



Heat Pump Water Heater Guide

Best Practices & Technical Considerations for Residential New Construction

June 2024

ENERGY STAR NextGen Certified Homes

INTRODUCTION

How to Use This Guide

This guide covers the basics of integrated Heat Pump Water Heaters¹ (HPWHs), from design to installation and maintenance. It highlights best practices and common technical considerations for professionals supporting HPWHs for single-family and multifamily new construction.



Image Credit: Beazer Homes

Heat pump water heaters are a key advanced electric technology that will help build our clean energy future.

HPWHs extract heat from the surrounding environment and transfer it into the water inside the tank. They are electrically powered and deliver hot water up to five times more efficiently than standard electric resistance, gas, and propane water heaters. The most commonly used heat pump technology for domestic water heating are integrated HPWHs². Integrated HPWHs have their heat pump compressor and heat exchangers attached directly to the water heater's storage tank. They typically harvest heat directly from the surrounding air, but can also draw from air supplied through ducted vents. Most models also have electric resistance heating elements—like traditional electric water heaters—to use as a backup when needed, which is why HPWHs are sometimes called Hybrid Water Heaters.

¹ The term heat pump water heaters (or HPWHs) used through most of this guide refers to integrated HPWHs, except where stated otherwise.

² Other heat pump technologies that can support domestic hot water production include split system HPWHs, air-to-water heat pumps (AWHPs) designed principally to provide space-conditioning, ground source heat pumps (GSHPs, also known as geothermal heat pumps), GSHPs with desuperheaters, central heat pump water heaters, and gas heat pump water heaters. These technologies may be suited for some applications, but are not discussed in this guide.

BENEFITS OF HPWHs

Benefits to Occupants

- **HPWHs can reduce operating costs.** Residents will enjoy significantly reduced operating costs compared to standard electric water heaters or oil, propane, or kerosene water heaters. ENERGY STAR certified HPWHs use 70% less energy than a standard electric water heater, which could save a household of four approximately \$550 per year on its electric bills and more than \$5,600 over the unit's lifetime. There can also be operating cost savings relative to natural gas, but these depend on local utility rate structures.
- **HPWHs can offer more control options.** HPWHs may offer flexibility with a digital control panel or remote management application to control temperature setpoints and adjust operational modes, maximizing efficiency. Most also provide grid connectivity and interoperability options for participating in demand response programs, and may allow the user or installer to enter a utility time-of-use rate plan to maximize cost savings. HPWHs may also provide more capabilities to track performance through energy consumption and operational status reporting.
- **HPWHs can improve indoor air quality and safety.** HPWHs do not create toxic combustion exhaust gases, such as carbon monoxide. By eliminating this combustion appliance, HPWHs also eliminate the risk of fire or explosion that can be caused by a fuel-fired water heater or associated gas piping.
- **HPWHs reduce residents' carbon footprint.** HPWHs run on electricity. Due to their high efficiency, this reduces the carbon impact of domestic hot water use, even in locations with carbon-intensive grid electricity. The emissions savings are even greater in locations with cleaner, low-carbon grids.
- **HPWHs can be a smart consumer choice.** With available local financial incentives and federal tax credits for qualified products, along with typical 10-year manufacturer warranties, HPWHs can be a cost-effective long-term product option.

Benefits to Builders and Installers:

- **HPWHs can create new business opportunities and jobs for installers.** Installers can be market leaders and help their customers take advantage of utility, local, state, and federal incentives for installing ENERGY STAR certified HPWHs, and also help builders meet advancing energy codes.
- **HPWHs can be marketable.** Some homeowners are concerned about home energy independence and reducing greenhouse gas emissions. HPWHs help address those concerns while providing access to special incentives, rates, tax credits, and smart connectivity information and controls, where available. Builders that install HPWHs can sell these benefits as part of a "smart home of the future." In some markets, HPWHs with communicating modules can allow the homeowner to take advantage of demand response programs or time of use electricity rates for additional benefits.
- **HPWHs can speed construction and design:** By avoiding gas service installation, contractors can eliminate construction delays caused by waiting for gas line easement approvals and avoid making accommodations to locate gas meters in construction plans that must meet difficult clearance requirements.

Heat Pump Water Heaters in ENERGY STAR® NextGen Certified Homes

While this guide is applicable to all residential new construction, it is primarily a resource for builders participating in the EPA’s ENERGY STAR NextGen™ Certified Homes and Apartments program, which requires the installation of ENERGY STAR certified HPWHs.

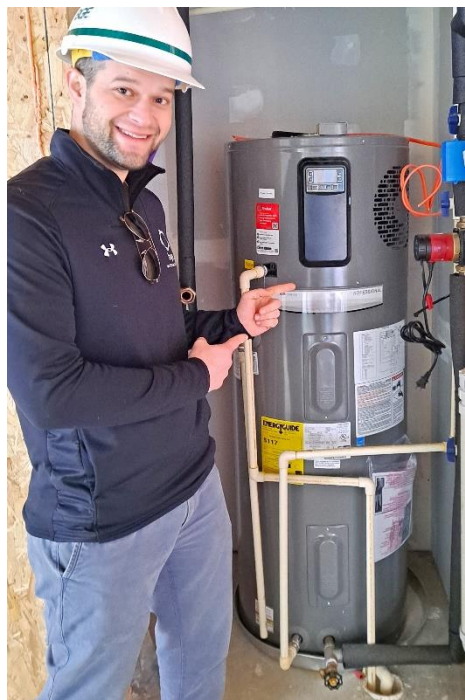


Image Credit: Carlos Rivas

ENERGY STAR NextGen offers an additional, optional level of recognition for homes and apartments equipped with leading-edge technologies that maximize energy and emissions savings of up to 80%. ENERGY STAR NextGen homes and apartments are on average 20% more energy efficient than homes built to typical code levels and come equipped with ENERGY STAR certified heat pumps, ENERGY STAR certified heat pump water heaters, electric cooktops and ovens, and EV charging capabilities. These features not only improve the occupant’s lifestyle, but the health of the planet.

Beyond equipping homes and apartments with HPWHs, the ENERGY STAR NextGen program also has additional specific requirements that ensure residents have a positive experience with this advanced technology. These include the use of ENERGY STAR certified units for maximum efficiency, maximum sound ratings when HPWHs are installed in occupiable spaces, minimum tank sizes to ensure a majority of the heating is performed by the heat pump, and connected capabilities to allow users to participate in optional demand response programs.

ACKNOWLEDGEMENTS

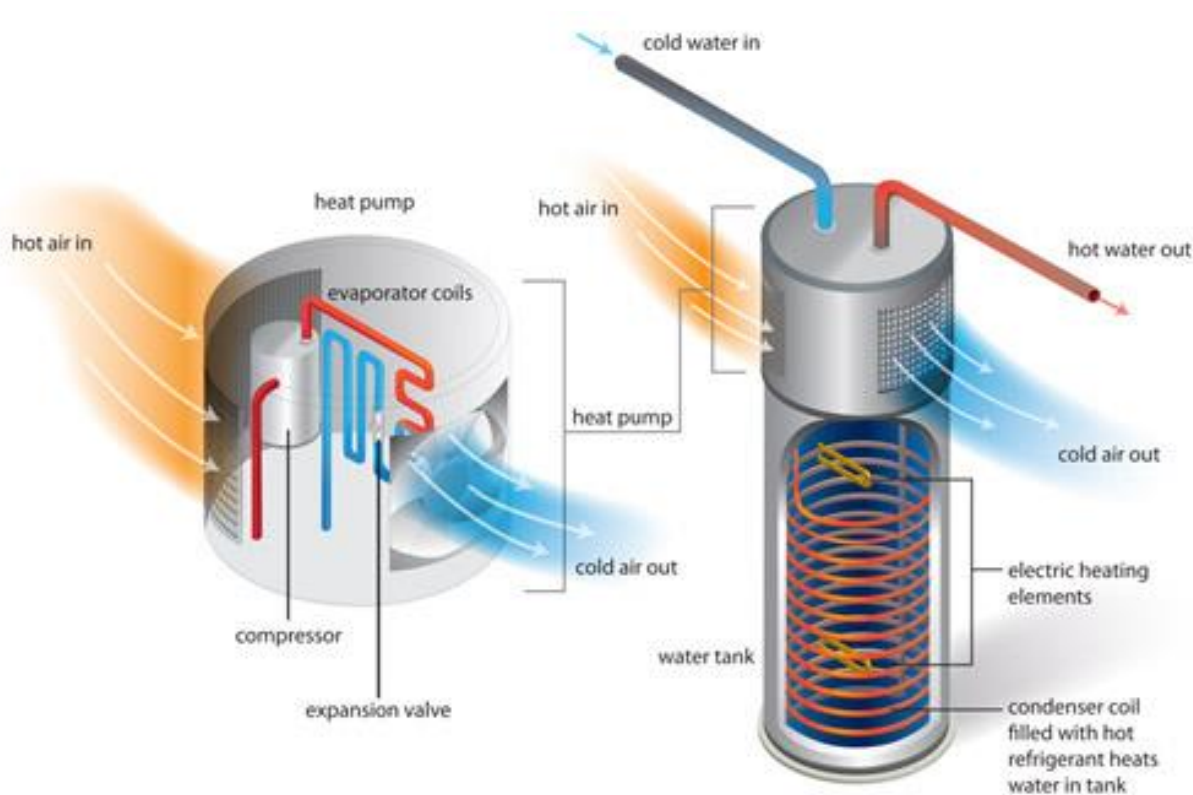
Appearing throughout this guide are background content and images provided by the Northwest Energy Efficiency Alliance , Southern California Edison, New Buildings Institute, the Advanced Water Heating Initiative and Efficiency Maine. The U.S. Environmental Protection Agency’s ENERGY STAR program thanks them for their support.

HOW IT WORKS:

The Anatomy of an Integrated HPWH

HPWHs work like a refrigerator in reverse: by extracting heat from the surrounding air and transferring it to the water inside the tank, HPWHs reduce the energy required to heat water compared to conventional water heaters, which use input energy—natural gas, electricity or other fuels—to create heat.

- 1** The heat pump's fans pull warm air from the room into a heat exchanger, warming the heat pump's refrigerant.
- 2** The heat pump compresses the refrigerant increasing its temperature.
- 3** High temperature refrigerant lines transfer that heat into the water.
- 4** The heat pump's fans blow out cooled air, its heat now in the water.
- 5** Hot water is supplied from the HPWH to plumbing fixtures.
- 6** Smart grid connectivity controls help manage energy use.



HPWH DESIGN CONSIDERATIONS

To ensure efficient operation, a HPWH should be installed in a sufficiently large room, or be properly vented. Manufacturers typically require access to a minimum of 450 or 700 cubic feet of free air space where the water heater is installed, along with ample space to allow installation and service. An 8-ft by 12-ft room with an 8-ft ceiling, for example, provides sufficient volume. The installation location relative to other parts of the home (hot water uses and living areas) will affect efficiency and may impact residents' comfort.

Be sure to consult the manufacturer's installation guide for recommendations specific to your model.

Sound

HPWHs have a fan and compressor, both of which can make a modest amount of noise when the HPWH is heating water. HPWHs that meet ENERGY STAR Version 5.0 product specifications emit sound levels less than 55 dBA—about the level of a background conversation. *55 dBA is also the maximum sound rating level allowed by the ENERGY STAR NextGen program for HPWHs installed in occupiable space.*

Sound levels vary among products. Some HPWHs have sound pressure ratings of 45 dBA—about the level of a quiet dishwasher—and even softer-sounding products are in development.



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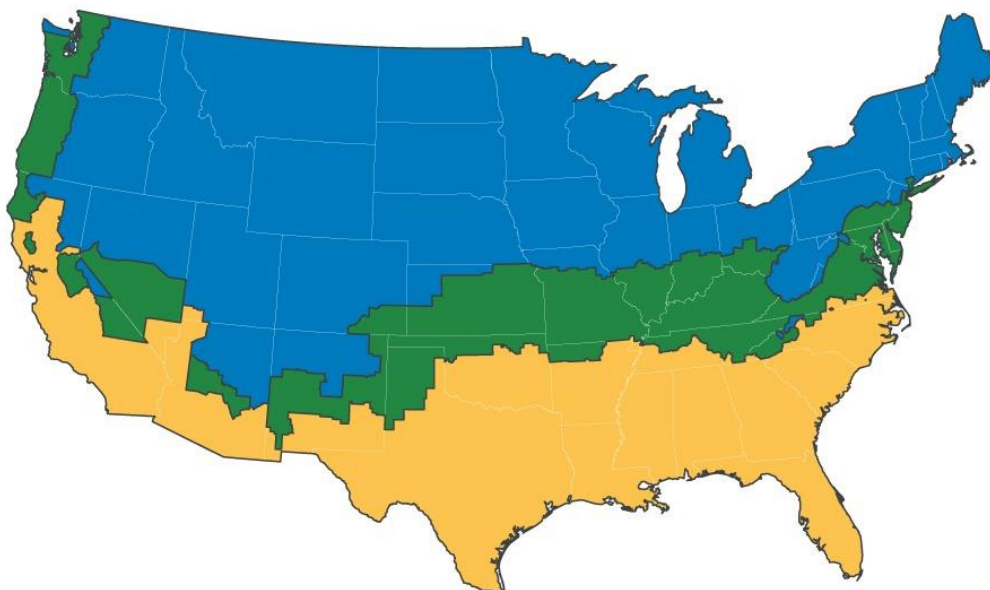
Avoid locating a HPWH next to rooms where sound levels are more important to comfort, such as bedrooms and living areas. To further reduce the impact of noise, consider additional sound insulation for the installation room.

Cool Exhaust Air

HPWHs exhaust air that has been cooled and dried. Avoid locating an HPWH near areas where residents will be sensitive to cooler air temperatures. Infrequently occupied spaces where temperature variations are less likely to be bothersome—like hallways, garages, and utility rooms—are good choices. Locations with waste heat available also serve as excellent locations. In some areas, the cooler and drier air can be a benefit, for example, in a laundry room or near a home gym.

Typical Installation Locations

The local climate will often determine best locations to install an HPWH. Use the IECC climate zone on the map below to determine the best HPWH installation locations for your area. Also, be sure to consult the manufacturer’s installation guide for recommendations specific to your model and follow applicable local codes.



Location in Home	Climate Zone		
	1 - 3	4	5 - 7
Basement	✓	✓	✓
Garage	✓	✓	X
Interior Room	✓	✓	✓
Uninsulated Room	✓	X	X

Basements, including unconditioned ones, are often the best locations for HPWHs in any climate.

Garages are also a great option because they can provide ample volume. In warmer climates, where outdoor temperatures are usually above 50° F, uninsulated garages are acceptable; however, if the building is in a cooler climate, consider possible freezing conditions and follow standard location practices in your area.

Interior rooms including utility, laundry, and IT rooms are other common choices that work in any climate. An HPWH can benefit from waste heat produced by other equipment in the space.

Rooms outside the thermal envelope—such as attached sheds and utility rooms—also work in warm climates. In hot climates, they can increase energy efficiency compared to interior spaces.

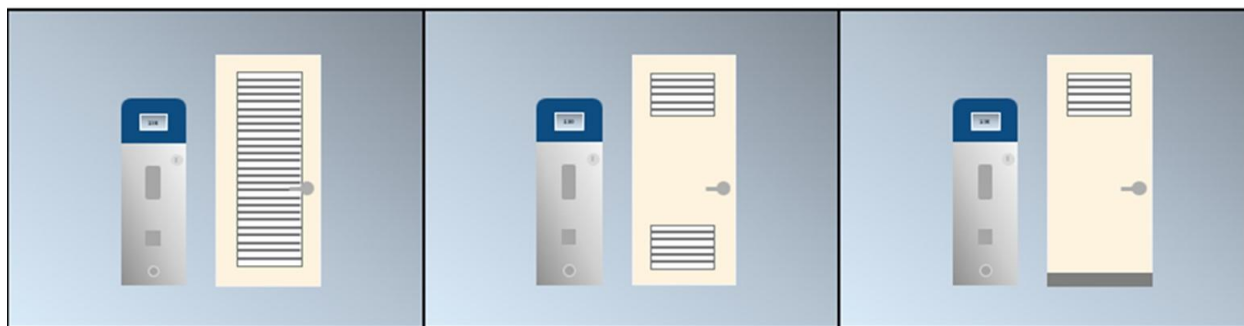
Venting in Closets

In some homes or dwelling units, it is necessary to plan for the HPWH to be placed in a confined space, such as a small mechanical closet. If the HPWH must be installed in closets adjacent to rooms that are frequently occupied, vent the cooler exhaust air through a duct or transfer grille into an area where temperature is not an issue.

Refer to manufacturer requirements for minimum requirements for the amount of air needed, and choose one of the following options to achieve proper airflow.

Passive venting options:

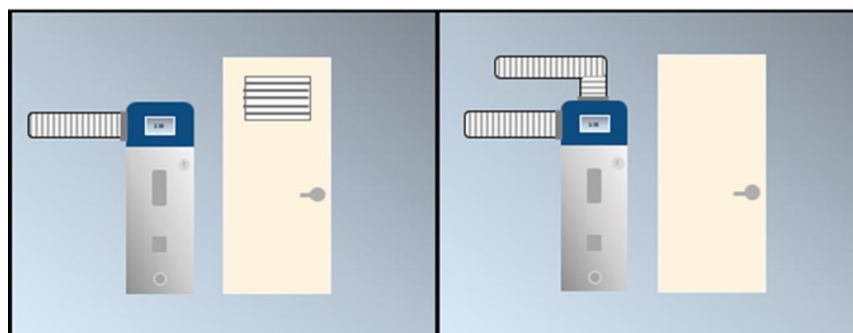
Best practice is to provide a total minimum net-free area of 240 square inches or greater, with both high and low openings to allow air to circulate. This can be done through a fully louvered door, using both high and low transfer grilles, or a high transfer grille and a 3/4" door undercut.



Passive Venting Options: Fully louvered door, high & low transfer grilles, and high transfer grille with a 3/4" door undercut.

Active venting options (ducted):

- *Duct HPWH intake air directly into the HPWH.* To allow cool exhaust air to leave the space, install a large louver or transfer grille that provides at least 130 square inches of net free area, placed in a location near the HPWH exhaust.
- *Duct HPWH exhaust out of the space.* To allow warm air to enter the space, install a large louver or transfer grille that provides at least 130 square inches of net free area or at least a 3/4" door undercut to allow air to enter the space.
- Duct both intake air and exhaust air with balanced airflow.



Active venting options: Intake OR exhaust air ducted to unit with a transfer grille, and ducted intake and exhaust

For active venting, ducts must be short, unrestricted, and as straight as possible. Design ducting to vent exhaust air into a location where a cool air stream will have minimal impact on occupant comfort. Only duct to the outside if located in a warm climate and ducting both the inlet and outlet. Refer to manufacturer guidance for duct sizing and maximum distance requirements.

DO NOT:

- Do not duct only the HPWH intake air or exhaust air to the outside. Doing so will create a pressure imbalance that will lead to air infiltration or exfiltration, increasing the load on the space heating and cooling systems.
- Do not run any ducts between the garage and the HPWH. This may bring exhaust fumes or other contaminants into the living space.
- Do not vent the water heater exhaust air near a thermostat. The cooler exhaust air will provide a false reading to heating and cooling systems.
- Do not duct both the HPWH intake and exhaust air to the outside in cold-climate regions or locate the HPWH outside in cold-climate regions. Intake air temperatures below approximately 40°F will trigger electric resistance elements and significantly reduce HPWH efficiency.

Tank Sizing

Follow the local plumbing code’s minimum first-hour rating (FHR) requirements and manufacturer recommendations for tank sizing. For maximum efficiency, upsize the tank over the standard practice used for electric resistance or fossil fuel-fired water heaters. HPWHs typically come with auxiliary resistance elements that can run to meet periods of high water demand when the unit is set to Hybrid Mode. Resistance operation is less efficient than running the heat pump alone. Upsizing the tank will minimize inefficient resistance heating, allowing the heat pump to do the majority of the water-heating work. *The ENERGY STAR NextGen program requires minimum rated tank volumes based on the number of bedrooms, as shown in the table below.*

- **TANK SIZE TIP #1**
Upsizing tank size increases the potential for thermal energy storage, which will allow a user to take maximum advantage of utility load-management programs or time-of-use electric rates.
- **TANK SIZE TIP #2**
Upsize the tank if the occupants are likely to have high hot water draw periods, such as a household with teenage children or occupants with a preference for baths.

Tank Size Guidelines (Gallon Capacity)											
Number of Bathrooms	1 to 1.5			2 to 2.5				3 to 3.5			
Number of Bedrooms	1	2	3	2	3	4	5	3	4	5	6
FHR per Uniform Plumbing Code	38	49	49	49	62	62	74	62	74	74	74
ENERGY STAR NextGen Minimum Tank Size	36	45	59	45	59	72	72	59	72	72	72

Condensate

HPWHs produce a benign condensate (water) that must be drained away from the heater. Unlike condensing gas water heaters, which produce acidic condensate as a combustion byproduct, there are no special piping or treatment requirements for HPWH condensate other than to pipe the water to a drain.

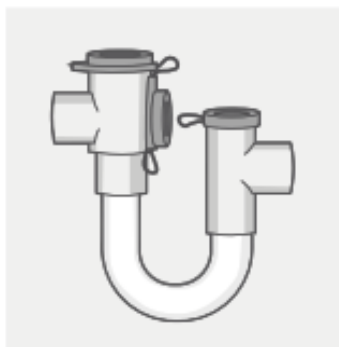


Image Credits: Northwest Energy Efficiency Alliance

Condensate drain lines are based on gravity moving the water to the drain. Do not locate any section of the drain line higher than the discharge port on the HPWH. Drain the condensate in a floor drain, trench drain, mop sink, hub drain, standpipe, utility sink, or laundry sink to prevent unsanitary conditions and potential health hazards. Do not drain condensate directly to drain waste vent (DWV) piping, nor the safety water pan under the heater.

- **CONDENSATE TIP #1**
As an additional feature for the residents, install the condensate drain with a tee port opening so they can periodically flush the condensate line with vinegar or a cleaning solution.
- **CONDENSATE TIP #2**
Condensate pumps—commonly used with air conditioners and space-conditioning heat pumps—can be used to drain the condensate produced by a heat pump water heater if a gravity drain is not practical. A single pump may be used for multiple products.

CONDENSATE PIPE ROUTING TIPS BY WATER HEATER LOCATION

Above Grade (e.g., garage)

- Install to ensure the drain line will not freeze (consult the installation manual for best practices)
- Laundry or utility sink drain

Below Grade (e.g., basement)

- Pump to outside
- Drain to floor drain, laundry sink, or p-trap to plumbing line

Connectivity and Controls

Water heating is an ideal demand response opportunity because connected electric water heaters can shift up to 1 kW per demand response event through pre-heating if they have the communication ability to load shift to respond to these events. Connected features allow for remote adjustments and alerts from anywhere and enable residents to further lower electric bills through optional participation in utility demand-response programs (where available). *The ENERGY STAR NextGen program requires that all heat pump water heaters meet EPA “connected” criteria or be equipped with a CTA-2045 communication EcoPort.*

HPWHs can also be an important element of a connected home package when installed with the following optional features and capabilities:

- Digital control interface on the HPWH
- WiFi connectivity and smartphone app for remote management to change temperature settings and modes, check operational status, monitor performance, and for energy reporting
- User alerts to consumers and consumer-authorized third parties, such as home automation and energy management systems
- Leak detection and automatic cold water supply valve shut off
- CTA-2045 (EcoPorts) that enable open, standards-based communication between the unit and consumer-authorized third parties (such as the utility) for optional participation in peak demand management and time-of-use rate programs
- JA-13 capabilities, which allow the user or installer to enter a utility time of use rate plan to limit usage when electricity rates are temporarily more expensive

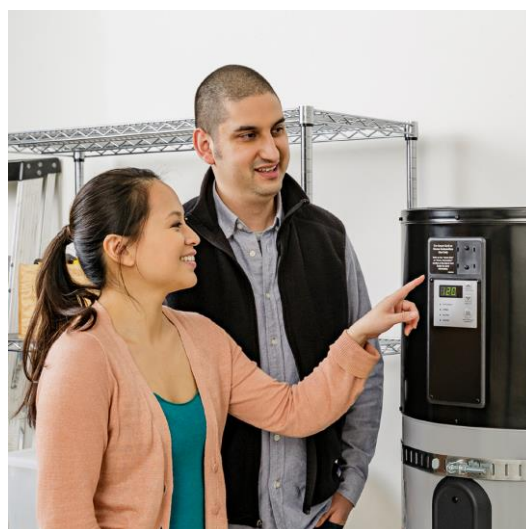


Image Credit: Northwest Energy Efficiency Alliance

Electrical Requirements

Electric service requirements for HPWHs are similar to those of electric resistance tanks. For new construction, power the HPWH with a 208/240-volt circuit/outlet and provide 30-amp panel service for the HPWH. *The ENERGY STAR NextGen program requires heat pumps to be 208/240-volt.* Most new single-family homes will have 200-amp or more service capacity installed at the main breaker, which will be sufficient to cover the 240-volt water heater and the home’s other electric loads. Refer to manufacturer requirements to determine the product’s needs. Follow National Electric Code (NEC) guidelines and local codes for all electric system decisions.

240-volt HPWHs using 15-amp breakers are available on the market, but are best suited for new construction applications that have only limited electric service capacity or for multifamily properties that must minimize overall electrical demand. These products have a smaller electric resistance element, which means they have a lower FHR than similarly sized 30-amp HPWHs.

DESIGN CONSIDERATIONS FOR MULTIFAMILY BUILDINGS

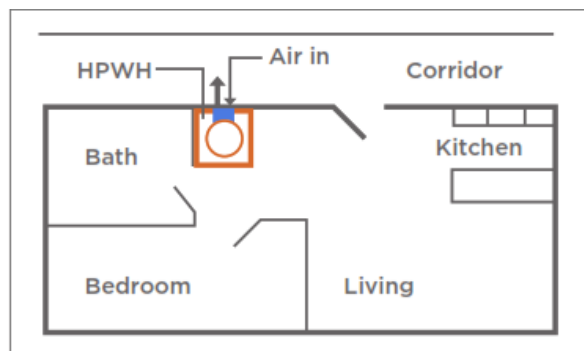
There is no one-size-fits all application option for heat pump water heaters in multifamily buildings. There are several design features that must be considered when planning to apply HPWHs in multifamily buildings. The architect and mechanical designer must engage early in the design process to account for these needs. The best system for a specific building will depend on a variety of factors including climate, number of units, type and size of units, number of floors, presence of a parking garage, roof access, balcony presence/absence, and interior or exterior corridors. HPWHs are most effectively integrated into multifamily buildings if considered from day one of the design process.

There are two primary domestic hot water system types for multifamily buildings: in-unit serving one dwelling unit per water heater or a central system serving all or part of the building. In-unit HPWHs are typically located in a closet within the apartment or just outside it. A variation on this approach is using a single 80-gallon HPWH to service two to four dwelling units.

Central systems heat and store hot water in a central location, such as a mechanical room, and use a recirculation loop to distribute the hot water. Unlike in-unit HPWHs, with central systems there is no need to figure out how to keep the cool exhaust air from impacting occupant comfort. A downside to central systems is that they must pump water long distances, resulting in energy losses of 30 to 50%.

Venting HPWHs into Corridors

Due to the smaller size of most apartments, for in-unit HPWHs, exhausting cool air into the living space can potentially cause comfort problems, especially in heating dominated climates. One solution to prevent comfort issues is to locate the HPWH in a (properly ventilated) closet off the corridor where heat can be harvested and cool air rejected. If the HPWH is accessed from the corridor, code will typically require fire-rated assemblies between the HPWH closet and the dwelling unit. These fire-rated assemblies will have the benefit of providing of additional sound proofing between the unit and the water heater.



*In-unit integrated HPWH circulating air from a corridor
Image Credit: Northwest Energy Efficiency Alliance*

When a heat pump water heater is actively operating (in heat pump mode), it generally is providing 2,500 to 5,000 btus/hr of cooling. This will nominally increase the amount of heating needed for the space, and decrease the required cooling. Designers should account for this additional cool air when sizing heating and cooling systems when multiple HPWHs reject cold air to the same space (eg corridor).

INSTALLATION BEST PRACTICES

Installing an HPWH is similar to installing an electric resistance water heater, so additional trades are typically not needed. Installation is usually simple, with no refrigerant handling required. In addition to following the guidance of product manuals, consider the following best practices:

Clearance and Positioning

- Position the unit so the control panel is easily accessible to the user.
- Make sure a service technician can access all data connection ports.
- Ensure the intake air path is sufficiently free and open.
- Make sure that the space and positioning allow for easy access to inspect the water heater and controls, service the air filter, and drain the tank.

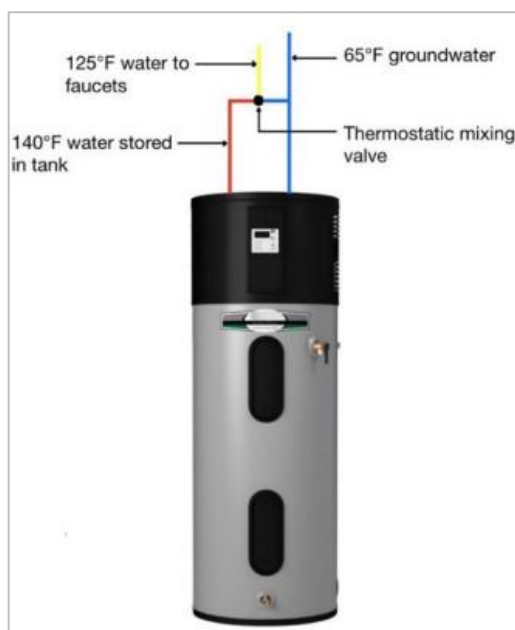


Image Credit: New Buildings Institute

KEY TAKE-AWAY: *Increasing the temperature of the tank from 125°F to 140°F adds an equivalent amount of available hot water as increasing tank capacity by about 10 to 15 gallons.*

Mixing Valve

A thermostatic mixing valve (TMV) can be used to regulate the temperature at plumbing fixtures to prevent hot water scald potential. The mixing valve will reduce the point-of-use water temperature by mixing the hot water from the water heater with a cold water supply. This allows the user to safely increase the tank water temperature setting above 125°F, which will increase the thermal storage capacity of the domestic hot water system. Heating tanks to 140°F significantly reduces legionella risk.

A TMV also allows for optimization between when the water heater uses electricity from the grid to heat the hot water versus when the occupants demand hot water. The HPWH can heat extra stored hot water when electricity rates are low, preventing the need to heat the water when electricity prices are high. Peak hot water demand often corresponds to periods of peak electric grid demand; TMVs allow occupants to better take advantage of utility load-management programs or time-of-use electric rates, managing electric demand and electricity costs.

Although TMVs are typically installed as a separate component, some manufacturers integrate them into their water heaters. Install a thermostatic mixing valve in the hot water supply line if the unit doesn't come with an integrated mixing valve.

Flexible Piping Connections

Install flex piping to the cold-water inlet and hot-water outlet connections to reduce vibrations from the HPWH. Flex piping is also recommended when the HPWH is in a confined space and the piping must bend.

Check Valve or Heat Trap

If the water heater lacks pre-installed check valves, install a check valve or heat trap on both the cold water inlet and hot water outlet piping as close to the tank as possible to reduce heat loss from natural convection. Flex piping can be used to create a U-shaped or loop-shaped heat trap. Check the manufacturer specifications or installation instructions for heat trap type installation recommendations and confirm if the water heater comes with pre-installed check valves.

Drain Pan

Some HPWHs are equipped with built-in leak detection at the bottom of the tank and automatic shut-off controls. Regardless of whether the HPWH is equipped with automatic leak detection, it is a best practice to install a drain pan to mitigate potential problems from leaks, especially if installed on a floor susceptible to water damage. Connect the outlet from the pan to a suitable drainage line and pitch for proper drainage.

No Stand Needed

Electric storage water heaters, including HPWHs, do not need to be raised off the floor with a stand; this was a safety provision for older atmospheric gas storage water heaters.



Image Credit: Northwest Energy Efficiency Alliance

Pipe Insulation

Insulate hot water piping to at least the minimum requirements in IECC R403.5.3 or in accordance with local codes—whichever is greater. To improve overall system performance, insulate all hot water piping. 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.

Tank Insulation

Most HPWHs have internally insulated tanks and do not require blanket insulation. The manufacturer's warranty may not cover damage or defects caused by installing blanket insulation.

Relief Valve

The temperature and pressure relief (TPR) valve should be installed per the manufacturer's recommendations. It is a best practice to install the discharge line to the outlet of the TPR valve and terminate the discharge line within 6 inches of a floor drain to prevent discharge water from contacting people or electrical parts.

Heated Water Circulation (Temperature Maintenance)

If pipe runs to fixtures are too long, use an on-demand, motion sensor, or occupant-activated pump to circulate just enough water to prime the loop with hot water. Connect the return pipe of the circulation loop to the cold inlet of the water heater; this will guide the cooler returning water to pool at the bottom of the tank so it does not interfere with hot water availability.

Do not use a continuously operated circulation pump. Continuous circulation is particularly detrimental to heat pump water heaters as it may force the unit into “Electric Only” mode, which will result in a lack of hot water availability and greatly increase energy use. Consequently, never set the circulation system controls to continuous, and advise the homeowner or occupant of this requirement.

Seismic Strapping

Check local codes to confirm if seismic strapping is required. Areas with medium to high levels of seismic activity require the water heater to be strapped with at least two 22-gauge straps. Refer to the product manual to ensure the straps are placed at the correct heights. Use rubber standoffs when attaching straps to the wall to minimize the vibration and transfer of sound to surrounding areas.

Operational Modes

There are four basic operating modes on most HPWHs: Economy, Heat Pump Only, Resistance Only, and Vacation. Some manufacturers may offer additional operating modes or use different names.

- **Economy Mode:** Default mode on 208/240-volt models. Utilizes both heat pump and electric resistance heating elements as needed, providing the highest volume and fastest recovery of hot water. Note that the Energy Guide only reflects the annual operating cost in this mode.
- **Heat Pump Only:** Provides the highest efficiency by utilizing only the heat pump to move heat for full tank recovery. Uses less energy, but will take significantly longer to recover than hybrid mode.
- **Resistance Only:** Found only in 208/240-volt models. Utilizes standard electric resistance elements to heat the tank without heat pump assistance. This is typically a backup/emergency operating mode that provides no energy savings.
- **Vacation:** No operation for a specified number of days unless the tank temperature drops below the minimum set point by the manufacturer.

The default for most HPWHs is hybrid operation mode where the heat pump is prioritized, but the unit may also use standard electric resistance during periods of high hot water demand. However, a properly-sized HPWH system can meet typical hot water demand without triggering electric resistance.

Operating the HPWH in “Heat Pump Only” mode prevents the system from switching over to electric resistance, thus maximizing energy and cost savings. If the user has a temporary increase in hot water use—such as when there are house guests—and runs low on hot water, they can use “Hybrid Mode.” If the user is running out of water in “Heat Pump Only” mode, they should consider adding a TMV for additional thermal storage capacity.

Controls located directly on the HPWH or those accessible remotely from a phone or computer make it easy to switch options during times of high water demand. Consult the manufacturer manual.



Image Credit: Northwest Energy Efficiency Alliance

After Installation: Servicing the Water Heater

Like any other water heater, HPWHs require modest servicing. Common routine maintenance requirements specific to HPWHs include cleaning the air filter and condensate lines. Air filters must be cleaned every 6 to 12 months, with a more frequent cleaning cadence in high-dust locations. Some units may provide automatic alerts when the filter needs cleaning. Condensate lines must be cleaned every year to make sure the condensate flows freely. Standing water in a lower metal drain pan may indicate a clogged condensate drain pan or lines. Be sure to refer to the manufacturer’s operation and

maintenance manual for specific guidance on the required maintenance and step-by-step instructions for the installed unit. Most current HPWHs come in either 6- or 10-year limited equipment warranties.

SPLIT-SYSTEM HEAT PUMP WATER HEATERS

Split systems are heat pump water heaters in two parts, with the air-to-refrigerant heat exchanger commonly designed to be located outside. With the heat pump outside and the tank inside or in a garage, the two components are then connected with piping.

Split systems offer several advantages, including:

- The storage tank can be in a confined space without access to airflow or a heat source. (Examples of confined spaces include closets, under stairs, and in low cabinets.)
- No cool air is created inside the house or apartment, making them advantageous for smaller dwelling units.
- The active end of the heat pump is outside, reducing indoor noise.
- The condensate is usually simpler to manage.
- Some currently on the market use carbon dioxide as a refrigerant, which has an extremely low global warming potential (GWP) compared to conventional refrigerants and can continue to operate in heat pump mode at much lower temperatures than integrated HPWHs.

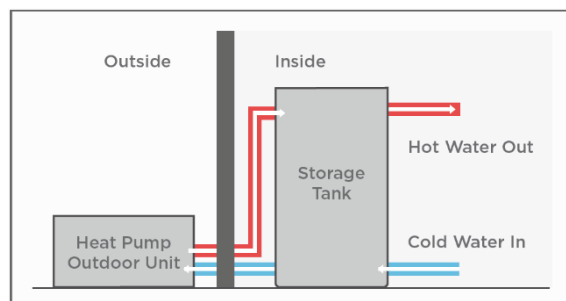


Image Credit: Northwest Energy Efficiency Alliance

FREQUENTLY ASKED QUESTIONS

Where can integrated HPWHs be installed?

HPWHs are designed to be used in spaces with ambient temperatures ranging from about 40 to 120 degrees Fahrenheit. This can include garages, basements, laundry rooms, and closets with louvered doors. The warmer the air, the more efficient the operation. HPWHs should always be protected from the elements.

The sound of an HPWH is similar to that of a dishwasher—between 45 dBA and 55 dBA—which may be noticeable if located near a bedroom. Since they will also have a localized cooling effect when the heat pump is running, do not place them in frequently occupied areas with temperature-sensitive activities.

How much airflow do HPWHs require?

The key to successful HPWH operation is to provide enough air for the water heater. Nothing needs to be done if the space around the HPWH meets manufacturer requirements (450 to 700 cubic feet). If installed in a small closet, a full louvered door can be used to circulate air into a larger space. If grilles are used, they should provide a total of 240 square inches of “free air,” which is the space between the fins. Placing a grille at both the top and bottom of a door or closet is the best application. Alternatively, in small closets, ducting can be used for the intake and/or exhaust air from another nearby location.

Can integrated HPWHs be installed outside?

In cold climate regions where water pipes can freeze, integrated HPWHs should not be installed outside. If located in a warm climate, an HPWH may be installed in a carport, garage or an attached outdoor closet provided with properly sized vents or louvers.

Can I use the HPWH to complement my solar thermal water heating system?

HPWHs can be used in conjunction with solar thermal. Refer to the manufacturer’s recommendations for installation methods.

What happens to an HPWH in the event of a power outage?

If the power goes out, an HPWH will continue to supply the remaining hot water in the storage tank. However, it will no longer heat hot water because neither the heat pump nor the resistance heating element will work without electrical power. When power is restored after the outage, the water heater will automatically revert back to the most recent user settings. In cases where a home is also equipped with batteries and disconnect from the grid, the HPWH can often continue to run in heat pump-only mode as it draws less than 500W of electricity.

Are HPWHs loud?

Heat pump water heaters have a fan and compressor, both of which make some noise. When installed in less frequently occupied areas—like garages and basements—most people are unbothered, or even unaware, of the sound. However, noise perception varies between individuals. To reduce the impact of noise, add sound insulation to the space where the water heater is installed or select a quieter model. The ENERGY STAR NextGen program requires that heat pump water heaters in occupiable spaces have sound at levels less than 55 dBA, which is the volume of a background conversation. Even quieter models (rated at 45 dBA and less) are also available.

If installed inside, will the HPWH's energy savings be offset by extra heating?

Studies have shown that HPWHs often do not significantly increase heating system runtime when installed in conditioned space because their cooling impacts are small and localized. Interactions are minimized when the HPWH is installed farther away from the thermostat and air handler, since the cooling from the HPWH is not mixed with the rest of the home. When an HPWH is actively heating water in heat pump mode, it generally provides 2,500 to 5,000 Btus/hour of cooling to the surrounding air. With an efficient space-heating system, energy savings from a properly installed HPWH will exceed any marginal space-heating energy increases, and in the summer, the home will gain some “free” localized cooling and dehumidification as heat is moved from inside the home and put into the HPWH. Even when there is some interaction, the HPWH overall provides energy savings compared to less efficient alternatives like gas and electric tank and tankless units. The small impact on heating and cooling is especially beneficial in warm climates.

How reliable are HPWHs?

HPWHs have been available for more than 40 years. Current heat pump water heaters are designed like refrigerators to operate as a fully sealed system. HPWHs have similar life spans to electric storage water heaters, and many come with 10-year warranties.

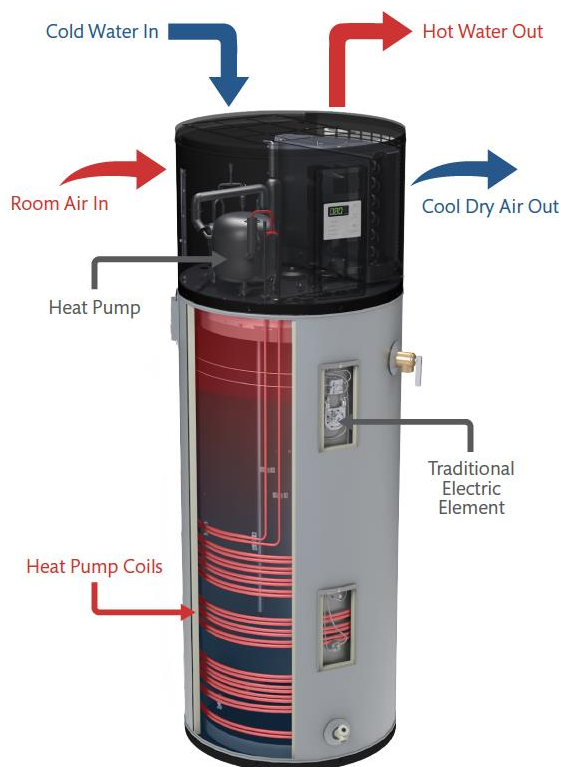


Image Credit: Efficiency Maine

Will the occupants have enough hot water?

HPWHs have hot water delivery capability comparable to (or greater than) electric-resistance tanks. Follow the tank-sizing guidelines on page 8 and review each model's First Hour Rating. Thermostatic mixing valves can also be installed to allow a higher set point on the water heater and increase the total capacity of the overall domestic hot water system.

When should I go to a bigger tank?

If space, budget, and location allow, a larger tank is typically a better choice. This allows more water to be heated during off-peak times for future hot water use at a later time. A larger tank size will also rely more on the heat pump rather than using the less efficient resistance heating element. The ENERGY STAR NextGen program requires a minimum tank size based on the number of bedrooms.