



Job Aids for the Retrofit Installation of Heat Pump Water Heaters

Final
US version



Richard Heath & Associates, Inc.
rhainc.com



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Walkthrough and Design Checklist

Walkthrough and Design

Pre-Installation

Installation

Post-Installation

- Follow all OSHA requirements for safety.
- Follow all codes and standards and manufacturer's guidelines.

Homeowner Awareness and Tank Sizing

- Discuss potential noise issues.
- Discuss potential cold air issues.
- Explain condensate draining needs.
- Explain the need for cleaning filters as per manufacturer's guidelines.
- Discuss water demand and hot water usage.
- Size the tank appropriately, considering recovery time.

Location

- Check for adequate temperature of the installation space.
- Measure the dimensions of the installation space.
- Ensure the tank will fit in the location, it least a 3'x3'x8' space.
- Ensure the doors near the HPWH can open at least 90 degrees post-installation.
- Ensure enough space for tank removal, component access, and filter handling.
- Consider space needs for future serviceability of the unit.
- Choose a new (better) location if necessary.
- Check if local rules require a stand/pedestal and consider height needs.
- Decide the location for condensate management and termination.
- Determine the location for the Temperature and Pressure (T&P) valve drain.
- Take photos of the current unit and location for later reference.

Walkthrough and Design Checklist

Walkthrough and Design

Pre-Installation

Installation

Post-Installation

Ventilation and Noise

- Measure the volume of the installation space.
- Consult product literature for exact air volume needed as manufacturers vary.
- If adding an exhaust vent inside the home, consider occupant discomfort.
- If adding an exhaust vent inside the home, consider the impact on nearby thermostats.
- Consider the impact of noise on the occupant.

Electrical

- Verify that the wire size, breaker, and panel accommodate the nameplate specs.
- If there's no 240VAC or limited panel capacity, consider a panel upgrade. Call an electrician for this.
- Verify that the existing wire is grounded. If not, an electrician may be needed.
- As an alternative, consider a 120V HPWH if there is a 120V outlet within 8 feet.
- For 120V: Check amperage of circuit per manufacturer and ensure other loads present on the circuit do not conflict.
- Do not use an extension cord.

Additional Items

- Check the existing thermal expansion tank for correct size.
- Determine pipe insulation needs between the tank and building envelope.
- Determine whether any existing recirculation line is needed or will need controls.
- Determine whether a thermostatic mixing valve exists or is beneficial to sizing for the installation.
- If removing a gas water heater that shares a flue with another device, ensure venting meets local codes and consider electrifying the remaining appliance.

Walkthrough and Design Job Aid

Homeowner

Location

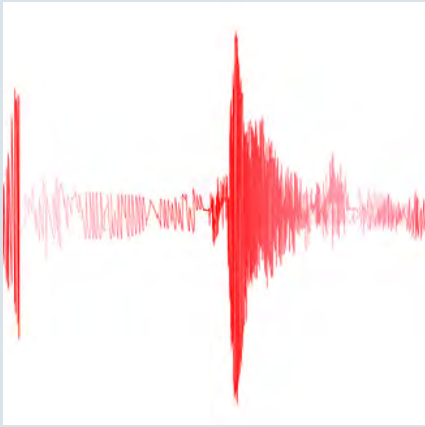
Ventilation and Noise

Electrical

Additional

1

Discuss potential noise issues.



2

Discuss potential cold air issues.



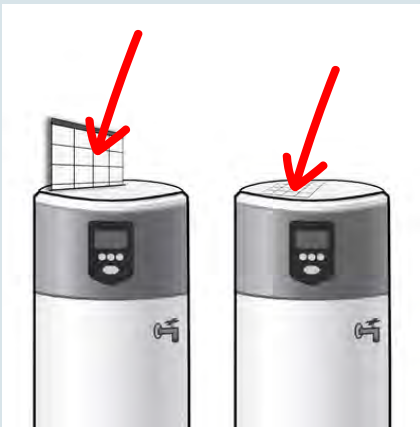
3

Explain condensate drainage needs.



4

Explain the need for the cleaning of filters.



5

Discuss water demand and predicted hot water usage.*



6

Size the tank appropriately, considering recovery time.*



* Reference: Appendices 1 and 2

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Walkthrough and Design Job Aid

Homeowner

Location

Ventilation and Noise

Electrical

Additional

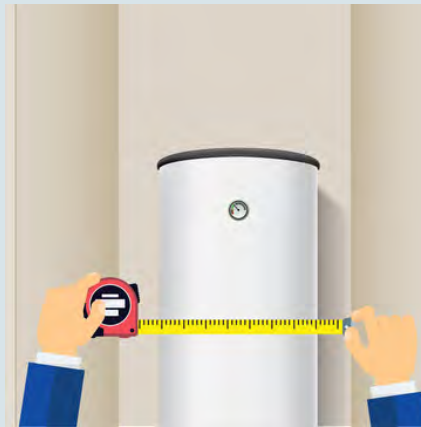
1

Check for adequate temperature of the installation space.*



2

Measure the dimensions of the installation space.



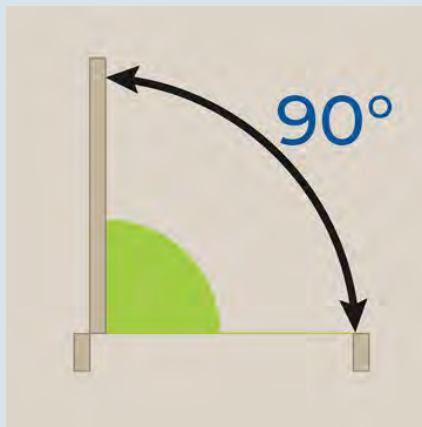
3

Ensure the tank will fit in the location, ideally at least a 3'x3'x8' space.*



4

Ensure the doors near the HPWH can open at least 90 degrees post-installation.



5

Ensure enough space for tank removal, component access, and filter handling.



6

Consider space needs for future serviceability of the unit.



* Reference: Appendices 2 and 3

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Walkthrough and Design Job Aid

Homeowner

Location

Ventilation and Noise

Electrical

Additional

7

Choose a new (better) location if necessary.



8

Check if local rules require a stand/pedestal and consider height needs.



9

Decide the location for condensate piping and termination.*



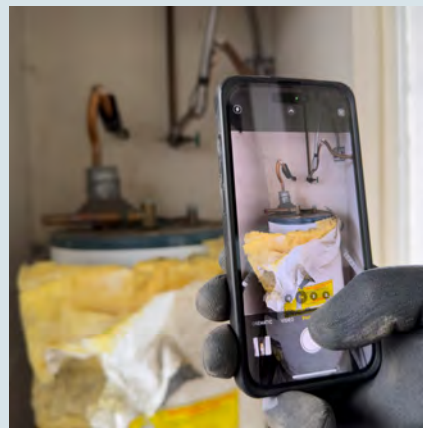
10

Determine the location for Temperature and Pressure (T&P) valve drain.*



11

Take photos of the current unit and location for later reference.



* Reference: Appendices 2 and 3

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Walkthrough and Design Job Aid

Homeowner

Location

Ventilation and Noise

Electrical

Additional

1

Measure the volume of the installation space.



2

Consult product literature for exact air volume needed as manufacturers vary. *



3

If adding an exhaust vent inside the home, consider occupant discomfort.



4

If adding an exhaust vent inside the home, consider the impact on nearby thermostats.



5

Consider the impact of noise on the occupant.*



* Reference: Appendices 4 and 5

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Walkthrough and Design Job Aid

Homeowner

Location

Ventilation and Noise

Electrical

Additional

1

Verify that the wire size, breaker, and panel accommodate the nameplate specs.*



2

If there's no 240VAC or limited panel capacity, consider a panel upgrade. Call an electrician.



3

Verify that the existing wire is grounded. If not, an electrician may be needed.



4

As an alternative, consider a 120V HPWH if there is a 120V outlet within 8 feet.



5

Check amperage of circuit per manufacturer. Ensure other loads present on the circuit do not conflict.



6

Do not use an extension cord.



* Reference: Appendix 6

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Walkthrough and Design Job Aid

Homeowner

Location

Ventilation and Noise

Electrical

Additional

1

Check the existing thermal expansion tank for correct size.



2

Determine pipe insulation needs between the tank and building envelope.



3

Determine whether any existing recirculation line is needed or will need controls.



4

Determine whether a thermostatic mixing valve exists or is beneficial to sizing for the installation.



5

If removing a gas water heater that shares a flue with another device, ensure venting meets local codes.



* Reference: Appendix 7

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Pre-Installation Checklist

Walkthrough and Design

Pre-Installation

Installation

Post-Installation

- Follow all OSHA requirements for safety.**
- Follow all codes and standards and manufacturer's guidelines.**

Existing Water Heater Removal

- Record the current hot water temperature for comparison after the new unit's installation.
- Set the expansion tank pressure to match the incoming water pressure.
- Shut off water and power to the unit. Confirm the power is off with a voltage tester.

Gas units:

- Notify the gas company if applicable.
- Turn off the gas to the unit and have a licensed technician cap the line.
- Cap and seal the vent flue at the ceiling.
- Drain the tank, using a transfer pump if needed. Caution; hot water can damage plants.
- Disconnect the pipes from the tank.
- Store the old unit safely until disposal and recycle as necessary.

Set Up

- Follow the ventilation plan from the design walkthrough as applicable.
- Install a stand, if required by code.
- Install a drain pan if there is a wooden floor or if the tank utilizes leak detection.
- If feasible, install an R10 rigid insulation pad under the unit, especially if it is on concrete.
- Implement noise mitigation strategies.

Pre-Installation Job Aid

Existing Water Heater Removal

Set-Up

1

Record the current hot water temperature for comparison after the new unit's installation.



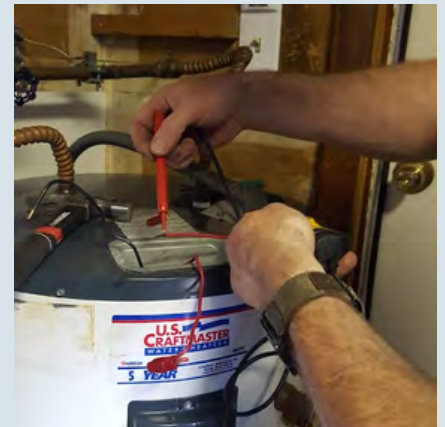
2

Set the expansion tank pressure to match the incoming water pressure.



3

Shut off water and power to the unit. Confirm the power is off with a voltage tester.



4

Gas units: Notify the gas company if applicable.



5

Gas units: Turn off the gas to the unit and have a licensed technician cap the line safely.



6

Gas units: Cap and seal the vent flue at the ceiling.



* Reference: Appendix 8

Photo credits: RHA/iStock, Bruce Manclark

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Pre-Installation Job Aid

Existing Water Heater Removal

Set-Up

7

Disconnect the pipes from the tank to break the vacuum.



8

Drain the tank, using a transfer pump if needed. Use caution; hot water can damage plants.



9

Store the old unit safely until disposal and recycle as necessary.



* Reference: Appendix 8

Photo credits: RHA

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Pre-Installation Job Aid

Existing Water Heater Removal

Set-Up

1

Follow the ventilation and ducting plan from the design walkthrough as applicable.*



2

Install a stand, if required by code.



3

Install a drain pan if there is a wooden floor or if the tank utilizes leak detection.



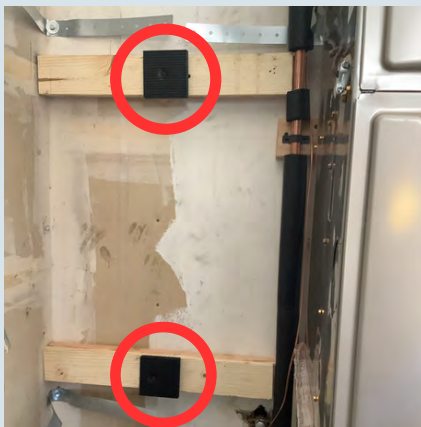
4

If feasible, install an R10 rigid insulation pad under the unit, especially if it is on concrete.



5

Implement noise mitigation strategies such as isolation pads.*



* Reference: Appendices 2, 4, and 6

Photo credits: PNNL, RHA, Aaron Gianni, Ben Foster, Bruce Manclark

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Installation Checklist

Walkthrough and Design

Pre-Installation

Installation

Post-Installation

- Follow all OSHA requirements for safety.**
- Follow all codes and standards and manufacturer's guidelines.**

Install the Unit

- Make sure the unit is level and plumb.
- Ensure the unit control panel is accessible to the occupant.
- Ensure easy access to drain the tank.
- Verify cold exhaust is away from thermostats and high-traffic areas.
- Add seismic strapping if code requires.
- Add isolation pads and webbing straps to reduce noise/vibration.

Condensate

- Install a condensate pump if gravity flow to a local drain is not available.
- Install a T-fitting on the condensate outlet and a removable cap to allow for cleaning.
- Install condensate drain lines.
- Route drain lines to outside or an existing drain, or use a condensate pump.
- Ensure the condensate drain's diameter matches manufacturer specs and has a 1/8" per foot slope.
- Ensure condensate cannot pool, return to the building, or drain onto non-absorbent walkways.

Temperature and Pressure

- If appropriate, install a thermostatic mixing valve (TMV) for additional thermal storage.
- Hook up the drain line for the T&P valve, using minimum fittings.
- Connect the T&P discharge pipe. Consider using a plastic pipe to reduce thermal losses, if allowable by code.
- Ensure the pipe terminates according to code.

Installation Checklist

Walkthrough and Design

Pre-Installation

Installation

Post-Installation

Plumbing and Insulation

- Install approved manual shut-off valves at the hot water outlet and cold water inlet.
- Connect the pipe for cold water input.
- Once the HPWH is in final position, start filling the tank with water.
- Insulate as much piping as possible, but at least the first 5' of hot and cold pipes from the tank.

Visual Check and Start Up

- Consult the manufacturer wiring diagram. Attach wires, ensuring proper ground.
- Verify the tank is nearly full of water and remove faucet aerators or flow regulators to clear debris.
- Connect hot water output.
- Open the water valves to the house.
- Purge the system. Run water through all hot water fixtures for several minutes.
- With the tank full of water, turn on the power.
- Follow the manufacturer's start-up sequence.

Verify and Final Steps

- Check for leaks or standing water.
- Check the temperature settings.
- Verify sound levels from the water heater comply with manufacturer specifications.
- Ensure there is compliant earthquake strapping where applicable.
- With gas water heater removal, ensure the exhaust vent is sealed and gas lines capped and not leaking.
- Seal where piping enters walls. Seal holes if any are present in drywall.
- If installation is part of a program, install a Flex-load/Demand Response module if required.
- If a recirculation line currently exists, install a timed or on-demand controller.
- Only if there is a thermal mixing valve, increase the tank temperature over 120F.

Installation Job Aid

Install the Unit

Plumbing and Insulation

Condensate

Visual Check and Start Up

Temperature and Pressure

Verify and Final Steps

1

Make sure the unit is level and plumb.



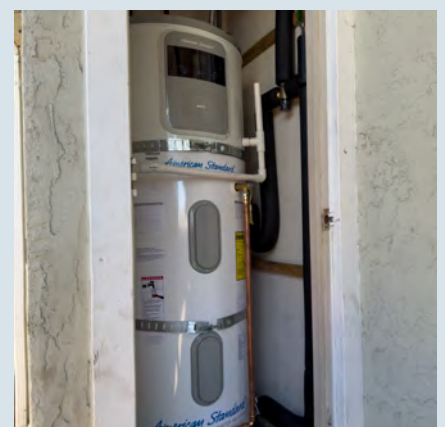
2

Ensure the control panel is accessible to the occupant.



3

Ensure easy access to drain the tank.



4

Verify cold exhaust is away from thermostats and high-traffic areas.



5

Add seismic strapping, if code requires.



6

Add isolation pads and webbing straps to reduce noise/vibration.



Installation Job Aid

Install the Unit

Plumbing and Insulation

Condensate

Visual Check and Start Up

Temperature and Pressure

Verify and Final Steps

1

Install a condensate pump if gravity flow to a local drain is not available.*



2

Install a T-fitting on the condensate outlet, or a T with a removable cap to allow for cleaning.



3

Install condensate drain lines.



4

Route drain lines to outside or an existing drain, or use a condensate pump.



5

Ensure the condensate drain's diameter matches manufacturer specs with at least 1/8" per foot slope.



6

Ensure condensate cannot pool, return to the building, or drain onto non-absorbent walkways.



* Reference: Appendix 3

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Installation Job Aid

Install the Unit

Plumbing and Insulation

Condensate

Visual Check and Start Up

Temperature and Pressure

Verify and Final Steps

1

If appropriate, install a thermostatic mixing valve (TMV) for additional thermal storage.*



2

Hook up the drain line for the T&P valve, using as few elbows as possible.



3

Connect the T&P discharge pipe. Consider using a plastic pipe, if allowable by code.



4

Ensure the pipe terminates according to code.



* Reference: Appendix 3

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Installation Job Aid

Install the Unit

Condensate

Temperature and Pressure

Plumbing and Insulation

Visual Check and Start Up

Verify and Final Steps

1

Install approved manual shut-off valves at the hot water outlet and cold water inlet.



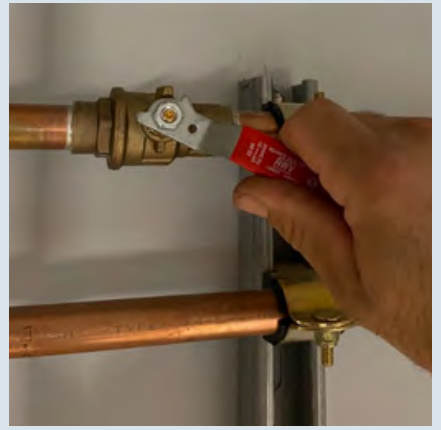
2

Connect the pipe for cold water input.



3

Once the HPWH is in final position, start filling the tank with water.



4

Insulate as much piping as possible, but at least the first 5' of hot and cold pipes from the tank.



Installation Job Aid

Install the Unit

Plumbing and Insulation

Condensate

Visual Check and Start Up

Temperature and Pressure

Verify and Final Steps

1

Consult the manufacturer wiring diagram. Attach wires, ensuring proper ground.



2

Verify the tank is nearly full of water and remove faucet aerators or flow regulators to clear debris.



3

Connect hot water output.



4

Open hot water discharge valves to the house.



5

Purge the system. Run water through all hot water fixtures for several minutes.



6

With the tank full of water, turn on the power. Follow the manufacturer's start-up sequence.



Installation Job Aid

Install the Unit

Plumbing and Insulation

Condensate

Visual Check and Start Up

Temperature and Pressure

Verify and Final Steps

1

Check for leaks or standing water.



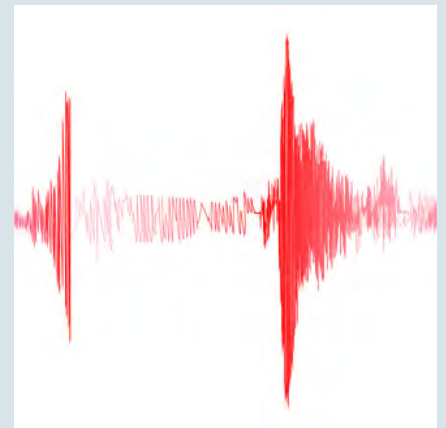
2

Check the temperature settings.



3

Verify that noises from the water heater comply with manufacturer specifications.



4

Ensure there is compliant earthquake strapping where applicable.



5

With gas WH removal, ensure the exhaust vent is sealed and gas lines capped and not leaking.



6

Seal where piping enters walls. Seal holes if any are present in drywall.



Installation Job Aid

Install the Unit

Plumbing and Insulation

Condensate

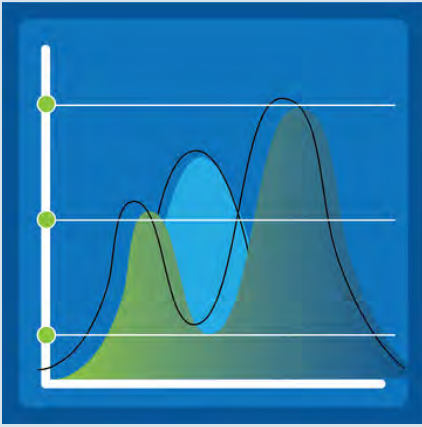
Visual Check and Start Up

Temperature and Pressure

Verify and Final Steps

7

If installation is part of a Flex-load/Demand Response program, install the module.



8

If a recirculation line currently exists, install a timed or on-demand controller.



9

Only if there is a thermal mixing valve set to 120F, increase the set point temperature over 120F.



* Reference: Appendix 7

Photo and image credits: RHA, Aaron Gianni, Bruce Manclark

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Post-Installation Checklist

Walkthrough and Design

Pre-Installation

Installation

Post-Installation

Customer Service

- Discuss the warranty information.
- Explain the use of the new unit's control panel, alarms, and maintenance needs.
- Guide the customer to download the tracking app and show its functions.
- Suggest relevant manuals and websites.
- Demonstrate how to clean the filter and discuss the frequency.
- Explain the differences in recovery time between the old and new water heater.
- Provide guidance on the uses and benefits of modes, such as vacation mode.
- Discuss the energy benefits of switching from the factory-set hybrid to heat pump-only mode.
- Discuss the benefits of raising the storage tank temperature to 140F in conjunction with a thermostatic valve.
- Explain how to reset the unit in the event of a power outage.
- Tape an envelope with the manual, warranty, and support info to the HPWH. Attach the company sticker.
- Refer customer to Demand Response programs where applicable.
- Ask customer to confirm the temperature with you after the tank has fully recovered.

Appendix 1: Tank Sizing Considerations

Determine Household Needs:

- Usage-Based: Discuss water usage with the customer. Consider number of bedrooms, bathrooms, house size, occupants, and special fixtures like soaking tubs. Account for long plumbing paths.
- Occupancy-Based:
 - Small (40-50 gallons): 1-2 adults.
 - Medium (66 gallons): 3 adults or 2 adults and 2 children.
 - Large (80 gallons): 5 or more adults and children.

Potential Limitations:

- A small tank might not meet simultaneous needs, like showers and dishwashing. Always discuss this with the customer.

When Uncertain, Go Bigger:

- Recommend a larger tank if unsure. Larger tanks can be more energy-efficient and rely less on energy-consuming backup systems.

Additional Tips:

- Thermal Mixing Valve: Install to increase storage capacity and optimize efficiency.
- Use larger tank and lower power: Suggest a larger tank with 120 volts or 15 amps for future flexibility. Ensure recovery times are known.
- Check Local Regulations: For example, some local jurisdictions require expansion tanks for retrofits.

Consumer Draw Pattern Table:

- A table showing hot water events, duration, and volume can guide both homeowners and installers for better HPWH selection.

Appendix 2: Climate Zones and Tank Locations

HPWHs can be used across different climate zones, but location of unit varies based on climate factors. Temperature, humidity, and regional weather patterns influence HPWH efficiency.

Use the guide below to determine possible HPWH locations in your climate zone.

Note: Current map is for 240V HPWHs. Once research is completed for newer 120V HPWHs, an updated map will be provided.

Climate Zone	Garage	Basement	Interior	Exterior Closet
1	✓	✓	✓	✓
2	✓	✓	✓	✓
3	✓	✓	✓	✓
4 A+B	✓	✓	✓	✗
4 C	✓	✓	✓	▲
5	▲	✓	✓	✗
6	✗	✓	✓	✗
7	✗	✓	✓	✗



Yellow triangle: Check with the manufacturer; location might not be ideal.

Graphic credit: NEEA

Appendix 3: Condensate Handling Strategies

HPWHs produce non-toxic, pH-neutral condensate which needs proper drainage. Below are drainage strategies, listed in preferable order:

Direct Gravity Drain: Ensure a continuous downward slope of at least 1/8" per foot and proper termination.

- Terminate at a utility sink or washer drain line port.
- Terminate to outside, ensuring the pipe remains unfrozen.

See installation manual for extra guidance.

Condensate Pump: Use when gravity drainage isn't feasible. The condensate reservoir collects condensate, then it is pumped to a termination point. If placed in attics or conditioned spaces, connect pumps and HPWH to an electrical switch system. That prevents HPWH operation if the pump fails, minimizing flood risk—a requirement in many areas.

Appendix 4: Ventilation in Small Spaces

HPWHs extract heat from surrounding air and uses it to warm water. In small spaces under 700 cubic feet (or per manufacturer's recommendation), ensuring adequate air for effective heat exchange is crucial. Strategies for additional ventilation may be required. See below options.

Ducted Intake/Exhaust:

- Install short, smooth duct runs for more intake and exhaust.
- Exhausting to conditioned spaces ups the home's heating need but cools during hot periods.
- Venting to the outside is usually a better practice.

Avoid Outside Intake with Conditioned Space Exhaust:

- This can enable unconditioned air to enter the home, which is not a best practice.

Louvered Door:

- Install a full or half-length louvered door.

Wall or Door Grilles:

- Install with high and low placements, totaling 250 square inches of Net Free Area.
- Maintain a minimum 5-foot separation between them.

Door Vent Gaps:

- Install high and low with 250 square inches of Net Free Area in total.
- Ensure at least 5 feet of separation.

Choose a ventilation method based on space, location, and homeowner preferences. Always engage the homeowner in decisions. For detailed venting advice, always adhere to manufacturer guidelines.

Appendix 5: Noise / Vibration Mitigation

HPWHs can sound louder than gas-fired or electric resistance water heaters. Ensuring low noise levels is vital for customer satisfaction. Follow these helpful hints below to minimize noise and vibration.

Discuss Noise Levels: Inform customers that HPWHs might sound like a quieter clothes dryer or wall A/C.

Pick Optimal Location: Install HPWHs away from frequently occupied areas, like bedrooms or living spaces, to reduce noise disturbances.

Vibration Isolation Pads: Place these pads beneath the heater to minimize noise and vibration. Ensure compatibility with your HPWH model.

Sound-Dampening Materials: Enhance noise reduction by adding sound-absorbing materials, like acoustic panels, to walls around the HPWH.

Insulate Ductwork: Insulate sheet metal ductwork to lessen noise from inside air movement.

Anti-Vibration Brackets: Install anti-vibration brackets to reduce noise by isolating the HPWH from its mount.

Rubber Grommets & Flex Connectors: Install these components when feasible to further deaden sounds.

Seismic Strapping (If Relevant): Use webbing straps in seismic zones when securing the HPWH. Add cushions to the straps to prevent the unit from vibrating against mounts during use.

Appendix 6: Electrical Evaluation

Before retrofitting a HPWH, ensure the home's electrical system is sufficient for the HPWH added load. Here are tips for evaluating the electrical needs:

Optimal Product: Ideally, use a 240VAC 30-amp HPWH if the electrical panel permits. Alternatively, consider HPWHs with less upgrade needs, like a 120V shared circuit model or a 240V 15-amp hybrid for locations that get very cold.

Electrical Panel Slots: If two slots in the electrical panel are not available for the HPWH consider using:

a 120V plug-in HPWH with a lesser electrical load.

- circuit sharers like simpleSwitch 240 to save panel space.
- circuit pausers (e.g., simpleSwitch 240M, Thermolec DCC9) for load sharing.
- tandem breakers for more circuits per space.

Panel Amp Rating: Check the panel's amp rating against the documented load.

Amp Adequacy: Add the amperage of existing breakers and compare to the panel's rating. Remember, the panel's size is typically smaller than the breaker totals since not all energy is used at once. Some over-amp capacity is permitted.

Repurpose Circuits: See if there's an unused 240V circuit, (like an old furnace); repurpose it for the HPWH. Or consider changing two 120V circuits to a 240V if feasible.

Space Evaluation: Inspect attics or crawlspaces for potential new or adjusted wiring routes.

Consult an Electrician: When unsure, get a professional's opinion / assistance.

Appendix 7: Controlled Recirculation Pumps

Uncontrolled recirculation pumps can reduce the efficiency of HPWHs. Here's a guide to managing these pumps:

Inspect the Current System: Before any changes, study the existing setup. Note the pump type, location, connections, controls, and pipe insulation.

Inform the Homeowner: Highlight the downsides of uncontrolled recirculation pumps, such as increased energy use and lowered HPWH efficiency.

Upgrade the Pump: Add controls to existing pumps and upgrade it to a smart system.

Install a Smart Recirculation Pumps: If adding a pump, use a “controlled pump”. Go for on-demand, learning, or timer-based systems that activate only when needed.

Ensure Compatibility: Verify that any new pumps work properly with the HPWH. Refer to manufacturer guidelines for suitable pumps, parts and operation.

Appendix 8: Capping a Gas Line

When removing a gas water heater, properly capping the gas line is essential to prevent potential hazards. Always consider hiring a licensed professional. Here's a guideline:

Permit Requirements: Consult the local authority about permits for removing a gas connection and its replacement.

Disconnect Gas Appliance:

- Turn off the main gas shutoff valves.
- Release the house gas line pressure using the gas water heater or another gas appliance until the gas in the line is consumed. Turn it off after the gas runs out.
- Detach the gas appliance, flex line and valve from the gas pipeline.

Gas Pipe Removal: A licensed technician may need to remove the gas pipe up to the next branch.

Leak Test:

- Turn the gas back on.
- Use leak detection fluid or an electronic gas leak detector to check for leaks at the cap. If bubbles form, redo the capping.

Label the Capped Pipe.

Assess Remaining Gas Devices:

- Follow proper procedures if adjusting other gas appliances when required.
- Relight pilot lights if needed.
- If all gas devices are removed, consider asking the gas utility provider to take out the gas meter to avoid additional charges.

Safety first – ensure that each step is performed with caution.

Appendix 9: Split Systems

The heat pump in a split system HPWHs is located outside and water storage tank inside. This design offers benefits but also poses unique installation challenges compared to unitary systems:

Space Benefits: Split systems save indoor space since only the water tank is inside. Ideal for space-constrained locations.

Ventilation: The outdoor heat pump configuration avoids indoor ventilation and air volume issues. Indoor air temperature is not impacted.

Noise: Since the noisy compressor is outside, split systems create less noise. Be mindful of its proximity to windows and living areas. Adhere to local codes, setbacks and property boundaries.

Installation: These systems are more intricate to install. They need connecting water lines between indoor and outdoor units and secure outdoor unit setup. Split HPWHs need outdoor power and require insulated water lines in cold climates.

Condensate Drain: Being outdoors, drainage concerns are lessened, but proper drainage requirements must be met.

Always consult the manufacturer's guidelines and local codes and ordinances for optimal installation.

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