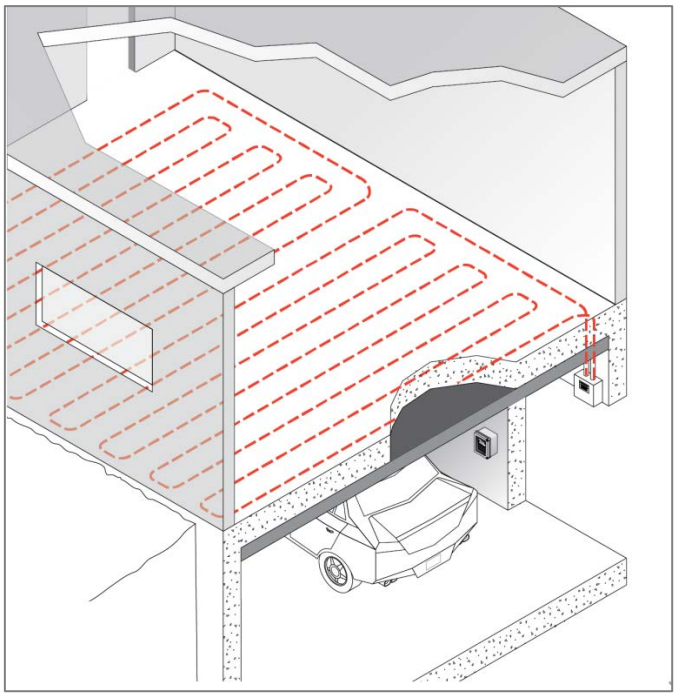
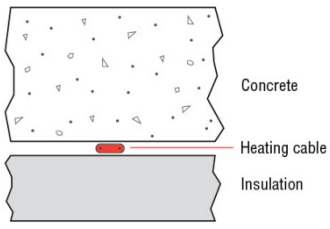
CSI Master Format 2004 Guide Specification for:
Floor Heating – Heat Loss Replacement (Self-Regulating)



System for floor heating with temperature control, monitoring, integrated ground-fault circuit protection and BMS communication capabilities.

Scope

This specification describes an energy efficient floor heating and control system that eliminates the chill felt from the heat lost through floors over non-heated areas such as garages and loading docks. The heating cable is attached underneath the floor and above the insulation (see below).



Depending on the system design and size of application, one of the two control options listed in Section 2.3.C should be selected.

These first few pages give 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

Self-Regulating Heating Cable

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.

System Connection Kits

Raychem FTC connection kits for power connections and end seals

Controller

Single Circuit Control

DigiTrace C910-485 digital controller with:

- Proportional Ambient Sensing Control (PASC).
- BMS interface.
- Two (2) temperature inputs.
- 30 A switching capacity rating.
- Selectable fail safe mode, either ON or OFF.
- NEMA 4X enclosure

Distributed Group Control

DigiTrace ACS-30 Multi-circuit digital control system with:

- 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 DigiTrace 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

Device Server

DigiTrace ProtoNode: A multi-protocol device server to interface the C910-485 or ACS-30 with a building management system (BMS).

Designer Notes

1. For proper cable selection, refer to the Floor Heating Design Guide (H58157) and RaySol Installation and Operation Manual (H58138).
2. Ground-fault circuit protection is integrated in the C910-485 and ACS-30 controllers, and does not need to be provided separately.
3. Multiple sensors can be integrated into all controllers.
4. The C910-485 or 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 C910-485 is a wall mounted controller with a Type 4X rated enclosure and can be mounted indoors or outdoors.
6. ACS-UIT2 should be conveniently 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.
7. 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 under Floor Heating folder.

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes a UL Listed and CSA Certified floor heating system consisting of self-regulating heating cable, connection kits and electronic controller.

1.2 RELATED SECTIONS

A. Section 03 30 00 – Cast-In Place Concrete
B. Section 07 24 00 – Exterior Insulation and Finish Systems
C. Section 25 12 16 – Direct-Protocol Integration Network Gateways
D. Section 25 51 00 – Integrated Automation Control of Facility Equipment

1.3 SYSTEM DESCRIPTION

A. System for floor heating with temperature control, monitoring, integrated ground-fault circuit protection and BMS communication capabilities.

1.4 SUBMITTALS

A. Product Data
   1. Heating cable data sheet
   2. UL, CSA approval certificates for floor heating
   3. Floor Heating design guide
   4. System installation and operation manual
   5. System installation details
   6. System layout drawings
   7. Connection kits and accessories data sheet
   8. Controller/Power Panel data sheet
   9. Controller/Power Panel wiring diagram

1.5 QUALITY ASSURANCE

A. Manufacturers' Qualifications
   1. Manufacturer to show minimum of thirty (30) years' experience in manufacturing mineral insulated heating cables.
   2. Manufacturer is ISO-9001 registered.
   3. Manufacturer to provide products that comply with UL 515, CSA 22.2 No 130-03 and IEEE 515.1 requirements.

B. Installer Qualifications
   1. System installer shall have a 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 floor heating.

D. Electrical Components, Devices, and Accessories: Listed and labelled as defined in Article 100 of NFPA 70 National Electrical Code 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
   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. Extended Warranty
   1. Manufacturer shall make available a ten (10) year limited warranty for RaySol 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. Manufacturer 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 freezer frost heave prevention.
         3. Manufacturer shall be Pentair Thermal Management, LLC, located at, 7433 Harwin Drive, Houston, TX 77036 Tel: (800) 545-6258 www.thermal.pentair.com
      b. Freezer Frost Heave Prevention System
         1. Raychem RaySol self-regulating heating cable
         2. Raychem FTC connection kits and accessories
         3. DigiTrace C910-485 digital controller **OR** DigiTrace ACS-30 **[Select one]**
         4. DigiTrace ProtoNode multi-protocol device server

2.2 PRODUCTS, GENERAL

A. Single Source Responsibility: Furnish heat tracing system for freezer frost heave prevention from a single manufacturer.

B. The system (heating cable and controller) shall be c-CSA-us Certified or FM Approved for freezer frost heave prevention. No parts of the system may be substituted or exchanged.

2.3 PRODUCTS

A. Self-Regulating Heating Cable
   1. Heating cable shall be Raychem RaySol self-regulating heating cable manufactured by Pentair Thermal Management
      a. Model Numbers **[Select One]**
         1. RaySol-1 (120 V)
         2. RaySol-2 (208 – 277 V)
   2. 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.
   3. The heating cable shall have a modified polyolefin inner jacket and a tinned-copper braid to provide a ground path and enhance the cables ruggedness.
   4. The heating cable shall have a fluoropolymer outer jacket for enhanced mechanical and chemical protection.
   5. The heating cable shall operate on line voltages of 120, 208, 240, or 277 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 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

B. Heating Cable Connection Kits
1. Heating cable connection kits shall be Raychem FTC connection kits.
2. Manufacturer shall provide power connection and end seal kits compatible with selected heating cable.
3. Connection kits shall be UL Listed and CSA Certified

C. Control Methodology **[Select one option]**
1. **[Option 1] Single Circuit Local Digital Controller**
a. Local digital controller shall be DigiTrace C910-485.
b. Heating cable manufacturer shall provide a local digital controller with built-in GFPD compatible with selected heating cable.
c. 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.
d. Enclosure type shall be Type 4X fiberglass reinforced plastic (FRP).
e. Digital controller shall have an integrated adjustable GFPD (10 – 200 mA).
f. 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.
g. Digital controller shall be capable of operating with supply voltages from 100 V to 277 V.
h. Digital controller will have a built-in self-test feature to verify proper functionality of heating cable system.
i. Digital controller will also be able to communicate with BMS by one of the following protocols. Certain protocols will require the DigiTrace ProtoNode multi-protocol gateway. **[Select one]**
1. Modbus®
2. LonWorks® **[Select ProtoNode-LER]**
3. BACnet® **[Select ProtoNode-RER]**
4. Metasys® N2 **[Select ProtoNode-RER]**
j. Digital controller will also supply an isolated triac alarm relay and a dry contact relay for alarm annunciation back to the BMS.
k. 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
l. Digital controller shall have c-CSA-us approvals

2. [Option 2] Distributed Control
a. Distributed digital control system shall be DigiTrace 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 DigiTrace C910-485 digital controller may be added to the ACS-30 Network for single circuit extensions.

f. Digital distributed 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 Type 4 for indoor or outdoor locations.

l. The ACS-PCM2-5 panel shall be in a Type 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 Thermal Management sales representative for more information and pricing]**

p. The ACS-PCM2-5 shall have an alarm contact including an alarm light on the panel cover.

q. Digital controller shall have an integrated adjustable GFPD (10 – 200 mA).

r. Digital controller can be configured for On/Off, ambient sensing, PASC and timed duty cycle control (HWAT only) modes based on the application.

s. Digital control system shall have power off delay, manual forced on/off override and high temperature override.

t. Digital control system will have a built-in self-test feature to verify proper functionality of heating cable system

u. Digital controller will also be able to communicate with BMS by one of the following protocols. Certain protocols will require the DigiTrace ProtoNode multi-protocol gateway. **[Select one]**
   1. Modbus
   2. LonWorks® **[Select ProtoNode-LER]**
   3. BACnet® **[Select ProtoNode-RER]**
   4. Metasys® N2 **[Select ProtoNode-RER]**

v. 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

w. 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 heating cable and connection kits shall be UL Listed and CSA Certified for Floor Heating.

B. The controller shall be c-CSA-us Certified for Floor Heating.

C. The floor heating system shall have a Design Guide and an Installation and Operation Manual.

END OF PART 2

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS

A. Subject to compliance with requirements of Contract Documents, installer shall be familiar with installing heating cable and equipment

3.2 INSTALLATION

A. Comply with manufacturer's recommendations in the RaySol System Installation and Operation Manual (H58138).

B. Install and secure the heating cable in accordance with the RaySol System 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."

3.3 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 RaySol Installation and Operation manual.
2. The heating cable circuit integrity shall be tested using a 2500-Vdc megohmmeter at the following intervals. Minimum acceptable insulation resistance shall be 1000 megohms.
   a. Before installing the heating cable
   b. After installing the cables
   c. Prior to initial start-up (commissioning)
   d. As part of the regular system maintenance
3. The technician shall verify that the DigiTrace C910-485 controller **OR** DigiTrace ACS-30 **[Select one]** control parameters are set to the application requirements.
4. The technician shall verify that the DigiTrace C910-485 controller **OR** DigiTrace ACS-30 **[Select one]** alarm contacts are correctly connected to the BMS.
5. The technician shall verify that the C910-485 **OR** ACS-30 **[Select one]** and ProtoNode-RER/-LER **[Select one]** is 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 found in RaySol System Installation and Operation Manual.

END OF SECTION

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