SECTION 223300 - ELECTRIC, DOMESTIC-WATER HEATERS

Revise this Section by deleting and inserting text to meet Project-specific requirements.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

This Section may include provisions for LEED 2009, LEED v4, ASHRAE 189.1, IgCC, and Green Globes. Note that some sustainable design requirements are either mandatory or optional requirements and may be inserted in the Section Text using the hypertext links. Other requirements that are associated with sustainable design, and may be considered "best practice" or retained even if a sustainable design standard is not a project requirement, are discussed in the Evaluations.

1. GENERAL
	* + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			1. SUMMARY
				1. Section Includes:

Commercial, electric, domestic-water booster heaters.

Commercial, electric, storage, domestic-water heaters.

Commercial, light-duty, storage, electric, domestic-water heaters.

Residential, small-capacity, electric, domestic-water heaters.

Residential, collector-to-tank, solar, electric, domestic-water heaters.

Residential, collector-to-tank-coil, solar, electric, domestic-water heaters.

Residential, electric, storage, domestic-water heaters.

Residential, tabletop, electric, domestic-water heaters.

Flow-control, electric, tankless, domestic-water heaters.

Thermostat-control, electric, tankless, domestic-water heaters.

Domestic-water heater accessories.

* + - 1. SUBMITTALS
				1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				2. Manufacturer’s installation instructions shall be provided along with product data.
				3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
				4. Product Data: For each type of product.

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

* + - * 1. Sustainable Design Submittals:
				2. Shop Drawings:

Include diagrams for power, signal, and control wiring.

Retain "Coordination Drawings" Paragraphparagraph below for situations where limited space necessitates maximum use for efficient installation of different components or if coordination is required for installation of products and materials by separate installers. Coordinate paragraph with other Sections specifying products listed below. Preparation of coordination drawings requires the participation of each trade involved in installations within the limited space.

* + - * 1. 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.

Retain "Seismic Qualification Data" Paragraphparagraph 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.

* + - * 1. Seismic Qualification Data: Certificates, for commercial domestic-water heaters, accessories, and components, from manufacturer.

Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

Retain "Product Certificates" Paragraphparagraph below to require submittal of product certificates from manufacturers. Certificates may indicate certification that products have passed certain performance testing or compliance with standards, such as ENERGY STAR, GreenGuard, or other product certification programs.

* + - * 1. Product Certificates: For each type of [**commercial**] [**residential**] [**and**] [**tankless**], electric, domestic-water heater.

Retain "Domestic-Water Heater Labeling" Paragraphparagraph below if plumbing codes for Project area require domestic-water heaters to be independent-testing-agency certified. Verify availability for units retained.

* + - * 1. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.
				2. Source quality-control reports.

Retain "Field quality-control reports" Paragraphparagraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
				2. Sample Warranty: For special warranty.
			1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For electric, domestic-water heaters to include emergency, operation, and maintenance manuals.
			2. COORDINATION
				1. Coordinate sizes and locations of concrete bases with actual equipment provided.
			3. WARRANTY

When warranties are required, verify with Owner's counselDirector’s Representative that warranties stated in this article are not less than remedies available to Owner under prevailing local laws.

* + - * 1. Special Warranty: Manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.

Failures include, but are not limited to, the following:

Structural failures including storage tank and supports.

Faulty operation of controls.

Deterioration of metals, metal finishes, and other materials beyond normal use.

Verify available warranties and warranty periods for units and components.

Warranty Periods: From date of Substantial Completion.

Commercial, Electric, Domestic-Water Booster Heaters:

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

Commercial, Electric, Storage, Domestic-Water Heaters:

Storage Tank: [**Three**] [**Five**] <**Insert number**> years.

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

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

Storage Tank: [**Three**] [**Five**] <**Insert number**> years.

Controls and Other Components: [**Two**] [**Three**] <**Insert number**> years.

Residential, Electric, Storage, Domestic-Water Heaters:

Storage Tank: [**Five**] [**Six**] [**10**] <**Insert number**> years.

Controls and Other Components: [**Two**] [**Three**] <**Insert number**> years.

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

Expansion Tanks: [**Five**] <**Insert number**> years.

1. PRODUCTS

Manufacturers and products listed in SpecAgent and MasterWorks Paragraph Builder are neither recommended nor endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications. For definitions of terms and requirements for Contractor's product selection, see Section 016000 "Product Requirements."

See discussions on various types of electric, domestic-water heaters in the Evaluations for minimum and maximum limits on capacity and recovery of domestic-water heaters in this Section.

* + - 1. PERFORMANCE REQUIREMENTS
				1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

Retain "Seismic Performance" Paragraphparagraph below with "Seismic Qualification Data" Paragraphparagraph in "Informational Submittals" Article for projects requiring seismic design. Delete paragraph if performance requirements are indicated on Drawings. Model building codes and ASCE/SEI 7 establish criteria for buildings subject to earthquake motions. Coordinate requirements with Structural Engineer.

* + - * 1. Seismic Performance: Commercial, electric, domestic-water heaters shall withstand the effects of earthquake motions determined in accordance with [**ASCE/SEI 7**] <**Insert requirement**>.

Retain subparagraph below to define the term "withstand" as it applies to this Project. Definition varies with type of building and occupancy and is critical to valid certification. Option is used for essential facilities where equipment must operate immediately after an earthquake.

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**]."

For life-safety components required to function after an earthquake (such as fire-sprinkler systems, components that contain hazardous content, and storage racks in structures open to the public), the Component Importance Factor is 1.5. For other components, the Component Importance Factor is 1.0 unless the structure is in Seismic Use Group III and component is necessary for continued operation of facility or failure of component could impair continued operation of facility, in which case the Component Importance Factor is 1.5.

Component Importance Factor: [**1.5**] [**1.0**].

See ASCE/SEI 7, Coefficients for Architectural Component Table and Seismic Coefficients for Mechanical and Electrical Components Table for requirements to be inserted in subparagraph below.

<**Insert requirements for Component Amplification Factor and Component Response Modification Factor**>.

Compliance with ASHRAE/IES 90.1 is required by LEED 2009, LEED v4, IgCC, ASHRAE 189.1, and Green Globes and may be required even when they do not apply.

* + - * 1. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.
				2. 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.
				3. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.
			1. COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

Domestic-water heaters in "Commercial, Electric, Domestic-Water Booster Heaters" Paragraphparagraph below are for at least 180 deg F (82 deg C) hot-water supply to dishwashers.

* + - * 1. Commercial, Electric, Domestic-Water Booster Heaters:

Source Limitations: Obtain domestic-water booster heaters from single source from single manufacturer.

Source Limitations: Obtain domestic-water booster heaters from single source from single manufacturer.

Standard: UL 1453.

Tank Construction: [**Corrosion-resistant metal**] [**or**] [**steel**].

Tappings: ASME B1.20.1 pipe thread.

Pressure Rating: 150 psig (1035 kPa).

Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.

Factory-Installed Tank Appurtenances:

Anode Rod: Replaceable magnesium.

Drain Valve: Corrosion-resistant metal with hose-end connection.

Insulation: Comply with ASHRAE/IES 90.1.

Jacket: Rectangular shaped, with stainless steel front panel, unless otherwise indicated.

Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.

Option: Booster heaters with total of 9 kW or less may have one, two, or three elements.

Temperature Control: Adjustable thermostat, to setting of at least 180 deg F (82 deg C).

Safety Controls: High-temperature-limit and low-water cutoff devices or systems.

Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valve. Include relieving capacity at least as great as heat input, andinput and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.

Gauges: Combination temperature-and-pressure type or separate thermometer and pressure gauge.

Retain "Special Requirements" Subparagraphsubparagraph below if domestic-water heater is required for foodservice equipment. Verify that NSF compliance is available for selected domestic-water heater.

Special Requirements: NSF 5 construction with [**brackets for undercounter**] [**legs for floor**] installation.

* + - * 1. Commercial, Electric, Storage, Domestic-Water Heaters:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2379) Subject to compliance with requirements, provide products by one of the following:

[A. O. Smith Corporation](http://www.specagent.com/Lookup?uid=123457143686).

[Bradford White Corporation](http://www.specagent.com/Lookup?uid=123457143674).

[Chronomite Laboratories, Inc; a division of Morris Group International](http://www.specagent.com/Lookup?uid=123457206883).

[Hubbell Electric Heater Co](http://www.specagent.com/Lookup?uid=123457143687).

Or equal.

Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.

Standard: UL 1453.

Storage-Tank Construction: [**Non-**]ASME-code, steel [**horizontal**] [**vertical**] arrangement.

Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.

NPS 2 (DN 50) and Smaller: Threaded ends in accordance with ASME B1.20.1.

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.

Pressure Rating: [**150 psig (1035 kPa)**] <**Insert value**>.

Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.

Factory-Installed, Storage-Tank Appurtenances:

Anode Rod: Replaceable magnesium.

Drain Valve: Corrosion-resistant metal with hose-end connection.

Insulation: Comply with ASHRAE/IES 90.1.

Jacket: Steel with enameled finish or high-impact composite material.

Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.

Temperature Control: Adjustable thermostat.

Safety Controls: High-temperature-limit and low-water cutoff devices or systems.

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, andinput 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.

Retain "Special Requirements" Subparagraphsubparagraph below if domestic-water heater is required for foodservice equipment. Verify that NSF compliance is available for selected domestic-water heater.

Special Requirements: NSF 5 construction.

* + - * 1. Commercial, Light-Duty, Storage, Electric, Domestic-Water Heaters:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2380) Subject to compliance with requirements, provide products by one of the following:

[A. O. Smith Corporation](http://www.specagent.com/Lookup?uid=123457143704).

[Bradford White Corporation](http://www.specagent.com/Lookup?uid=123457143699).

[Hubbell Electric Heater Co](http://www.specagent.com/Lookup?uid=123457143705).

Or equal.

Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.

Commercial, light-duty, storage, electric, domestic-water heaters are limited to 120-gal. (454-L) capacity. These commercial domestic-water heaters are covered by UL 174 for residential domestic-water heaters.

Standard: UL 174.

Storage-Tank Construction: Steel, vertical arrangement.

Tappings: ASME B1.20.1 pipe thread.

Pressure Rating: 150 psig (1035 kPa).

Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.

Factory-Installed, Storage-Tank Appurtenances:

Anode Rod: Replaceable magnesium.

Dip Tube: Required unless cold-water inlet is near bottom of tank.

Drain Valve: Corrosion-resistant metal with hose-end connection.

Insulation: Comply with ASHRAE/IES 90.1.

Jacket: Steel with enameled finish or high-impact composite material.

Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.

Heating Elements: Electric, screw-in immersion type.

Temperature Control: Adjustable thermostat.

Safety Control: High-temperature-limit cutoff device or system.

Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, andinput and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.

Retain "Special Requirements" Subparagraphsubparagraph below if domestic-water heater is required for foodservice equipment. Verify that NSF compliance is available for selected domestic-water heater.

Special Requirements: NSF 5 construction with legs for off-floor installation.

If more than one commercial, electric, domestic-water heater is required on Project, delete "Capacity and Characteristics" Paragraphparagraph below and schedule commercial, electric, domestic-water heaters on Drawings.

* + - * 1. Capacity and Characteristics:

Capacity: <**Insert gal. (L)**>.

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.

Temperature Setting: [**125 deg F (52 deg C)**] [**140 deg F (60 deg C)**] [**180 deg F (82 deg C)**] <**Insert temperature**>.

Power Demand: <**Insert kilowatts**>.

Heating Elements:

Number of Elements: [**Two**] [**Three**] [**Six**] [**Nine**] <**Insert number**>.

Kilowatts Each Element: <**Insert kilowatts**>.

Number of Stages: [**One**] [**Two**] [**Three**] [**Four**] <**Insert number**>.

Electrical Characteristics:

Volts: [**120**] [**240**] [**277**] [**480**] <**Insert value**> V.

Phases: [**Single**] [**Three**].

Hertz: 60 Hz.

Full-Load Amperes: <**Insert value**> A.

Minimum Circuit Ampacity: <**Insert value**> A.

Maximum Overcurrent Protection: <**Insert value**> A.

* + - 1. RESIDENTIAL, ELECTRIC, DOMESTIC-WATER HEATERS
				1. Residential, Small-Capacity, Electric, Domestic-Water Heaters:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2381) Subject to compliance with requirements, provide products by one of the following:

[A. O. Smith Corporation](http://www.specagent.com/Lookup?uid=123457143716).

[Bradford White Corporation](http://www.specagent.com/Lookup?uid=123457143706).

[Eemax, Inc.; a Rheem brand](http://www.specagent.com/Lookup?uid=123457197276).

Or equal.

Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.

Residential, small-capacity, electric, domestic-water heaters are limited to between 1- and 5-gal. (3.8- and 18.9-L) capacity.

Standard: UL 174.

Verify availability if option in "Storage-Tank Construction" Subparagraphsubparagraph below is required.

Storage-Tank Construction: Corrosion-resistant metal[**or steel with corrosion-resistant coating**].

Tappings: ASME B1.20.1 pipe thread.

Pressure Rating: 150 psig (1035 kPa).

Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.

Factory-Installed, Storage-Tank Appurtenances:

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."

Insulation: Comply with [**ASHRAE/IES 90.1**] [**ASHRAE 90.2**].

Jacket: Steel with enameled finish or high-impact composite material.

Heating Element: One; electric, screw-in immersion type.

Temperature Control: Adjustable thermostat.

Safety Control: High-temperature-limit cutoff device or system.

Power Supply Cord: 24 to 72 inches (610 to 1830 mm) with plug.

Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, andinput and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.

* + - * 1. Residential, Collector-to-Tank, Solar, Electric, Domestic-Water Heaters:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2383) Subject to compliance with requirements, provide products by one of the following:

[Bradford White Corporation](http://www.specagent.com/Lookup?uid=123457143722).

[Lochinvar, LLC](http://www.specagent.com/Lookup?uid=123457143723).

[Rheem Manufacturing Company](http://www.specagent.com/Lookup?uid=123457143719).

Or equal.

Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.

Residential, collector-to-tank, solar, electric, domestic-water heaters are limited to 120-gal. (454-L) capacity.

Standard: UL 174 with piping and electrical connections for UL 1279 solar collector system.

Storage-Tank Construction: Steel.

Tappings: ASME B1.20.1 pipe thread.

Pressure Rating: 150 psig (1035 kPa).

Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.

Factory-Installed, Storage-Tank Appurtenances:

Sensor electrical connections and tank stud for sensor.

Anode Rod: Replaceable magnesium.

Dip Tube: Required unless cold-water inlet is near bottom of tank.

Drain Valve: Corrosion-resistant metal with hose-end connection.

Insulation: Comply with [**ASHRAE/IES 90.1**] [**ASHRAE 90.2**].

Jacket: Steel with enameled finish.

Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.

Heating Element: Electric, screw-in immersion type.

Temperature Control: Adjustable thermostat.

Safety Control: High-temperature-limit cutoff device or system.

Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, andinput and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.

* + - * 1. Residential, Collector-to-Tank-Coil, Solar, Electric, Domestic-Water Heaters:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2385) Subject to compliance with requirements, provide products by one of the following:

[Alternate Energy Technologies, LLC](http://www.specagent.com/Lookup?uid=123457143724).

[Bradford White Corporation](http://www.specagent.com/Lookup?uid=123457143727).

[Hubbell Electric Heater Co](http://www.specagent.com/Lookup?uid=123457143728).

Or equal.

Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.

Residential, collector-to-tank-coil, solar, electric, domestic-water heaters are limited to 120-gal. (454-L) capacity.

Standard: UL 174 with integral coil-type heat exchanger.

Storage-Tank Construction: Steel.

Tappings: ASME B1.20.1 pipe thread.

Pressure Rating: 150 psig (1035 kPa).

Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.

Factory-Installed, Storage-Tank Appurtenances:

Anode Rod: Replaceable magnesium.

Dip Tube: Required unless cold-water inlet is near bottom of tank.

Drain Valve: Corrosion-resistant metal with hose-end connection.

Insulation: Comply with [**ASHRAE/IES 90.1**] [**ASHRAE 90.2**].

Jacket: Steel with enameled finish or high-impact composite material.

Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.

Heat Exchanger: Corrosion-resistant-metal immersion coil.

Heating Element: Electric, screw-in immersion type.

Temperature Control: Adjustable thermostat.

Safety Control: High-temperature-limit cutoff device or system.

Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, andinput and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.

* + - * 1. Residential, Electric, Storage, Domestic-Water Heaters:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2386) Subject to compliance with requirements, provide products by one of the following:

[A. O. Smith Corporation](http://www.specagent.com/Lookup?uid=123457143739).

[Bradford White Corporation](http://www.specagent.com/Lookup?uid=123457143736).

[Rheem Manufacturing Company](http://www.specagent.com/Lookup?uid=123457143730).

Or equal.

Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.

Residential, electric, storage, domestic-water heaters are limited to between 6- and 120-gal. (22.7- and 454-L) capacity.

Standard: UL 174.

Storage-Tank Construction: Steel.

Tappings: ASME B1.20.1 pipe thread.

Pressure Rating: 150 psig (1035 kPa).

Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.

Factory-Installed, Storage-Tank Appurtenances:

Anode Rod: Replaceable magnesium.

Dip Tube: Required unless cold-water inlet is near bottom of tank.

Drain Valve: Corrosion-resistant metal with hose-end connection.

Insulation: Comply with [**ASHRAE/IES 90.1**] [**ASHRAE 90.2**].

Jacket: Steel, cylindrical, with enameled finish or high-impact composite material.

Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.

Heating Elements: Electric, screw-in immersion type.

Temperature Control: Adjustable thermostat.

Safety Control: High-temperature-limit cutoff device or system.

Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, andinput and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.

* + - * 1. Residential, Tabletop, Electric, Domestic-Water Heaters:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2387) Subject to compliance with requirements, provide products by one of the following:

[A. O. Smith Corporation](http://www.specagent.com/Lookup?uid=123457143745).

[American Water Heaters](http://www.specagent.com/Lookup?uid=123457143741).

[Rheem Manufacturing Company](http://www.specagent.com/Lookup?uid=123457143743).

Or equal.

Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.

Residential, tabletop, electric, domestic-water heaters are limited to between 6- and 120-gal. (22.7- and 454-L) capacity.

Standard: UL 174.

Storage-Tank Construction: Steel.

Tappings: ASME B1.20.1 pipe thread.

Pressure Rating: 150 psig (1035 kPa).

Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.

Factory-Installed, Storage-Tank Appurtenances:

Anode Rod: Replaceable magnesium.

Dip Tube: Required unless cold-water inlet is near bottom of tank.

Drain Valve: Corrosion-resistant metal with hose-end connection.

Insulation: Comply with [**ASHRAE/IES 90.1**] [**ASHRAE 90.2**].

Jacket: Steel, rectangular, with flat-top work surface, raised back, and enameled finish.

Heat-Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.

Heating Elements: Electric, screw-in immersion type.

Temperature Control: Adjustable thermostat.

Safety Control: High-temperature-limit cutoff device or system.

Relief Valve: ASME rated and stamped for combination temperature-and-pressure relief valves. Include relieving capacity at least as great as heat input, andinput and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valve with sensing element that extends into storage tank.

If more than one residential, electric, domestic-water heater is required on Project, delete "Capacity and Characteristics" Paragraphparagraph below and schedule residential, electric, domestic-water heaters on Drawings.

* + - * 1. Capacity and Characteristics:

Capacity: <**Insert gal. (L)**>.

Recovery: <**Insert gph (L/s)**> at [**100 deg F (56 deg C)**] <**Insert temperature**> temperature rise.

Temperature Setting: [**125 deg F (52 deg C)**] <**Insert temperature**>.

Power Demand: <**Insert kilowatts**>.

Heating Elements: <**Insert kilowatts**>.

Electrical Characteristics:

Volts: [**120**] [**240**] <**Insert value**> V.

Phases: [**Single**] [**Three**].

Hertz: 60 Hz.

Full-Load Amperes: <**Insert value**> A.

Minimum Circuit Ampacity: <**Insert value**> A.

Maximum Overcurrent Protection: <**Insert value**> A.

* + - 1. ELECTRIC, TANKLESS, DOMESTIC-WATER HEATERS
				1. Flow-Control, Electric, Tankless, Domestic-Water Heaters:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2389) Subject to compliance with requirements, provide products by one of the following:

[Bradford White Corporation](http://www.specagent.com/Lookup?uid=123457143693).

[Chronomite Laboratories, Inc; a division of Morris Group International](http://www.specagent.com/Lookup?uid=123457143690).

[Eemax, Inc.; a Rheem brand](http://www.specagent.com/Lookup?uid=123457143691).

Or equal.

Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.

Standard: UL 499 for electric, tankless, (domestic-water-heater) heating appliance.

Construction: Copper piping or tubing complying with NSF 61 and NSF 372 barrier materials for potable water, without storage capacity.

Connections: ASME B1.20.1 pipe thread.

Pressure Rating: [**150 psig (1035 kPa)**] <**Insert value**>.

Heating Element: Resistance heating system.

Temperature Control: Flow-control fitting.

Safety Control: High-temperature-limit cutoff device or system.

Jacket: Aluminum or steel with enameled finish or plastic.

Support: Bracket for wall mounting.

If more than one flow-control, electric, tankless, domestic-water heater is required on Project, delete "Capacity and Characteristics" Subparagraphsubparagraph below and schedule flow-control, electric, tankless, domestic-water heaters on Drawings.

Capacity and Characteristics:

Flow Rate: <**Insert gpm (L/s)**>.

Maximum Temperature Setting: <**Insert temperature**>.

Power Demand: <**Insert kilowatts**>.

Electrical Characteristics:

Volts: [**120**] [**240**] [**277**] [**480**] <**Insert value**> V.

Phases: [**Single**] [**Three**].

Hertz: 60 Hz.

Full-Load Amperes: <**Insert value**> A.

Minimum Circuit Ampacity: <**Insert value**> A.

Maximum Overcurrent Protection: <**Insert value**> A.

* + - * 1. Thermostat-Control, Electric, Tankless, Domestic-Water Heaters:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=2390) Subject to compliance with requirements, provide products by one of the following:

[Bradford White Corporation](http://www.specagent.com/Lookup?uid=123457143661).

[Chronomite Laboratories, Inc; a division of Morris Group International](http://www.specagent.com/Lookup?uid=123457143655).

[Eemax, Inc.; a Rheem brand](http://www.specagent.com/Lookup?uid=123457197275).

Or equal.

Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.

Standard: UL 499 for electric, tankless, (domestic-water-heater) heating appliance.

Construction: Copper piping or tubing complying with NSF 61 and NSF 372 barrier materials for potable water, without storage capacity.

Connections: ASME B1.20.1 pipe thread.

Pressure Rating: [**150 psig (1035 kPa)**] <**Insert value**>.

Heating Element: Resistance heating system.

Temperature Control: Thermostat.

Safety Control: High-temperature-limit cutoff device or system.

Jacket: Aluminum or steel with enameled finish or plastic.

Support: Bracket for wall mounting.

If more than one thermostat-control, electric, tankless, domestic-water heater is required on Project, delete "Capacity and Characteristics" Subparagraphsubparagraph below and schedule thermostat-control, electric, tankless, domestic-water heaters on Drawings.

Capacity and Characteristics:

Flow Rate: <**Insert gpm (L/s)**> at [**100 deg F (56 deg C)**] <**Insert temperature**> temperature rise.

Temperature Setting: [**125 deg F (52 deg C)**] [**140 deg F (60 deg C)**] <**Insert temperature**>.

Power Demand: <**Insert kilowatts**>.

Electrical Characteristics:

Volts: [**120**] [**240**] [**277**] [**480**] <**Insert value**> V.

Phases: [**Single**] [**Three**].

Hertz: 60 Hz.

Full-Load Amperes: <**Insert value**> A.

Minimum Circuit Ampacity: <**Insert value**> A.

Maximum Overcurrent Protection: <**Insert value**> A.

* + - 1. DOMESTIC-WATER HEATER ACCESSORIES

Retain "Domestic-Water Expansion Tanks" Paragraphparagraph below only if small, non-ASME-code, diaphragm tanks with a capacity of 25 gal. (95 L) or less are required. Small tanks are usually available with 150-psig (1035-kPa) working-pressure rating. Large tanks are usually available with 100-psig (690-kPa) working-pressure rating. A multiple small-tank arrangement may be used to match system pressure and volume requirements. Other expansion tanks are specified in Section 221216 "Facility Elevated, Potable-Water Storage Tanks" or Section 221219 "Facility Ground-Mounted, Potable-Water Storage Tanks."

* + - * 1. Domestic-Water Expansion Tanks:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=13514) Subject to compliance with requirements, provide products by one of the following:

[A. O. Smith Corporation](http://www.specagent.com/Lookup?uid=123457143752).

[AMTROL, Inc](http://www.specagent.com/Lookup?uid=123457143747).

[Honeywell International Inc](http://www.specagent.com/Lookup?uid=123457143749).

Or equal.

Source Limitations: Obtain domestic-water expansion tanks from single source from single manufacturer.

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.

Construction:

Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.

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.

Air-Charging Valve: Factory installed.

If more than one domestic-water expansion tank is required on Project, delete "Capacity and Characteristics" Subparagraphsubparagraph below and schedule domestic-water expansion tanks on Drawings.

Capacity and Characteristics:

Working-Pressure Rating: [**100 psig (690 kPa)**] [**150 psig (1035 kPa)**] <**Insert value**>.

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.

Air Precharge Pressure: <**Insert system pressure**>.

* + - * 1. 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.
				2. Piping-Type Heat Traps: Field-fabricated piping arrangement in accordance with [**ASHRAE/IES 90.1**] [**ASHRAE 90.2**].
				3. Heat-Trap Fittings: [**ASHRAE/IES 90.1**] [**ASHRAE 90.2**].

Retain "Manifold Kits" Paragraphparagraph below only if required for multiple domestic-water heater arrangement. Verify availability. Some domestic-water-heater manufacturers can provide piping manifold kits for their domestic-water heaters. Larger manifolds can be field fabricated from water piping and valves.

* + - * 1. 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.

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."

Comply with requirements for balancing valves specified in Section 221119 "Domestic Water Piping Specialties."

* + - * 1. Pressure-Reducing Valves: ASSE 1003 for water. Set at 25-psig- (172.5-kPa-) maximum outlet pressure unless otherwise indicated.

Relief valves in "Combination Temperature-and-Pressure Relief Valves," "Pressure Relief Valves," and "Vacuum Relief Valves" paragraphs below are for installation in piping or where no relief valve is specified with the domestic-water heater.

* + - * 1. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, andinput and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.
				2. Pressure Relief Valves: ASME rated and stamped. Include pressure setting less than working-pressure rating of domestic-water heater.
				3. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4.
				4. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

Indicate on Drawings where each type of domestic-water heater support in "Domestic-Water Heater Stands" and "Domestic-Water Heater Mounting Brackets" paragraphs below is required. Delete support types not required. Domestic-water heaters can also be installed at or above ceilings on suspended platforms or brackets.

* + - * 1. 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.
				2. Domestic-Water Heater Mounting Brackets: Manufacturer's factory-fabricated steel bracket for wall mounting, capable of supporting domestic-water heater and water.
			1. SOURCE QUALITY CONTROL

Retain "Factory Tests" Paragraphparagraph below for factory-assembled domestic-water heaters. Factory tests are an added cost option and may not be available from some manufacturers. Verify requirement with Owner.

* + - * 1. Factory Tests: Test and inspect domestic-water heaters specified to be ASME-code construction, in accordance with ASME Boiler and Pressure Vessel Code.

Retain option in first paragraph below if testing of only commercial domestic-water heaters is required.

* + - * 1. Hydrostatically test[**commercial**] domestic-water heaters to minimum of one and one-half times pressure rating before shipment.

See Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

* + - * 1. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.
				2. Prepare test and inspection reports.
1. EXECUTION
	* + 1. DOMESTIC-WATER HEATER INSTALLATION
				1. 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."

Exception: Omit concrete bases for commercial, electric, domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.

Maintain manufacturer's recommended clearances.

Arrange units so controls and devices that require servicing are accessible.

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.

For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

Install anchor bolts to elevations required for proper attachment to supported equipment.

Anchor domestic-water heaters to substrate.

Retain second or third option in "Residential, Electric, Domestic-Water Heater Mounting" Paragraphparagraph below if domestic-water heaters (possible source of ignition) will be installed in a location where hazardous fumes can accumulate.

* + - * 1. 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**].

Maintain manufacturer's recommended clearances.

Arrange units so controls and devices that require servicing are accessible.

Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

Install anchor bolts to elevations required for proper attachment to supported equipment.

Anchor domestic-water heaters to substrate.

Retain option in "Electric, Tankless, Domestic-Water Heater Mounting" Paragraphparagraph below if domestic-water heaters (possible source of ignition) will be installed in a location where hazardous fumes can accumulate.

* + - * 1. Electric, Tankless, Domestic-Water Heater Mounting: Install electric, tankless, domestic-water heaters[**at least 18 inches (457 mm) above floor**] on wall bracket.

Maintain manufacturer's recommended clearances.

Arrange units so controls and devices that require servicing are accessible.

Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

Install anchor bolts to elevations required for proper attachment to supported equipment.

Anchor domestic-water heaters to substrate.

* + - * 1. 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.

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."

Retain first paragraph below if domestic-water heaters are required to withstand seismic design loads. Insert special requirements for seismic restraints here or detail on Drawings.

* + - * 1. 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."**]
				2. 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.
				3. 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.
				4. 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."
				5. 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."
				6. 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."
				7. 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."
				8. 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."
				9. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.
				10. Fill electric, domestic-water heaters with water.
				11. Charge domestic-water expansion tanks with air to required system pressure.
				12. 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.
			1. PIPING CONNECTIONS

Coordinate piping installations and specialty arrangements with Drawings and with requirements specified in piping systems. If Drawings are explicit enough, these requirements may be reduced or omitted.

* + - * 1. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
				2. 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.
			1. IDENTIFICATION
				1. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."
			2. FIELD QUALITY CONTROL

Retain one of first four paragraphs below. Retain first "Testing Agency" Paragraphparagraph below if Owner will hire an independent testing agency.

* + - * 1. Testing Agency: Director’s Representative will engage a qualified testing agency to perform tests and inspections.

Retain "Testing Agency" Paragraphparagraph below to require Contractor to hire an independent testing agency.

* + - * 1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

Retain "Manufacturer's Field Service" Paragraphparagraph below to require a factory-authorized service representative to perform tests and inspections.

* + - * 1. Manufacturer's Field Service: Engage a Company Field Advisor per OGS Spec Section 014216factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

Retain "Perform tests and inspections" Paragraphparagraph below to require Contractor to perform tests and inspections and retain option to require Contractor to arrange for the assistance of a factory-authorized service agent.

* + - * 1. Perform tests and inspections[**with the Company Field Advisor per OGS Spec Section 014216assistance of a factory-authorized service representative**].

Retain test requirements below with any combination of paragraphs above.

* + - * 1. Tests and Inspections:

Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.

Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

See Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

* + - * 1. Electric, domestic-water heaters will be considered defective if they do not pass tests and inspections.
				2. Prepare test and inspection reports.
			1. DEMONSTRATION

Retain this article for commercial and tankless, electric, domestic-water heaters.

* + - * 1. [**Engage a Company Field Advisor per OGS Spec Section 014216factory-authorized service representative to train**] [**Train**] Director’s Representative's Facility’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