

**SECTION 223500**  
**DOMESTIC-WATER HEAT EXCHANGERS**

**PART 1 GENERAL****1.01 SUMMARY**

- A. Section Includes:
  - 1. Indirect-fired, semi-instantaneous, partial storage, domestic-water heaters.
  - 2. Brazed Plate, domestic-water heat exchangers.
  - 3. Accessories.

**1.02 SUBMITTALS**

- A. Product Data: For each type of product. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings:
  - 1. Include field piping and plumbing diagrams
  - 2. Include diagrams for power, signal, and control wiring.

**1.03 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For domestic-water heat exchangers and heaters to include in emergency, operation, and maintenance manuals.
- B. Warranty Certificate/Information: Including Expiration date and contact information for warranty service agent (installing contractor unless noted otherwise).
- C. Field Quality Control (Startup) Reports

**1.04 COORDINATION**

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate ingress path, assembly, and wiring with applicable trades.

**1.05 WARRANTY**

- A. Special Warranty: Manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including storage tank and supports.
    - b. Faulty operation of controls.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
  - 2. Warranty Periods: From date of Substantial Completion.
    - a. Indirect Fired, Storage, Domestic-Water Heaters:
      - 1) Tank: Including Parts and Labor, for Evidence of or directly observed corrosion, Leaks, Chloride Stress Corrosion Cracking, Leaking on fireside due to condensation or heat cycling.
        - (a) Total Coverage Period: Twenty Five (25) Years
        - (b) Repair or Replace: Fifteen (15) years.
        - (c) Prorated: Years 16-25
        - (d) Service and Shipping: Fully covered by manufacturer for replacements within the first 5 years.
      - 2) Heat Exchanger(s): Including Parts and Labor, for failures including but not limited to Thermal Shock or Manufacturing Defects
        - (a) Coverage Period: 18 Months
      - 3) Controls, and Other Components Coverage Period: 18 Months
    - b. Expansion Tanks: Five (5) years.
  - 3. Non-standard Warranties not offered by Manufacturer shall be provided and facilitated by the installing contractor if factory will not provide coverage.

## PART 2 PRODUCTS

### 2.01 PERFORMANCE REQUIREMENTS

- A. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1.
- B. ASME Compliance: Where ASME-code construction is indicated, fabricate and label heat-exchanger storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- C. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

### 2.02 INDIRECT-FIRED, SEMI-INSTANTANEOUS, PARTIAL STORAGE, DOMESTIC-WATER HEATERS

- A. Drawing Designation: NHT-WH-1
- B. Basis of Design Product: PVI, EZ PLATE STORAGE, 900-2 L 150A TRBPDW
- C. Description: Factory-packaged, hot-water storage tank with double wall, duplex, plate heat-exchangers, circulators, piping, controls, and specialties for heating domestic water with heating hot water.
- D. Heat Exchanger(s): Double Wall, Brazed Plate, Counter Flow, utilizing "Boiler" heating hot water to heat Domestic Water by way of domestic water circulation between the storage tank and the exchangers.
  - 1. Plate Material: 316L Stainless Steel
  - 2. ASME Stamped, Section VIII
  - 3. Max Operating Pressure: 326psi
  - 4. Max Operating Temperature: 445°F
  - 5. Mounted on separate skid for field connection to the storage tank, sidearm.
- E. Storage-Tank: ASME-code, Unlined, duplex alloy stainless steel with 150-psig working-pressure rating.
  - 1. Construction: Unlined, Non-porous phase-balanced austenitic and ferritic duplex steel with a chemical structure containing a minimum of 21% chromium to prevent corrosion
    - a. Mill certified per ASTM A 923 Methods A to ensure that the product is free of detrimental chemical precipitation that affects corrosion resistance.
    - b. Tested and certified to pass stress chloride cracking test protocols as defined in ISO 3651-2 and ASTM G123 - 00(2005) "Standard Test Method for Evaluating Stress-Corrosion Cracking of Stainless Alloys with Different Nickel Content in Boiling Acidified Sodium Chloride Solution."
    - c. Welded utilizing joint designs to minimize volume of weld deposit and heat input. All heat affected zones (HAZ) shall be processed after welding to ensure the HAZ corrosion resistance is consistent with the mill condition base metal chemical composition. Weld procedures (amperage, volts, welding speed, filler metals and shielding gases) utilized shall result in a narrow range of austenite-ferrite microstructure content consistent with phase balanced objectives for welds, HAZ and the base metal.
  - 2. Configuration: Vertical.
  - 3. Domestic Water Flow: Counter-flow arrangement, with domestic water inlet at circulation outlet tapping, teed to tank and heat-exchanger. HX domestic flow returned to tank. Include hot-water outlet located at top of tank and temperature sensor in tank.
  - 4. Internal Surface Finishing: Immersion Passivation and pickling processing to meet critical temperature, duration and chemical concentration controls required to complete corrosion resistance restoration of pressure vessel surfaces.
  - 5. Galvanic Action Protection: Inherent (No sacrificial anode necessary or allowable)
  - 6. Materials: ASME Section II compliant, NSF 61 Compliant, made from min 80% post consumer recycled materials and 100% Recyclable

7. Tappings/Fittings: Factory fabricated of non-ferrous metal(s), compatible with tank. Attach tappings to tank before testing and labeling.
  - a. NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
  - b. NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges and in accordance with ASME B16.24 for copper and copper-alloy flanges.
  - c. Drain Valve at bottom of tank with ball valve
8. Insulation: Rigid Glass Fiber, Complying with ASHRAE/IES 90.1, unless otherwise indicated, and suitable for operating temperature. Surround entire storage tank and nozzle, except connections and controls.
9. Jacket Panels: Powder Coated Steel
10. Skids: Powder Coated Extruded Channel Steel
11. Manway: Full body internal tank access
- F. Domestic Water Piping: Factory complete for minimal field assembly using bronze or brass unions.
  1. Tubing and Fittings: Type L or K Copper complying with "Domestic Water Piping" Section with press fittings.
  2. Valves & Strainer: Cast Bronze or Brass with stainless trim. Strainer to employ blowdown valve
  3. Clean-in-place Valves: For each heat exchanger with isolation ball valves for serving/replacing/cleaning a heat exchanger while the other continues to operate.
  4. ASME Pressure Relief Valve: Sized and Pressure rating by factory.
- G. Temperature Control: Electronic, Adjustable-temperature control with digital display,
  1. Electronic Sensor mounted in storage-tank shell head unless otherwise indicated.
  2. Sequence of Operation: Call for heat will be initiated when the main operating probe located in the storage tank senses stored water temperature below the set point temperature programmed into the operating control. The operating control will then energize the circulating pump to flow water from the tank and into the plate exchanger. Optional boiler water control valve will be included on the heating side of the exchanger. On a call for heat, this valve will open to allow boiler water to flow through the heat exchanger. When the tank temperature is satisfied, this valve will be closed.
- H. Safety Controls: Automatic, high-temperature-limit cutoff device or system. Include automatic low-water cutoff device or system.
- I. Relief Valve(s): ASME rated and stamped for combination temperature- and pressure-relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting of less than working-pressure rating of heat exchanger. Select one relief valve with sensing element that extends into storage tank.
- J. Gauges: Factory-mounted pressure gauge.
- K. Circulating Pump: UL 778, all-bronze, centrifugal, overhung-impeller, close or separately coupled in-line pump as defined in HI 1.1-1.2 and HI 1.3. Include mechanical seals, 125-psig minimum working-pressure rating, and 225 deg F continuous-water-temperature rating.
  1. Pump Control: Temp Sensor for operating pump and control valve.
- L. Support: Factory mounted on skids.
- M. Energy Management System Interface: Native MODBUS RTU Protocol relaying the following points for monitoring and/or control as applicable.
  1. Sensed Temperature
  2. Control/Setpoint Temperature with default and override
  3. Alarms
  4. Pump & Valve Status
- N. Required Connections: Domestic cold water in; domestic hot water out; heating hot-water supply in; heating hot water out.
- O. Options and Accessories:

1. Y-Strainer on boiler inlets (1 each)
  2. BACnet IP & MSTP Gateway(s)
- P. Capacity and Characteristics:
1. Domestic Water:
    - a. Storage Capacity: 150 Gal
    - b. Pipe Size: 2".
    - c. Hot Water Temperature Setting: 125°F
  2. Heating Hot-Water
    - a. 30% Glycol Solution
    - b. Connections Sized: 2½" NPT
    - c. Design Flow (gpm): 15 each HX
  3. Minimum Performance:
    - a. Boiler/Heating Water EWT: 150°F
    - b. Boiler/Heating Water LWT: 75°F
    - c. Recovery Rate (gallons per hour): 1700
  4. Electrical Characteristics:
    - a. Volts: 120
    - b. Single Phase
    - c. Hertz: 60
    - d. Full-Load Amperes: 5

### 2.03 PLATE, DOMESTIC-WATER HEAT EXCHANGERS

- A. Brazed-Plate, Domestic-Water Heat Exchangers:
1. Description: Factory-packaged assembly of heat-exchanger plates, permanently brazed together, for using heating hot water to heat domestic water.
  2. Working-Pressure Rating: 300 psig Minimum
  3. Plate Construction: Vented, double wall.
  4. Plate Material: 316L Stainless steel.
  5. Connections: Stainless steel, threaded.
  6. Brazing Filler Metal: Copper or Nickel
- B. Required Connections: Domestic cold water in; domestic hot water out; heating hot water supply in; heating hot water out.

### 2.04 ACCESSORIES

- A. Domestic-Water Compression Tanks:
1. Description: Steel pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system operating pressure at tank.
  2. Construction:
    - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
    - b. Interior Finish: Comply with NSF 61 barrier materials for potable water tank linings, including extending finish into and through tank fittings and outlets.
    - c. Air-Charging Valve: Factory installed.
  3. Capacity and Characteristics: As noted or schedule on the drawings
- B. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IES 90.1 or ASHRAE 90.2.
- C. Heat-Trap Fittings: ASHRAE 90.2.
- D. Combination Temperature- and Pressure-Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than heat-exchanger working-pressure rating. Select relief valves with sensing element that extends into storage tank.
- E. Pressure-Relief Valves: ASME rated and stamped. Include pressure setting less than heat-exchanger working pressure rating.

- F. Vacuum-Relief Valves: ANSI Z21.22/CSA 4.4.

## **2.05 SOURCE QUALITY CONTROL**

- A. Factory Tests: Test and inspect domestic-water heat exchangers and domestic-water heaters specified to ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test domestic-water heat exchangers and domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

## **PART 3 EXECUTION**

### **3.01 INSTALLATION OF DOMESTIC-WATER HEAT EXCHANGERS AND DOMESTIC-WATER HEATERS**

- A. Field Assemble factory piping packages as required.
- B. Complete any field wiring of controls and circulation line voltage power for single point connection units.
- C. Install domestic-water heat exchangers and domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
  - 1. Install shutoff valves on domestic cold-water supply piping to domestic-water heat exchangers and domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523.
  - 2. Install shutoff valves on heating hot-water piping to domestic-water heat exchangers and domestic-water heaters. Comply with requirements for shutoff valves specified in Section 230523.12 "Ball Valves for HVAC Piping," Section 230523.13 "Butterfly Valves for HVAC Piping," and Section 230523.15 "Gate Valves for HVAC Piping."
  - 3. Install shutoff valves on steam and condensate piping to domestic-water heat exchangers and domestic-water heaters. Comply with requirements for shutoff valves specified in Section 230523.12 "Ball Valves for HVAC Piping," Section 230523.13 "Butterfly Valves for HVAC Piping," and Section 230523.15 "Gate Valves for HVAC Piping."
- D. Install temperature- and pressure-relief valves in top portion of domestic-water storage tank shells. Use relief valves with sensing elements that extend into shells. Extend relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- E. Install combination temperature- and pressure-relief valves in water piping for domestic-water heat exchangers and domestic-water heaters without storage. Extend relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- F. Install domestic-water heat exchangers and domestic-water heaters drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in domestic-water piping for heat exchangers and heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."
- G. Install thermometer on each domestic-water heat exchanger and domestic-water heater outlet piping, and install thermometer on each heat exchanger and heater heating-fluid inlet and outlet piping. Comply with requirements for thermometers specified in Section 220519 "Meters and Gauges for Plumbing Piping."
- H. Install pressure gauges on domestic-water heat exchanger and domestic-water heater heating-fluid piping. Comply with requirements for pressure gauges specified in Section 220519 "Meters and Gauges for Plumbing Piping."
- I. Fill domestic-water heat exchangers and domestic-water heaters with water.
- J. Charge domestic-water compression tanks with air.

**3.02 PIPING CONNECTIONS**

- A. Field Assemble factory piping packages as required.
- B. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping."
- C. Comply with requirements for heating hot-water piping specified in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties."
- D. Comply with requirements for steam and condensate piping specified in Section 232213 "Steam and Condensate Heating Piping" and Section 232216 "Steam and Condensate Heating Piping Specialties."
- E. Drawings indicate general arrangement of piping, fittings, and specialties.
- F. Where installing piping adjacent to domestic-water heat exchangers and heaters, allow space for service and maintenance. Arrange piping for easy removal of heat exchangers and heaters.

**3.03 IDENTIFICATION**

- A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

**3.04 FIELD QUALITY CONTROL**

- A. Perform tests and inspections as prescribed by the manufacturer's installation manual.
- B. Tests and Inspections:
  - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Domestic-water heat exchangers and domestic-water heaters will be considered defective if they do not pass tests and inspections.
- D. Prepare factory test and inspection (startup) report.

**3.05 DEMONSTRATION**

- A. Train Owner's maintenance personnel to adjust, operate, and maintain domestic-water heating equipment.

**END OF SECTION 223500**