System Outline - Pentair Raychem Roof and Gutter De-Icing Icestop System - Re-Roof - Banff Upper Hot Spring Bath House

1.	Heating Cable coverage for gutters (Northeast Side 1)	= 1.0 ft x 80 ft	= 80 ft
2.	Heating Cable coverage for gutters (Northeast Side 2)	= 1.0 ft x 80 ft	= 80 ft
3.	Heated downspouts (30 ft downspout length, Side 1)	= 30 ft x 2 locations	= 60 ft
4.	Heated downspouts (30 ft downspout length, Side 2)	= 30 ft x 2 locations	= 60 ft
5.	Circuit termination allowance (5 ft per cct, 2 circuits req'd)		= 10 ft
6.	Tee termination allowance for downspouts (5ft per connection)		= 20 ft
7.	Design allowance, 3% (safety factor)		= 10 ft
8.	Total cable requirement		= 320 ft

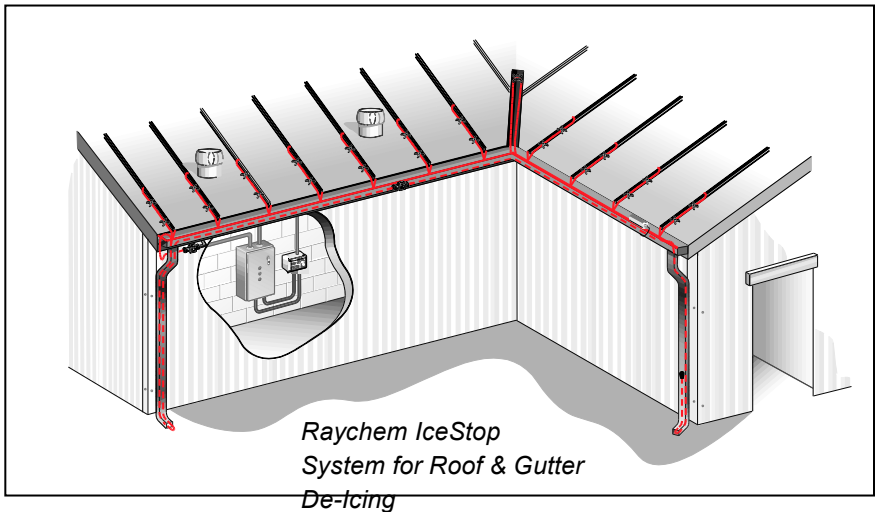
9. Design is based on using 208/240V, single phase
10. Heating cable is to be installed and secured inside the gutter to provide a continuous heated melt path
11. Per the CEC, ground fault protection is required for all heating cable circuits (APS-4C controller has this function built-in)
12. The maximum circuit length for Icestop heating cable is 180ft (based on a 15A GFCB, 20°F start-up temperature)
13. This application will require 2 15A circuits fed from southeast & northwest sides

Materials List - Pentair Raychem Roof and Gutter De-Icing Icestop System - Re-Roof - Banff Upper Hot Springs Bath House

1.	320 ft	GM2-XT Raychem IceStop Heating Cable, 12W/ft, UV Stabilized Jacket, 208-277V
2.	2 ea	RayClic-PC Raychem Quick Connect Power Termination Kit (includes gel filled end seal)
3.	4 ea	FTC-HST Raychem Low Profile Heat-Shrink Tee Connection Kit
4.	4 ea	GM-RAKE Downspout Hanger Bracket
5.	5 ea	GMK-RC Roof Clips (50/pkg), secure cable every 18" inside gutter
6.	12 ea	Momentive RTV167 10.3 oz tube Roof Adhesive (used with roofing clips)
7.	2 ea	APS-4C-208/240 SM Controller, 208-240V, built-in ground fault, high limit cutout sensor
8.	2 ea	GIT-1 Gutter-Mounted Snow/Ice Sensor

Note that additional items required may not listed above dependent on planned installation layout and system control - Bill of Materials should be reviewed to ensure its suitability for this project.

CSI Master Format 2004 Guide Specification for: Roof and Gutter De-Icing



Raychem IceStop System for Roof & Gutter De-Icing

System for de-icing of roofs and gutters with ambient and moisture sensing control, monitoring, integrated ground-fault circuit protection and BMS communication capabilities.

Scope

This specification describes an energy efficient de-icing system for roofs, gutters and downspouts, various attachment methods and control systems. Depending on the system design and 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 5. The specification can be modified to better suit individual projects.

System Description

Self-Regulating Heating Cable

120-277 V, Raychem IceStop heating cable with a fluoropolymer protective outer jacket. The heating cable shall be part of a UL Listed, CSA Certified and FM Approved system.

System Connection Kits

Raychem RayClic or FTC connection kits for power connections, tees/splices and end seals.

Accessories

GMK-RC: Roof clips
GMK-RAKE: Downspout hanger

Controller

Single Circuit Control

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

Individual circuit control

- Up to six (6) ambient or 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: 208 – 240 V, 277 V single phase
- Switching Capacity
  - APS-3C: 24 A
  - APS-4C: 40 A
- NEMA 3R enclosure

Group Control

DigiTrace SMPG1 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) ambient or moisture sensor inputs
- Adjustable hold-on timer (0 – 10 hours)
- Integrated high-limit temperature sensor
- Operating Voltages: 208 V or 277 V, single phase
- 6, 12, or 18 ground-fault circuit breakers up to 50 A
- Optional main circuit breaker
- Multiple configurations available

Distributed Control

DigiTrace ACCS-30 Multi-circuit digital control system plus external snow/ice melting controller:
Single controller, multiple circuits, individual circuit contactors
ACCS-30 Features:

- Pre-programmed application based heat-tracing controller.
- Touch-screen user interface (ACCS-UIT2) communicates with up to 52 ACCS-PCM2-5 modular control panels.
- 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:
  - ACCS-UIT2: NEMA 4
  - ACCS-PCM2-5: NEMA 4/12

Snow/Ice Melting Controller (required) Features:

- Aerial or gutter moisture and temperature sensor

Device Server

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

Designer Notes

1. For proper cable selection refer to the IceStop Roof and Gutter De-icing Design Guide (H56070) and Installation and Operation Manual (H58067).
2. Ground-fault circuit protection is integrated in the APS-4C and ACCS-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 ACCS-30 may be connected to the BMS through the ProtoNode using two conductor twisted pair shielded RS-485 cable (TTC 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. ACCS-UIT2 should be centrally located in the building connected to the remote ACCS-PCM2-5 control panels using RS-485 cable. The ACCS-PCM2-5 control panels may be located indoors or outdoors throughout the installation.
8. The location of the controller, power connection, tees/splices and end seals must be shown on the drawings.

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes a UL Listed, CSA Certified and FM Approved roof and gutter de-icing heat tracing system consisting of self-regulating heating cable, connection kits and electronic controller.

1.2 RELATED SECTIONS

A. Section 02 58 00 – Snow Control
B. Section 07 20 00 – Thermal Protection
C. Section 07 30 00 – Steep Slope Roofing
D. Section 07 40 00 – Roofing and Siding Panels
E. Section 07 50 00 – Membrane Roofing
F. Section 07 60 00 – Flashing and Sheet Metal
G. Section 07 71 23 – Manufactured Gutters and Downspouts
H. Section 25 12 16 – Direct-Protocol Integration Network Gateways
I. 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, FM approval certificates for roof and gutter de-icing
   3. Roof and gutter de-icing 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 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, CSA Certified and FM Approved for roof and gutter de-icing.
D. Electrical Components, Devices, and Accessories: Listed and labeled 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
   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 provide ten (10) year limited warranty for GM-2XT heating cables and components. Provide one (1) year warranty for all heat trace controllers.
   2. Contractor shall submit to owner results of 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, CSA, FM approval certificates for roof and gutter de-icing.
         3. Manufacturer shall be Tyco Thermal Controls LLC, located at 7433 Harwin Drive, Houston, TX 77036 Tel: (800) 545-6258 www.tycothermal.com
      b. Roof and Gutter De-icing System
         1. Raychem IceStop self-regulating heating cable with fluoropolymer (XT) outer jacket
         2. Raychem RayClic and FTC connection kits and accessories
         3. APS-4C snow/icing melting controller snow/ice melting controller

2.2 PRODUCTS, GENERAL

A. Single Source Responsibility: Furnish heat tracing system for roof and gutter de-icing from a single manufacturer.

B. The system (heating cable, connection kits, and controller) shall be UL Listed, CSA Certified and FM Approved for roof and gutter de-icing. No parts of the system may be substituted or exchanged.

2.3 PRODUCTS

A. Self-Regulating Heating Cable

1. Heating cable shall be Raychem IceStop self-regulating heating cable manufactured by Tyco Thermal Controls.
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 (XT) outer jacket for enhanced mechanical and chemical protection.
5. The heating cable shall have an inherently UV-resistant outer jacket (fluoropolymer).
6. The heating cable shall have a self-regulating factor of at least 75 percent. The self-regulating factor is defined as the percent reduction of the heating cable power output going from a 0°F to 80°F roof temperature.
7. The heating cable shall operate on line voltages of 208/240 without the use of transformers.
8. The heating cable power output shall be 12 W/ft at 32°F in ice or snow.
9. The heating cable shall be part of a UL Listed, CSA Certified and FM Approved system.
10. 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 RayClic and FTC connection kits.
2. Manufacturer shall provide power connection, splice/tee and end seal kits compatible with selected heating cable.
3. Installation shall not require the installing contractor to cut into the heating-cable core to expose the bus wires.
4. Connection kits shall be rated NEMA 4X to prevent water ingress and corrosion. All components shall be UV stabilized.
5. Connection kits shall be UL Listed, CSA Certified and FM Approved.

C. Heating Cable Installation Accessories

1. Roof clips – Used to secure IceStop heating cables to roofs and gutters. The clips may be attached with mechanical fasteners (screws or nails) on shake roofs or using adhesive on metal, slate or composite roofing. (TTC Catalog Number: GMK-RC)
2. Downspout Hangers - Used to provide mechanical protection and strain relief to the IceStop heating cable as it goes over sharp edges and to hold the heating cable in place at the top of downspouts. (TTC Catalog Number: GMK-RAKE)

D. Control Methodology

1. Single Circuit Control
    a. Single circuit snow/ice melting controller shall be APS-4C.
    b. Heating cable manufacturer shall provide a single circuit snow/ice melting controller with built-in GFPD compatible with selected heating cable.
    c. Electronic snow/ice melting controller shall have a GFPD with adjustable trip levels of 30, 60, 120 mA.
    d. Electronic snow/ice melting controller shall have 40-A (APS-4C) switching capacity rating.

e. Electronic snow/ice melting controller shall be capable of operating with supply voltages of 208/240 V (APS-4C).
f. Electronic snow/ice melting controller shall be capable of supporting up to six (6) aerial or gutter mounted temperature/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 to interface with an Energy Management Computer (EMC).
k. Digital controller shall have c-UL-us approvals.

2.4 SYSTEM LISTING

A. The system (heating cable, connection kits, and controller) shall be UL Listed, CSA Certified and FM Approved for roof and gutter de-icing.
B. The roof and gutter de-icing system shall have a design, installation and operating manual.

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 IceStop System Installation and Operation Manual (H58067).
B. Install and secure the heating cable in accordance with the IceStop System Installation and Operation Manual (H58067).
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 IceStop 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 onto the roof, gutters and/or downspouts.
c. After installing connection kits

d. Prior to initial start-up (commissioning)

e. As part of the regular system maintenance

3. The technician shall verify that the APS-4C snow/icing melting controller control parameters are set to the application requirements.

4. The technician shall verify that the APS-4C snow/icing melting controller alarm contacts are corrected connected to the BMS.

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

3.4 MAINTENANCE

A. Maintenance Service

1. Comply with manufacturer's recommendations in IceStop System Installation and Operation Manual.

END OF SECTION