

SECTION 22 34 00
FUEL-FIRED DOMESTIC WATER HEATERS

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 91 00, GENERAL COMMISSIONING REQUIREMENTS.
- D. Deleted.
- E. Deleted.
- F. Section 09 91 00, PAINTING: Preparation and finish painting.
- H. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- I. Deleted.
- 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. Deleted.
- O. Deleted.

1.3 APPLICABLE PUBLICATIONS

- 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.
 - 8. Gas Shut-off 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.
- G. Submit documentation indicating compliance with applicable requirements of ASHRAE 90.1 or Energy Star for Service Water Heating.
- 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

- 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.
- F. The domestic water heater shall be certified and labeled by an independent testing agency.

1.6 AS-BUILT DOCUMENTATION

- 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 2013 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

2.1 CONDENSING, GAS FIRED, STORAGE DOMESTIC WATER HEATERS

- A. The gas fired domestic water heater shall comply with 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, type 444 stainless steel, with 861 kPa (125 psig) working pressure. Helical heat exchanger shall also be of type 444 stainless steel construction.
- 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. Ultra-low NOX modulating burner 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 electronic touch screen display for advanced status and diagnostics, as well as temperature adjustment and control. 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. Provide with 1 - year parts warranty, 10 year limited tank warranty.

2.4 CONDENSING, GAS FIRED, SEMI-INSTANTANEOUS DOMESTIC WATER HEATERS - NOT

2.5 GAS-FIRED, TANKLESS, DOMESTIC-WATER HEATERS - NOT USED

2.6 DOMESTIC HOT WATER EXPANSION TANKS - NOT USED

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. Deleted.

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

- 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.
- 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. Install vents for condensing heaters in accordance with manufacturer's recommendations.
- 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 include system 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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