

22 30 00 - Domestic Hot Water Systems

1. Introduction

- A. Domestic hot water systems are critical to all building types on the University campus: residential, administrative, laboratory/research, classroom and athletic facilities. This standard identifies the design criteria and guidelines for domestic hot water systems. This includes all non-HVAC systems with operating temperatures from 100°F to 140°F for potable and non-potable use.
- B. Designers should coordinate with Duke Utilities & Engineering Services (DUES) on all phases of projects requiring domestic hot water service. Particular attention must be paid to any retrofit projects that may require evaluation of past and future hot water needs for a particular system.

2. References

- A. North Carolina Plumbing Code 2012
- B. Duke University Design Guidelines, Section 22 00 00. General Plumbing Requirements
- C. Duke University Design Guidelines, Section 22 07 00, Insulation for Plumbing Piping
- D. Duke University Design Guidelines, Section 23 22 13, Medium and Low Pressure Steam Systems
- E. ASHRAE Standard 90.1 – 2007

3. Design Standards

- A. All domestic hot water system designs must identify energy efficiency, reliability, serviceability, operational functionality and life-safety issues such that Duke University may fully and accurately evaluate the project.
- B. Detailed documentation is required with regard to existing conditions. This may include, but is not limited to, documentation of existing steam-fired equipment, analysis of building steam loads and evaluation of building distribution piping.
- C. All equipment must be supported directly by structural members with adequate load-bearing capacity and material integrity, using appropriate anchoring/connection hardware. Under no circumstances may equipment be supported by connections to finish materials. For example, equipment hung from toggle bolts through plaster-on-lath, gypsum board or ACT ceilings is **not acceptable**.
- D. Potable Hot Water Systems:

1. Preferred manufacturers:
 - a. Aerco
 - b. Cemline
2. Design temperature for potable systems is 120°F.
3. Design temperatures for kitchen systems is 140°F.
4. Where feasible, pumped recirculation loops should be utilized.
 - a. Refer to Duke Design Guidelines section 22 10 10 Plumbing Pumps for details regarding recirculation pumps.
5. Piping
 - a. Hot water piping should be installed per Duke University Design Guidelines, section 22 11 18 Plumbing Piping.
 - b. Pipe should be insulated per Duke University Design Guidelines, section 22 07 00 Insulation for Plumbing Piping.
 - c. Pipe should be hung per NC Plumbing Code.
 - d. Hot water systems should include isolation valves at all major branch connections and at equipment terminations per Duke University Design Guidelines, section 23 05 23 General Duty Valves for Piping.
 - e. A drain valve shall be installed downstream of all branch isolation valves.
6. Hot Water Generating Equipment
 - a. Selection of the water heater firing method is subject to DUES review and approval on a case-by-case basis. Consultants should contact DUES for guidance on selection of the hot water heating system.
 - b. Multiple heat exchangers are required to provide redundancy. Units shall be selected at 50% of peak calculated load. In a case where more than 2 units are required, the units shall be selected so the sum of their load equals the peak calculated load. Example: If 3 units are required, each should be selected at 33% of peak load.
 - c. Mixed-use facilities with highly diverse domestic hot water usage profiles should utilize multiple hot water generating systems. For example, a café kitchen within a classroom building should be designed with a dedicated hot water system.
 - d. When steam service is available, steam-fired, semi-instantaneous type hot water heaters are generally preferred. Where steam service is unavailable or in

facilities that are slated to be disconnected from steam service as part of the long-term Steam to Hot Water Conversion project, acceptable alternative firing methods include electrical and natural gas firing.

- e. When distributed heating water is available, a double wall, plate and frame, water to water heat exchanger is preferred for large domestic water load requirements.
 - (1) Plate and frame heat exchanger shall be equipped with a bypass to keep heating water hot at the inlet of the unit.
 - (2) A globe valve shall be installed in the bypass to control how much heating water is bypassed.
 - (3) Full size taps shall be installed between the heat exchanger isolation valves and the unit for flushing and cleaning purposes.
- f. Steam-fired semi-instantaneous type water heaters should be factory-assembled, skid-mounted, vertical tank type with integral controls and tank circulation pump. Controls must have the ability to interface with campus building automation system for alarming and control. Tank should be fabricated per ASME Pressure Vessel code, rated for 150 psig shell pressure, with grade 316 stainless steel internals and cupro-nickel alloy tube bundle.
- g. In situations where domestic hot water loads are not significant, a commercial electric hot water heater is preferred.
- h. The use of large volume hot water storage tanks in combination with instantaneous shell-and-tube type heat exchangers (or in-tank tube bundles) is generally discouraged except where this equipment provides the most efficient means of hot water provision. Examples may include kitchens, gymnasiums and laundry facilities with consistently high hot water demand Non-Potable Hot Water Systems.
- i. Thermostatic mixing valves should only be used where consistent hot water temperature is extremely critical. The type of mixing valve shall be reviewed with DUES prior to selection.

E. Non-Potable Hot Water Systems

- 1. Non-potable hot water systems include any non-HVAC hot water system for industrial, laboratory, medical usage or other specialized non-domestic use.
- 2. In all cases, non-potable water systems should be protected from contaminating potable water systems with backflow prevention devices and dedicated heating and pumping equipment.

3. Non-potable systems may have varying service temperature requirements; design according to specific project needs.
4. Where feasible, recirculation loops should be utilized.
5. Hot Water Generating Equipment
 - a. Selection of the water heater firing method is subject to DUES review and approval on a case-by-case basis. Consultants should contact DUES for guidance on selection of the hot water heating system. The system must conform to requirements described in the Duke University Design Guidelines, Section 23 22 13, Medium and Low Pressure Steam Systems.
 - b. When steam service is available, steam-fired, semi-instantaneous type hot water heaters are generally preferred. Where steam service is unavailable or in facilities that are slated to be disconnected from steam service as part of the long-term Steam to Hot Water Conversion project, acceptable alternative firing methods include electrical and natural gas firing.
 - c. Steam-fired semi-instantaneous type water heaters should be factory-assembled, skid-mounted, vertical tank type with integral controls and tank circulation pump. Controls must have the ability to interface with campus building automation system for alarming and control. Tank should be fabricated per ASME Pressure Vessel code, rated for 150 psig shell pressure, with grade 316 stainless steel internals and cupro-nickel alloy tube bundle.
 - d. Where instantaneous-type heat exchangers are used, steam flow must be controlled via parallel control valves sized for proper control at low flow and peak flow requirements.

F. Monitoring and Control

1. All systems and equipment must be integrated with existing Siemens Insight building automation system.
2. Hot water system should include, at minimum, following monitoring and control points:
 - a. Supply temperature
 - b. Return temperature
 - c. Mixed temperature (if tempered with thermostatic mixing device)
 - d. Supply pressure
 - e. Loop differential pressure

- f. Circulation motor current/power draw
- 3. Supply and return temperatures shall be read independently from equipment controls.
- 4. Documentation and Review Requirements
 - A. Analysis of the building domestic hot water systems should be considered in the Life Cycle Cost analysis required for project approval.
 - B. Provide estimated energy loss calculation for all distribution piping.
- 5. Installation and Performance Requirements
 - A. Confirm installation responsibilities at outset of project. Installation services will be provided in-house or contracted out.
 - B. Coordinate all required tie-in points with Duke Utilities and Engineering Services.
 - C. Coordinate all commissioning efforts with Duke Utilities and Engineering Services.