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CSI SPECIFICATION: *Snow Melt Control 680*
SECTION: 230913 Instrumentation and Control Devices for HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Snow melt control for under slab hydronic heating systems.

1.2 REFERENCES

A. Canadian Standards Association (CSA):
   1. C22.2 No. 24-93 – Temperature Indicating and Regulating Equipment

B. Underwriters Laboratories, Inc. (UL):
   1. UL 873 – Temperature Indicating and Regulating Equipment

C. American National Standards Institute (ANSI) and American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)
   1. ANSI/ASHRAE Standard 135 – “BACnet – A Data Communication Protocol for Building Automation and Control Networks”

1.3 REGULATORY APPROVALS

A. CSA C US
   1. The control must be tested and certified per CSA standard C22.2 No.24-93, “Temperature Indicating and Regulating Equipment”.
   2. The control must be tested and certified per UL standard 873, “Temperature Indicating and Regulating Equipment”.

B. BACnet Testing Laboratories (BTL)
   3. The control must be BACnet Testing Laboratories tested and certified to meet BACnet protocol specifications.

1.4 CONTROL OPERATION

A. **Description:** The control shall operate on 115 V (ac), with a maximum power of 320 Watts. The control shall be pre-engineered and programmed exclusively for the operation of under slab snow and ice melting systems. The control shall communicate with Building Automation Systems using BACnet or Modbus for alert notification, remote monitoring, and adjustment capability. It shall incorporate the following integrated functions: Warm Weather Shut Down, Cold Weather Cut Off, Melting Setpoint, Idling Setpoint, Slab Outdoor Reset, Slab Protection, Exercising, energy monitoring, and pressure monitoring.

B. **Snow Melting Operating Concept:** Using an outdoor sensor and an in-slab temperature and moisture detection sensor, the control monitors the system temperatures while measuring for the presence of moisture. If moisture is detected and the outdoor and slab temperatures are sufficient for frozen precipitation, the heating system is activated to melt and evaporate the moisture.

Up to two in-slab temperature and moisture detection sensors can be installed, thereby increasing detection area and providing redundancy in the case of sensor failure.

C. **Sequence of Operation:**

If moisture is detected while the outdoor temperature is between Warm Weather Shut Down and Cold Weather Cut Off, the control shall enter the “Melting” state. In this state the control shall determine a slab target temperature, based on the melting setpoint and the current outdoor temperature, and regulate the heat source and/or operate the mixing device to maintain this target. It shall remain in this state until moisture is no longer detected and any additional melt time (as programmed) has expired. During operation, should the outdoor temperature drop below the Cold Weather Cut Off setpoint, the control shall shut down the heating system to conserve energy; the controls shall enter a ‘melt pending’ state and will resume melting when the outdoor temperature rises above the Cold Weather Cut Off setpoint.

If an Idle setpoint has been configured, the control shall maintain the desired slab temperature while the outdoor temperature is between Warm Weather Shut Down and Cold Weather Cut Out. If inclement weather is expected and a Storm signal is communicated from the Building Management System using BACnet or Modbus, the control shall temporarily idle the slab in a Storm state for a given period of time.

D. **Features:**

1. **Warm Weather Shut Down Setpoint:** The control shall incorporate an adjustable Warm Weather Shut Down setpoint. When the outdoor temperature rises above the WWSD, the control will deactivate the snow melting system, thereby conserving energy.
2. **Cold Weather Cut Off Setpoint:** The control shall incorporate an adjustable Cold Weather Cut Off setpoint. When the outdoor temperature falls below this setting, the control will deactivate the system, thereby conserving energy. If a melt is in progress when the temperature falls below this setpoint, the control shall enter a pending state until the outdoor temperature rises above the Cold Weather Cut Off. The control will resume melting until moisture is no longer detected.
3. **Melting Setpoint:** The control shall incorporate an adjustable Melting Setpoint. The control will maintain the slab surface at the Melting Setpoint by accounting for outdoor temperature while the control is in the Melt state.
4. **Idling Setpoint:** The control shall incorporate an adjustable Idle Setpoint. The control will maintain the slab surface at the Idle setpoint if one is configured; otherwise, the Idle feature shall be OFF.
5. **Storm Setpoint:** The control shall incorporate an adjustable Storm Setpoint. When a storm is expected, the control may enter the temporary idle, or Storm, state through BACnet or Modbus communication protocol. The control will maintain the slab surface at the Storm Setpoint for a time frame up to 24:00 hours.
6. **Slab Outdoor Reset**: The control shall maintain a setpoint slab surface temperature by adjusting target water temperatures in proportion to the current outdoor temperature. Efficiency is maximized by accounting for changes in heat loss that result with changes in outdoor temperature.

7. **Slab Protection:** The control shall provide optional Slab Protection. Once enabled, Slab Protection shall limit the temperature of the supply water to help protect the slab against thermal stresses.
8. **Redundant In-Slab Sensor:** The control shall be able to monitor a single zone with two moisture and temperature sensors to provide redundancy and increased snow detection area.
9. **Energy Monitoring:** The control shall be able to provide energy usage data, in Therms or GJ, if a system return sensor and flow sensor are connected.
10. **Exercising:** The control shall be able to operate the pumps and mixing valve every three days to prevent pump and valve seizure.
11. **Memory:** The control shall store all configuration and settings in non-volatile memory. In case of power failure the control should be able to retrieve all of its latest settings.
12. **Display:** The control shall have a color touchscreen display to clearly display the current system operation with a color coded illuminated status message.
13. **BACnet MSTP/IP or Modbus:** The control shall be capable of communicating over BACnet MSTP, BACnet IP or Modbus. The communication shall allow for viewing of all sensor values and shall allow for modification of all system status settings and all setpoint values.
14. **System Pressure:** The control shall be capable of measuring water pressure if an analog pressure sensor is connected.

E. **Inputs:**

1. **In-Slab Sensor:** The control shall be capable of accepting up to two in-slab temperature and moisture sensors to measure the current slab temperature and detect precipitation. It shall be installed level with the slab. It shall facilitate easy replacement without the need for slab repair.
    1. Operating Range — -30 to 170F
    2. Cable Material jacket — 5 conductor stranded wire with polyethylene
    3. Manufacturer — tekmar Controls
    4. Model — 090 (65 ft cable) or 094 (200 ft cable)
2. **System Supply and Return Temperatures:** The control shall be capable of accepting two thermistor-type temperature sensors to be used to read the current supply water temperature and return water temperature.
    1. Operating Range — -60 to 221F
    2. Sensor β=3892 — NTC thermistor, 10 kΩ @ 77°F (25°C ±0.2°C)
    3. Manufacturer — tekmar Controls
    4. Model — 082
3. **Boiler Supply and Return Temperatures:** The control shall be capable of accepting two thermistor-type temperature sensors to be used to read the current boiler supply temperature and boiler return temperature.
    1. Operating Range — -60 to 221F
    2. Sensor β=3892 — NTC thermistor, 10 kΩ @ 77°F (25°C ±0.2°C)
    3. Manufacturer — tekmar Controls
    4. Model — 082
4. **Flow Rate:** The control shall be capable of accepting an analog 4-20 mA flow sensor to provide flow rate data for energy output monitoring.
5. **Pressure:** The control shall be capable of accepting an analog pressure sensor to provide water pressure monitoring.
6. **BACnet MSTP or Modbus MSTP:** The control shall be capable of accepting and transmitting communications with BACnet MSTP or Modbus via an RS 485 connection.
7. **BACnet IP:** The control shall be capable of accepting and transmitting communications with BACnet IP via an RJ45 connection with Cat-5E or CAT-6 Ethernet cable.

F. **Outputs:**
   1. Boiler pump relay
   2. One or two stage burner output relays
   3. Modulating boiler output (0-10V or 4-20mA)
   4. Primary pump relay
   5. System pump relay
   6. Floating motorized valve outputs (open and close) relays
   7. Injection mixing output
   8. Analog mixing output (0-10V or 4-20mA)

G. **Optional Add-Ons:**
   a. **In-Slab Snow/Ice Sensor:** for automatic enable and disable of the snow melting system. The sensor shall have a brass housing and a brass sensor enclosure to withstand heavy vehicle traffic. It shall be capable of accurately measuring the slab temperature and shall be capable of detecting traces of precipitation. Its temperature measuring component shall be of the thermistor type capable of measuring between –30°F to 170°F.
   b. **Aerial Snow Sensor:** for applications where an in-slab sensor cannot be installed, such as roof or gutter melting.
   c. **2-Way Motorized Valves:** for low-pressure steam systems with electric actuator.
   d. **3-Way Motorized Valves:** for Hydronic systems (sizes from ¾ “to 2”) with electric actuator.
   e. **Boiler Return Temperature Sensor:** to be used in hydronic motorized valve applications.
   f. **Flow sensor:** for energy output monitoring.
   g. **Pressure Sensor:** for water pressure monitoring.

1.5 Included Items

A. Outdoor Temperature Sensor: The outdoor sensor will allow for Warm Weather Shut Down, Cold Weather Cut Off, and Slab Outdoor Reset. The sensor shall be of the thermistor type capable of measuring from –60°F to 140°F.

B. **System Supply and Return Temperature Sensors:** Both the supply and return temperature sensors shall be of the thermistor type capable of measuring from –60°F to 221°F.

C. **Boiler Supply Temperature Sensor:** The boiler supply temperature sensor shall be of the thermistor type capable of measuring from –60°F to 221°F.

1.6 BMS Communication (BACnet MSTP, BACnet IP, and Modbus)

A. **BACnet Communication:** The control shall be BACnet MSTP and BACnet IP. The control shall be designed to be BACnet Application Specific Controller (B-ASC). The control shall manage the mixing device (valve or injection pump), boilers, boiler modulation, and the pumps through direct wiring to the equipment and not through the BACnet network. The communication shall allow for viewing of all sensor values and shall allow for modification of all control operating settings.

B. **Modbus Communication:** The control shall be MODBUS capable. It shall provide the user with RS485 communication Interface to an Energy Management System (EMS) or Building Management System (BMS) on the same Modbus network. The control shall manage the valve and/or boiler through direct wiring to the equipment and not through the MODBUS network.