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Heat Pump Water Heater Technical Guide

for R-2 Occupancy (Low-rise multifamily new construction, three stories and fewer)

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Heat pump water heaters are a proven technology known to improve water-heating energy efficiency.

Heat pump water heaters (HPWHs) are now more available, efficient and reliable than ever, with many products carrying a 10-year warranty. As water heating accounts for roughly 25% of multifamily building energy use, HPWHs can dramatically reduce the energy load of the entire building.[1]

In this guide, you'll find installation tips and best practices for R-2, low-rise multifamily new construction buildings that are three stories and fewer, as well as information on achieving 2-3 credits from Washington State Energy Code (WSEC) Table R406.3.

HPWHs are most effectively integrated into multifamily buildings if considered from day one of the design process. There are several design features that must be considered for the HPWH to work—specifying a HPWH for a multifamily building involves more than simply specifying a tank with an increased efficiency rating.

This technical guide will help you understand these considerations and provide solutions to common design challenges. There is no one-size-fits all application option for HPWH in R-2 occupancy. The best system for your building will depend on factors including number of units, type and size of units, number of floors, presence of parking garage, roof access, balcony presence/absence, and interior or exterior corridors.

FEATURES AND BENEFITS

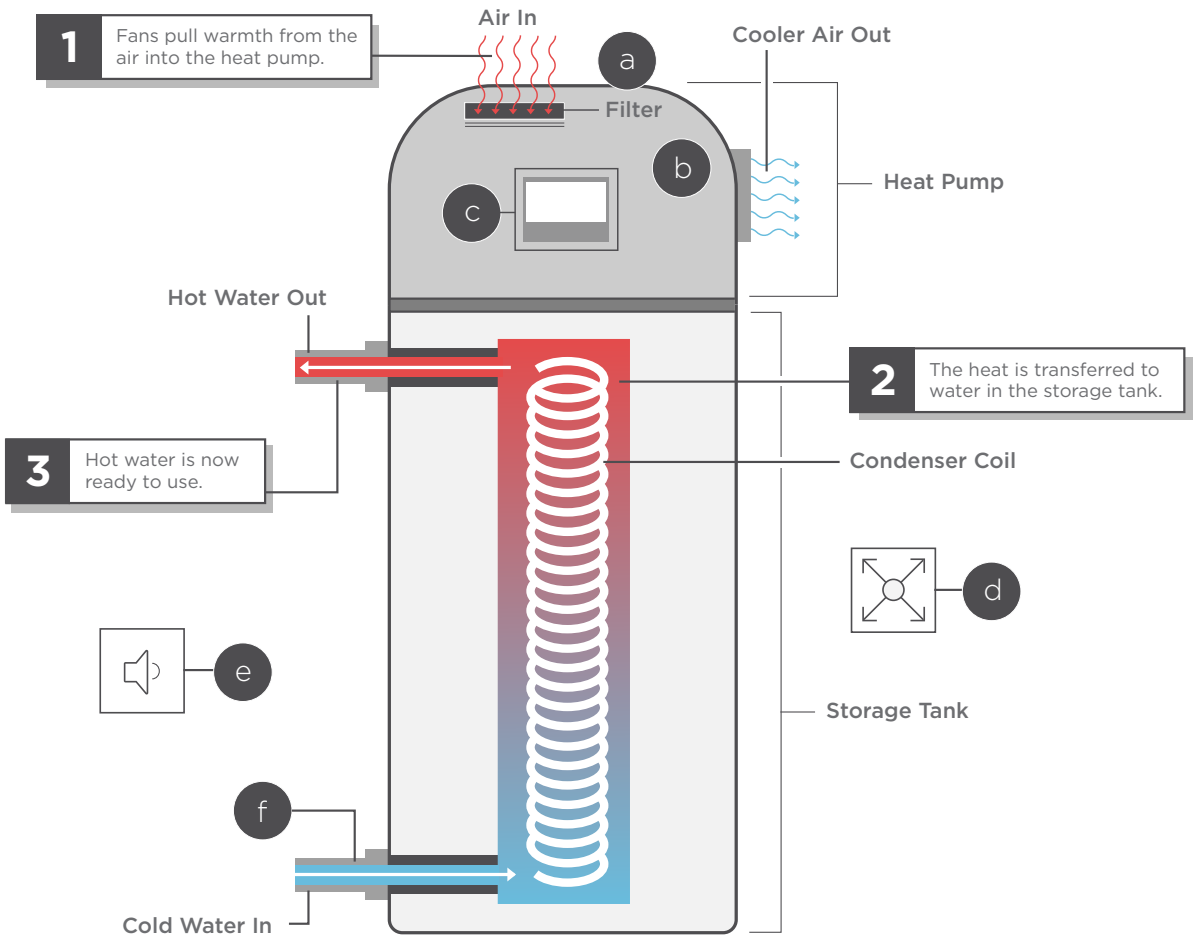
- As water heaters typically last 12–14 years, the improved efficiency of HPWHs can have a significant impact on total lifetime energy use.
- HPWHs are now more efficient and reliable than ever, with readily available HPWHs carrying a 10-year warranty.
- Plumbing trades are familiar with the technology.
- From an installation standpoint, HPWHs are the same as standard tank water heaters aside from the addition of condensate management.
- HPWHs help with decarbonization goals for buildings, communities, states and regions.
- By helping you earn 2-3 credits[2] from Table R406.3, HPWHs offer a cost-optimal path to code compliance and provide the most points of any water-heating option.
- HPWHs feature a digital touchscreen control panel to allow customers to easily set the temperature and change operational modes to maximize efficiency. Additional features may include:
    - Wi-Fi connectivity (availability varies by model) to remotely change temperatures, engage vacation mode, and monitor performance.
    - Leak detection (some models).
    - Participation in the smart grid to enable more renewable electricity generation (availability varies by model).

[1]Heller, Jonathan, et al. Multifamily Billing Analysis: New Mid-Rise Buildings in Seattle. 2009. https://www.seattle.gov/Documents/Departments/OSE/MF-Billing-Analysis-MidRise2009.pdf

[2]Credit value determined by selected water heater equipment efficiency.

HOW IT WORKS:
THE ANATOMY OF AN INTEGRATED HPWH

Standard water heaters require a significant amount of energy to heat water. In contrast, HPWHs use less than half the energy to heat the same amount of water. By extracting heat from the surrounding air and transferring it to the water inside the tank, HPWHs are able to reduce the amount of heat that must be created.



▸ Key Differences from Standard Water Heaters

a. Filter cleaning required, along with sufficient space above

b. Cold exhaust air

c. Digital control panel

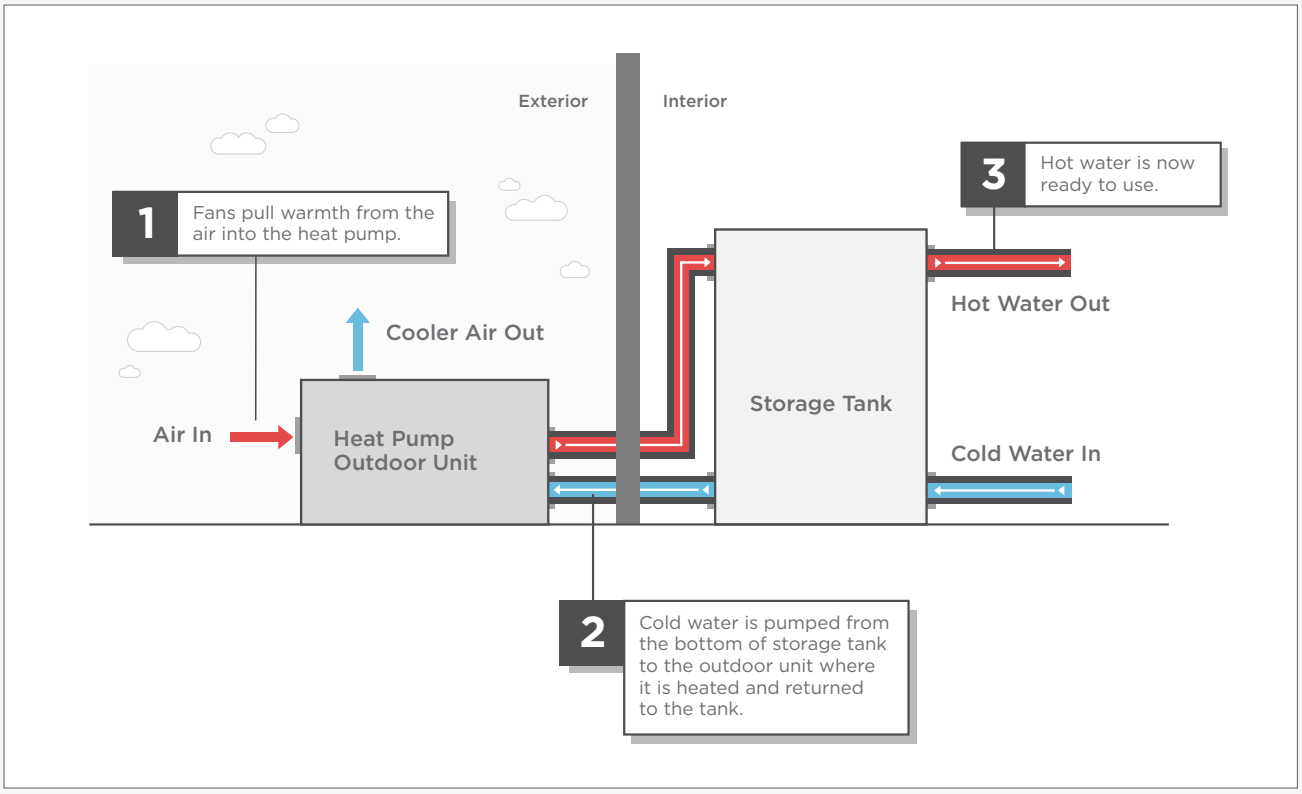
d. May require a little more physical space and sufficient make-up air volume

e. Modest amount of noise

f. Side piping on most units

HOW IT WORKS:
THE ANATOMY OF A SPLIT-SYSTEM HPWH

Split-system HPWHs operate with the same thermodynamic principles as integrated HPWHs, but they separate the tank from the heat pump. Separated from the tank, the heat pump may be located outside the unit on the building exterior or in places like a parking garage, mechanical room, or rooftop space. Heat from the outdoor unit may be transfered via refrigerant or water lines to the indoor tank. The air that is made colder by the heat pump stays outside the apartment or building. This separation may allow more design flexibility in the often cramped confines of multifamily buildings.



Note

This guide considers integrated and split-system HPWHs and focuses on design configurations in which a HPWH serves each unit (Tank-per-Unit) and configurations in which a HPWH serves several units (Tank-per-Cluster). While this guide touches on central plants, or central systems, as possible options for certain scenarios, please consult an experienced mechanical design engineer for specific design guidance on central-plant installation scenarios. For helpful information on HPWH design for single-family homes, visit {link to single-family tech sheet}.

Heat pump waters heaters have several unique installation requirements in comparison to standard electric or gas water heaters.

The following includes system features, installation and operating tips and best practices by audience:

PROJECT DEVELOPERS

- HPWHs are most effectively integrated into multifamily buildings if considered from day one of the design process. Be sure to alert the architect and mechanical designer that you want a HPWH system for your building so they can coordinate from the start.
- By helping you earn 2-3 credits from Table R406.3, HPWHs offer a cost-optimal path to code compliance and provide the most points of any water-heating option.
- Following the guidance provided in this document will help ensure a high-quality installation and satisfied occupants.

RESIDENTS

- HPWHs use 60% less energy than traditional systems.
- (If integrated HPWH in unit): There is a filter-cleaning requirement.

BUILDING OWNERS

- HPWHs reduce energy costs.
- There are modest maintenance needs, including:
    - Integrated units require filter cleaning.
    - Split systems may need outdoor coil cleaning like any other heat pump.

ARCHITECTS AND MECHANICAL DESIGNERS

Basic Equipment Options

There are two fundamental equipment choices for HPWHs:

1) Integrated HPWHs contain the tank and the heat pump in a single, integrated piece. Currently available integrated HPWH products use R-134a refrigerant and are designed to be located indoors or in temperature buffered spaces such as parking garages or basements. These products cannot be exposed directly to the outdoor elements. They also lose heating capacity at colder air temperatures and typically do not operate the heat pump below 40F. If the air falls below those temperatures, they will heat with their resistance elements.

2) Split-System HPWHs separate the tank and the heat pump components into two pieces. The heat pumps are designed to operate in outside conditions with the range of operating temperatures depending on the product. For example, equipment with CO2 or R-410a refrigerant typically runs at all ambient air temperatures. Split-systems offer added design flexibility in multifamily buildings because the tank can be located inside the unit. Additional planning is required to connect the tank and outdoor unit.

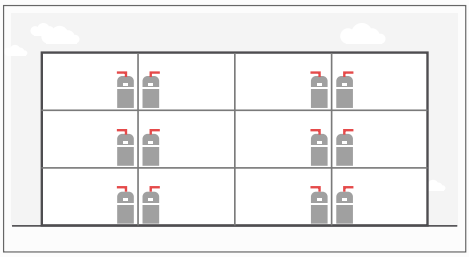
! Integrated HPWH caution

Take care when locating the integrated HPWH inside a multifamily unit. As multifamily units are smaller than single-family homes, it can be challenging to situate a HPWH so that it is not a nuisance to the occupants. If installed near frequently occupied space, they may prove to be too loud or too drafty.

Basic System Types

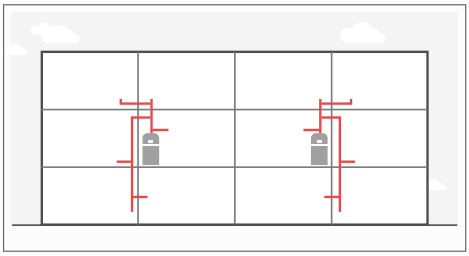
There are three essential system configuration types for R-2 occupancy HPWHs. Within each system configuration type there are a variety of deployment options that use either integrated or split-system HPWHs that can be tailored to suit a particular building design.

1. Tank-per-Unit—*One HPWH serves a single unit.*



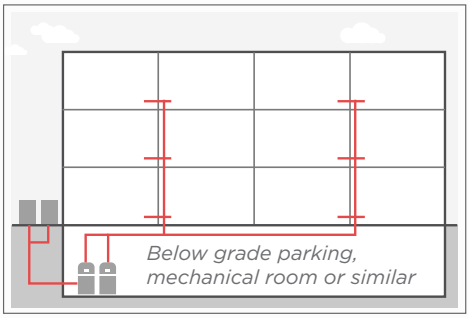
2. Tank-per-Cluster—*One HPWH serves multiple units.*

Pipe runs to each unit are short enough to retain minimum hot water delivery time. Multiple tanks are distributed throughout the building to provide hot water to clusters of grouped units.



3. Central System—*A single HPWH plant serves the entire building.*

Hot water is distributed throughout the building from one location. This distribution system typically employs a strategy to maintain water temperature within the pipe between the central plant and the units. The design complexities require more information than provided in this guide. For example, see ***https://efiling.energy.ca.gov/GetDocument.aspx?tn=231318****. Consult with a mechanical design engineer for specific guidance on central-system configurations.*



System Configuration and Deployment Options

Within each of the basic system types, there are multiple configurations and deployment options. The optimal choice for your building will depend on the building-design features.

System Configuration Key

System Type

T – Tank-per-unit
D – Distributed cluster
C – Central system

Equipment Type

P – Integrated equipment
S – Split system

Deployment Options

1 – Interior closet accessible from corridor
2 – Exterior closet accessible from unit balcony or similar space
3 – Garage, mechanical room or similar buffer space
4 – Inside unit
5 – Split-system outdoor unit, exterior placement
6 – Solarium or greenhouse space on roof

Deployment Concept: Providing integrated HPWHs with adequate air circulation

Integrated HPWHs, because they extract heat from the air surrounding them, require air circulation or other thermal resource to operate properly. It is possible to install integrated HPWHs in small, enclosed spaces by taking additional steps to increase air exchange with adjacent spaces. When in spaces smaller than 700 cubic feet in volume, employ one of the two strategies below (and always refer to product installation manuals for manufacturer specific instructions).

Option 1

Increase passive air circulation by creating openings in the wall or door with transfer grilles, louvers, or undercuts. Provide for air transfer both high and low in the space - a single location is inadequate. Options include a full louvered door or a half-louvered door in combination with a door undercut of at least 18 square inches. Install the water heater within 1 foot of the grille or louver and position the exhaust air to point at the opening. Install the louver or grille at the same height as the air exhaust.

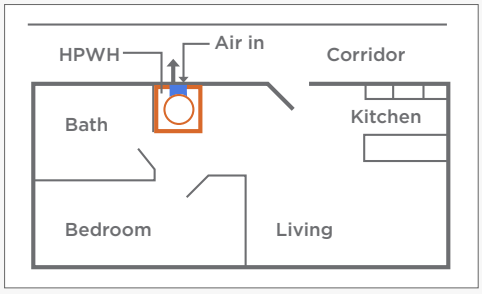
Option 2

Actively force air circulation with ducting. Connect ducts to either the HPWH exhaust air, supply air, or both. Single ducting of exhaust or supply requires one additional air opening to the enclosed space. Use a transfer grille or door undercut of at least 18 square inches (or 5/8-inch for a 30-inch door). For dual ducting, no additional venting to the space is needed.

Tank-Per-Unit Options

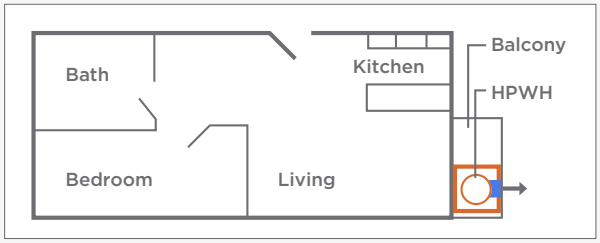
TP1: Integrated HPWH in interior closet accessible from interior corridor.

- Circulate air between closet and corridor. Isolate from dwelling unit. For options, see the Adequate Air Circulation section on page 8.
- Access the HPWH from outside the unit through door between closet and corridor.



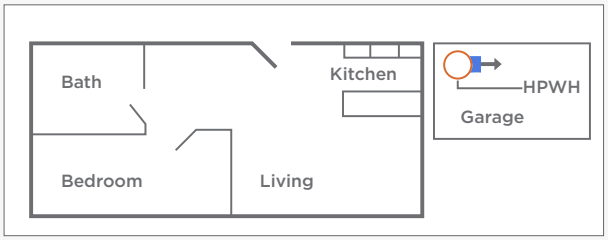
TP2: Integrated HPWH in exterior closet located adjacent to unit balcony or similar space.

- Circulate air between closet and exterior. For options, see the Adequate Air Circulation section on page 8.
- Access the HPWH from outside the unit through door between closet and balcony.
- Consider only when outdoor temperatures are unlikely to freeze. The HPWH may operate in resistance-only mode for portions of the year when the closet temperature drops below 40F.
- Upsize the tank. The cooler winter temperatures encountered in an exterior closet will reduce the water-heating rate. To help provide enough hot water, install a 65-gallon tank or larger instead of a 50-gallon tank, and an 80-gallon tank instead of a 65-gallon tank.



TP3: Integrated HPWH in garage, mechanical room or similar buffer space.

- Place HPWH in a temperature-buffered space, like a parking garage or mechanical room.
- Boost HPWH efficiency by co-locating HPWH with other devices that give off heat.
- Evaluate whether pipe runs from the water heater to the unit are short enough to deliver hot water in adequate time. Unless mitigated with temperature-maintenance strategies compliant with WSEC section R403.5, overly long pipe runs may render this deployment option unsuitable for buildings with many floors and units. Insulated pipes in excess of R-8 will lead to more success with this option.

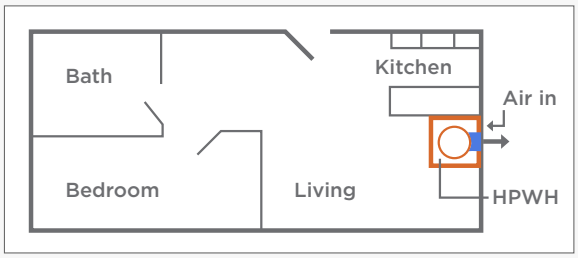


TP4: Integrated HPWH inside each unit.

- Place HPWH near exterior wall, and circulate air from the exterior across the HPWH. For options, see the Adequate Air Circulation section on page 8. Circulate air only with the exterior and not with the dwelling unit. If dual-ducting is selected, the HPWH does not need to be isolated in its own compartment.
- The HPWH will operate in resistance-only mode for portions of the year when outside-air temperatures are below 40F.
- Do not configure the HPWH in an exhaust-only configuration that draws air through the equipment and out of the dwelling unit. Any exhaust air requires additional make-up air be supplied to the dwelling unit which creates an excessive energy waste in cooler climates where the outside, make-up air is, on average, colder than the HPWH exhaust.

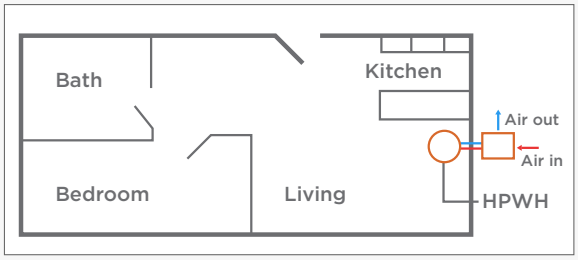
Continued ▶

- Upsize the tank. The cooler winter temperatures encountered when supplying with exterior air will reduce the water-heating rate. To help provide enough hot water, install a 65-gallon tank or larger instead of a 50-gallon tank, and an 80-gallon tank instead of a 65-gallon tank.



TS5: Split-system HPWH with tank in unit and outdoor unit placed on exterior.

- Locate outdoor unit in an appropriate place including on rooftop, mounted on exterior wall bracket, at grade adjacent to building, or in a parking garage.
- Observe manufacturer requirements for maximum vertical and horizontal separation of outdoor unit and indoor tank.



Distributed Cluster Options

For these configurations, pipe runs to units must be minimized to avoid long wait times for hot water. Unless mitigated with temperature maintenance strategies compliant with WSEC section R403.5, overly long pipe runs may render this deployment option unsuitable for buildings with many floors and units. Insulated pipes in excess of R-8 will lead to more success with these options.

DP1: Integrated HPWH in closet accessible from corridor.

- Place in mid-level of building to minimize pipe runs to units.
- Circulate air between closet and corridor. For options, see the Adequate Air Circulation section on page 8.

DP3: Integrated HPWH in garage, mechanical room, or similar buffer space.

- Place centrally among each cluster of units to minimize pipe runs.
- Locate in garage, mechanical room, or similarly sized room to provide enough buffer space so that venting is unnecessary.

DP6: Integrated HPWH located in solarium or greenhouse space on roof.

- Construct a direct-solar gain space (likely on rooftop) to house the water heaters. This gain space will act as a greenhouse to provide passive solar assist.

DS5: Split-system HPWH with tank in building and outdoor unit placed on exterior.

- Locate outdoor unit on rooftop, mounted on exterior wall bracket, at grade adjacent to building, in a parking garage, or similar.
- Observe manufacturer requirements for maximum vertical and horizontal separation of outdoor unit and indoor tank.
- Locate the tank in the building's mid-level, central to the cluster of units it serves.
- Minimize length of pipe runs to units to avoid long wait times for hot water.

Central System Options

CS3 & CS5: Central plant used to heat water for building, which is circulated from the plant to the unit. Depending on operating requirements, locate heat pumps in either buffered space, such as a parking garage, or exterior. Both split-system and integrated HPWHs may be used in a central design; however, the output capacity of split-systems is typically much higher, making them better suited for such applications. Be sure to minimize the length of distribution piping while maximizing pipe insulation.

System Type Selection

The following table summarizes criteria and considerations to help you select the best system type for your building.

	Tank-per-Unit	*Tank-per-Cluster*	*Central System*
Sound and cold drafts	Integrated HPWHs are likely to be a nuisance to occupants if placed within a small apartment. This can be avoided by locating the HPWH in corridor closet, outdoor closet, or by dual ducting each HPWH. This is not a concern for split systems.	For both integrated and split systems, sound and cold drafts are not a concern because the HPWH is located outside the unit.	Sound and cold drafts are not a concern because the HPWH is located outside the unit.
Capital and installation cost	The cost is one system per unit.	The equipment costs are divided across the number of units each HPWH serves. Additional pipe runs are required to deliver hot water from the tank to clustered units.	Central plant equipment costs are shared across entire building. A complete distribution and temperature maintenance system is required.
Maintenance	Often requires access to each unit, which may disturb occupants. Certain designs can avoid this problem. *System failure outcomes:* If one water heater fails, only one unit is without hot water.	Water heater maintenance does not require access to units. The additional short, distribution piping may require maintenance. *System failure outcomes:* If one water heater fails, several units are without hot water.	Water heater maintenance does not require access to units. The distribution piping and temperature-maintenance system will require additional maintenance. *System failure outcomes:* If the central system fails, the entire building is without hot water.
Water leaks	When they happen, water leaks will occur in individual units at the tank. This can be mitigated by installing a drain pan and selecting equipment with leak detection to provide maximum protection.	When they happen, water leaks will occur in mechanical space, which can be easier to deal with than in-unit situations. This can be mitigated by installing a drain pan and selecting equipment with leak detection to provide maximum protection.	When they happen, water leaks will occur in a central plant location, which can be easier to deal with than in-unit situations. Adding building-wide distribution piping can increase the leak potential over the building's lifespan.
Floor area utilization	Requires one HPWH for each unit.	Increases the rentable area by spreading the floor area of a single HPWH across several units.	Increases the rentable area by spreading the HPWH floor area across several units. The distribution system will reclaim a small portion of that space.
Metering hot water use / Energy	Energy use directly incorporated into unit utility meters and therefore directly billed by utility.	Per Washington Administrative Code (WAC) **51-11C-40409**, a hot water submeter in each unit must be installed to bill occupants individually for energy associated with hot water use (wired and wireless options exist).	Per Washington Administrative Code (WAC) **51-11C-40409**, a hot water submeter in each unit must be installed to bill occupants individually for energy associated with hot water use (wired and wireless options exist).
System design	Off-the-shelf equipment is available. When HPWH-specific deployment options are considered, traditional, in-unit pipe layout practices can be used.	Off-the-shelf equipment is available. Deployment options, specific to HPWH needs, must be considered. Unit layouts, plumbing "wet walls," and tank location must be considered to minimize pipe runs from water heater to unit.	No off-the-shelf systems exist. Full system design, including heat pump, storage-tank size, and temperature maintenance strategy, must be conducted for each building. Consult an experienced design engineer for guidance.

System Configuration and Deployment Options

Building Characteristic	Configuration and Deployment Type To Consider		
	Tank-per-Unit	*Tank-per-Cluster*	*Central System*
Common entry to building (interior corridors provide entry to unit)	TP1, TS5, TP4	DP1, DS5, DP6	CS3, CS5
Garden style (exterior entry to unit)	TP4, TS5	DS5, DP6	CS3, CS5
Units have balconies/ decks/outdoor space	TP2, TS5	DS5	CS3, CS5
Below grade parking garage	TP3, TS5	DP3, DS5	CS3, CS5
Building has a single mechanical room	n/a	n/a	CS3, CS5
Building has a mechanical room per floor	n/a	DP3, DS5	n/a
None of the above	Consider using a split-system HPWH or dual-duct an integrated HPWH inside each unit.		

System Configuration Key

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Further Design Considerations

Tank Size

For individual tanks per unit, refer to guidance in the *Heat Pump Water Heater Technical Guide for Detached Single-Family New Construction and Additions Greater than 500 Sq. Ft.* When the HPWH is installed in a vented exterior closet, or has supply air ducted from outside, upsize the tank over standard practice.

For equipment serving multiple dwelling units, including both clusters and central systems, consult the equipment manufacturer. Additional guidance can be found in Table 7 of the *American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) Handbook – HVAC Applications 2015, Chapter 50 Service Water Heating.*

Pipe Length

A leading design goal should be to minimize the time it takes for hot water to be delivered, ideally under thirty seconds. This is attained by minimizing both the distance between the HPWH and the fixture and the pipe diameter. Conduct proper engineering calculations to account for pipe diameters, lengths, and fixture flow rates. If calculated wait times are too long, either redesign the plumbing layout or consider temperature maintenance strategies compliant with WSEC section R403.5. Insulated pipes in excess of R-8 will lead to more success in these scenarios.

Drain water heater recovery (DWHR)

DWHR is an effective way to reduce the energy use of the HPWH, increase useful stored hot water capacity, and receive another 0.5 credit from Table 406.3 (using option 5.1). Further, DWHR is a natural pairing with HPWH and any number of DWHR plumbing layouts will complement the HPWH.

Central Systems

Central systems are currently not available as off-the-shelf products; they must be designed and built-up for each installation. Critical design considerations for central systems include:

- Equipment must be located in a place suitable to the air temperature operating range.
    - The heat pumps should be located in a space where they can operate year-round regardless of outdoor temperature. In Washington's climate, for equipment with R-134a refrigerant, this typically means locating them in a below-grade parking garage or buffer space.
- Reduce heat loss of the distribution system:
    - Pipe runs must be minimized
    - Insulation must be maximized, with these best practices:
        - Pipe hangers with thermal breaks
        - R-20 insulation levels
- Consider implications of heating the return water on heat pump efficiency.
    - The effect of reheating already mildly warm water in the distribution system must be considered as heat pumps respond in a vastly different way to varying incoming water temperatures than traditional gas or electric-resistance boilers.
    - With hot return water, the heat pumps may not operate, or may operate at extremely low efficiencies; therefore, it is often beneficial to have a primary heating system for heating the cold, main water, and a secondary system for maintaining the water temperature in the circulation loop.
- Compared to traditionally designed central, gas boiler systems, HPWHs will operate better, and cost less, with large storage volumes and smaller output capacities. The increased storage volume will meet the building's peak water demands and then the heat pumps will run more than gas boilers throughout the day to reheat the storage tanks.

General Best Practices

- Locate HPWHs where they can draw air from rooms with waste heat from other sources (i.e., cars in garages, photo-voltaic inverters, other mechanical equipment, etc.).
- Do not draw air from rooms with high dust loads (e.g., laundry rooms).
- Use the lowest possible fixture flow rates to minimize hot water waste.
- Use compact plumbing layouts.
- Consider DWHR to feed the supply side of water heaters to capture some of the heat going to the drain.

CONSTRUCTION TEAMS AND PLUMBERS

In addition to the guidance of product manuals, consider the following best practices:

Clearance and Positioning

- Follow manufacturer specifications regarding HPWH clearance and seismic strapping.
- Ensure the intake air path is sufficiently free and open.
- If installed in an enclosed space with air transfer grilles, place HPWH so exhaust port is within one foot of, and directed at, the grilles or louvers.
- Position to allow for access to inspect the HPWH, change the air filter, and drain the tank.
- Rotate the unit so the control panel is facing outward and easily accessible to the occupant and/or building maintenance personnel. Make sure all data connection ports are accessible.

Condensate

HPWHs produce a non-acidic condensate that must be drained away. Unlike condensing gas water heaters, which produce acidic condensate as a combustion byproduct, there are no special piping or handling requirements for HPWHs other than to safely convey the benign condensate to a drain. Condensate may be piped to the nearest convenient location including laundry drains, and may also be conveyed with a common condensate pump.

▶ Condensate Tip

Condensate pumps, commonly paired with air conditioners, can be used to drain the condensate produced by a HPWH.

Insulation Pad

Provide minimum R-10 foam pad under the tank to minimize unnecessary heat loss through the bottom of water heater. (Note: this is required by WSEC R403.5.5 for all unconditioned spaces or installations on concrete floors). This is a best practice regardless of floor type, and R-10 foam pads are readily available at plumbing supply centers.

Seismic Strapping

As with other water heaters, your local code may require seismic strapping. When installing, use rubber standoffs when attaching straps to the wall to minimize vibration and sound transfer.

Drain Pan

If installing on a floor susceptible to water damage, install a drain pan to guard against any problems from future leaks. Connect the outlet from the pan to suitable drainage in accordance with your local code.

No Stand Needed

Electric storage water heaters, including HPWHs, do not need to be raised off the floor with a stand. That was a safety provision for older atmospheric gas storage water heaters located in garages. Most electric HPWHs are taller than electric storage water heaters—they have the same nominal volume, but their connections are in different places. Make sure there is space above and around the heater to accommodate the variations for the models you are considering.

Pipe Insulation

Insulate the hot water piping to at least the minimum requirements in IECC R403.5.3, or in accordance with your local codes—whichever is greater. To improve the system performance overall, insulate all of the hot water piping in all locations whether inside or outside conditioned space. It is more important to make sure the pipe insulation is continuous than it is to increase the wall thickness or R-value of the pipe insulation.

Servicing the Water Heater Post-Installation

HPWHs that meet NEEA's Tier-3 requirements come with a 10-year equipment warranty. Equipment used in central system applications may have different warranties. After installation, HPWHs require modest servicing.

For integrated HPWHs, the air filter should be cleaned every 3–6 months, with a more frequent cleaning cadence in high-dust locations. The heat pumps in current integrated water heaters are designed like refrigerators to operate as a fully sealed system with no servicing, so there are no ports to add or remove refrigerant. On extremely rare occasions, the condensate drain port may need to be cleared should it become blocked.

For split-system HPWHs, the outdoor unit heat exchange coil may need occasional cleaning like any other heat pump.

For central systems that are custom-designed and built for each building, additional maintenance and refrigerant servicing needs may apply. Check with manufacturer's recommendations for service requirements.

Like any other water heater, follow the manufacturer's recommended regular maintenance for draining the tank and servicing the anode rod.

CHECKLISTS

Based on the requirements and best practices outlined above, the following checklists provide guidance on how best to verify the proper installation:

Code Officials/Inspectors, verify:

- ☐ Condensate safely conveyed to drain or exterior. *(Note: condensate is benign water requiring no special pipe material.)*
- ☐ Proper wire gauge is used. *(Note: Most heat pump water heaters still have full-size resistance elements, so wiring requirements are identical to standard electric-resistance water heaters).*
- ☐ T&P valve is properly plumbed.
- ☐ Wiring is grounded with proper gauge.
- ☐ Water heater is on minimum R-10 foam pad if in unconditioned space or on concrete floor.
- ☐ Seismic strapping is employed, as required by local jurisdiction.
- ☐ No stand is needed for installation.
- ☐ For water heaters serving a single dwelling unit, pipe insulation is minimum R-3 or local code—whichever is greater.
- ☐ For water heaters serving more than one dwelling unit, pipe insulation is minimum R-8 or local code—whichever is greater.
- ☐ Correct spacing is provided around the heat pump (per manufacturer's instructions).
- ☐ Heated water circulation systems, if present, are configured to pump only on demand for hot water within the occupancy.
- ☐ The NEEA Tier Level of the HPWH.

HERS Raters/Home Energy Inspectors, verify:

- ☐ Water heater is positioned with clear intake air path.
- ☐ Water heater is positioned for easy access to the control panel and to change or service the filter.
- ☐ Connections to the water heater are located so that the water heater can be easily removed for repair or replacement.
- ☐ The NEEA Tier Level of the HPWH..
- ☐ Pipes insulated where required.
- ☐ Make-up air volume around the water heater is large enough, or make-up air is provided as per the manufacturer's requirements.
- ☐ For enclosed space installs, verify air circulation is adequate by including enough air transfer openings, both high and low in the space, and by directing the HPWH exhaust at the grilles or louvers.
- ☐ Recirculation loop (if present) returns pipe to cold inlet of water heater.
- ☐ Mode of operation is at a minimum of hybrid, and preferably heat-pump only.

FREQUENTLY ASKED QUESTIONS

How much space is required around the HPWH?

Providing enough warm air for the water heater is key to successful HPWH operation. HPWHs can be located in a small space as long as there is adequate air exchange. For guidance, see the Adequate Air Circulation section on page 8.

For a tank serving each unit, when should tank size be increased?

If providing enough hot water for occupants is a concern, go from a 50-gallon tank to a 65-gallon tank, or from a 65-gallon tank to an 80-gallon tank. It is recommended to go up one size on the water heater if use is expected to be larger than usual, or if the water heater is sourcing air from the outside.

How do the NEEA Tiers work and why should I care?

The Northwest Energy Efficiency Alliance (NEEA) has created a specification and test procedures that are suited both for cool and warm climates. The Advanced Water Heating Specification (AWHS) is paired with a Qualified Products List (QPL). The different tier levels range from 1-5 (1 being the lowest performing, and 5 being the highest performing). Higher tiers mean better performance, quieter operation, less dependency on electric resistance, and more integration to the utility grid. Considerations in choosing a specific tier may include locational challenges, attaining HERS points, and/or energy credits required in the residential WSEC.

Can I duct air to the water heater from the outside and exhaust it to the outside (a.k.a., "dual ducting")?

Yes, but consider the following: 1) the HPWH should be located near an exterior wall with at least 6-inch wall penetrations per duct; 2) the HPWH will operate in resistance-only mode for portions of the year when outside-air temperatures are below 40F; and 3) the tank should be upsized to counteract cooler winter temperatures slowing the water-heating rate (i.e., use a 65-gallon tank instead of a 50-gallon tank, and an 80-gallon tank in place of a 65-gallon tank).

Should I draw air from the dwelling unit, through the HPWH and exhaust it to the outside (i.e., exhaust ducting)?

No, HPWHs should not be used in an exhaust-only configuration. Any exhaust air requires additional make-up air be supplied to the dwelling unit which creates an excessive energy waste in cooler climates where the outside, make-up air is, on average, colder than the HPWH exhaust.

What heating and cooling systems should I use with a HPWH?

Any high-efficiency heating system pairs well with a HPWH. Select heating systems with maximum credits from section 3 in the Energy Credits table (406.3) to provide maximum energy savings.

Will the HPWH reduce the temperature of the room it is located in?

HPWHs work efficiently by extracting heat from the surrounding air and transferring it to the water inside the tank. For small, enclosed spaces (typically, fewer than 700 cubic feet), the temperature can drop to a point where the HPWH no longer operates properly. For proper operation, provide enough air exchange, or other thermal resource, with an adjacent space, or the exterior.

If installed inside a dwelling unit, will the HPWH's energy savings be offset by the extra heating system runtime?

The deployment options suggested in this guide provide optimum energy savings configurations for low-rise multifamily buildings. To avoid potential occupant dissatisfaction, the suggested configurations do not circulate air within the dwelling unit and therefore do not impact heating energy in any way.

Are HPWHs loud?

HPWHs have a fan and compressor—both of which make noise. Tier-3 HPWHs emit sound at levels less than 55 dBA, which is quieter than a typical conversation. On the other side of a wall or door, this drops to 35–40 dBA, which is quieter than a refrigerator. The deployment options suggested in this guide all place the water heater in locations to sufficiently mitigate sound concerns.

Can I reduce the sound of a HPWH?

To reduce HPWH sound levels, locate the unit far from the most actively occupied areas of the living unit. Additionally, use vibration-dampening standoffs to connect the seismic strapping from the water heater to the wall. Placing the water heater on an insulating pad will also help. Attaching a short duct run, such as a 90-degree elbow, can reduce sound. Finally, insulating the walls between the installation location and occupied house spaces can reduce sound levels.

How reliable are HPWHs?

HPWHs have been available for more than 40 years. Current HPWHs are designed like refrigerators to operate as fully sealed systems with no servicing required. The only additional, regular service required is to check the air filter every 3 months. Further, Tier-3 HPWH come with a category-leading 10-year warranty.

Will the occupants have enough hot water?

HPWHs have hot water delivery capability that is equal to or greater than electric-resistance tanks. If concerned about delivery capability, consider upsizing the volume of the storage tank.

When should I upsize the tank?

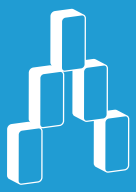
If given the chance, larger tanks are the better choice as they rely on the heat pump for the majority, if not all, of the water heating.

What if I need more hot water but can't install a larger tank?

One approach is to install a tempering valve, which allows a higher set point on the water heater. Note that higher temperatures may increase energy use, and be sure to always consult with local plumbing codes to guide professional installation and fail-safe equipment.

Where can I find additional information?

- NEEA's Qualified Products List: **neea.org/img/documents/qualified-products-list.pdf**
- Additional general information: **hotwatersolutionsnw.org**
- AO Smith: **aosmith.com**
- Bradford White: **bradfordwhite.com**
- Rheem: **rheem.com**
- Sanden: **sandenwaterheater.com**



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