notes

1. For proper cable selection, refer to the Surface Snow Melting – MI Design Guide (H57045) and Installation and Operation Manual (H57754).
2. Ground-fault circuit protection is integrated in the APS-4C and ACS-30 controllers, and SMPG1 control panel, and does not need to be provided separately.
3. Multiple sensors can be integrated into all controllers.
4. The ACS-30 may be connected to the BMS through the ProtoNode using two conductor twisted pair shielded RS-485 cable (PTM Catalog Number: MONI-RS485-WIRE). The ProtoNode is connected to the BMS by Ethernet or RS-485. The installation of the communication wiring is included in specification section 25 50 00.
5. The APS-3C or APS-4C is a wall mounted controller with a NEMA 3R rated enclosure and can be mounted indoors or outdoors.
6. The SMPG1 control panel can be installed indoors (NEMA 1/12) or outdoors (NEMA 3R/4).
7. Custom SMPG and ACS-PCM2-5 panel designs are available if standard configurations are not suitable. Please contact your Pentair Thermal Building Solutions sales representative for more information and pricing.
8. ACS-UIT2 should be centrally located in the building connected to the remote ACS-PCM2-5 control panels using RS-485 cable. The ACS-PCM2-5 control panels may be located indoors or outdoors throughout the installation.
9. The location of the controller, power connection, tees/splices and end seals must be shown on the drawings.

## Drawing Details

Installation details can be found at [CADdetails.com](http://CADdetails.com) under Snow Melting folder.

## **PART 1 – GENERAL**

### **1.1 SUMMARY**

- A. This Section includes a UL Listed and CSA Certified snow melting heat tracing system consisting of mineral insulated heating cable, connection kits and electronic controller.

### **1.2 RELATED SECTIONS**

- A. Section 03 06 00 – Schedules for Concrete
- B. Section 03 10 00 – Concrete Forming and Accessories
- C. Section 03 30 00 – Cast-In Place Concrete
- D. Section 25 12 16 – Direct-Protocol Integration Network Gateways
- E. Section 25 51 00 – Integrated Automation Control of Facility Equipment

### **1.3 SYSTEM DESCRIPTION**

- A. System for roof and gutter de-icing with ambient and moisture sensing control, monitoring, integrated ground-fault circuit protection and Building Management System (BMS) communication capabilities.

### **1.4 SUBMITTALS**

- A. Product Data
  - 1. Heating cable data sheet
  - 2. UL, CSA approval certificates for snow melting
  - 3. Snow melting design guide
  - 4. System installation and operation manual
  - 5. System installation details
  - 6. Connection kits and accessories data sheet
  - 7. Controller/Power Panel data sheet
  - 8. Controller/Power Panel wiring diagram

### **1.5 QUALITY ASSURANCE**

- A. Manufacturers' Qualifications
  - 1. Manufacturer to show minimum of thirty (30) years experience in manufacturing electric self-regulating heating cables.
  - 2. Manufacturer will be ISO-9001 registered.
  - 3. Manufacturer to provide products consistent with IEEE 515.1 and CSA 22.2 No 130-03 requirements.
- B. Installer Qualifications
  - 1. 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.
- C. Regulatory Requirements and Approvals
  - 1. The system (heating cable, connection kits, and controller) shall be UL Listed and CSA Certified for snow melting
- D. 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.

### **1.6 DELIVERY, STORAGE AND HANDLING**

- A. General Requirements: Deliver, store and handle products to prevent their deterioration or damage due to moisture, temperature changes, contaminates or other causes.
- B. 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 Operation Manual
  - 5. MSDS (if applicable)
- C. Storage and Handling Requirements

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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. Extended Warranty
  1. Manufacturer shall make available a ten (10) year limited warranty for MI heating cables and components. Provide one (1) year warranty for all heat trace controllers.
  2. Contractor shall submit to owner the results of all installation tests required by the manufacturer.

**END OF PART 1**

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS AND PRODUCTS**

- A. Contract Documents are based on manufacturer and products named below to establish a standard of quality.
- B. Basis of Design
  1. Basis of Design Product Selections
    - a. Manufacturer
      1. Manufacturers shall have more than thirty (30) years' experience with manufacture & installation self-regulating heating cables.
      2. Manufacturer shall provide UL and CSA approval certificates for snow melting  
Manufacturer shall be Pentair, located at, 7433 Harwin Drive, Houston, TX 77036  
94025 Tel: (800) 545-6258 www.pentairthermal.com
    - b. Snow Melting System
      1. Pyrotenax MI heating cable
      2. APS-3C/APS-4C snow/icing melting controller **OR** Raychem SMPG1 control panel  
**OR** Raychem SMPG3 control panel **OR** Raychem ACS-30 with snow/ice melting controller **[Select one]**
      3. Raychem ProtoNode multi-protocol device server

**2.2 PRODUCTS, GENERAL**

- A. Single Source Responsibility: Furnish heat tracing system for snow melting from a single manufacturer.
- B. The system (heating cable, connection kits, and controller) shall be UL Listed and CSA Certified for snow melting. No parts of the system may be substituted or exchanged.

**2.3 PRODUCTS**

- A. HDPE Jacketed Copper Sheathed Mineral Insulated Heating Cable
  1. Heating cable shall be Pyrotenax MI heating cable manufactured by Pentair.
  2. The heating cable shall consist of a single conductor surrounded by magnesium oxide insulation with a solid, seamless copper sheath.
  3. The heating cable shall have an extruded high density polyethylene (HDPE) jacket to protect the cable from corrosive elements that can exist in the concrete.
  4. The heating cable shall be factory terminated with a minimum 7 foot cold lead (unheated) length.
  5. The heating cable shall operate on line voltages of 120, 208, 240, 277, 347, 480 or 600 volts [Select one] without the use of transformers.
  6. The heating cable shall be part of a UL Listed and CSA Certified system.
  7. The MI heating cable tag shall have the following markings:
    - a. Complete heating cable model number
    - b. Agency listings
    - c. Meter mark
    - d. Lot/Batch ID
- B. Heating Cable Installation Accessories
  1. Prepunched strapping – Used to maintain proper spacing of the MI heating cable during installation. (PTM Catalog Number: SPACER-GALV)

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2. Junction Box – The junction box is a cast aluminium junction box (NEMA 3) for installation in non-hazardous and C1D2 locations. There are three (3) ½” NPT entries on the bottom, provided with plugs, and includes a 4-pole terminal block. (PTM Catalog Number: D1297TERM4)
  3. Snow Melting Caution Sign – The snow melting caution sign is required by national electrical codes to indicate that an electrical snow melting system is installed in the slab. (PTM Catalog Number: SMCS)
- C. Control Methodology **[Select one option]**
1. **[Option 1] Single Circuit Control**
    - 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, and 120 mA. **(APS-4C only)**
    - d. Electronic snow/ice melting controller shall have 24-A (APS-3C) **OR** 40-A (APS-4C 277 V single phase) **OR** 50-A (APS-4C 208 – 240 V single phase, 277/480 V, 600 V three phase) **[Select one]** switching capacity rating.
    - e. Electronic snow/ice melting controller shall be capable of operating with supply voltages of 120, 208 – 240 V single phase (APS-3C) **OR** 277 V single phase (APS-4C) **OR** 208 – 240 V three phase (APS-4C) **OR** 277/480 V three-phase (APS-4C) **OR** 600 V three phase (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 (10-mA dry switch contact) to interface with an Energy Management Computer (EMC).
      1. Inputs: Override On, Override Off
      2. Outputs: Supply, Snow, Heat, High Temp, Alarm
    - k. Digital controller shall have c-UL-us approvals.
  2. **[Option 2] Group Control**
    - a. Group controller shall be Raychem SMPG1 **OR** SMPG3 **[Select one]** snow melting and de-icing power distribution and control panel.
    - b. Heating cable manufacturer shall provide a group snow/ice melting controller with built-in GFPD compatible with selected heating cable.
    - c. Group snow/ice melting controller shall have an integrated 30-mA ground-fault circuit breakers.
    - d. 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 Pentair sales representative for more information and pricing]**
    - e. Group snow/ice melting controller shall have a main circuit breaker [Select if applicable]
    - f. Group snow/ice melting controller shall be capable of operating with supply voltages of 208 V **OR** 277 V single phase (SMPG1) **OR** 208 V, 480 V, 600 V three phase (SMPG3) **[Select one]**.
    - g. Group 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.
    - h. Group snow/ice melting controller enclosure shall be NEMA 1/12 or NEMA 3R/4 **[Select one]**.
    - i. Group snow/ice melting controller shall have an adjustable hold-on timer (0 – 10 hours).
    - j. Group snow/ice melting controller shall have an integrated high-limit temperature sensor.
    - k. Electronic snow/ice melting controller shall have contacts (floating switch contacts rated at

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5 Vdc at 10 mA) to interface with an Energy Management Computer (EMC).

1. Inputs: Override On, Override Off
  2. Outputs: Supply, Snow/Ice, Heat
- l. Digital controller shall have c-UL-us approvals
3. **[Option 3] Distributed Control**
- a. Distributed digital control system shall be Raychem ACS-30 heat-trace control system.
  - b. Heating cable manufacturer shall provide a distributed digital control system with 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.
  - c. All programming shall be done through the central User Interface Terminal (ACS-UIT2).
  - d. The ACS-UIT2 shall be a color LCD touch-screen display with password protection to prevent unauthorized access to the system.
  - e. 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. The Raychem C910-485 digital controller may be added to the ACS-30 Network for single circuit extensions.
  - f. Digital control system shall be capable of assigning up to four (4) RTD temperature or external temperature and moisture-sensing device inputs per heat-tracing circuit.
  - g. The ACS-UIT2 shall communicate with up to sixteen (16) Remote Monitoring Modules (RMM2), where each module can accept up to 8 temperature inputs.
  - h. The ACS-UIT2 shall have a USB port to allow for quick and easy software update.
  - i. The ACS-UIT2 shall have three (3) programmable alarm contacts including an alarm light on the enclosure cover.
  - j. 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.
  - k. The ACS-UIT2 enclosure shall be NEMA 4 for indoor or outdoor locations.
  - l. The ACS-PCM2-5 panel shall be in a NEMA 4/12 enclosure approved for nonhazardous indoor and outdoor locations.
  - m. The ACS-PCM2-5 panel shall provide ground-fault and line current sensing, alarming, switching and temperature inputs for five (5) heat tracing circuits.
  - n. Each ACS-PCM2-5 panel shall have five (5) 3-pole, 30 A contactors (EMR type).
  - o. 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 Pentair sales representative for more information and pricing]**
  - p. The ACS-PCM2-5 panel shall be capable of operating at 208 V, 480 V, or 600 V three phase via a custom panel design.
  - q. The ACS-PCM2-5 shall have an alarm contact including an alarm light on the panel cover.
  - r. Digital controller shall have an integrated adjustable GFPD (10 – 200 mA).
  - s. Digital control system can be configured for ambient sensing, surface temperature and external device control modes for the snow melting application. External control mode requires a separate snow/ice melting controller type LCD-7A or approved equivalent.
  - t. Digital control system shall have power off delay, manual forced on/off override and high temperature override.
  - u. Digital control system will have a built-in self-test feature to verify proper functionality of heating cable system.
  - v. Digital control system will also be able to communicate with BMS by one of the following protocols using the Raychem ProtoNode multi-protocol gateway. **[Select one]**
    1. Modbus®
    2. LonWorks® **[Select ProtoNode-LER]**

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3. BACnet® **[Select ProtoNode-RER]**
4. Metasys® N2 **[Select ProtoNode-RER]**
- w. The following variables will be monitored by the digital controller and reported back to the BMS.
  1. Temperature
  2. Ground-fault
  3. Current draw
  4. Power consumption
  5. Associated alarms
- x. The ACS-UIT2 shall be c-CSA-us Certified. The ACS-PCM2-5 panel shall be c-UL-us Listed.

**2.4 SYSTEM LISTING**

- A. The system (heating cable, connection kits, and controller) shall be UL Listed and CSA Certified for snow melting.
- B. The snow melting system shall have design and installation & operating manuals.

**END OF PART 2**

**PART 3 - EXECUTION**

**3.1 INSTALLERS**

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

**3.2 INSTALLATION**

- A. Comply with manufacturer's recommendations in the Surface Snow Melting - MI Installation and Operation Manual (H57754).
- B. Install and secure the heating cable in accordance with the Surface Snow Melting - MI Installation and Operation Manual (H57754).
- 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 equipment 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."

**3.3 FIELD QUALITY CONTROL**

- A. Start-up of system shall be performed by factory technician or factory representative per the owner's requirements.
- B. Field Testing and Inspections
  1. The system shall be commissioned in accordance to the ElectroMelt 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 or greater.
    - a. Before installing the heating cable
    - b. After heating cable has been installed onto the pipe
    - c. After installing connection kits
    - d. After the thermal insulation is installed onto the pipe
    - e. Prior to initial start-up (commissioning)
    - f. As part of the regular system maintenance
  3. The technician shall verify that the APS-3C/APS-4C snow/icing melting controller **OR** Raychem SMPG1 control panel **OR** Raychem SMPG3 control panel **OR** Raychem ACS-30 with snow/ice melting controller **[Select one]** control parameters are set to the application requirements.
  4. The technician shall verify that the APS-3C/APS-4C snow/icing melting controller **OR** Raychem SMPG1



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control panel **OR** Raychem SMPG3 control panel **OR** Raychem ACS-30 with snow/ice melting controller  
**[Select one]** alarm contacts are corrected connected to the BMS.

5. The technician shall verify that the ACS-30 and ProtoNode-RER/-LER **[Select one]** are configured correctly with the BMS.

6. All commissioning results will be recorded and presented to the owner.

**3.4 MAINTENANCE**

A. Maintenance Service

1. Comply with manufacturer's recommendations in Surface Snow Melting - MI Installation and Operation Manual.

**END OF SECTION**



[WWW.PENTAIRTHERMAL.COM](http://WWW.PENTAIRTHERMAL.COM)

**NORTH AMERICA**

Tel: +1.800.545.6258  
Fax: +1.800.527.5703  
Tel: +1.650.216.1526  
Fax: +1.650.474.7711  
[thermal.info@pentair.com](mailto:thermal.info@pentair.com)

**EUROPE, MIDDLE EAST, AFRICA**

Tel: +32.16.213.511  
Fax: +32.16.213.603  
[thermal.info@pentair.com](mailto:thermal.info@pentair.com)

**ASIA PACIFIC**

Tel: +86.21.2412.1688  
Fax: +86.21.5426.2937  
[cn.thermal.info@pentair.com](mailto:cn.thermal.info@pentair.com)

**LATIN AMERICA**

Tel: +1.733.868.4800  
Fax: +1.713.868.2333  
[thermal.info@pentair.com](mailto:thermal.info@pentair.com)

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