

**SECTION 22 35 00**  
**DOMESTIC HOT WATER GENERATORS**

**PART 1 - GENERAL****1.1 DESCRIPTION**

- A. This section describes the requirements for domestic hot water generators using instantaneous steam heat exchangers including thermometers and all necessary accessories, connections and equipment.
- B. Application is for indirect water heating utilizing steam as a medium.
- C. 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 11, SUSTAINABLE DESIGN REQUIREMENTS.
- D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.
- E. Section 03 30 00, CAST-IN-PLACE CONCRETE: Concrete and Grout.
- F. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENT FOR NON STRUCTURAL COMPONENTS: Seismic Restraint for Equipment.
- G. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- H. Section 22 05 19, GAGES FOR PLUMBING PIPING.
- I. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING.
- J. Section 22 07 11, PLUMBING INSULATION.
- K. Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.
- L. Section 22 11 00, FACILITY WATER DISTRIBUTION: Piping, Fittings, Valves and Gages.
- M. Section 22 11 23, DOMESTIC WATER PUMPS: Recirculating Pump.

**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 Society for Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
  - 90.1 (2013).....Energy Standard for Buildings Except Low-Rise Residential Buildings
- C. American National Standard Institute (ANSI):
  - Z21.22B-2001 (R2008)....Relief Valves for Hot Water Supply Systems

## 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 StandardB16.24-2011.....Cast Copper Alloy Pipe Flanges and Flanged  
Fittings: Classes 150, 300, 600, 900, 1500, and  
2500

PTC 25.3-02.....Pressure Relief Devices

## E. National Fire Protection Association (NFPA):

70-2014.....National Electrical Code (NEC)

## F. NSF International (NSF):

61-2014.....Drinking Water System Components - Health  
Effects

372-2011.....Drinking Water System Components - Lead Content

## G. Underwriter Laboratories (UL):

207-2013.....Standard for Refrigerant-Containing Components  
and Accessories, Nonelectrical

778-2010.....Standard for Motor-Operated Water Pumps

**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 35 00, DOMESTIC WATER HEAT EXCHANGERS", 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. Hot Water Generator.

2. Pressure and Temperature Relief Valves.

3. Steam Control Valves.

4. Heating Hot Water Control Valves.

5. Thermometers.
  6. Pressure Gages.
  7. Vacuum Breakers.
  8. Safety Valves.
  9. Expansion Tanks.
  10. Heat Traps.
- D. 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. 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. Equipment components in contact with potable water shall meet compliance requirements in documents NSF 61 and NSF 372.
- B. Comply with American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 90.1 for efficiency performance.
- C. The domestic hot water generator shall conform to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENT 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.

- D. The hot water generator shall be certified and labeled by an independent testing agency.
- E. Recirculating pump shall be installed per NFPA 70.
- F. 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**

- 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 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. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the Government 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 2014 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 DOMESTIC HOT WATER GENERATORS**

- A. The hot water generator shall be heat exchangers, double wall, instantaneous type, with steam in the shell and water in the tubes. The hot water generator shall be a packaged assembly of heat exchanger coils, control valves, controls, and specialties constructed of ASME code with 1035 kPa (150 psig) minimum working pressure. The hot water generator shall comply with NSF 61 and NSF 372 for barrier materials

for potable-water tank linings. Heat exchanger capacities are scheduled on the drawings.

- B. The stand or skid shall be heavy-duty angle iron frame factory fabricated for floor mounting, entirely pre-piped.
- C. 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, and controls. The openings 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.
- D. Equip with a recirculation system with a non-adjustable valve to set the recirculation temperature.
  - 1. The recirculation system shall be integrally mounted and shall not alter the overall dimensions of the heater.
- E. Provide factory-supplied, reuseable insulation cover and ties that shall comply with ASHRAE 90.1 and suitable for operating temperature.
- F. The heat exchanger coils shall be constructed from copper. The pressure rating shall be 1035 kPa (150 psig) minimum.
- G. The temperature controls shall be designed for an output temperature of 55 degrees C (130 degrees F) based upon an adjustable temperature transmitter that operates a control valve and is capable of maintaining outlet water temperature within 2 degrees C (4 degrees F) of setting. Heaters shall be capable of raising the discharge temperature to 77-82 degrees C (170-180 degrees F) for thermal eradication.
  - 1. The feed forward blending valve shall regulate the flow of cold water to the heating coil to control water temperature and shall be electronically operated. The outlet water temperature shall not vary more than +/- 1 degrees C (2.5 degrees F).
- H. Safety control shall be automatic in the event the movement of the blending valve is restricted by a foreign matter, an internal spring shall allow the diaphragm and stem to move up, uncovering a heat damper that allows cold water to enter the blended mix, eliminating the possibility of overheating or scalding.

- I. The relief valves shall be ASME rated and stamped for combination temperature and pressure relief valves.

## **2.2 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, no mercury) 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 210 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.

## **2.3 SAFETY VALVES**

- A. Separate combination pressure/temperature relief valves shall be provided on each water heater.

## **2.4 DOMESTIC HOT WATER EXPANSION TANKS**

- A. An ASME-rated 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 for 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.

## **2.5 HEAT TRAPS**

- A. Heat traps shall be installed in accordance with ASHRAE 90.1 unless provided integrally with the heaters.

## **2.6 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.

**PART 3 - EXECUTION****3.1 INSTALLATION**

- A. The hot water generators shall be installed on concrete bases. Refer to Specification Section 03 30 00, CAST-IN-PLACE CONCRETE and Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- B. The hot water generators shall be installed level and plumb and securely anchored.
- C. Hot water generators 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 nearby floor drains with air gap or break.
- E. Thermometers and isolation valves shall be installed on hot water generator 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. The thermostatic control shall be set for a minimum setting of 54 degrees C (130 degrees F).
- G. Shutoff valves shall be installed on the domestic water supply piping to the hot water generator and on the domestic hot water outlet piping.
- H. All manufacturer's required clearances shall be maintained.
- I. The domestic hot water generators shall be installed with seismic restraint devices.
- J. Dielectric unions shall be provided if there are dissimilar metals between the water heater connections and the attached piping.
- K. If an installation is unsatisfactory to the Contracting Officer's Representative (COR), the Contractor shall correct the installation at no cost to the Government.

**3.2 LEAKAGE TEST**

- A. Before piping connections are made, the hot water generators shall be tested at a hydrostatic pressure of 1380 kPa (200 psig) for hot water generators rated at less than 1103 kPa (160 psig). Any failed test shall be corrected and the hot water generator shall be replaced with a new unit at no additional cost to the VA.

**3.3 PERFORMANCE TEST**

- A. Ensure that all of the remote water outlets will have a minimum of 43 degrees C (110 degrees F) and a maximum of 49 degrees C (120 degrees F) water flow at all times. If necessary, make all correction to balance

the return water system or reset the thermostat to make the system comply with design requirements.

#### **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 2 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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