

**SECTION 22 34 00
FUEL-FIRED DOMESTIC WATER HEATERS**

SPEC WRITER NOTES:

1. Delete between //----// if not applicable to project. Also delete any other item or paragraph not applicable in the section and renumber the paragraphs.
2. The "Safe Drinking Water Act" (SDWA) was originally passed into law in 1974. It was amended several times. The "Reduction of Lead in Drinking Water Act" was passed in January 2011 and amends the SDWA to the new lead free standard to include NSF 61 and NSF 372.
3. Federal agencies are required by law to purchase products that are designated by the Federal Energy Management Program (FEMP) or qualified by ENERGY STAR. Ensure that the efficiencies are equal to or greater than the required values released by FEMP. These values can be found at: <http://www1.eere.energy.gov/femp>.
4. If solar domestic water heating is deemed economically feasible, refer to Section 23 56 00, SOLAR ENERGY HEATING SYSTEM for specification requirements.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section describes the requirements for installing a complete gas fired domestic water heating system ready for operation including water heaters, thermometers, and all necessary accessories, connections, and equipment.
- B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- //D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.//
- //E. Section 03 30 00, CAST-IN-PLACE CONCRETE: Concrete and Grout.//
- F. Section 09 91 00, PAINTING: Preparation and finish painting.
- //G. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Seismic Restraint for Equipment.//

- H. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- I. Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING.
- J. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING.
- K. Section 22 07 11, PLUMBING INSULATION.
- //L. Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.//
- M. Section 22 11 00, FACILITY WATER DISTRIBUTION: Piping, Fittings, Valves and Gages.
- N. Section 22 11 23, DOMESTIC WATER PUMPS: Circulating Pump.
- O. Section 23 56 00, SOLAR ENERGY HEATING SYSTEM.

1.3 APPLICABLE PUBLICATIONS

SPEC WRITER NOTE: Make material requirements agree with applicable requirements specified in the referenced Applicable Publications. Verify and update the publication list to that which applies to the project, unless the reference applies to all plumbing systems. Publications that apply to all plumbing systems may not be specifically referenced in the body of the specification, but, shall form a part of this specification.

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standard Institute (ANSI):
 - Z21.10.1-2013.....Gas Water Heaters - Volume 1, Storage Water Heaters with Input Ratings of 75,000 Btu per hour or less
 - Z21.10.3-2013.....Gas-Fired Water Heaters, Volume III, Storage Water Heaters with Input Ratings Above 75,000 Btu per hour, Circulating and Instantaneous
 - Z21.15B-2013.....Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves
 - Z21.18B-2012.....Gas Appliance Pressure Regulators
 - Z21.20A-2010 (R2012)....Automatic Electrical Controls for Household and Similar Use
 - Z21.21-2012.....Automatic Valves for Gas Appliance
 - Z21.22B-2001 (R2008)....Relief Valves for Hot Water Supply Systems
 - Z21.66-1996 (R2001)....Automatic Vent Damper Devices for Use With Gas-Fired Appliances

- C. American Society for Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
 - 90.1-(2013).....Energy Standard for Buildings Except Low-Rise Residential Buildings
- D. American Society of Mechanical Engineers (ASME):
 - ASME Boiler and Pressure Vessel Code -
 - BPVC Section IV-2013....Rules for Construction of Heating Boilers
 - BPVC Section VIII-1-2013 Rules for Construction of Pressure Vessels, Division 1
 - Form U-1.....Manufacturer's Data Report for Pressure Vessels
 - B1.20.1-2013).....Pipe Threads, General Purpose (Inch)
 - B16.5-2013.....Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard
 - B16.24-2011.....Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500
 - CSD-1-2012.....Controls and Safety Devices for Automatically Fired Boilers
- E. American Society of Sanitary Engineering (ASSE):
 - 1005-1999.....Performance Requirements for Water Heater Drain Valves, 3/4 inch size
- F. National Electrical Manufacturers Association (NEMA):
 - ICS 6-2011.....Industrial Control and Systems: Enclosures
- G. National Fire Protection Association (NFPA):
 - 54-2012.....National Fuel Gas Code
 - 70-2011.....National Electrical Code (NEC)
- H. NSF International (NSF):
 - 5-2012.....Water Heaters, Hot Water Supply Boilers, and Heat Recovery Equipment
 - 61-2012.....Drinking Water System Components - Health Effects
 - 372-2011.....Drinking Water System Components - Lead Content
- I. Underwriters Laboratories, Inc. (UL):
 - 429-2013.....Standard for Electrically Operated Valves
 - 795-2011.....Standard for Commercial-Industrial Gas Heating Equipment

1.4 SUBMITTALS

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 34 00, FUEL-FIRED DOMESTIC WATER HEATERS", with applicable paragraph identification.
- C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
 - 1. Water Heaters.
 - 2. Pressure and Temperature Relief Valves.
 - 3. Thermometers.
 - 4. Pressure Gages.
 - 5. Vacuum Breakers.
 - 6. Expansion Tanks.
 - 7. Heat Traps.
 - 8. Gas Shut-off Valves.
 - 9. Motorized Gas Valves.
 - 10. Gas Pressure Regulators.
 - 11. Manifold Kits.
- D. For each gas fired domestic hot water heater type and size, the following characteristics shall be submitted:
 - 1. Rated Capacities
 - 2. Operating characteristics
 - 3. Electrical characteristics
 - 4. Furnished specialties and accessories
 - 5. A form U-1 or other documentation stating compliance with the ASME Boiler and Pressure Vessel Code.
- E. Shop drawings shall include wiring diagrams for power, signal and control functions.
- //F. Seismic qualification certificates shall be submitted that details equipment anchorage components identifies equipment center of gravity with mounting and anchorage provisions, and whether the seismic qualification certificate is based on an actual test or calculations.//
- G. Submit documentation indicating compliance with applicable requirements of ASHRAE 90.1 or Energy Star for Service Water Heating.

SPEC WRITER NOTE: Coordinate O&M Manual and commissioning requirements with Section 01 00 00, GENERAL REQUIREMENTS and Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS. O&M Manuals shall be submitted for content review as part of closeout documents.

- H. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replaceable parts:
1. Include complete list indicating all components of the systems.
 2. Include complete diagrams of the internal wiring for each item of equipment.
 3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

//I. Completed System Readiness Checklist provided by the Commissioning Agent and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.//

//J. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.//

1.5 QUALITY ASSURANCE

SPEC WRITER NOTE: Gas water heaters up to 530 liters (140 gallons) are covered under the FEMP and the ENERGY STAR program. Verify the latest minimum efficiencies with corresponding tank capacities are specified. Use ASHRAE 90.1 for tank sizes greater than 530 liters (140 gallons).

- A. //Gas water heaters up to 530 liters (140 gallons) are covered under the FEMP and the ENERGY STAR program. Federal laws and executive orders mandate the purchase of gas water heaters that meet or exceed the ENERGY STAR listed minimum efficiency.// Comply with American Society of Heating, Refrigerating and Air- Conditioning Engineers (ASHRAE) for efficiency performance ASHRAE 90.1, "Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings for commercial water heaters."
- B. Electrical components, devices and accessories shall be listed and labeled as defined in NFPA 70 by a qualified testing agency, and marked for intended location and application.

- C. ASME code construction shall be a vessel fabricated in compliance with the ASME BPVC Section VIII-1.
- D. Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.
- //E. The gas fired domestic water heater shall conform to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS on seismic restraint requirements, withstanding seismic movement without separation of any parts from the equipment when subjected to a seismic event. //
- F. The domestic water heater shall be certified and labeled by an independent testing agency.
- G. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit <http://www.biopreferred.gov>.

1.6 AS-BUILT DOCUMENTATION

SPEC WRITER NOTE: Coordinate O&M Manual and commissioning requirements with Section 01 00 00, GENERAL REQUIREMENTS and Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.

- A. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.
- B. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings

are to be provided, and a copy of them on Auto-Cad version //____// provided on compact disk or DVD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.

PART 2 - PRODUCTS

SPEC WRITER NOTES:

1. Coordinate and assure that the electrical characteristics specified below are clearly shown on appropriate drawings. Coordinate with Electrical Engineer.
2. Gas water heaters up to 530 liters (140 gallons) are covered under the FEMP and the ENERGY STAR program. Verify the latest minimum efficiencies and maximum surface loss criteria with corresponding tank capacities are specified. Use ASHRAE 90.1 for tank sizes greater than 530 liters (140 gallons).
3. Heaters shall be capable of withstanding thermal and/or chemical eradication procedures to control bacteria.
4. Ensure stated temperature settings are in compliance with latest VA directive for hot water storage units.

2.1 ATMOSPHERIC GAS FIRED, STORAGE DOMESTIC WATER HEATERS

- A. The gas fired domestic water heater shall comply with // ANSI Z21.10.1 // ANSI Z21.10.3 //. Provide with access for cleaning and disinfection.
- B. The water heater design shall provide a combustion efficiency of at least //82// //84// //85// //88// //95// percent at operating conditions. Water heater capacities are scheduled on the drawings.
- C. The vessel shall be ASME BPVC Section VIII-1, Steel, //glass// //cement// lined, fabricated with a pressure rating of 1035 kPa (150 psig). Tank shall comply with NSF 61 and NSF 372 for barrier materials for potable-water tank linings.
- D. The tappings (openings) shall be factory fabricated of materials compatible with the tank and in accordance with appropriate ASME standards for piping connections, pressure and temperature relief valve, pressure gauge, thermometer, drain valve, anode rods and controls. The tappings shall be in accordance with ASME standards listed below:

1. 50 mm or DN50 (2 inch) and smaller: Threaded ends according to ASME B1.20.1.
 2. 65 mm or DN65 (2-1/2 inch) and larger: Flanged ends according to ASME B16.5 for steel and stainless steel flanges, and according to ASME B16.24.
- E. The gas fired burner shall include the following:
1. Thermostatically adjustable.
 2. High temperature limit and low water cutoff devices for safety controls.
 3. Automatic ignition in accordance with ANSI Z21.20.
 4. Automatic damper in accordance with ANSI Z21.66. The automatic dampers shall be //electrically operated// //mechanically activated// //thermally activated//, automatic vent damper device with size matching draft hood for 300,000 BTUH and below.
- F. Temperature Setting shall be set for a minimum water temperature of 60 degrees C (140 degrees F). The temperature setting shall be adjustable. Heaters shall be capable of raising the discharge temperature to 77 to 82 degrees C (170 to 180 degrees F) for thermal eradication.
- G. The insulation shall surround the entire storage tank except connection and controls and shall comply with ASHRAE 90.1.
- H. The jacket shall be steel with enameled finish.
- I. The drain valve shall be corrosion resistant metal complying with ASSE 1005.
- J. The anode rod shall be replaceable magnesium.
- K. The Combination Pressure and Temperature relief Valve shall be ANSI Z21.22 rated and constructed of all brass or bronze with a self-closing reseating valve.
- L. Special requirements: NSF 5 construction.

2.2 POWER VENT, GAS FIRED, STORAGE DOMESTIC WATER HEATERS

- A. The gas fired domestic water heater shall comply with // ANSI Z21.10.1 // ANSI Z21.10.3 //. Provide with access for cleaning and disinfection.
- B. The water heater design shall provide a combustion efficiency of at least //82// //84// //85// //88// //95// percent at operating conditions. Water heater capacities are scheduled on the drawings.
- C. The tank construction shall be ASME BPVC Section VIII-1, Steel, //glass// //cement// lined, with 1035 kPa (150 psig) working pressure rating complying with NSF 61 and NSF 372 for barrier materials for potable water tank linings.

- D. The tapping (openings) shall be factory fabricated of materials compatible with the tank and in accordance with appropriate ASME standards for piping connection, pressure and temperature relief valve, pressure gauge, thermometer, drain valve, anode rods and controls. The tappings shall be:
1. 50 mm or DN50 (2 inch) and smaller: Threaded ends according to ASME B1.20.1.
 2. 65 mm or (DN65) (2-1/2 inch) and larger: Flanged ends according to ASME B16.5 for steel and stainless steel flanges, and according to ASME B16.24.
- E. The gas-fired burner shall include the following:
1. Thermostatic adjustment.
 2. Designed for use with power vent heaters
 3. High temperature limit and low water cutoff devices for safety controls.
 4. Automatic ignition in accordance with ANSI Z21.20.
 5. Automatic damper in accordance with ANSI Z21.66. The automatic dampers shall be //electrically operated// //mechanically activated// //thermally activated//, automatic vent damper device with size matching draft hood for 300,000 BTUH and below.
- F. Temperature Setting shall be set for a minimum water temperature of 60 degrees C (140 degrees F). The temperature setting shall be adjustable. Heaters shall be capable of raising the discharge temperature to 77 to 82 degrees C (170 to 180 degrees F) for thermal eradication.
- G. The insulation shall surround the entire storage tank except connection and controls and shall comply with ASHRAE 90.1.
- H. The jacket shall be steel with enameled finish.
- I. The drain valve shall be corrosion resistant metal complying with ASSE 1005.
- J. Anode rod shall be replaceable magnesium.
- K. The power vent system shall be interlocked with the burner.
- L. Combination Pressure and Temperature relief Valve: ANSI Z21.22 rated, constructed of all brass or bronze with a self-closing reseating valve.
- M. Special requirements: NSF 5 construction.
- 2.3 CONDENSING, GAS FIRED, STORAGE DOMESTIC WATER HEATERS**
- A. The gas fired domestic water heater shall comply with // ANSI Z21.10.1 // ANSI Z21.10.3 //. Provide with access for cleaning and disinfection.

- B. The water heater design shall provide a combustion efficiency of at least 95 percent at operating conditions. Water heater capacities are scheduled on the drawings.
- C. The tank construction shall be ASME BPVC Section VIII-1, steel, glass lined, with 861 kPa (125 psig) working pressure complying with NSF 61 and NSF 372 for barrier materials for potable-water tank linings.
- D. The tapping (openings) shall be factory fabricated of materials compatible with the tank and in accordance with appropriate ASME standards for piping connection, pressure and temperature relief valve, pressure gauge, thermometer, drain valve, anode rods and controls. The tappings shall be:
 - 1. 50 mm or DN50 (2 inch) and smaller: Threaded ends according to ASME B1.20.1.
 - 2. 65 mm or (DN65) (2-1/2 inch) and larger: Flanged ends according to ASME B16.5 for steel and stainless steel flanges, and according to ASME B16.24.
- E. The natural gas-fired burner shall include the following:
 - 1. Metal-fiber mesh covering a stainless steel body with spark ignition and flame rectification.
 - 2. All burner material exposed to the combustion zone shall be of stainless steel construction.
 - 3. High temperature limit and low water cutoff devices for safety controls.
 - 4. Automatic ignition in accordance with ANSI Z21.20.
 - 5. The modulating motor must be linked to both the gas valve body and air valve body with a single linkage. The linkage shall not require any field adjustment.
- F. The control shall provide an integral sensor set point adjustment. The set point shall be adjustable in 1 degrees C (1 degrees F) increments.
- G. Temperature Setting shall be set for a minimum water temperature of 60 degrees C (140 degrees F). The temperature setting shall be adjustable. Heaters shall be capable of raising the discharge temperature to 77 to 82 degrees C (170 to 180 degrees F) for thermal eradication.
- H. The drain valve shall be corrosion resistant metal complying with ASSE 1005.
- I. The power vent system shall be interlocked with the burner.
- J. Combination Pressure and Temperature relief Valve: ANSI Z21.22 rated, constructed of all brass or bronze with a self-closing reseating valve.

K. Special requirements: NSF 5 construction.

2.4 CONDENSING, GAS FIRED, SEMI-INSTANTANEOUS DOMESTIC WATER HEATERS

- A. The gas fired domestic water heater shall comply with // ANSI Z21.10.1 // ANSI Z21.10.3 //.
- B. The water heater design shall provide a combustion efficiency of at least 95 percent at operating conditions. Water heater capacities are scheduled on the drawings.
- C. The tank construction shall be 304 stainless steel with 1035 kPa (150 psig) working pressure rating and an input to storage ratio of 4,000 BTU/hr per gallon or greater.
- D. The tapping (openings) shall be factory fabricated of materials compatible with the tank and in accordance with appropriate ASME standards for piping connection, pressure and temperature relief valve, pressure gauge, thermometer, drain valve, anode rods and controls. The tappings shall be:
1. 50 mm or DN50 (2 inch) and smaller: Threaded ends according to ASME B1.20.1.
 2. 65 mm or (DN65) (2-1/2 inch) and larger: Flanged ends according to ASME B16.5 for steel and stainless steel flanges, and according to ASME B16.24.
- E. The natural gas-fired burner shall include the following:
1. Metal-fiber mesh covering a stainless steel body with spark ignition and flame rectification.
 2. All burner material exposed to the combustion zone shall be of stainless steel construction.
 3. High temperature limit and low water cutoff devices for safety controls.
 4. Automatic ignition in accordance with ANSI Z21.20.
 5. The modulating motor must be linked to both the gas valve body and air valve body with a single linkage. The linkage shall not require any field adjustment.
- F. Water heater shall have an operational setpoint capability of 10 to 88 degrees C (50 to 190 degrees F) and shall maintain the outlet temperature within an accuracy of +/- 2 degrees C (4 degrees F) during load changes of up to 50 percent rated capacity.
- G. Heater shall operate quietly, less than 55 db(A).

- H. The heat exchanger shall be constructed with 316L stainless steel helical fire tubes, combustion chamber and dished tubesheet, with a two-pass combustion gas flow design.
- I. The drain valve shall be corrosion resistant metal complying with ASSE 1005.
- J. The power vent system shall be interlocked with the burner.
- K. Combination Pressure and Temperature relief Valve: ANSI Z21.22 rated, constructed of all brass or bronze with a self-closing reseating valve.
- L. Water Heater Management: the water heater control system shall incorporate onboard multi-unit sequencing logic that would allow lead-lag functionality & sequencing between multiple water heaters operating in parallel and must have the following capabilities:
 - 1. Efficiently sequence 2 up to 8 units on the same system to meet the load requirement.
 - 2. Individual unit feed-forward logic will still be enabled for accurate temperature control equal to individual unit's specification.
 - 3. Operate one motorized valve per unit as an element of the load sequencing. Valves shall close with decreased load as heaters turn off, minimum of one (quantity must be selectable) must always stay open for recirculation.
 - 4. Automatically rotate lead/lag amongst the units on the chain and monitor run hours per unit and balance load in an effort to equalize unit run hours.
 - 5. Automatic bump-less transfer of master function to next unit on the chain in case of designated master unit failure; master/slave status should be shown on the individual unit displays.
 - 6. Units will default to individual control upon failure of the communications chain.
 - 7. Night temperature setback.
 - 8. Designated master control, used to display and adjust key system parameters.
- M. Each water heater shall be supplied with a factory packaged and pre-wired motorized ball valve. This valve shall be controlled by the water heater control system as an element of the onboard water heater management.

2.5 GAS-FIRED, TANKLESS, DOMESTIC-WATER HEATERS

- A. Standard: ANSI Z21.10.3 for gas-fired, instantaneous, domestic-water heaters for indoor application.
- B. The water heater design shall provide a combustion efficiency of at least 95 percent at operating conditions. Water heater capacities are scheduled on the drawings.
- C. Construction: Copper piping or tubing complying with NSF 61 and NSF 372 barrier materials for potable water, without storage capacity.
 - 1. Openings: ASME B1.20.1 pipe thread.
 - 2. Pressure Rating: 1035 kPa (150 psig).
 - 3. Heat Exchanger: Copper tubing.
 - 4. Insulation: Comply with ASHRAE 90.1.
 - 5. Jacket: Metal, with enameled finish, or plastic.
 - 6. Burner: For use with tankless, domestic-water heaters and fuel gas.
 - 7. Automatic Ignition: Manufacturer's proprietary system for automatic, gas ignition.
 - 8. Temperature Control: Adjustable thermostat.
- D. Water heater shall have an operational setpoint capability of 10 to 88 degrees C (50 to 190 degrees F) and shall maintain the outlet temperature within an accuracy of +/- 2 degrees C (4 degrees F) during load changes of up to 50 percent rated capacity.
- E. Support: Bracket for wall mounting.

2.6 DOMESTIC HOT WATER EXPANSION TANKS

- A. A steel pressure rated tank constructed with welded joints and factory installed butyl rubber diaphragm shall be installed as scheduled. The air precharge shall be set to minimum system operating pressure at tank.
- B. The tappings shall be factory fabricated steel, welded to the tank and include ASME B1.20.1 pipe thread.
- C. The interior finish shall comply with NSF 61 and NSF 372 barrier materials for potable water tank linings and the liner shall extend into and through the tank fittings and outlets.
- D. The air charging valve shall be factory installed.

2.7 HEAT TRAPS

- A. Heat traps shall be installed in accordance with ASHRAE 90.1 if not provided integral with the heater.

2.8 COMBINATION TEMPERATURE AND PRESSURE RELIEF VALVES

- A. The combination pressure and temperature relief Valve shall be ANSI Z21.22 and ASME rated and constructed of all brass or bronze with a self-closing reseating valve. The relief valves shall include a relieving capacity greater than the heat input and include a pressure setting less than the water heater's working pressure rating. Sensing element shall extend into storage tank.

2.9 GAS SHUTOFF VALVES

- A. The gas shutoff valve shall be manually operated with proof of closure conforming to ANSI Z21.15.

//B. In high seismic areas, an earthquake shear valve shall be installed.//

2.10 MOTORIZED GAS VALVES

SPEC WRITER NOTE: Valves used in natural-gas piping for automatic shutoff service when interlocked with a hazard-condition initiating device. Retain type for intended operation.

- A. Automatic Gas Valves: Comply with ANSI Z21.21 and shall have the following characteristics:

1. Body: Brass or aluminum.
2. Seats and Disc: Nitrile rubber.
3. Springs and Valve Trim: Stainless steel.
4. Normally closed.
5. Visual position indicator.
6. //Electrical //Mechanical// operator for actuation by appliance automatic shutoff device.

SPEC WRITER NOTE: Valves in paragraph below are solenoid type and are used in natural-gas piping for automatic shutoff service when interlocked with a hazard-condition initiating device.

- B. Electrically Operated Valves: Comply with UL 429 and shall have the following characteristics:

1. Pilot operated.
2. Body: Brass or aluminum.
3. Seats and Disc: Nitrile rubber.
4. Springs and Valve Trim: Stainless steel.
5. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
6. NEMA ICS 6, Type 4, coil enclosure.

7. Normally closed.
8. Visual position indicator.

2.11 GAS PRESSURE REGULATORS

- A. The gas pressure regulator shall be appliance type, pressure rating matching inlet gas supply temperature, and conforming to ANSI Z21.18.

2.12 AUTOMATIC GAS VALVES

- A. Each water heater shall incorporate dual over-temperature protection with manual reset, in accordance with ASME BPVC Section IV and ASME CSD-1. The automatic gas valves shall be appliance type, electrically operated, on-off automatic control, and conforming to ANSI Z21.21.

2.13 THERMOMETERS

- A. Thermometers shall be rigid stem or remote sensing, scale or dial type with an aluminum, black metal, stainless steel, or chromium plated brass case. The thermometer shall be back connected, red liquid (alcohol or organic-based) fill, vapor, bi-metal or gas actuated, with 225 mm (9 inches) high scale dial or circular dial 50 to 125 mm (2 to 5 inches) in diameter graduated from 4 to 100 degrees C (40 to 212 degrees F), with two-degree graduations guaranteed accurate within one scale division. The socket shall be separable, double-seat, micrometer-fittings, with extension neck not less than 65 mm (2-1/2 inches) to clear tank or pipe covering. The thermometer shall be suitable for 20 mm (3/4 inch) pipe threads. Thermometers may be console-mounted with sensor installed in separate thermometer well.

2.14 SUPPORTS

- A. Water heater stands shall be factory-fabricated steel for floor mounting capable of supporting water heater and water a minimum of 450 mm (18 inches) above the floor.
- B. Wall brackets for wall mounted heaters shall be factory-fabricated steel capable of supporting water heater and water.

2.15 MANIFOLD KITS

- A. For multiple water heater installation, provide factory-fabricated copper manifold kits to include ball-type shutoff valves to isolate each water heater and balancing valves to provide balanced flow through each water heater.

PART 3 - EXECUTION**3.1 INSTALLATION**

- A. The water heaters shall be installed on concrete bases unless elevated above the floor. Refer to Specification Section 03 30 00, CAST-IN-PLACE CONCRETE and Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- B. The water heaters shall be installed level and plumb and securely anchored.
- C. The water heaters shall be installed and connected in accordance with manufacturer's written instructions with manufacturer's recommended clearances.
- D. All pressure and temperature relief valves discharge shall be piped to a nearby floor drains with air gap or break.
- E. Thermometers shall be installed on the water heater inlet and outlet piping and shall be positioned such that they can be read by an operator or staff standing on floor or walkway.
- F. Vent piping from gas-train pressure regulators and valves shall be piped to the outside of building and shall conform to NFPA 54.
- G. The thermostatic control shall be set for a minimum setting of 60 degrees C (140 degrees F) for storage heaters and regulated to a maximum discharge temperature of 54 degrees C (130 degrees F) for distribution to personnel.
- H. Shutoff valves shall be installed on the domestic water supply piping to the water heater and on the domestic hot water outlet piping.
- I. All manufacturer's required clearances shall be maintained.
- //J. The gas fueled domestic water heaters shall be installed with seismic restraint devices.//
- K. A combination temperature and pressure relief valve shall be installed at the top portion of the storage tank in accordance with manufacturer's recommendations. The sensing element shall extend into the tank. The relief valve outlet drain piping shall discharge by positive air gap or break into a floor drain.
- L. Piping type heat traps shall be installed on the inlet and outlet piping of the domestic water heater storage tanks, unless provided integrally with the tanks.
- M. Water heater drain piping shall be installed as indirect waste to spill by positive air gap into open drains or over floor drains. Hose end drain valves shall be installed at low points in water piping for gas fueled domestic hot water heaters without integral drains.

- N. The type B galvanized or stainless steel combustion vent shall be installed and sized according to the water heaters recommendations and extended through the roof or wall as allows by the local fuel gas code or NFPA 54. Install vents for condensing heaters in accordance with manufacturer's recommendations.
- O. Dielectric unions shall be provided if there are dissimilar metals between the water heater connections and the attached piping.
- P. Provide vacuum breakers per ANSI Z21.22 on the inlet pipe if the water heater is bottom fed.
- Q. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no cost to the Government.

3.2 LEAKAGE TEST

- A. Before piping connections are made, the water heaters shall be tested at a hydrostatic pressure of 1380 kPa (200 psig) and 1654 kPa (240 psig) for a unit with a MAWP of 1103 kPa (160 psig). If any leakage is found on the water heater, the water heater shall be replaced with a new unit at no additional cost to the VA.

3.3 PERFORMANCE TEST

- A. All of the remote water outlets shall be tested to ensure a minimum of 43 degrees C (110 degrees F) and a maximum of 49 degrees C (120 degrees F) water flow at all times.

3.4 STARTUP AND TESTING

- A. As recommended by product manufacturer and listed standards and under actual or simulated operating conditions, tests shall be conducted to prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with each integrated system.
- B. The tests shall includesystem capacity, control function, and alarm functions.
- C. When any defects are detected, correct defects and repeat test at no additional costs to the Government.
- //D. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Contracting Officer's Representative and Commissioning Agent. Provide a minimum of 7 days prior to notice.//

//3.5 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.//

3.6 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer's technical representative for //four// // // hours to instruct VA Personnel in operation and maintenance of the system.

//B. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.//

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