

**SECTION 22 35 00  
DOMESTIC WATER HEAT EXCHANGERS**

**PART 1 - GENERAL****1.1 DESCRIPTION:**

- A. This section describes the requirements for domestic hot water heat exchangers including thermometers and all necessary accessories, connections and equipment.

**1.2 SUBMITTALS:**

- A. Submit manufacturer's literature and data pertaining to the water heater in properly bound package, in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Include the following as a minimum:
1. Heat Exchangers.
  2. Pressure and Temperature Relief Valves.
  3. Steam Control Valves
- B. Equipment components in contact with potable water shall meet NSF compliance requirements in document NSF 61, "Drinking Water System Components - Health Effects.
- C. A form U-1 or other documentation stating compliance with the ASME Boiler and Pressure Vessel code.

**1.3. APPLICABLE PUBLICATIONS:**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standard Institute (ANSI):
- Z21.22-00/4.4A-00.....Relief Valves for Hot Water Supply systems
- C. American Society of Mechanical Engineers (ASME):
- B1.20.1-01.....Pipe Threads, General Purpose
- B16.5-03.....Pipe Flanges and Flanged Fittings, NPS ½  
through NPS 24
- B16.24-06.....Cast Copper Alloy Pipe Flanges, Class 150,  
300,600, 900, 1500, 2500
- PTC 25.3-02.....Pressure Relief Devices
- Section IV-07.....Heating Boilers
- Section VIII-07.....Pressure Vessels Division 1

**1.4 AS-BUILT DOCUMENTATION**

- A. The electronic documentation and copies of the Operations and Maintenance Manual, approved submittals, shop drawings, and other closeout documentation shall be prepared by a computer software program complying with Section 508 of the Rehabilitation Act of 1973, as amended (29 U.S.C 794d). The manufacturer or vendor of the software used to prepare the electronic documentation shall have a Voluntary Product Accessibility Template made available for review and included as part of the Operations and Maintenance Manual or closeout documentation. All available accessibility functions listed in the Voluntary Accessibility Template shall be enabled in the prepared electronic files. As Adobe Acrobat is a common industry format for such documentation, following the document, "Creating Accessible Adobe PDF files, A Guide for Document Authors" that is maintained and made available by Adobe free of charge is recommended."
- B. Four sets of manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- C. Four sets of operation and maintenance data updated to include submittal review comments shall be inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

**PART 2 - PRODUCTS****2.1 PLATE AND FRAME, DOMESTIC WATER HEAT EXCHANGERS:**

- A. SEE PLANS FOR MORE SPEC INFORMATION.
- E. The stand shall be factory fabricated for floor mounting
- G. The temperature controls shall be based upon an adjustable temperature transmitter that operates a control valve and is capable of maintaining outlet water temperature within 2 degrees C (4 degrees F) of setting.

- H. Safety control shall be automatic, high temperature limit shutoff device.
- I. The relief valves shall be ASME rated and stamped for combination temperature and pressure relief valves. One or more relief valves with total relieving capacity at least as great as heat input shall be included. The pressure setting shall be less than the working pressure rating of the heat exchanger minus 10 percent.
- J. Electronic Control System:
1. The heater shall maintain +/- 4°F Max temperature fluctuation from temperature setpoint under normal diversified load conditions (load fluctuations of up to 25% of water heater capacity).
  2. The system shall consist of an electronic control valve, constant speed domestic water circulator pump, control panel enclosure housing a PID temperature controller with digital indication of shell outlet water temperature, digital over-temperature limit switch, and feed-forward and feedback temperature sensors. The limit switch shall close the control valve and open a solenoid valve to function as a secondary water relief valve in an over-temperature condition.
  3. The system shall have the following additional characteristics:
    - a. Controller temperature setpoint range between 50°F to 205°F maximum
    - b. Configured for 120V/1 Phase/60 Hz.
  4. The electronic steam control valve shall be manufactured by water heater manufacturer and be of the balanced, pilot-operated type, having a soft seat for ANSI Class VI bubble tight shut-off and equal percentage flow characteristics. Valves shall be applied directly for specified steam pressure without the need for extraneous PRV's. The valve shall have the following performance characteristics:
    - a. 50 to 1 Turndown.
    - b. Electronic Actuator with Fail Closed Design-particularly on loss of power
    - c. Time to Full Open Position: 7 seconds on 1 to 2 Inch; 9 seconds on 2 ½ to 4 inch
    - d. Time to Full Closed Position: 7 seconds on 1 to 2 Inch; 9 seconds on 2 ½ to 4 inch, including failsafe mode.

5. The PID temperature controller shall incorporate a feed-forward function and be password protected. The controller shall be capable of remote communications with Building Automation Systems (BAS) through a BACnet communications interface with microprocessor controls.
6. Non-volatile backup of all point mappings and programs shall be internally provided as standard. Connection between Gateway and individual water heaters shall be "daisy chain" with shielded, twisted pair, low voltage wiring for ease of installation.
7. The following information shall be accessible locally at the controller or remotely via the communications port:
  - a. Setpoint - can be changed remotely
  - b. Outlet Temperature
  - c. Over Temperature Alarm
  - d. Control Output Signal to valve
8. A drip trap, steam condensate trap (if required), Y strainer, vacuum breaker, and pressure gage shall be factory sized and piped with steam control valve.

## **2.2 THERMOMETERS:**

- A. Thermometers shall be rigid stem or remote sensing, dial type with an aluminum, black metal, stainless steel, or chromium plated brass case. The thermometer shall be back connected, mercury, vapor, BI-metal or gas actuated, with circular dial 90 mm (3 1/2 inches) in diameter graduated from 4 to 100°C (40 to 210°F), with two-degree graduations guaranteed accurate within one scale division. The socket shall be separable, double-seat, micrometer-fittings, with extension neck not less than 65 mm (2 1/2 inches) to clear tank or pipe covering. The thermometer shall be suitable for 20 mm (3/4 inch) pipe threads. Thermometers may be consoles mounted with sensor installed in separate thermometer well.

## **2.3 SAFETY VALVES FOR PLATE AND FRAME HEATERS:**

- A. Separate temperature relief valve and pressure relief valve or combination pressure/temperature relief valves shall be provided on each water heater. The safety valve discharge shall be routed to nearest floor drain.
- B. Temperature Relief Valves shall be constructed from all brass or bronze material. The temperature relief valves shall be automatic, self-

closing reseating type valve, equipped with a noncorrosive metal thermostat with bulb extending into tank that can be manually displaced from its seat for test purposes. The temperature relief valve shall be tested and approved as to its BTU capacity by ASME or an independent laboratory satisfactory to the Contracting Officer. In no case shall total rated BTU relieving capacity of temperature relief valve, or valves, be less than BTU input into water heater. Temperature relief valve shall be completely open before temperature reaches 98°C (210°F) and shall close when temperature goes below 93°C (200°F).

- C. Pressure relief valves shall conform to requirements of ASME, Section IV. BTU relieving capacity of pressure relief valve, or valves, shall be not less than BTU input of the water heater. The pressure relief shall be set at 690 kPa (100 psig) pressure.
- D. A double solenoid safety system shall be provided for each shell and steam coil heater to function as a safety over temperature prevention system. System shall consist of aquastat, pilot light, solenoid steam safety valve and solenoid water safety valve located in the control circuit. The aquastat shall be set at 60°C (140°F).

#### **2.4 DOMESTIC HOT WATER COMPRESSION TANKS**

- A. A steel pressure rated tank constructed with welded joints and factory installed butyl rubber diaphragm shall be installed as scheduled. The air pre-charge shall be set to minimum system operating pressure at tank.
- B. The tappings shall be factory fabricated steel, welded to the tank and include ASME B1.20.1 pipe thread.
- C. The interior finish shall comply with NSF 61 barrier materials for potable water tank linings and the liner shall extend into and through the tank fittings and outlets.
- D. The air charging valve shall be factory installed.

#### **2.5 COMBINATION TEMPERATURE AND PRESSURE RELIEF VALVES**

- A. The combination temperature and pressure relief valves shall be ASME rated and stamped and include a relieving capacity at least as great as the heat input and include a pressure setting less than the water heater's working pressure rating.

**PART 3 - EXECUTION****3.1 INSTALLATION:**

- A. The water heaters shall be installed on concrete bases. Refer to Specification Section 03 30 00, CAST-IN-PLACE CONCRETE and Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING
- B. The water heaters shall be installed level and plumb.
- C. Water heaters shall be installed and connected in accordance with manufacturer's written instructions.
- D. All pressure and temperature relief valves discharge shall be pipe to nearby floor drains.
- E. Thermometers shall be installed on water heater inlet and outlet piping.
- F. The control thermostats shall be set for a maximum setting of 54°C (130°F).

**3.2 LEAKAGE TEST:**

- A. Before piping connections are made, the water heaters shall be tested at a hydrostatic pressure of 1375 kPa (200 psi) for water heaters rated at less than 1103 kPa (160 psig) and 1654 kPa (240 psig) for units with an maximum working pressure of 1103 kPa (160 psig) or over. Any failed test shall be corrected and the water heater shall be retested at no additional cost to the VA.

**3.3 PERFORMANCE TEST:**

- A. Ensure that all of the remote water outlets will have a minimum of 49°C (120°F) and a maximum of 54°C (130°F) water flow at all times. If necessary, make all correction to balance the return water system or reset the thermostat to make the system comply with design requirements.

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