

SECTION 223500 - DOMESTIC-WATER HEAT EXCHANGERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and **[Division 01 and Division 20]** Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Shell-and-tube, heating-fluid-in-U-tube-coil, domestic-water heat exchangers.
 - 2. Circulating, compact, domestic-water heat exchangers.
 - 3. Circulating, storage, domestic-water heat exchangers.
 - 4. Noncirculating, storage, domestic-water heat exchangers.
 - 5. Frame-and-plate, domestic-water heat exchangers.
 - 6. Domestic-water, heat-exchanger accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type and size of domestic-water heat exchanger indicated. **[Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.]**
- B. Shop Drawings:
 - 1. Wiring Diagrams: For power, signal, and control wiring.
 - 2. Piping Diagrams: For hot water system including heat exchangers, valves (shut-off, safety, thermostatic mixing), expansion tanks and return pump (if applicable).

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of **[shell-and-tube]** **[and]** **[plate]**, domestic-water heat exchanger, from manufacturer.
- B. Domestic-Water, Heat-Exchanger Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
- C. Source quality-control reports.
- D. Field quality-control reports.
- E. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic-water heat exchangers to include in

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emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1.
- C. 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.
- D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.7 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of domestic-water heat exchangers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including heat exchanger, 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. Shell-and-Tube, Domestic-Water Heat Exchangers:
 - 1) Tube Coil: 10 year.
 - 2) Controls and Other Components: **[One]** year.
 - 3) Shell: 10 year.
 - b. Plate, Domestic-Water Heat Exchangers:
 - 1) Brazed-Plate Type: **[One]** year.
 - 2) Plate-and-Frame Type: **[One]** year.
 - c. Compression Tanks: **[One]** year.

PART 2 - PRODUCTS

2.1 SHELL-AND-TUBE, DOMESTIC-WATER HEAT EXCHANGERS

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A. Shell-and-Tube, Heating-Fluid-in-U-Tube-Coil, Domestic-Water Heat Exchangers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aerco.
 - b. Patterson-Kelley; a division of Harsco Corporation.
 - c. RECO USA.
 - d. Cemline.
2. Description: Tankless, packaged assembly of heat-exchanger coil, controls, and specialties for heating domestic water in shell with steam in coil.
3. Construction: ASME-code, negligible-capacity or copper-alloy shell with [300-psig (1035-kPa)] minimum working-pressure rating.
 - a. Configuration: Vertical.
 - b. Shell Tappings: Factory fabricated of copper-alloy compatible with domestic-water, heat-exchanger shell. Attach tappings to shell before testing and labeling.
 - 1) NPS 2 (DN 50) and Smaller: Threaded ends according to ASME B1.20.1.
 - 2) NPS 2-1/2 (DN 65) and Larger: Flanged ends according to ASME B16.24 for copper and copper-alloy flanges.
 - c. Insulation: Complying with ASHRAE/IESNA 90.1, unless otherwise indicated, and suitable for operating temperature. Surround entire shell and nozzle except connections and controls.
4. Heat-Exchanger Coil: Copper, double-wall U tubes for heating fluid. Include tube pressure rating equal to or greater than heating-fluid supply pressure.
5. Temperature Control: Adjustable thermostat that operates steam-control valve and is capable of maintaining outlet-water temperature within 5 deg F (3 deg C) of setting.
6. Safety Control: Automatic, high-temperature-limit cutoff device or system.
7. Relief Valves: 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 less than working-pressure rating of heat exchanger. Select one relief valve with sensing element that extends into shell.
8. Miscellaneous Components for Steam Unit: Strainers, steam-control valve, steam trap, valves, pressure gage, thermometer, and piping.
9. Stand: Factory fabricated for floor mounting, with clearance for pulling the tube bundle.

B. Capacity and Characteristics:

1. Flow Rate: Scheduled on drawings.
2. Hot-Water Temperature Setting: Scheduled on drawings.
3. Domestic-Water Pipe Size: Scheduled on drawings.
4. Steam Supply:
 - a. Inlet Pressure: Scheduled on drawings.
 - b. Demand Rate: Scheduled on drawings.

- c. Input Rating: Scheduled on drawings.
 - d. Steam Pipe Size: Scheduled on drawings.
- 5. Condensate Pipe Size: Scheduled on drawings.
 - 6. Electrical Characteristics:
 - a. Volts: Scheduled on drawings.
 - b. Phases: Scheduled on drawings.
 - c. Hertz: Scheduled on drawings.

2.2 PLATE, DOMESTIC-WATER HEAT EXCHANGERS

A. Frame-and-Plate, Domestic-Water Heat Exchangers:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Alfa Laval, Inc.
 - b. API Heat transfer, Inc.
 - c. Mueller, Paul, Company.
 - d. B+G - XYLEM.
- 2. Description: Assembly of nonfixed-position, heat-exchanger plates, with frame, for using domestic water to heat domestic water.
- 3. Working-Pressure Rating: **[400 psig (2760 kPa)]** minimum.
- 4. Frame:
 - a. Fixed, Frame Plate.
- 5. Channel Plates:
 - a. Type: **[Single]** wall.
 - b. Material: Stainless steel.
 - c. Plate Thickness: Not less than **[0.157 inch]**
 - d. Gasket Material: Butyl or acrylonitrile-butadiene rubber, suitable for potable water.
- 6. Connections: **[Stainless steel]** suitable for potable water.
 - a. **NPS 2 (DN 50)** and Smaller: Threaded.
 - b. **NPS 2-1/2 (DN 65)** and Larger: Flanged.
- 7. Protective Shroud: Steel, covering channel plates.
- 8. Insulation: Complying with ASHRAE/IESNA 90.1, unless otherwise indicated, and suitable for operating temperature. Surround entire heat exchanger except connections.

2.3 DOMESTIC-WATER, HEAT-EXCHANGER ACCESSORIES

A. Domestic-Water Compression Tanks:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL Inc.
 - b. B+G -XLEM

- c. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
 - d. Wessels.
 - e. Taco, Inc.
2. 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.
 3. 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.
 4. Capacity and Characteristics:
 - a. Working-Pressure Rating: **300 psig**.
- B. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 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-M.

2.4 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect domestic-water heat exchangers specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test domestic-water heat exchangers to minimum of one and one-half times pressure rating before shipment.
- C. Domestic-water heat exchangers will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

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3.1 DOMESTIC-WATER, HEAT-EXCHANGER INSTALLATION

- A. Domestic-Water, Heat-Exchanger Mounting: Install domestic-water heat exchangers on concrete base. Comply with requirements for concrete bases specified in Division 03 Section "[**Cast-in-Place Concrete**] [**Miscellaneous Cast-in-Place Concrete**]."
1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on **18-inch (450-mm)** centers around the full perimeter of concrete base.
 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
 5. Anchor heat exchangers to substrate.
- B. Install domestic-water heat exchangers 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-water-supply piping to heat exchangers and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
 2. Install shutoff valves on heating hot-water piping to heat exchangers. Comply with requirements for shutoff valves specified in Division 23 Section "General-Duty Valves for HVAC Piping."
 3. Install shutoff valves on steam and condensate piping to heat exchangers. Comply with requirements for shutoff valves specified in Division 23 Section "General-Duty Valves for HVAC Piping."
- C. Install temperature and pressure relief valves in top portion of storage-tank shells of domestic-water heat exchangers with domestic-water storage. 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.
- D. Install combination temperature-and-pressure relief valves in water piping for domestic-water heat exchangers 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.
- E. Install heat-exchanger 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 water piping for domestic-water heat exchangers that do not have tank drains. Comply with requirements for hose-end drain valves specified in Division 22 Section "Domestic Water Piping Specialties."
- F. Install thermometer on each domestic-water, heat-exchanger, inlet and outlet piping, and install thermometer on each domestic-water, heat-exchanger, heating-fluid[**inlet and**] outlet piping. Comply with requirements for thermometers specified in Division 22 Section "Meters and Gages for Plumbing Piping."

- G. Install pressure gages on domestic-water, heat-exchanger, heating-fluid piping. Comply with requirements for pressure gages specified in Division 22 Section "Meters and Gages for Plumbing Piping."
- H. Point-of-use instantaneous water heaters shall have an internal burnout element or shall have a factory set thermostat that is not adjustable to higher than 110°F.
- I. Fill domestic-water heat exchangers with water.
- J. Charge domestic-water compression tanks with air.
- K. All heat exchangers shall be double-walled with air gap open to the atmosphere between the two walls.
- L. Water heaters installed above fixtures they serve or water heater is bottom fed, a vacuum relief valve shall be installed and comply with ANSI Z21.22.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Division 22 Section "Domestic Water Piping."
- B. Comply with requirements for heating hot-water piping specified in Division 23 Section "Hydronic Piping."
- C. Comply with requirements for steam and condensate piping specified in Division 23 Section "Steam and Condensate Heating Piping." **Steam and Condensate piping by Div 23**
- D. Drawings indicate general arrangement of piping, fittings, and specialties.
- E. Where installing piping adjacent to domestic-water heat exchangers, allow space for service and maintenance of heat exchangers. Arrange piping for easy removal of domestic-water heat exchangers.

3.3 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.

4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Domestic-water heat exchangers will be considered defective if they do not pass tests and inspections. Comply with requirements in Division 01 Section "Quality Requirements" for retesting and reinspecting requirements and Division 01 Section "Execution" for requirements for correcting the Work.
- C. Prepare test and inspection reports.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain brazed plate domestic-water heat exchangers.

END OF SECTION 223500