

### 1 General

1. Furnish and Install a UL Listed, CSA Certified and FM Approved system of electric self-regulating heating cable, connection kits and electronic controller for maintaining the hot water as indicated on the drawings. The cable shall utilize a radiation-crosslinked conductive polymer as the heating element, and the cable shall be specifically designed, manufactured and UL Listed, CSA Certified and FM Approved for hot water temperature maintenance.
2. Submittals
  - i) Copy of UL, CSA and FM file indicating the heating cable is specifically intended to provide supplementary heating to hot water service supply systems utilizing thermally insulated metal or plastic pipe
  - ii) Manufacturer's catalog cuts showing materials and performance data

### 2 Materials

1. Construction: The self-regulating heating cable shall consist of two (2) 16 AWG (1.2 mm<sup>2</sup>) nickel-coated copper bus wires embedded in a radiation-crosslinked conductive polymer core. It shall be covered by a radiation-crosslinked, polyolefin, dielectric jacket surrounded by a polymer-coated aluminum wrap, and enclosed in a tinned copper braid of 14 AWG (2.5 mm<sup>2</sup>) equivalent wire size. The braid shall be covered with a (nominal) 40 mil (1 mm) polyolefin outer jacket, color coded for easy identification.
2. Mechanical: The cable shall have a minimum cut-through resistance of 100 lb (445 N) per the IEEE 515.1 (4.3.3) and CSA 130-03 (6.28) Resistance to Cutting Tests. The cable shall have a minimum impact resistance of 10 ft-lbs per the IEEE 515.1 (4.2.9) and CSA 130-03 (6.2.10.2) Impact Tests. The cable shall have a minimum abrasion resistance of 2500 cycles per the IEEE 515.1 (4.3.4) Abrasion Test. The cable shall withstand a crush resistance of 225 lbs per the IEEE 515.1 (4.2.8) Deformation Test, and withstand a crush resistance of 345 lbs (1500 N) per the CSA 130-03 (6.2.7) Crush Resistance Test.
3. Connection Kits: All heating cable connection kits shall be UL Listed, CSA Certified and FM Approved for use as part of the system to maintain hot water temperature. Component enclosures shall be rated NEMA 4X to prevent water ingress and corrosion. Installation shall not require the installing contractor to cut into the heating cable core to expose the bus wires. Connection systems requiring the installing contractor strip the bus wires, or which use crimps or terminal blocks, shall not be acceptable. All connection kits except for the power connection shall be installed under the thermal insulation. The end seal shall use silicone gel.

### 3 Performance

1. Maintain Temperatures: The system shall maintain temperature @ 125 F at 120 V. Temperature shall be maintained by without the need for a controller with straight runs of heating cable on the pipe.
2. Insulation schedule shall be as follows:

**Table 5.1 Insulation Thickness**

Copper pipe size (in)	IPS insulation size (in)	Insulation thickness (in)
1/2 – 1 1/2"	1 IPS size larger	1/2
2	2	1"

**Note:** For pipe 1 1/2 inches and smaller, use insulation that is oversized by 1/4 inch to allow room for installing over the heating cables.

3. Power control (self-regulating index): The slope of the power/temperature shall be such that the power of the heating cable shall increase with decreasing temperature at a rate of at least 0.028 W/ft-°F (0.16W/m-°C) from 50°F (10°C) to 100°F (38°C)
4. Long-term thermal stability (as determined by accelerated testing): The power retention of the heating cable shall be at least 90% after 300 cycles between 50°F (10°C) and 212°F (100°C).
5. High temperature withstand: The heater shall not decrease in resistance, overheat, or burn when powered at 120 V and exposed to 400°F (205°C) in an oven for 30 minutes.

### 4 Manufacturer

1. Experience: The manufacturer shall have more than ten years experience with self-regulating heating cables for temperature maintenance of domestic hot water.
2. Acceptable product and manufacturer: Raychem HWAT-P1 by Tyco Thermal Controls

## 5 Execution

1. Installation: The system shall be installed according to the drawings and the manufacturer's instructions. The installer shall be responsible for providing a functional system, installed in accordance with applicable national and local requirements. Each circuit shall be protected with a 30 mA ground-fault protection device.

### 2. Testing

i) Procedure: Measure the heater circuit continuity and the insulation resistance between the braid and the bus wires with a 2500 Vdc megohmmeter (megger).

ii) Timing: The tests should be performed after the pipe insulation has been installed and prior to the installation of wall or ceiling panels, and shall be witnessed by the Construction Manager and the manufacturer or the manufacturer's representative.

iii) Acceptable results: The heater circuit shall be continuous and megger readings shall be at least 1000 megohm regardless of the heater length. Circuits yielding unacceptable readings must be repaired or replaced.

iv) Submittal of results: Submit records of the test data to the Construction Manager. Self-regulating heating cables and components to have a limited 10-year warranty extension from the date of installation if a properly completed online warranty form is completed within 30 days from the date of installation.

### **Appendix: Installation Alternatives**

Depending on the local requirements, there are several alternative installation methods that can be used in the specification.

1. *Plumber purchases, plumber installs:* Plumber shall purchase material, and is responsible for entire system, including testing before and after insulation. Installation, including all splices, tees and end terminations, shall be performed by plumbing contractor, with the exception of any power connections, which shall be installed and connected to power by a qualified electrical contractor.

2. *Plumber purchases, electrician installs:* Plumber shall purchase material, and is responsible for entire system, including testing before and after insulation. Installation, including all splices, tees and end terminations and power connections shall be performed by qualified electrical contractor.

3. *Electrician purchases, electrician installs:* Electrician shall purchase material, and is responsible for entire system, including testing before and after insulation. Installation, including all splices, tees and end terminations and power connections shall also be performed by qualified electrical contractor. Electrical contractor shall coordinate with responsible plumbing contractor regarding material requirements and scheduling.