BASIS OF DESIGN
POAH Design + Building Performance Dept.

LAST UPDATED 04.09.2024

DOMESTIC HOT WATER
EXISTING CONSTRUCTION

WHEN TO USE THIS BASIS OF DESIGN SECTION

This BOD section should be used for 1) rehab projects to guide Architects, Engineers, and Development staff, and 2) during system replacement to guide maintenance staff. Modifications to existing DHW equipment present significant and uncommon opportunities to increase heating system efficiency and reduce utility costs.

DURING REHAB + REPLACEMENT OF DHW SYSTEMS + EQUIPMENT:

A. EVALUATE CONVERTING TO ELECTRIC HEAT PUMP WATER HEATERS:

- Engineers shall provide a high-level evaluation for the removal of existing DHW plants and the installation of new heat pump water heaters (either split systems or a packaged systems).
- **COMPRESSOR PLACEMENT (only if water heater has outdoor compressor):** Compressors should be placed away from windows and outdoor patios, and should be easily accessed by maintenance. Compressors should be installed on stands a minimum of 18 inches off the ground or roof. Any/all refrigerant lines should be covered/ protected. Landscape plans should include a visual barrier of compressors without interfering with required clearances, operation, or access by maintenance.

If converting to heat pumps is not possible or practical, proceed with the following requirements:

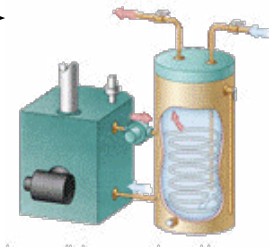
B. USE A GAS FIRED DHW SYSTEM:

If a heat pump water heater is not possible or practical, a gas-fired water heater may be used. Combustion equipment must be "condensing", and be capable of operating in both condensing and non-condensing modes.

Use either:

1. **Water Heater(s) with Built-In Heating Element:** A direct-fired, power direct-vent water heater may be used. The water heater must have a thermal efficiency above 90 and an EF or UEF above 0.8. The water heater must be ENERGY STAR.

2. **Or, Water Storage Tank(s) with Adjacent Boiler(s) (2 Options):** →



a) **Option 1: Boiler(s) Provides Heat for Heating and DHW (combined system):** In most situations it is ideal to separate the DHW from the space heating boilers. In some buildings, the DHW may be produced by the space heating boilers, with indirect tanks, but only when the boiler(s) output and controls are suitable for DHW operations. Criteria for using space heating boilers to produce DHW:

a. **Capacity:** The boiler capacity must be able to carry the DHW load. If the project involves providing a new combination boiler, it must be sized to effectively and efficiently carry the DHW load; I.E. not oversized.

b. **Controls:** The boiler controls must allow for DHW priority. In larger buildings with larger heating loads, the heating plant may include a bank of boilers. On top of → the controls to operate these with suitable modulation and lead/lag for space heating, such heating plants will also require controls for DHW priority.

c. Boilers must be low-mass (short recovery time for reheating) and direct vent.

b) **Option 2: Boiler(s) Provide Heat for DHW Only (independent system):** If a dedicated condensing, low-mass (short recovery time for reheating), direct vent boiler is provided for DHW heating, an indirect, storage-type water heater may be used. The indirect water heater tank should be constructed of 316L stainless steel (or better), with stainless steel or copper-nickel heat exchanger, rated thermal loss of less than 1°F per hour.

PROPERLY VENT THE COMBUSTION EXHAUST:

Boilers and direct-fired DHW water heaters must be direct vented. That is, both supply (combustion air) and exhaust vents shall be piped directly to the exterior from the combustion appliance. The exhaust vent must be located away from ventilation intakes, operable windows, etc. Refer to the International Mechanical Code (IMC) or the manufacturer's installation instructions.

1. Inlet and outlet need to be located above anticipated snow load. Clearances above grade must account for not just average snowfall, but also snowdrifts and piles made from snow plowing/blowing.
2. Configure the exhaust vent such that condensate will not fall upon any building surfaces or walks.

This boiler vent deposits condensate on the wall of the buildings and on the stairs leading to a shared laundry facility.

DEMOLISH UNUSED FLUE / VENT + PATCH THE VENT PENETRATIONS:

When converting the hot water heating to either electric heat-pump or direct-vent combustion, the existing exhaust vent that is no longer needed should be removed. Abandoned exhaust vents should be demolished and the ceilings, floors, roofs and/or walls that the vent went through should be patched and made good. The abandoned shaft must be closed and sealed at the floor of the attic.

1. Where the vent penetrated a roof and or wall, the water control of must be restored with the water control layer properly sealed (made intact).
2. Any penetrations in the ceiling of the boiler room must be patched and sealed.
3. Floor penetrations that are accessible or can be accessed as part of the renovation work should be sealed air tight and as required for fire safety.
4. If the vent cannot be fully demolished – e.g., the flue chase is in occupied apartments with no provision for work in those apartments – then the accessible portions of the vent should be demolished with the chase and vent sealed at the top and bottom.
5. If using the vent chase for new vent or intake pipes, or refrigerant lines, or ventilation ductwork, electrical service, etc. be sure to seal around the pipes and wires where they enter the chase. The top and bottom of the chase should be closed and sealed.

This abandoned exhaust vent provides a direct air leakage path to the exterior. It requires patching.

C. SIZE ALL REPLACEMENT EQUIPMENT BASED ON LOAD CALCULATIONS:

Calculate the load and size the system based on the current and anticipated use. Do not rely upon the existing equipment size as a determinant of the current load since the existing equipment might have been improperly sized or sized for a different configuration. Equipment should also be sized based on any building enclosure work that will occur during rehab. Engineers shall submit system designs with corresponding calculations or justification for the proposed sizing. Engineers shall establish the required capacity of the water-heating equipment and the general type of system to be used by accounting for the following:

1. The building's estimated load profile and peak demands
2. The programmatic demands of each space, the building type, fixture and equipment information, and any project-specific POAH requirements
3. Consumption based on end-use
4. Water heater manufacturer sizing guidelines

D. MIXING VALVE FOR SCALD PROTECTION:

Unless there is a working anti-scald valve at every point of use, provide an approved mixing valve to control the temperature of water delivered to the building. DHW should be delivered to the building no hotter than 120F.

E. HEAT TRAPS:

Hot water storage tanks not supplied with integral heat traps and serving noncirculating systems shall be provided with heat traps on the supply and discharge piping.

F. PIPING + DISTRIBUTION:

Insulate all accessible hot water piping per IECC:

Pipe Location	Pipe Diameter	R-Value	Minimum Tabular Insulation Thickness
Between the water heater + fixtures	Up to 1-1/2"	R-4	1"
	Greater than 1-1/2"	R-4	1-1/2"
Between a boiler + the water heater	Up to 1-1/2"	R-4	1-1/2"
	Greater than 1-1/2"	R-4	2"

G. DHW CIRCULATION:

1. **Pumps:** Use premium efficiency recirculation pumps: The recirculation pump will have significant run time and should, therefore be a premium efficiency pump. It is not necessary to use a variable frequency drive on the recirculation pump as it will be operated as on/off. The pump should be sized for high flow rate. The pump selection must also take into account the frequent stop-start operation of modern, code-compliant recirculation control.

    a) All pumps 1/4 HP and larger shall include a soft start.

2. **Controls:** Controls for DHW circulation system pumps shall start the pump on demand for hot water within the connected fixtures (i.e., a flow switch is required). The controls shall also automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is no demand for hot water. The temperature sensor for the recirculation loop shall be located as close to the furthest fixture as feasible. This may necessitate an access panel located in an apartment.

H. INCLUDE SPECIFICATIONS FOR COMMISSIONING (CX):

The following specification sections are required in all new construction projects. Commissioning specifications to be reviewed, updated to reflect the current project, and included within the design specification. The Plumbing Section (Division 22) must reference the following specifications:

1. **Section 019013 – General Commissioning Specification:** Section includes general and specific requirements that apply to the implementation of commissioning process for Plumbing systems, assemblies, and equipment.
2. **Section 019013.01 Sample Commissioning (CX) Plan:** Provide a sample Cx Plan. This document outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process. Each commissioning plan should include:
    a) Commissioning Objectives
    b) Systems to be Cx.
    c) Project team contact list, Cx roles and responsibilities of team, general management plan, communication protocols.
    d) Summary of Cx process, schedule for Cx activities.

e) Documentational requirements. Plan for delivery and review of submittals, systems manuals, and other documents and reports.
f) Process and schedule for completing construction checklists and manufacturer's prestart and startup checklists for HVAC&R systems, assemblies, equipment, and components to be verified and tested.
g) Certifications: installation, prestart checks, and startup procedures have been completed. Ready for testing.
h) Verification of testing, adjusting, and balancing (TAB) reports.
i) Sample Issues Log and Corrective Action document.

3. **Section 220800 - Commissioning of Plumbing:** Section includes commissioning process requirements for plumbing systems, assemblies, and equipment.
    a) If a Building Automation System (BAS/BME/EMS) is to be installed, the Integrated Automation Cx specifications within Section 22 Plumbing will also require the following specification. All Cx specifications will also need to reference this specification.
        a. **Section 250800 - Commissioning of Integrated Automation:** Section includes commissioning process requirements for BAS.
    b) The Cx specifications within Section 22 Plumbing must also reference the following specifications, as applicable to the project:
        a. **Section 230800 - Commissioning of HVAC:** Section includes commissioning process requirements for HVAC&R systems, assemblies, and equipment.
        b. **Section 260800 - Commissioning of Electrical:** Section includes commissioning process requirements for electrical systems, assemblies, and equipment.