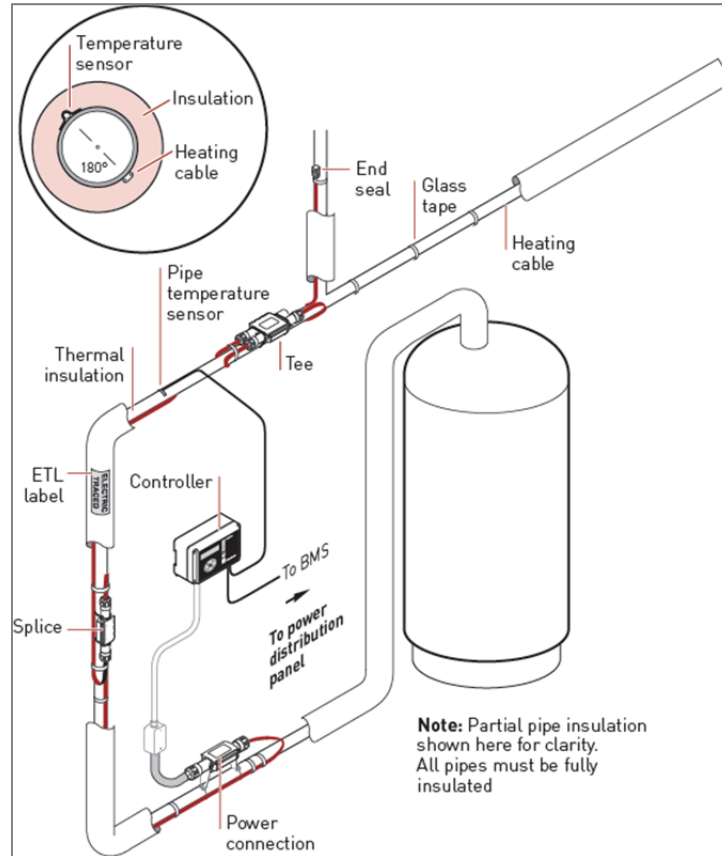


CSI Master Format 2012 Guide Specification for: Hot Water Temperature Maintenance (HWAT) Systems



System for temperature maintenance of domestic hot water supply systems with energy efficient time based control and BMS communication capabilities.

Scope

This specification describes an energy efficient system for temperature maintenance of domestic hot water supply systems without the need for recirculation designs.

This page gives a general overview of the system and the CSI formatted specification begins on page 4.

System Description

The HWAT system complies with local energy codes, including California Title 24, due to a time based control methodology and an energy efficient thermal insulation schedule

Self-Regulating Heating Cable

Raychem HWAT self-regulating heating cable (HWAT-R2) with plasticizer diffusion shield, heavy tinned copper braid and polyolefin outer jacket. The heating cable shall be part of a UL Listed, CSA Certified and FM Approved system.

System Connection Kits

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

Controller

Single Circuit Control

Raychem HWAT-ECO digital controller with:

- Flexible temperature control from 105 – 140°F.
- Three programmable temperature set points for maximum energy efficiency:
 - Maintain
 - Economy
 - Off
- Heat cycle setting.
- 24/7 time based control.
- Nine pre-defined temperature setpoint programs.
- BMS interface.
- Pipe temperature sensor.
- Master/slave function.
- 24 A switching capacity rating.
- NEMA 12 enclosure

Distributed Group Control

DigiTrace ACS-30 Multi-circuit digital control system with:

- Pre-programmed application based heat-tracing controller.
- Touch-screen user interface (ACS-UIT2) communicates with up to 52 ACS-PCM2-5 modular control panels. The DigiTrace C910-485 controller may be used in the ACS-30 system for single circuit extensions.
- 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:
 - ACS-UIT2: NEMA 4
 - ACS-PCM2-5: NEMA 4/12

Device Server

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

Thermal Pipe Insulation

Flame retardant insulation (closed-cell or fiberglass) with waterproof covering is required following Pentair Thermal Management' insulation schedule as detailed in the HWAT Product Selection and Design Guide.

Designer Notes

1. For proper cable selection refer to the HWAT product selection and design guide.
2. External 30-mA ground-fault circuit protection is required when using the HWAT-ECO. Ground-fault circuit protection (adjustable) is integrated in the ACS-30 controller and does not need to be provided separately.
3. No temperature sensors are required for pipe temperature control. Temperature sensors can be used to monitor the water heater or mixing valve output. With ACS-30, additional temperature sensors can be used to monitor the overall performance of the system.
4. The HWAT-ECO may be connected to the BMS using two conductor twisted pair shielded RS-485 cable (PTM Catalog Number: MONI-RS485-WIRE). The installation of the communication wiring is included in specification section 25 50 00.
5. The ACS-30 may be connected to the BMS through the ProtoNode using two conductor twisted pair shielded RS-485 cable (PTM 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.
6. The HWAT-ECO is a wall mounted controller with a NEMA 12 rated enclosure for indoor installation.
7. ACS-UIT2 should be centrally located in the building connected to the remote ACS-PCM2-5 control panels using RS-485 cable. The ACS-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.

Drawing Details

Installation details can be found at CADdetails.com under Hot Water Temperature Maintenance (HWAT) folder.

PART 1 – GENERAL

1.1 SUMMARY

- A. This Section includes a UL Listed, CSA Certified and FM Approved heat tracing system for temperature maintenance of domestic hot water supply systems consisting of self-regulating heating cable, connection kits and energy efficient time based control.
- B. The system complies with California Title 24 energy requirements.

1.2 RELATED SECTIONS

- A. Section 22 05 33 – Heat Tracing for Plumbing Piping
- B. Section 22 07 19 – Plumbing Piping Insulation
- C. Section 25 34 00 – Integrated Automation Instrumentation and Terminal Devices for Plumbing
- D. Section 25 54 00 – Integrated Automation Control of Plumbing

1.3 SYSTEM DESCRIPTION **[Select one]**

- A. **[Select for HWAT-ECO]** System for temperature maintenance of domestic hot water supply systems with energy efficient time based control, monitoring, and Building Management System (BMS) communication capabilities.
- B. **[Select for ACS-30]** System for temperature maintenance of domestic hot water supply systems with energy efficient time based control, multi-point 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 hot water temperature maintenance systems
 - 3. Hot water temperature maintenance design guide
 - 4. System installation and operation manual
 - 5. System installation details
 - 6. Connection kits and accessories data sheet
 - 7. Controller data sheet
 - 8. Controller 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 IEEE 515.1 and CSA 22.2 No 130-03 requirements.
- B. Installer Qualifications
 - 1. System installer shall have 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 hot water temperature maintenance.
- D. Electrical Components, Devices, and Accessories: Listed and labelled 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, contaminants 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

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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 offer a ten (10) year warranty for all 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 hot water temperature maintenance system
 3. Manufacturer shall be Pentair Thermal Management, LLC, located at, 7433 Harwin Drive, Houston, TX 77036 Tel: (800) 545-6258 www.thermal.pentair.com
 - b. Hot Water Temperature Maintenance System
 1. Raychem HWAT self-regulating heating cables with plasticizer diffusion shield, heavy tinned copper braid and polyolefin outer jacket.
 2. Raychem RayClic and accessories.
 3. Raychem HWAT-ECO or DigiTrace ACS-30 **[Select one]** digital controller
 4. DigiTrace ProtoNode multi-protocol device server.
 5. The HWAT system complies with local energy codes, including California Title 24, due to a time based control methodology (HWAT-ECO or ACS-30 **[Select one]**) and an energy efficient thermal insulation schedule.

2.2 PRODUCTS, GENERAL

- A. Single Source Responsibility: Furnish heat tracing system for the temperature maintenance of domestic hot water supply systems from a single manufacturer.
- B. The system (heating cable, connection kits, and controller) shall be UL Listed, CSA Certified and FM Approved for hot water temperature maintenance. No parts of the system may be substituted or exchanged.

2.3 PRODUCTS

- A. Self-Regulating Heating Cable
1. Heating cable shall be Raychem HWAT self-regulating heating cable manufactured by Pentair Thermal Management.
 - a. Model Numbers: HWAT-R2
 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 pipe temperature changes.
 3. The heating cable shall have a modified polyolefin inner jacket for dielectric integrity.

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4. The heating cable shall have a plasticizer diffusion shield.
 5. The heating cable shall have a thicker gauge (5/24) tinned copper braid for ground path and mechanical ruggedness.
 6. The heating cable shall have a color coded polyolefin outer jacket.
 7. The heating cable shall have a self-regulating factor of at least 70 percent for HWAT-R2. The self-regulating factor is defined as the percent reduction of the heating cable power output going from a 40°F pipe temperature to 150oF pipe temperature.
 8. The heating cable shall operate on line voltages of 208, 220, 240 or 277 volts without the use of transformers. **[Select one]**
 9. The heating cable shall be UL 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 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 and CSA Certified.
- C. Heating Cable Installation Accessories
1. High temperature, glass filament tape for attachment of heating cable to fire sprinkler piping. Cable ties are not permitted. (PTM Catalog Number: GT-66)
 2. Plastic Piping – provide an aluminium self-adhesive tape over the heating cable on all plastic piping if required. (PTM Catalog Number: AT-180)
 3. Labels – Provide warning labels every 10 feet on exterior of insulation, opposite sides of pipe. (PTM Catalog Number: ETL)
- D. D. Energy Efficient Time Based Control **[Select one option]**
1. **[Option 1] Single Circuit Local Digital Controller**
 - a. Local digital controller shall be the Raychem HWAT-ECO.
 - b. Digital controller shall operate on 208 – 240 V.
 - c. Pre-programmed duty cycles based on ambient temperature ranging from 60 – 80°F.
 - d. The pre-programmed duty cycles shall be based on Raychem HWAT heating cables only. No other heating cables may be used with the HWAT-ECO controller.
 - e. Flexible temperature control from 105 – 140°F.
 - f. Three programmable temperature set points for maximum energy efficiency.
 1. Maintain
 2. Economy
 3. Off
 - g. Controller shall have heat cycle setting.
 - h. Heating cable manufacturer shall provide a local digital controller with 24/7 pre-programmed time based profiles specific to the selected heating cable application such as schools, hospitals and prisons.
 - i. Controller shall have remote temperature setting through 0 – 10 Vdc BMS interface.
 - j. Controller shall have a pipe temperature sensor, low/high pipe temperatures alarms and high temperature cut-out.
 1. To maximize the energy efficiency of the HWAT system by verifying that the hot

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- pipe temperature is at the correct temperature (low temperature alarm).
 - 2. To monitor and alarm if the pipe temperature is hotter than intended (high temperature alarm and cut-out)
 - k. Multiple HWAT-ECO controllers can be networked together (master/slave association):
 - 1. Allows BMS to interface with a master HWAT-ECO to control cloned circuits
 - 2. Minimizes the number of HWAT-ECO controllers that must be individually programmed
 - l. Controller shall have 24 A switching capacity rating.
 - m. Enclosure type shall be NEMA 12 (ABS).
 - n. Controller shall have NO/NC alarm contacts. Controller shall alarm on:
 - 1. Loss of power
 - 2. Controller reinitialized
 - 3. Internal controller temperature too high
 - 4. Pipe temperature too high
 - 5. Pipe temperature too low
 - 6. Master/slave error
 - o. Digital controller shall have c-UL-us approvals specifically for use with the HWAT-R2 heating cable.
2. **[Option 2] Multiple Circuit Distributed Digital Control System**
- a. Distributed digital control system shall be DigiTrace ACS-30 heat-trace control system.
 - b. Heating cable manufacturer shall provide a distributed digital control system with pre-programmed parameters to provide concurrent control for heating cables used for pipe freeze protection, flow maintenance, hot water temperature maintenance, surface snow melting, roof and gutter de-icing, freezer frost heave prevention and floor heating applications.
 - c. All programming shall be done through the central User Interface Terminal (ACS-UIT2).
 - d. The ACS-UIT2 shall be a color LCD touch-screen display with password protection to prevent unauthorized access to the system.
 - e. The ACS-UIT2 shall communicate with up to fifty-two (52) ACS Power Control Panels (ACS-PCM2-5) where each panel can control up to five (5) circuits and accept up to five (5) temperature inputs. C910-485 controllers may also be added to the ACS-30 system for single circuit extensions.
 - f. Digital control system shall be capable of assigning up to four (4) RTD temperature inputs per heat-tracing circuit.
 - g. The ACS-UIT2 shall communicate with up to sixteen (16) Remote Monitoring Modules (RMM2), where each module can accept up to 8 temperature inputs.
 - h. The ACS-UIT2 shall have a USB port to allow for quick and easy software update.
 - i. The ACS-UIT2 shall have three (3) programmable alarm contacts including an alarm light on the enclosure cover.
 - j. A separate offline software tool shall be made available to allow users to pre-program the digital control system and transfer program via a USB drive or Ethernet.
 - k. The ACS-UIT2 enclosure shall be NEMA 4 for indoor or outdoor locations.
 - l. The ACS-PCM2-5 panel shall be in a NEMA 4/12 enclosure approved for nonhazardous indoor and outdoor locations.
 - m. The ACS-PCM2-5 panel shall provide ground-fault and line current sensing, alarming, switching and temperature inputs for five (5) heat tracing circuits.
 - n. Each ACS-PCM2-5 panel shall have five (5) 3-pole, 30 A contactors (EMR type).
 - o. The ACS-PCM2-5 panel shall be capable of operating at 120 V to 277 V.
 - p. The ACS-PCM2-5 shall have an alarm contact including an alarm light on the panel cover.
 - q. Digital controller shall have an integrated adjustable GFPD (10 – 200 mA).
 - r. Digital control system can be configured for On/Off, ambient sensing, PASC and timed duty

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- cycle control (HWAT only) modes based on the application. PASC control proportionally energizes the power to the heating cable to minimize energy based on ambient sensed conditions.
- s. Upon communication loss with the user interface terminal (ACS-UIT2) the ACS-PCM2-5 panels shall control with the last downloaded set point.
 - t. In HWAT control mode, the ACS-30 shall have time based control algorithm with three programmable temperature setpoints for maximum energy efficiency (Maintain, Economy and Off)
 - u. In HWAT control mode, the pre-programmed duty cycles shall be based on Raychem HWAT heating cables only. No other heating cables may be used in the HWAT control mode.
 - v. Digital control system will have a built-in self-test feature to verify proper functionality of heating cable system.
 - w. Digital control system will also be able to communicate with BMS by one of the following protocols using the DigiTrace ProtoNode multi-protocol gateway. **[Select one]**
 - 1. Modbus®
 - 2. LonWorks® **[Select ProtoNode-LER]**
 - 3. BACnet® **[Select ProtoNode-RER]**
 - 4. Metasys® N2 **[Select ProtoNode-RER]**
 - x. The following variables will be monitored by the digital controller and reported back to the BMS.
 - 1. Temperature
 - 2. Ground-fault
 - 3. Current draw
 - 4. Power consumption
 - 5. Associated alarms
 - y. The ACS-UIT2 shall be c-CSA-us Certified. The ACS-PCM2-5 panel shall be c-UL-us Listed.
- E. Thermal Pipe Insulation
- 1. Pipes must be thermally insulated in accordance with the HWAT Design Guide requirements.
 - 2. Thermal insulation must be a type that is flame retardant (closed-cell or fiberglass) with waterproof covering.

2.4 SYSTEM LISTING

- A. The system (heating cable, connection kits, and controller) shall be UL Listed, CSA Certified and FM Approved for hot water temperature maintenance.
- B. The temperature maintenance system shall have a design, installation and operating manual specific to domestic hot water piping.

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 HWAT System Installation and Operation Manual.
- B. Apply the heating cable linearly on the pipe after piping has successfully completed any pressure tests. Secure the heating cable to piping with fiberglass tape.
- 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.

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- 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."
- F. Pipes must be thermally insulated in accordance with the HWAT design guide requirements.

3.3 FIELD QUALITY CONTROL

- A. Initial start-up and field testing (commissioning) of the 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 HWAT Installation and Operation manual.
 - 2. The heating cable circuit integrity shall be tested using a 2500 Vdc megohmmeter at the following intervals;
 - a. Before installing the heating cable
 - b. After heating cable has been installed onto the pipe
 - c. After installing connection kits
 - d. After the thermal insulation is installed onto the pipe
 - e. Prior to initial start-up (commissioning)
 - f. As part of the regular system maintenance
 - g. Minimum acceptable insulation resistance shall be 1000 megohms or greater
 - 3. The technician shall verify the insulation schedule is in compliance with the HWAT Installation and Operation manual.
 - 4. The technician shall verify that the HWAT-ECO OR ACS-30 [Select one] control parameters are set to the application requirements.
 - 5. The technician shall verify that the HWAT-ECO OR ACS-30 [Select one] alarm contacts are corrected connected to the BMS.
 - 6. The technician shall verify that the ACS-30 and ProtoNode-RER/-LER [Select one] are configured correctly with the BMS.
 - 7. All commissioning results will be recorded and presented to the owner.

3.4 MAINTENANCE

- A. Maintenance Service
 - 1. Comply with manufacturer's recommendations in HWAT System Installation and Operation Manual.

END OF SECTION



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