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SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

TIPS:

To view non-printing **Editor's Notes** that provide guidance for editing, click on MasterWorks/Single-File Formatting/Toggle/Editor's Notes.

To read **detailed research, technical information about products and materials, and coordination checklists**, click on MasterWorks/Supporting Information.

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PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial, electric, domestic-water booster heaters.
2. Commercial, electric, storage, domestic-water heaters.
3. Commercial, electric, small-capacity storage, domestic-water heaters.
4. Commercial, light-duty, storage, electric, domestic-water heaters.
5. Residential, small-capacity, electric, domestic-water heaters.
6. Residential, collector-to-tank, solar, electric, domestic-water heaters.
7. Residential, collector-to-tank-coil, solar, electric, domestic-water heaters.
8. Residential, electric, storage, domestic-water heaters.
9. Residential, tabletop, electric, domestic-water heaters.

10. Undercounter, Electric, Tankless, Domestic-Water Heaters.
11. Undercounter, Electric, Tankless, Fixed-Temperature Domestic-Water Heaters with Mixing Valve.
12. Electric, Tankless, Fixed-Temperature Domestic-Water Heaters - Commercial.
13. Electric, Tankless, Domestic-Water Heaters for Safety Fixtures.
14. Domestic-water heater accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Sustainable Design Submittals:

1. Product Data: For energy efficiency.

C. Shop Drawings:

1. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Equipment room drawing or BIM model, drawn to scale, on which the items described in this Section are shown and coordinated with all building trades.

1.4 Retain "Seismic Qualification Data" Paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment." See ASCE/SEI 7 for certification requirements for equipment and components.

A. Seismic Qualification Data: Certificates, for commercial domestic-water heaters, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Product Certificates: For each type of [commercial] [residential] [and] [tankless], electric, domestic-water heater.

C. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For electric, domestic-water heaters to include emergency, operation, and maintenance manuals.

1.6 COORDINATION

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

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of electric, 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. Commercial, Electric, Domestic-Water Booster Heaters:

- 1) Controls and Other Components: [**Three**] [**Five**] <Insert number> years.

- b. Commercial, Electric, Storage, Domestic-Water Heaters:

- 1) Storage Tank: [**Three**] [**Five**] <Insert number> years.
- 2) Controls and Other Components: [**Three**] [**Five**] <Insert number> years.

- c. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:

- 1) Storage Tank: [**Three**] [**Five**] <Insert number> years.
- 2) Controls and Other Components: [**Two**] [**Three**] <Insert number> years.

- d. Residential, Electric, Storage, Domestic-Water Heaters:

- 1) Storage Tank: [**Five**] [**Six**] [**10**] <Insert number> years.
- 2) Controls and Other Components: [**Two**] [**Three**] <Insert number> years.

- e. Electric, Tankless, Domestic-Water Heaters: **[One]** **[Two]** **[Five]** **<Insert number>** year(s).
- f. Expansion Tanks: **[Five]** **<Insert number>** years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.
- B. Seismic Performance: Commercial, electric, domestic-water heaters shall withstand the effects of earthquake motions determined in accordance with **[ASCE/SEI 7]** **<Insert requirement>**.
 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified[**and the unit will be fully operational after the seismic event**]."
 2. Component Importance Factor: **[1.5]** **[1.0]**.
 3. **<Insert requirements for Component Amplification Factor and Component Response Modification Factor>**.
- C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.
- D. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- E. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

2.2 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

- A. Commercial, Electric, Domestic-Water Booster Heaters:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. Coates Heater Company, Inc.
 - c. Electric Heater Company (The).
 - d. Hatco Corporation.
 - e. HESco Industries, Inc.
 - f. Lochinvar, LLC.
 - g. Rheem Manufacturing Company.
 - h. **<Insert manufacturer's name>**.

2. Source Limitations: Obtain domestic-water booster heaters from single source from single manufacturer.
3. Standard: UL 1453.
4. Tank Construction: [**Corrosion-resistant metal**] [**or**] [**steel**].
 - a. Tappings: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: **150 psig (1035 kPa)**.
 - c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
5. Factory-Installed Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - c. Insulation: Comply with ASHRAE/IES 90.1.
 - d. Jacket: Rectangular shaped, with stainless steel front panel, unless otherwise indicated.
 - e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
 - 1) Option: Booster heaters with total of 9 kW or less may have one, two, or three elements.
 - f. Temperature Control: Adjustable thermostat, to setting of at least **180 deg F (82 deg C)**.
 - g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
 - h. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valve. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.
 - i. Gauges: Combination temperature-and-pressure type or separate thermometer and pressure gauge.
6. Special Requirements: NSF 5 construction with [**brackets for undercounter**] [**legs for floor**] installation.

B. Commercial, Electric, Storage, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. American Water Heaters.
 - c. Bradford White Corporation.
 - d. Cemline Corporation.
 - e. HESco Industries, Inc.
 - f. Hubbell Water Heaters.
 - g. Lochinvar, LLC.
 - h. Precision Boilers.
 - i. PVI; A WATTS Brand.

- j. Rheem Manufacturing Company.
 - k. State Industries.
 - l. Vaughn Thermal Corporation.
 - m. <Insert manufacturer's name>.
- 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 - 3. Standard: UL 1453.
 - 4. Storage-Tank Construction: [Non-]ASME-code, steel [horizontal] [vertical] arrangement.
 - a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
 - 1) NPS 2 (DN 50) and Smaller: Threaded ends in accordance with ASME B1.20.1.
 - 2) NPS 2-1/2 (DN 65) 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.
 - b. Pressure Rating: [150 psig (1035 kPa)] <Insert value>.
 - c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
 - 5. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - c. Insulation: Comply with ASHRAE/IES 90.1.
 - d. Jacket: Steel with enameled finish or high-impact composite material.
 - e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
 - f. Temperature Control: Adjustable thermostat.
 - g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
 - h. 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 domestic-water heater. Select one relief valve with sensing element that extends into storage tank.
 - 6. Special Requirements: NSF 5 construction.
- C. Commercial, Electric, Small-Capacity Storage, Domestic-Water Heaters:
- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Chronomite; <CMT Series> or comparable product by one of the following:
 - a. A.O. Smith
 - b. Bosch.
 - c. Eemax.
 - d. <Insert manufacturer's name>.

2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
3. Standard: UL 174.
4. Storage-Tank Construction: Corrosion-resistant metal[**or steel with corrosion-resistant coating**].
 - a. Tappings: ASME B1.20.1 pipe thread, NPS 1/2.
 - b. Pressure Rating: **150 psig (1035 kPa)**.
 - c. Operating Pressure: **80 psig (552 kPa)**, maximum.
 - d. Water Temperature: **50 to 140 deg F (10 to 60 deg C)**, adjustable.
 - e. Tank Volume: [**1.3 gallons (4.9 liter)**] [**2.5 gallons (9.5 liter)**] [**4.0 gallons (15 liter)**] [**6.0 gallons (23 liter)**].
 - f. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
 - g. Provide wall bracket.
5. Factory-Installed, Storage-Tank Appurtenances:
 - a. Drain Valve: Corrosion-resistant metal with hose-end connection if tank has drain outlet. Provide hose-end drain valve in piping for domestic-water heaters without drain outlet. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."
 - b. Insulation: Comply with [**ASHRAE/IES 90.1**] [**ASHRAE 90.2**].
 - c. Jacket: Steel with enameled finish or high-impact composite material.
 - d. Heating Element: One; electric, screw-in immersion type.
 - e. Temperature Control: Adjustable thermostat.
 - f. Safety Control: High-temperature-limit cutoff device or system.
 - g. Power Supply Cord: **24 to 72 inches (610 to 1830 mm)** with plug.
 - h. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.

D. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. American Water Heaters.
 - c. Bradford White Corporation.
 - d. Heat Transfer Products, Inc.
 - e. Hubbell Water Heaters.
 - f. Lochinvar, LLC.
 - g. Rheem Manufacturing Company.
 - h. State Industries.
 - i. **<Insert manufacturer's name>**.
2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.

3. Standard: UL 174.
4. Storage-Tank Construction: Steel, vertical arrangement.
 - a. Tappings: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: **150 psig (1035 kPa)**.
 - c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
5. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - d. Insulation: Comply with ASHRAE/IES 90.1.
 - e. Jacket: Steel with enameled finish or high-impact composite material.
 - f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - g. Heating Elements: Electric, screw-in immersion type.
 - h. Temperature Control: Adjustable thermostat.
 - i. Safety Control: High-temperature-limit cutoff device or system.
 - j. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.
6. Special Requirements: NSF 5 construction with legs for off-floor installation.

E. Capacity and Characteristics:

1. Capacity: **<Insert gal. (L)>**.
2. Recovery: **<Insert gph (L/s)>** at **[40 deg F (22 deg C)] [50 deg F (28 deg C)] [100 deg F (56 deg C)] <Insert temperature>** temperature rise.
3. Temperature Setting: **[125 deg F (52 deg C)] [140 deg F (60 deg C)] [180 deg F (82 deg C)] <Insert temperature>**.
4. Power Demand: **<Insert kilowatts>**.
5. Heating Elements:
 - a. Number of Elements: **[Two] [Three] [Six] [Nine] <Insert number>**.
 - b. Kilowatts Each Element: **<Insert kilowatts>**.
 - c. Number of Stages: **[One] [Two] [Three] [Four] <Insert number>**.
6. Electrical Characteristics:
 - a. Volts: **[120] [240] [277] [480] <Insert value> V**.
 - b. Phases: **[Single] [Three]**.
 - c. Hertz: 60 Hz.
 - d. Full-Load Amperes: **<Insert value> A**.
 - e. Minimum Circuit Ampacity: **<Insert value> A**.
 - f. Maximum Overcurrent Protection: **<Insert value> A**.

2.3 RESIDENTIAL, ELECTRIC, DOMESTIC-WATER HEATERS

A. Residential, Small-Capacity, Electric, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. American Water Heaters.
 - c. Bosch Thermotechnology Corp.
 - d. Bradford White Corporation.
 - e. GSW Water Heating.
 - f. Hubbell Water Heaters.
 - g. Lochinvar, LLC.
 - h. Rheem Manufacturing Company.
 - i. Stiebel Eltron, Inc.
 - j. WaiWela.
 - k. <Insert manufacturer's name>.
2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
3. Standard: UL 174.
4. Storage-Tank Construction: Corrosion-resistant metal[**or steel with corrosion-resistant coating**].
 - a. Tappings: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: **150 psig (1035 kPa)**.
 - c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
5. Factory-Installed, Storage-Tank Appurtenances:
 - a. Drain Valve: Corrosion-resistant metal with hose-end connection if tank has drain outlet. Provide hose-end drain valve in piping for domestic-water heaters without drain outlet. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."
 - b. Insulation: Comply with [ASHRAE/IES 90.1] [ASHRAE 90.2].
 - c. Jacket: Steel with enameled finish or high-impact composite material.
 - d. Heating Element: One; electric, screw-in immersion type.
 - e. Temperature Control: Adjustable thermostat.
 - f. Safety Control: High-temperature-limit cutoff device or system.
 - g. Power Supply Cord: **24 to 72 inches (610 to 1830 mm)** with plug.
 - h. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.

B. Residential, Collector-to-Tank, Solar, Electric, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Alternate Energy Technologies, LLC.
 - b. American Water Heaters.
 - c. Bradford White Corporation.
 - d. Lochinvar, LLC.
 - e. Rheem Manufacturing Company.
 - f. **<Insert manufacturer's name>**.
 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 3. Standard: UL 174 with piping and electrical connections for UL 1279 solar collector system.
 4. Storage-Tank Construction: Steel.
 - a. Tappings: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: **150 psig (1035 kPa)**.
 - c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
 5. Factory-Installed, Storage-Tank Appurtenances:
 - a. Sensor electrical connections and tank stud for sensor.
 - b. Anode Rod: Replaceable magnesium.
 - c. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - d. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - e. Insulation: Comply with **[ASHRAE/IES 90.1] [ASHRAE 90.2]**.
 - f. Jacket: Steel with enameled finish.
 - g. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - h. Heating Element: Electric, screw-in immersion type.
 - i. Temperature Control: Adjustable thermostat.
 - j. Safety Control: High-temperature-limit cutoff device or system.
 - k. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.
- C. Residential, Collector-to-Tank-Coil, Solar, Electric, Domestic-Water Heaters:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Alternate Energy Technologies, LLC.
 - b. Bradford White Corporation.
 - c. Hubbell Water Heaters.
 - d. Vaughn Thermal Corporation.
 - e. **<Insert manufacturer's name>**.

2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
3. Standard: UL 174 with integral coil-type heat exchanger.
4. Storage-Tank Construction: Steel.
 - a. Tappings: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: **150 psig (1035 kPa)**.
 - c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
5. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - d. Insulation: Comply with [ASHRAE/IES 90.1] [ASHRAE 90.2].
 - e. Jacket: Steel with enameled finish or high-impact composite material.
 - f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - g. Heat Exchanger: Corrosion-resistant-metal immersion coil.
 - h. Heating Element: Electric, screw-in immersion type.
 - i. Temperature Control: Adjustable thermostat.
 - j. Safety Control: High-temperature-limit cutoff device or system.
 - k. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.

D. Residential, Electric, Storage, Domestic-Water Heaters:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. American Water Heaters.
 - c. Bradford White Corporation.
 - d. GSW Water Heating.
 - e. Heat Transfer Products, Inc.
 - f. Lochinvar, LLC.
 - g. Rheem Manufacturing Company.
 - h. State Industries.
 - i. Vaughn Thermal Corporation.
 - j. **<Insert manufacturer's name>**.
2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
3. Standard: UL 174.
4. Storage-Tank Construction: Steel.
 - a. Tappings: ASME B1.20.1 pipe thread.

- b. Pressure Rating: **150 psig (1035 kPa)**.
 - c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
 5. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - d. Insulation: Comply with [ASHRAE/IES 90.1] [ASHRAE 90.2].
 - e. Jacket: Steel, cylindrical, with enameled finish or high-impact composite material.
 - f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
 - g. Heating Elements: Electric, screw-in immersion type.
 - h. Temperature Control: Adjustable thermostat.
 - i. Safety Control: High-temperature-limit cutoff device or system.
 - j. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.
- E. Residential, Tabletop, Electric, Domestic-Water Heaters:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. American Water Heaters.
 - c. Rheem Manufacturing Company.
 - d. State Industries.
 - e. **<Insert manufacturer's name>**.
 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 3. Standard: UL 174.
 4. Storage-Tank Construction: Steel.
 - a. Tappings: ASME B1.20.1 pipe thread.
 - b. Pressure Rating: **150 psig (1035 kPa)**.
 - c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
 5. Factory-Installed, Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal with hose-end connection.
 - d. Insulation: Comply with [ASHRAE/IES 90.1] [ASHRAE 90.2].
 - e. Jacket: Steel, rectangular, with flat-top work surface, raised back, and enameled finish.

- f. Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
- g. Heating Elements: Electric, screw-in immersion type.
- h. Temperature Control: Adjustable thermostat.
- i. Safety Control: High-temperature-limit cutoff device or system.
- j. Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.

F. Capacity and Characteristics:

- 1. Recovery: <Insert **gph (L/s)**> at [**100 deg F (56 deg C)**] <Insert temperature> temperature rise.
- 2. Temperature Setting: [**125 deg F (52 deg C)**] <Insert temperature>.
- 3. Heating Elements: <Insert kilowatts>.
- 4. Electrical Characteristics:
 - a. Volts: [**120**] [**208**] [**240**] [**277**] <Insert value> V.
 - b. Phases: Single.
 - c. Hertz: 60 Hz.
 - d. Full-Load Amperes: <Insert value> A.
 - e. Minimum Circuit Ampacity: <Insert value> A.
 - f. Maximum Overcurrent Protection: <Insert value> A.

2.4 ELECTRIC, TANKLESS, DOMESTIC-WATER HEATERS

A. Undercounter, Electric, Tankless, Domestic-Water Heaters:

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Chronomite; <CM Series> or comparable product by one of the following:
 - a. A.O. Smith
 - b. Bosch Thermotechnology Corp.
 - c. Eemax, Inc.
 - d. Stiebel Eltron, Inc.
 - e. <Insert manufacturer's name>.
- 2. Source Limitations: Obtain undercounter, tankless, domestic-water heaters from single source from single manufacturer.
- 3. Standard: UL 499 for electric, tankless, domestic-water-heating appliance.
- 4. Construction: Plastic heating chamber with direct-insertion heating element, mounted in [**metal**] [**ABS plastic**] housing.
 - a. Connections: [**3/8 inch compression fittings**] [**1/2 NPS ASME B1.20.1 male pipe thread**].
 - b. Operating Pressure: [**25 psig (175 kPa)**] <Insert value>.
 - c. Pressure Rating: [**150 psig (1035 kPa)**] <Insert value>.
 - d. Minimum Operating Flow: **0.2 gpm (0.75 L/m)**.

- e. Heating Element: Celcon plastic element with nichrome coil, resistance-type heating system.
 - f. Temperature Control: Microprocessor-based, to maintain temperature setpoint over full range of flows.
 - g. Enclosure: Cast aluminum, NEMA 1.
5. Accessories:
- a. Enclosure: [PA765, ABS plastic] [Stainless steel, No. 4 brushed finish] [Stainless steel, No. 8 high-polish finish].
 - b. Temperature and pressure relief valve.
 - c. Disconnect Switch: 40A, lockable, in NEMA 4X enclosure.
 - d. Field Temperature Adjustment: 104 - 125 deg F (40 - 52 deg C).
6. Support: Bracket for wall mounting.
7. Capacity and Characteristics:
- a. Flow Rate: [0.25 - 2.0 gpm (0.75 - 7.6 L/m)] <Insert gpm (L/m)>.
 - b. Minimum Operating Flow to Activate Heater: 0.2 gpm (0.05 L/m).
 - c. Temperature Setting: [104 deg F (40 deg C)] [110 deg F (43 deg C)] [120 deg F (49 deg C)] <Insert temperature>.
 - d. Electrical Characteristics:
 - 1) Volts: [120] [240] [277] <Insert value> V, hard-wired.
 - 2) Phase: Single.
 - 3) Hertz: 60 Hz.
 - 4) Full-Load Amperes: <Insert value> A.
 - 5) Minimum Circuit Ampacity: <Insert value> A.
 - 6) Maximum Overcurrent Protection: <Insert value> A.
 - 7) Ambient Operating Temperature: 140 deg F (60 deg C), maximum.
- B. Undercounter, Electric, Tankless, Fixed-Temperature Domestic-Water Heaters with Mixing Valve:
- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Chronomite; <CMI Series> or comparable product by one of the following:
 - a. A.O. Smith.
 - b. Bosch Thermotechnology Corp.
 - c. Eemax, Inc.
 - d. Stiebel Eltron, Inc.
 - e. <Insert manufacturer's name>.
 - 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 - 3. Standard: UL 499, ASSE 1069, ASSE 1070, CSA B125.3.12 for electric, tankless, (domestic-water-heater) heating appliance.
 - 4. Construction: Plastic heating chamber with direct-insertion heating element and mixing valve, mounted in metal housing.

- a. Connections: [3/8 inch compression fittings] [1/2 NPS ASME B1.20.1 male pipe thread].
 - b. Operating Pressure: [25 psig (175 kPa)] <Insert value>.
 - c. Pressure Rating: [150 psig (1035 kPa)] <Insert value>.
 - d. Minimum Operating Flow: 0.2 gpm (0.75 L/m).
 - e. Heating Element: Celcon plastic element with nichrome coil, resistance-type heating system.
 - f. Temperature Control: Microprocessor-based, to maintain temperature setpoint over full range of flows.
 - g. Enclosure: Cast aluminum, NEMA 1.
5. Accessories:
- a. Temperature and pressure relief valve.
 - b. Disconnect Switch: 40A, lockable, in NEMA 4X enclosure.
6. Support: Bracket for wall mounting.
7. Capacity and Characteristics:
- a. Flow Rate: 0.35 - 2.0 gpm (1.3 - 7.6 L/m) <Insert gpm (L/m)>.
 - b. Minimum Operating Flow to Activate Heater: 0.2 gpm (0.05 L/m).
 - c. Temperature Setting: 104 deg F (40 deg C).
 - d. Electrical Characteristics:
 - 1) Volts: [120] [208] [240] [277] <Insert value> V, hard-wired.
 - 2) Phase: Single.
 - 3) Hertz: 60 Hz.
 - 4) Full-Load Amperes: <Insert value> A.
 - 5) Minimum Circuit Ampacity: <Insert value> A.
 - 6) Maximum Overcurrent Protection: <Insert value> A.
 - 7) Ambient Operating Temperature: 110 deg F (43 deg C), maximum.
- C. Electric, Tankless, Fixed-Temperature Single-Phase Domestic-Water Heaters - Commercial:
1. Basis-of-Design Product: Subject to compliance with requirements, provide Chronomite model ER Twins Series, Single-Phase; or comparable product by one of the following:
 - a. A.O. Smith.
 - b. Bosch Thermotechnology Corp.
 - c. Eemax, Inc.
 - d. Stiebel Eltron, Inc.
 - e. <Insert manufacturer's name>.
 2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 3. Standard: [UL 499] [UPC] for electric, tankless, (domestic-water-heater) heating appliance.
 4. Construction: Plastic heating chamber with direct-insertion heating element, mounted in metal housing.

- a. Connections: 3/4 NPS ASME B1.20.1 female pipe thread.
 - b. Operating Pressure: [**25 psig (175 kPa)**] <Insert value>.
 - c. Pressure Rating: [**80 psig (552 kPa)**] <Insert value>.
 - d. Minimum Operating Flow: [**0.8 gpm (3.0 L/m)**] [**1.2 gpm (4.5 L/m)**] [**1.8 gpm (6.75 L/m)**] [**2.8 gpm (10.5 L/m)**].
 - e. Heating Element: Celcon plastic element with nichrome coil, resistance-type heating system.
 - f. Temperature Control: Microprocessor-based, to maintain temperature setpoint over full range of flows.
 - g. Enclosure: [Steel] [**Stainless steel, No. 4 brushed finish**] [NEMA 4] [NEMA 4X].
5. Accessories:
- a. Enclosure: [**Stainless steel, No. 4 brushed finish**] [**Stainless steel, No. 8 high-polish finish**].
 - b. Digital readout.
 - c. Y-strainer.
 - d. Disconnect Switch: 80A, lockable, in NEMA 4X enclosure.
6. Support: Bracket for wall mounting.
7. Capacity and Characteristics:
- a. Flow Rate: **4.0 - 6.0 gpm (7.5- 11.3 L/m)** <Insert gpm (L/m)>.
 - b. Minimum Operating Flow to Activate Heater: **0.8 gpm (3.0 L/m)**.
 - c. Temperature Setting, Adjustable: [**70 - 125 deg F (21 - 52 deg C)**] [**90 - 160 deg F (32 - 71 deg C)**] <Insert temperature>.
 - d. Electrical Characteristics:
 - 1) Volts: [**208**] [**240**] [**277**] <Insert value> V, hard-wired.
 - 2) Phase: Single.
 - 3) Hertz: 60 Hz.
 - 4) Full-Load Amperes: <Insert value> A.
 - 5) Minimum Circuit Ampacity: <Insert value> A.
 - 6) Maximum Overcurrent Protection: <Insert value> A.
 - 7) Ambient Operating Temperature: **140 deg F (60 deg C)**, maximum.
8. Basis-of-Design Product: Subject to compliance with requirements, provide Chronomite model ER Triplet Series, Single Phase; or comparable product by one of the following:
- a. A.O. Smith.
 - b. Bosch Thermotechnology Corp.
 - c. Eemax, Inc.
 - d. Stiebel Eltron, Inc.
 - e. <Insert manufacturer's name>.
9. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
10. Standard: [UL 499] [UPC] for electric, tankless, (domestic-water-heater) heating appliance.

11. Construction: Plastic heating chamber with direct-insertion heating element, mounted in metal housing.
 - a. Connections: 3/4 NPS ASME B1.20.1 female pipe thread.
 - b. Operating Pressure: [25 psig (175 kPa)] <Insert value>.
 - c. Pressure Rating: [80 psig (552 kPa)] <Insert value>.
 - d. Minimum Operating Flow: [0.8 gpm (3.0 L/m)] [1.2 gpm (4.5 L/m)] [1.8 gpm (6.75 L/m)] [2.8 gpm (10.5 L/m)].
 - e. Heating Element: Celcon plastic element with nichrome coil, resistance-type heating system.
 - f. Temperature Control: Microprocessor-based, to maintain temperature setpoint over full range of flows.
 - g. Enclosure: [Steel] [Stainless steel, No. 4 brushed finish] [NEMA 4] [NEMA 4X].

12. Accessories:
 - a. Enclosure: [Stainless steel, No. 4 brushed finish] [Stainless steel, No. 8 high-polish finish].
 - b. Digital readout.
 - c. Y-strainer.
 - d. Disconnect Switch: 80A, lockable, in NEMA 4X enclosure.

13. Support: Bracket for wall mounting.
14. Capacity and Characteristics:
 - a. Flow Rate: .35 – 4.5 gpm (1.3- 17 L/m) <Insert gpm (L/m)>.
 - b. Minimum Operating Flow to Activate Heater: 0.35 gpm (3.0 L/m).
 - c. Temperature Setting, Adjustable: [70 - 125 deg F (21 - 52 deg C)] [90 - 160 deg F (32 - 71 deg C)] <Insert temperature>.
 - d. Electrical Characteristics:
 - 1) Volts: [208] [240] [480] <Insert value> V, hard-wired.
 - 2) Phase: Single.
 - 3) Hertz: 60 Hz.
 - 4) Full-Load Amperes: <Insert value> A.
 - 5) Minimum Circuit Ampacity: <Insert value> A.
 - 6) Maximum Overcurrent Protection: <Insert value> A.
 - 7) Ambient Operating Temperature: 140 deg F (60 deg C), maximum.

- D. Electric, Tankless, Fixed-Temperature Three-Phase Domestic-Water Heaters - Commercial:
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Chronomite model ER Triplet Series, 3-Phase Series; or comparable product by one of the following:
 - a. A.O. Smith.
 - b. Bosch Thermotechnology Corp.
 - c. Eemax, Inc.
 - d. Stiebel Eltron, Inc.
 - e. <Insert manufacturer's name>.

2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
3. Standard: [UL 499] [UPC] for electric, tankless, (domestic-water-heater) heating appliance.
4. Construction: Plastic heating chamber with direct-insertion heating element, mounted in metal housing.
 - a. Connections: 3/4 NPS ASME B1.20.1 female pipe thread.
 - b. Operating Pressure: [25 psig (175 kPa)] <Insert value>.
 - c. Pressure Rating: [80 psig (552 kPa)] <Insert value>.
 - d. Minimum Operating Flow: [0.8 gpm (3.0 L/m)] [1.2 gpm (4.5 L/m)] [1.8 gpm (6.75 L/m)] [2.8 gpm (10.5 L/m)].
 - e. Heating Element: Celcon plastic element with nichrome coil, resistance-type heating system.
 - f. Temperature Control: Microprocessor-based, to maintain temperature setpoint over full range of flows.
 - g. Enclosure: [Steel] [Stainless steel, No. 4 brushed finish] [NEMA 4] [NEMA 4X].
5. Accessories:
 - a. Enclosure: [Stainless steel, No. 4 brushed finish] [Stainless steel, No. 8 high-polish finish].
 - b. Digital readout.
 - c. Y-strainer.
 - d. Disconnect Switch: 80A, lockable, in NEMA 4X enclosure.
6. Support: Bracket for wall mounting.
7. Capacity and Characteristics:
 - a. Flow Rate: .35 – 4.5 gpm (1.3- 17 L/m) <Insert gpm (L/m)>.
 - b. Minimum Operating Flow to Activate Heater: 0.35 gpm (3.0 L/m).
 - c. Temperature Setting, Adjustable: [70 - 125 deg F (21 - 52 deg C)] [90 - 160 deg F (32 - 71 deg C)] <Insert temperature>.
 - d. Electrical Characteristics:
 - 1) Volts: [208] [240] [480] <Insert value> V, hard-wired.
 - 2) Phase: Three.
 - 3) Hertz: 60 Hz.
 - 4) Full-Load Amperes: <Insert value> A.
 - 5) Minimum Circuit Ampacity: <Insert value> A.
 - 6) Maximum Overcurrent Protection: <Insert value> A.
 - 7) Ambient Operating Temperature: 140 deg F (60 deg C), maximum.
8. Basis-of-Design Product: Subject to compliance with requirements, provide Chronomite model ERB Series, 3-Phase Series; or comparable product by one of the following:
 - a. A.O. Smith.
 - b. Bosch Thermotechnology Corp.
 - c. Eemax, Inc.

- d. Stiebel Eltron, Inc.
 - e. <Insert manufacturer's name>.
9. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
 10. Standard: [UL 499] [UPC] for electric, tankless, (domestic-water-heater) heating appliance.
 11. Construction: Plastic heating chamber with direct-insertion heating element, mounted in metal housing.
 - a. Connections: 3/4 NPS ASME B1.20.1 female pipe thread.
 - b. Operating Pressure: [25 psig (175 kPa)] <Insert value>.
 - c. Pressure Rating: [80 psig (552 kPa)] <Insert value>.
 - d. Minimum Operating Flow: [2.6 gpm (9.75 L/m)] [6.0 gpm (22.5 L/m)] [9.0 gpm (33.75 L/m)].
 - e. Heating Element: Celcon plastic element with nichrome coil, resistance-type heating system.
 - f. Temperature Control: Microprocessor-based, to maintain temperature setpoint over full range of flows.
 - g. Enclosure: [Steel] [Stainless steel, No. 4 brushed finish] [NEMA 4] [NEMA 4X].
 12. Accessories:
 - a. Enclosure: [Stainless steel, No. 4 brushed finish] [Stainless steel, No. 8 high-polish finish].
 - b. Digital readout.
 - c. Y-strainer.
 - d. Disconnect Switch: 80A, lockable, in NEMA 4X enclosure.
 13. Support: Bracket for wall mounting.
 14. Capacity and Characteristics:
 - a. Flow Rate: .35 – 4.5 gpm (1.3- 17 L/m) <Insert gpm (L/m)>.
 - b. Minimum Operating Flow to Activate Heater: 0.35 gpm (3.0 L/m).
 - c. Temperature Setting, Adjustable: [70 - 125 deg F (21 - 52 deg C)] [90 - 160 deg F (32 - 71 deg C)] <Insert temperature>.
 - d. Electrical Characteristics:
 - 1) Volts: [208] [240] [480] <Insert value> V, hard-wired.
 - 2) Phase: Three.
 - 3) Hertz: 60 Hz.
 - 4) Full-Load Amperes: <Insert value> A.
 - 5) Minimum Circuit Ampacity: <Insert value> A.
 - 6) Maximum Overcurrent Protection: <Insert value> A.
 - 7) Ambient Operating Temperature: 140 deg F (60 deg C), maximum.

E. Flow-Control, Electric, Tankless, Domestic-Water Heaters:

1. Basis-of-Design Product: Subject to compliance with requirements, provide Chronomite; <R Series> or comparable product by one of the following:
 - a. A.O. Smith.
 - b. Bosch Thermotechnology Corp.
 - c. Eemax, Inc.
 - d. Stiebel Eltron, Inc.
 - e. <Insert manufacturer's name>.
2. Source Limitations: Obtain undercounter, tankless, domestic-water heaters from single source from single manufacturer.
3. Standard: UL 499 for electric, tankless, domestic-water-heating appliance.
4. Construction: Plastic heating chamber with direct-insertion heating element, mounted in [metal] [ABS plastic] housing.
 - a. Connections: 3/4 NPS ASME B1.20.1 male pipe thread.
 - b. Operating Pressure: [25 psig (175 kPa)] <Insert value>.
 - c. Pressure Rating: [150 psig (1035 kPa)] <Insert value>.
 - d. Minimum Operating Flow: 0.35 gpm (1.3 L/m).
 - e. Heating Element: Celcon plastic element with nichrome coil, resistance-type heating system.
 - f. Temperature Control: Microprocessor-based, to maintain temperature setpoint over full range of flows.
 - g. Enclosure: Cast aluminum, NEMA 1.
5. Accessories:
 - a. Enclosure: Stainless steel, No. 4 brushed finish.
 - b. Disconnect Switch: 80A, lockable, in NEMA 4X enclosure.
 - c. [Q-Quite,]clickless activation.
 - d. Digital readout.
6. Support: Bracket for wall mounting.
7. Capacity and Characteristics:
 - a. Flow Rate: 0.35 - 5.0 gpm (1.3 - 18.9 L/m) <Insert gpm (L/m)>.
 - b. Minimum Operating Flow to Activate Heater: 0.35 gpm (1.3 L/m).
 - c. Temperature Setting, Adjustable: 70 - 125 deg F (21 - 52 deg C).
 - d. Electrical Characteristics:
 - 1) Volts: [208] [240] [277] <Insert value> V, hard-wired.
 - 2) Phases: Single.
 - 3) Hertz: 60 Hz.
 - 4) Full-Load Amperes: <Insert value> A.
 - 5) Minimum Circuit Ampacity: <Insert value> A.
 - 6) Maximum Overcurrent Protection: <Insert value> A.
 - 7) Ambient Operating Temperature: 140 deg F (60 deg C), maximum.
8. Basis-of-Design Product: Subject to compliance with requirements, provide Chronomite; <SR Series> or comparable product by one of the following:

- a. A.O. Smith
 - b. Bosch Thermotechnology Corp.
 - c. Eemax, Inc.
 - d. Stiebel Eltron, Inc.
 - e. **<Insert manufacturer's name>**.
9. Source Limitations: Obtain undercounter, tankless, domestic-water heaters from single source from single manufacturer.
10. Standard: UL 499 for electric, tankless, domestic-water-heating appliance.
11. Construction: Plastic heating chamber with direct-insertion heating element, mounted in **[metal]** **[ABS plastic]** housing.
- a. Connections: **[3/8 inch compression fittings]** **[1/2 NPS ASME B1.20.1 male pipe thread]**.
 - b. Operating Pressure: **[25 psig (175 kPa)]** **<Insert value>**.
 - c. Pressure Rating: **[150 psig (1035 kPa)]** **<Insert value>**.
 - d. Minimum Operating Flow: **0.35 gpm (1.3 L/m)**.
 - e. Heating Element: Celcon plastic element with nichrome coil, resistance-type heating system.
 - f. Temperature Control: Microprocessor-based, to maintain temperature setpoint over full range of flows.
 - g. Enclosure: Cast aluminum, NEMA 1.
12. Accessories:
- a. Enclosure: **[PA765, ABS plastic]** **[Stainless steel, No. 4 brushed finish]** **[Stainless steel, No. 8 high-polish finish]**.
 - b. Temperature and pressure relief valve.
 - c. Disconnect Switch: 40A, lockable, in NEMA 4X enclosure.
 - d. Field Temperature Adjustment: **104 - 125 deg F (40 - 52 deg C)**.
13. Support: Integral pre-drilled tabs for wall mounting.
14. Capacity and Characteristics:
- a. Flow Rate: **[0.35 - 1.0 gpm (1.3 - 3.8 L/m)]****<Insert gpm (L/m)>**.
 - b. Minimum Operating Flow to Activate Heater: **0.35 gpm (1.3 L/m)**.
 - c. Temperature Setting: **[104 deg F (40 deg C)]** **[110 deg F (43 deg C)]** **[120 deg F (49 deg C)]** **<Insert temperature>**.
 - d. Electrical Characteristics:
 - 1) Volts: **[120]** **[240]** **[277]** **<Insert value>** V, hard-wired.
 - 2) Phase: Single.
 - 3) Hertz: 60 Hz.
 - 4) Full-Load Amperes: **<Insert value>** A.
 - 5) Minimum Circuit Ampacity: **<Insert value>** A.
 - 6) Maximum Overcurrent Protection: **<Insert value>** A.
 - 7) Ambient Operating Temperature: **140 deg F (60 deg C)**, maximum.

2.5 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Expansion Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. A. O. Smith Corporation.
 - b. AMTROL, Inc.
 - c. Flexcon Industries.
 - d. Honeywell.
 - e. Pentair Pump Group.
 - f. State Industries.
 - g. TACO Comfort Solutions, Inc.
 - h. **<Insert manufacturer's name>**.
2. Source Limitations: Obtain domestic-water expansion tanks from single source from single manufacturer.
3. 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.
4. 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 and NSF 372 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.
5. Capacity and Characteristics:
 - a. Working-Pressure Rating: **[100 psig (690 kPa)] [150 psig (1035 kPa)] <Insert value>**.
 - b. Capacity Acceptable: **[2 gal. (7.6 L)] [4 gal. (15.1 L)] [7 gal. (26.5 L)] [10 gal. (37.9 L)] <Insert value>** minimum.
 - c. Air Precharge Pressure: **<Insert system pressure>**.

B. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than **NPS 3/4 (DN 20)** with ASME B1.20.1 pipe threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement in accordance with **[ASHRAE/IES 90.1] [ASHRAE 90.2]**.

D. Heat-Trap Fittings: **[ASHRAE/IES 90.1] [ASHRAE 90.2]**.

E. Manifold Kits: Domestic-water-heater manufacturer's factory-fabricated inlet and outlet piping for field installation, for multiple domestic-water heater installation. Include ball-, butterfly-, or

gate-type shutoff valves to isolate each domestic-water heater and [calibrated] [memory-stop] balancing valves to provide balanced flow through each domestic-water heater.

1. Comply with requirements for ball-, butterfly-, or gate-type shutoff valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."
 2. Comply with requirements for balancing valves specified in Section 221119 "Domestic Water Piping Specialties."
- F. Pressure-Reducing Valves: ASSE 1003 for water. Set at ~~25-psig-~~ (172.5-kPa-) maximum outlet pressure unless otherwise indicated.
- G. 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 working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.
- H. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than working-pressure rating of domestic-water heater.
- I. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.
- J. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.
- K. Domestic-Water Heater Stands: Manufacturer's factory-fabricated steel stand for floor mounting, capable of supporting domestic-water heater and water. Include dimension that will support bottom of domestic-water heater a minimum of [18 inches (457 mm)] <Insert dimension> above the floor.
- L. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.
- 2.6 SOURCE QUALITY CONTROL
- A. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test[commercial] domestic-water heaters to minimum of one and one-half times pressure rating before shipment.
- C. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

- A. Commercial, Electric, Domestic-Water Heater Mounting: Install commercial, electric, domestic-water heaters on concrete base. Comply with requirements for concrete bases specified in Section 033000 "Cast-in-Place Concrete."
1. Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.
 2. Maintain manufacturer's recommended clearances.
 3. Arrange units so controls and devices that require servicing are accessible.
 4. 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.
 5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 7. Install anchor bolts to elevations required for proper attachment to supported equipment.
 8. Anchor domestic-water heaters to substrate.
- B. Residential, Electric, Domestic-Water Heater Mounting: Install residential, electric, domestic-water heaters [**on floor**] [**on water-heater stand on floor**] [**on domestic-water heater mounting bracket**].
1. Maintain manufacturer's recommended clearances.
 2. Arrange units so controls and devices that require servicing are accessible.
 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 domestic-water heaters to substrate.
- C. Electric, Tankless, Domestic-Water Heater Mounting: Install electric, tankless, domestic-water heaters[**at least 18 inches (457 mm) above floor**] on wall bracket.
1. Maintain manufacturer's recommended clearances.
 2. Arrange units so controls and devices that require servicing are accessible.
 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 domestic-water heaters to substrate.
- D. Install electric, domestic-water heaters level and plumb, in accordance with 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 domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified

in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

- E. Install commercial, electric, domestic-water heaters with seismic-restraint devices. Comply with requirements for seismic-restraint devices specified in [**Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."**] [**Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment."**]
- F. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-water heater 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.
- G. Install [**combination temperature-and-**]pressure relief valves in water piping for electric, domestic-water heaters without storage. Extend domestic-water heater 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.
- H. Install water-heater 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 electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."
- I. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- J. Install thermometers on inlet and outlet piping of residential, solar, electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- K. Assemble and install inlet and outlet piping manifold kits for multiple electric, domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each electric, domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each electric, domestic-water heater outlet. Comply with requirements for valves specified in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping," and comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- L. Install pressure-reducing valve with integral bypass relief valve in electric, domestic-water booster-heater inlet piping and water hammer arrester in booster-heater outlet piping. Set pressure-reducing valve for outlet pressure of [**25 psig (172 kPa)**] <Insert value>. Comply with requirements for pressure-reducing valves and water hammer arresters specified in Section 221119 "Domestic Water Piping Specialties."
- M. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.
- N. Fill electric, domestic-water heaters with water.

- O. Charge domestic-water expansion tanks with air to required system pressure.
- P. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.

3.2 PIPING CONNECTIONS

- A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

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

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections[**with the assistance of a factory-authorized service representative**].
- E. 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.
- F. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.
- G. Prepare test and inspection reports.

3.5 DEMONSTRATION

- A. **[Engage a factory-authorized service representative to train] [Train]** Owner's maintenance personnel to adjust, operate, and maintain **[commercial] [and] [tankless]**, electric, domestic-water heaters. Training shall be a minimum of **[one] [two] <Insert duration>** hour(s).

END OF SECTION 223300