

SECTION 238316 – ELECTRIC SNOW MELT SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes snow and ice melting systems utilizing self-regulating heat trace and the Frio Controls platform.

B. System Components:

1. At least one Frio S1-A Controller per control zone
2. Up to 6 total sensors per primary controller
 - i. AER-1 Aerial Sensor
 - ii. GUT-1 Gutter Sensor
 - iii. PVT-1 Pavement Sensor
3. Sensors communicate via Modbus RS-485
4. Sensors powered by 24VAC via SM-JB-1

C. Sequence of Operations:

1. Sensors configured to detect moisture (snow/ice) and ambient temperature conditions.
2. Controller activates heating circuits when moisture and freezing conditions are present. System shall activate when any connected sensor detects snow/ice conditions.
3. Controller deactivates heating circuits after adjustable hold-on period.
4. System includes ambient temperature sensor to allow for fallback mode control if moisture sensors are lost

D. System Configurations

1. Single Circuit – One primary controller per heat trace circuit.
2. Satellite Contactors – One primary controller with up to 20 additional satellite contactors.
3. Pilot Duty – One primary controller uses a 120V control signal to activate a contactor panel, energizing the heat trace.

1.3 BASIS OF DESIGN

A. System shall be based on Frio Controls snow melting system.

C. Alternate manufacturers must provide equivalent:

1. Moisture sensor-based control logic with programable hold-on time
2. Ambient fallback in case of sensor failure
3. Multi-circuit scalability and pilot duty mode
4. Cloud diagnostics and commissioning capability

1.4 SUBMITTALS

A. Product Data:

1. Controllers
2. Sensors
3. Junction boxes
4. Contactor Panel (if applicable)

B. Shop Drawings:

1. Sensor layout and zoning
2. Control architecture selection
3. Wiring diagrams (power + RS-485 network)

C. Calculations:

1. Heat trace load
2. Circuit sizing

D. Closeout Submittals:

1. O&M manuals
2. Commissioning reports (Spot Check)

1.5 REFERENCES

- A. UL 1053 – Ground Fault Equipment Protection
- B. UL 60730 – Automatic Electrical Controls
- C. NEC / NFPA 70
- D. IEEE / RS-485 communication standards

1.6 WARRANTY

- A. Provide minimum:
 - 1. Heat Trace: [5] years
 - 2. Controller: 2 years
 - 3. Sensors: 1 year
 - 4. Extended warranties as offered by manufacturer

PART 2 – PRODUCTS

2.1 SELF-REGULATING HEATING CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Thermon Americas Inc. (Basis-of-Design)
 - 2. Nelson
 - 3. or equal
- B. Comply with IEEE 515.1.
- C. Heating Element: Pair of parallel 16 AWG, nickel-plated copper bus wires embedded in crosslinked conductive polymer core, varying heat output in response to temperature along its length. Cable shall be capable of crossing over itself once without overheating.
- D. Cable Cover: Polyolefin outer jacket.
- E. Maximum Operating Temperature (Power On): 150 deg F.
- F. Maximum Exposure Temperature (Power Off): 185 deg F.
- G. Electrical Components shall be listed and labeled per NFPA 70.
- H. Capacities and Characteristics:
 - 1. Maximum Heat Output: 3 W/ft, 5 W/ft, 8 W/ft as required per manufacturer's design guide.
 - 2. Piping Diameter: Size as indicated on drawings.
 - 3. Number of Parallel Cables: As required per manufacturer's design guide.
 - 4. Use 208-277V when possible.
 - 5. Volts: [120] [208] [240] [277] <Insert value>.
 - 6. Phase: 1.
 - 7. Hertz: 60.

2.2 CONTROLS & SENSORS

- A. General
 - 1. Primary Controller: Frio S1-A Smart Heat Trace Controller
 - 2. Moisture Sensors:
 - i. AER-1 Aerial Sensor
 - ii. GUT-1 Gutter Sensor
 - iii. PVT-1 Pavement Sensor
 - 3. Moisture Sensor Interface: SM-JB-1 Junction Box
- B. Controller Performance Requirements
 - 1. Voltage: 120–277 VAC
 - 2. Load: 30A resistive per controller
 - 3. Integrated GFEP:
 - i. Adjustable 30–300 mA
 - ii. UL 1053 Listed - Ground Fault Equipment Protection
 - 4. Enclosure:
 - i. NEMA 4X / IP67
 - 5. Communications:
 - i. RS-485 Modbus

- ii. WiFi / Ethernet
 - iii. Dry-Contact Alarm
- C. Moisture Sensor Performance Requirements
1. Sensors shall:
 - i. Communicate via RS-485
 - ii. Be powered at 24VAC
 - iii. Include heated sensing surface
 - iv. Gutter sensor and Pavement sensor shall be stainless steel
 - v. Gutter and Aerial Sensors include moisture sensing and ambient temperature sensor
 - vi. Pavement sensor only detects moisture and requires secondary ambient sensor
 2. Total sensors per primary controller:
 - i. Maximum: 6
 3. SM-JB-1 Junction Box
 - i. Integrated 24VAC power supply
 - ii. Terminal blocks for sensor wiring
 - iii. NEMA 4X Enclosure
 - iv. Capacity: Up to (6) AER-1/GUT-1 sensors OR up to (2) PVT-1 sensors OR (2) AER-1/GUT-1 sensors and (1) PVT-1 sensor.
- D. Temperature Sensors
1. Ambient Temperature Sensor [\[Recommended for fallback mode\]](#)
 - i. Thermistor (included with controller) or RTD
 - ii. Required for: Fallback operation and Pavement systems
 2. Slab Temperature Sensor [\[Recommended for surface melting systems\]](#)
 - i. Type: PT100 RTD
 - ii. Embedded in slab
 - iii. Used for slab temperature control
- E. Functional Features
1. Snow melt control logic
 2. Manual override
 3. Ambient Fallback Mode
 4. Pilot Duty Mode
 5. Slab Temperature Control Mode
 6. Remote monitoring capability
 7. Alarms
 - i. Power Loss
 - ii. Sensor Loss
 - iii. High/Low Current
 - iv. High/Low Temperature
 - v. GFEP Trip
 8. Spot Check commissioning diagnostics:
 - iv. Automated system verification
 - v. PDF report generation
 - vi. Cloud storage
- F. Control Modes [\[Select Local Control or Weather Forecast Control\]](#)
1. Local Snow Melt Control (Primary Mode)
 - i. Requires both moisture detection and temperature below 38°F.
 2. Manual override
 - i. Option for 5 min, 1hr, 24hr, or custom override period using remote control via Frio Dashboard.
 3. Ambient Temperature Fallback Mode
 - i. System shall include ambient temperature sensor
 - ii. Upon moisture sensor failure, system shall revert to ambient thermostat mode
 - iii. Heater activates below setpoint (adjustable, typical 38°F)
 - iv. Prevents operation in warm weather while maintaining freeze protection
 4. Weather Forecast Control
 - i. Uses cloud-based forecast data

- ii. Predictive activation based on precipitation and temperature
 - iii. Multiple algorithms for energy optimization based on system type.
- G. Control Architecture [\[Select One\]](#)
1. Single Circuit Control (Suitable for small systems)
 - i. One S1-A per heating circuit
 - ii. Direct switching of load with S1-A performing GFEP and circuit monitoring.
 2. Satellite Contactor Configuration (Up to 21 circuits per control zone)
 - i. One primary S1-A controller
 - ii. Up to 20 satellite S1-A controllers
 - iii. Direct switching of load with S1-A performing GFEP and circuit monitoring.
 3. Pilot Duty (Contactor Panel)
 - i. S1-A provides 120VAC control signal to drive multi-circuit contactor panel
 - ii. Capacity:
 1. 2–12 circuits standard
 2. Larger custom panels available
 - iii. Panels must include integrated GFEP
 - iv. Panels to include circuit monitoring [\[Optional\]](#)
- H. Moisture Sensor Design Requirements
1. Roof and Gutter Snow Melt System
 - i. (1) AER-1 aerial sensor
 1. Install in exposed location
 - ii. (1–5) GUT-1 gutter sensors
 1. Install in active meltwater paths
 2. Provide sensors in each unique drainage zone
 2. Surface Snow Melt System
 - i. (1) AER-1 aerial sensor
 1. Install in exposed location
 - ii. (1–5) PVT-1 pavement sensors
 1. Install flush with surface
 2. Locate in representative snow accumulation area

2.3 ACCESSORIES

A. Cable Installation Accessories: Silicone end seals, splice kits, and installation clips furnished by manufacturer.

B. Warning Labels: As required by local code per NEC.

PART 3 – EXECUTION

3.1 CONTROL SYSTEM INSTALLATION

A. Sensor Installation

1. AER-1:
 - i. Install in exposed location
 - ii. Avoid sheltered or heated areas
2. GUT-1:
 - i. Install in active meltwater flow
 - ii. Provide one per drainage zone
3. PVT-1:
 - i. Install flush with surface
 - ii. Locate in representative snow accumulation area

B. Sensor Wiring

1. RS-485 communication:
 - i. Shielded cable
 - ii. Minimum 18 AWG
2. Maximum cable length:
 - i. 1000 ft
3. Provide separation from power wiring

C. Controller Installation

1. Install in accessible location – may be outdoors
2. Avoid direct sun exposure and dripping water
3. Provide dedicated circuit breaker ($\leq 30A$)

3.2 FIELD QUALITY CONTROL

- A. Engage factory-authorized representative for testing and inspection.
- B. Test for heat trace continuity and insulation resistance before and after installation.
- C. Verify voltage and current during energization.
- D. Provide automatically generated system verification report (Frio Spot Check) prior to hand-off.

[Optional]

- E. Test Sensor communication verification
- F. Perform ground fault test
- G. Confirm moisture sensors read by primary controller
- H. Confirm temperature sensors reading normal

3.5 PROTECTION

- A. Protect installed heating cables from construction damage.
- B. Remove and replace damaged cables.

END OF SECTION