# 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

   B. Duke University Design Guidelines, Section 220000. General Plumbing Requirements

   C. Duke University Design Guidelines, Section 220700, Thermal Insulation

   D. Duke University Design Guidelines, Section 232213, 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. Design temperature for potable systems is 120°F.
2. Design temperatures for kitchen systems is 140°F.
3. Where feasible, pumped recirculation loops should be utilized.
    a. Recirculation pumps must be fitted with bronze volute and impeller.
    b. Recirculation pump motors over 2 hp must be utilize variable-frequency drives (VFD), automatically controlled based on system differential pressure. Differential pressure sensor(s) should be placed in the furthest (highest head loss) location from the pump.
4. Piping
    a. Hot water piping should be of Type L copper, hard drawn, with solder connections for joints.
    b. Pipe should be insulated per Duke University Design Guidelines, Section 220700, Thermal Insulation.
    c. Pipe should be hung per Section 220000 - General Plumbing Requirements. (Section 220000 is to be released at a later date.)
    d. Hot water systems should include isolation valves at all major branch connections and at equipment terminations.
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.
    b. 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.
    c. 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.
    d. 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.

Preferred equipment manufacturers include:

1) Aerco SWDW
2) Cemline
3) Spirax Sarco

e. 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.

f. Thermostatic mixing valves should only be used where consistent hot water temperature is extremely critical. Otherwise, hot water should be generated at usage temperature to maintain energy efficiency.

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 232213, 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.

   Preferred equipment manufacturers include:

   a. Aerco SWDW
   b. Cemline
   c. Spirax Sarco

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.

6. Piping

   a. Hot water piping should be of Type L copper unless another material is determined to be better suited to the system. Use of piping materials other than Type L copper is subject to DUES review and approval.

   b. Pipe should be insulated per Duke University Design Guidelines, Section 220716, Thermal Insulation

   c. Pipe should be hung per Section 220000 - General Plumbing Requirements. (Section 220000 is to be released at a later date.)

   d. Hot water systems should include isolation valves at all major branch connections and at equipment terminations.

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

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.

6. As-Built Requirements

A. Designer must provide drawings showing all as-built piping and equipment. Drawings must include final site plan layout and elevation profile, details of pertinent equipment (pumps, plumbing fixtures, terminal equipment, et al.), details of all building connection points, as well as anchorage points, cross-over/under of other utilities, obstructions and other pertinent data.

B. Provide identifying list for all valves. Coordinate with Duke Utilities and Engineering Services for formatting and compliance with existing recordkeeping. Field-applied identification tags and nameplates must match as-built drawings (e.g. “P-1” location on drawings must be “P-1” physical location).