

Specification: Raychem® HWAT® Hot Water Temperature Maintenance System

1 General

- 1 Furnish and Install a UL Listed, CSA Certified and FM Approved system of electric selfregulating 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.
 - iii) Project list of at least 20 projects, installed for at least five years, with at least 2000 ft (600 m) of heating cable in each project.

2 Materials

- 1 **Construction:** The self-regulating heating cable shall consist of two (2) 16 AWG (1.2 mm²) 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 mm²) 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.
- 4 **Controller:** Installed system shall include at least one agency-approved electronic controller. The controller shall not be of line sensing over-limit design. The controller shall be capable of setting different pipe temperatures based on ambient and voltage with 24 hour, 7 day/week programmable options. The controller shall have the energy savings feature of lowering pipe temperature during low use periods and the ability to raise the temperature of the pipes for a programmed interval. The controller shall have BMS interface capabilities to set pipe temperatures and provide alarm relays in loss of power, incorrect water heater temperature and communication failure. The controller shall have flexible wiring configurations to operate individually or control up to eight additional controllers.

3 Performance

- 1 **Maintain Temperatures:** The system shall maintain temperatures between 105°F (40°C) and 140°F (60°C) at 208 V or 240 V. Temperature shall be maintained by utilizing an electronic controller with straight runs of heating cable on the pipe.
- 2 Insulation schedule shall be as follows:

Insulation Thickness		
Copper pipe size (in)	IPS insulation size (in)	Insulation thickness (in)
½	¾	1/2
¾	1	1
1	1 ¼	1
1 ¼	1 ½	1 ½
1 ½	1 ½	1 ½
2	2	2
2 ½	2 ½	2 1/2
3	3	3

Note: For pipe 1 ¼ inches and smaller, use insulation that is oversized by ¼ inch to allow room for installing over the heating cables. For pipes three inches and larger, the thickness of insulation can be equal to the pipe diameter with one heating cable or 1/3 the pipe diameter with two runs of heating cable.

- 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° (100°C).
- 5 **High temperature withstand:** The heater shall not decrease in resistance, overheat, or burn when powered at 208 V or 240 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

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.

Tyco, HWAT and Raychem are trademarks of Tyco Thermal Controls LLC or its affiliates.

Worldwide Headquarters
Tyco Thermal Controls
 300 Constitution Drive
 Menlo Park, CA 94025-1164
 USA
 Tel (800) 545-6258
 Fax (800) 596-5004
 info@tycothermal.com
 www.tycothermal.com

Canada
Tyco Thermal Controls
 250 West Street
 Trenton, Ontario
 Canada K8V 5S2
 Tel (800) 545-6258
 Fax (800) 596-5004

Important: All information, including illustrations, is believed to be reliable. Users, however, should independently evaluate the suitability of each product for their particular application. Tyco Thermal Controls makes no warranties as to the accuracy or completeness of the information, and disclaims any liability regarding its use. Tyco Thermal Controls' only obligations are those in the Tyco Thermal Controls Standard Terms and Conditions of Sale for this product, and in no case will Tyco Thermal Controls or its distributors be liable for any incidental, indirect, or consequential damages arising from the sale, resale, use, or misuse of the product. Specifications are subject to change without notice. In addition, Tyco Thermal Controls reserves the right to make changes—without notification to Buyer—to processing or materials that do not affect compliance with any applicable specification.