

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

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

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

**1.2 RELATED WORK:**

- A. Section 09 91 00, PAINTING: Preparation and finish painting.
- B. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- C. Section 22 11 23, DOMESTIC WATER PUMPS: Circulating Pump.
- D. Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION: Heater Insulation.
- E. Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING, 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING, and 22 11 00, FACILITY WATER DISTRIBUTION: Piping, Fittings, Valves and Gages.

**1.3 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.
  - 4. Thermometers.
  - 5. Pressure Gages.
  - 6. Vacuum Breakers.
- 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.

**1.4 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

Section VIII-07.....Pressure Vessels Division 1

**PART 2 - PRODUCTS**

**2.1 SHELL AND TUBE, DOMESTIC WATER HEAT EXCHANGERS:**

- A. The shell and tube heat exchangers shall be semi-instantaneous type, vertical with water in the shell and steam in the tubes. The shell and tube heat exchanger shall be a packaged assembly of tank, heat exchanger coils, controls, and specialties constructed of ASME code copper lined, carbon steel shell with 1035 kPa (150 psig) minimum working pressure.
- B. The stand shall be factory fabricated for floor mounting.
- C. The tappings shall be factory fabricated of materials compatible with heat exchanger shell. For sizes 50 millimeter or DN50 (NPS 2) and smaller, the tappings shall be threaded ends fabricated in accordance to ASME B1.20.1. For sizes 65 millimeters or DN65 (NPS 2-1/2) and larger, the tappings shall be flanged according to ASME B16.5 for steel and stainless steel flanges and ASME 16.24 for copper and copper alloy flanges.
- D. Shell insulation shall comply with ASHRAE 890.1 and suitable for operating temperature. The entire shell and nozzles shall be completely surrounded except connections and controls.
- E. The heat exchanger coils shall be constructed from copper and fabricated in a helix wound for steam heating medium. The pressure rating shall be equal to or greater than the steam supply pressure plus 50%.
- F. 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.
- G. Safety control shall be automatic, high temperature limit shutoff device.
- H. 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.
- I. Controls:
  - 1. Steam control valve shall regulate the control of steam flow to the heating coil to control water temperature and shall be electronic operated. The outlet water temperature shall not vary more than  $\pm 1$  degrees C ( $\pm 2.5$  degrees F).

2. 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.
3. A normally closed solenoid Valve shall be rated at 5 amps, 120-volt solenoid valve shall close the steam supply to the heating coil, should the water temperature in the tank reach the high set point.

## **2.2 CIRCULATING DOMESTIC WATER HEAT EXCHANGERS**

- A. A packaged small capacity hot water storage tank shall be provided with circulator, heat exchanger coil, controls, and specialties. The domestic water heat exchanger with circulator shall be based upon a standard flow arrangement with water from bottom of storage tank circulated across the heat exchanger coil and returned to tank.
- B. A hot water outlet shall be included at the top of the tank.
- C. A temperature sensor shall be located inside the storage tank.
- D. A circulating pump complying with UL 778, all bronze construction, overhung impeller, and separately coupled inline pump shall be included. The pump shall have mechanical seals. The working pressure shall be rated at 860 kPa (125 psig).
- E. The stand shall be factory fabricated for floor mounting.
- F. The tappings shall be factory fabricated of materials compatible with heat exchanger shell. For sizes 50 millimeters or DN50 (NPS 2) and smaller, the tappings shall be threaded ends fabricated in accordance to ASME B1.20.1. For sizes 65 millimeters or DN65 (NPS 2-1/2) and larger, the tappings shall be flanged according to ASME B16.5 for steel and stainless steel flanges and ASME 16.24 for copper and copper alloy flanges.
- G. Shell insulation shall comply with ASHRAE 90.1 and suitable for operating temperature. The entire shell and nozzles shall be completely surrounded except connections and controls.
- H. The heat exchanger coils shall be constructed from copper and fabricated in a helix wound for steam heating medium. The pressure rating shall be equal to or greater than the steam supply pressure plus 50%.
- I. 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°C (4°F) of setting.
- J. Safety control shall be automatic, high temperature limit shutoff device.

- K. 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.

**2.3 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.

**2.4 SAFETY VALVES FOR SHELL AND STEAM 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).

## **2.5 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.

## **2.6 HEAT TRAPS**

- A. Heat traps shall be installed in accordance with ASHRAE 90.1, latest edition.

## **2.7 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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