GUIDELINES FOR INTEGRATED HPWH IN MULTIFAMILY

FOR COLDER CLIMATES, CZ 4+

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Current integrated heat pump water heater (iHPWH) products are generally designed for single family homes and have tank volumes of 50-80 gallons. The following is meant to guide iHPWH applications in multifamily buildings. These guidelines will often lead to lower electricity consumption than with electric resistance water heaters – perhaps substantially lower.

However, these guidelines should not be considered authoritative. As of this writing, there are very few data available on real-world, installed performance of iHPWHs in multifamily buildings. These guidelines are based on the best available information available at the time of writing, but they are no substitute for careful, thoughtful design.

iHPWHs can be challenging to incorporate into multifamily buildings, particularly in colder climates. Challenges include:

- iHPWHs extract heat from intake air and cool the space where air is delivered.
  - This can offset cooling loads, but it also increases heating loads.
  - Cool air can cause local comfort problems.
- iHPWHs can be loud, but most new devices are getting quieter with sound pressure ratings <50 dBA.
- Most current devices require intake air of ~45°F or greater to operate efficiently.

Many recommendations here are based on a NEEA study and report.[1] While this study is tremendously helpful, it focused on a single iHPWH model. The study also did not include thermal comfort impacts, though assessing potential comfort problems is quite subjective. This document also builds on Eversource multifamily iHPWH guidelines developed with input from SWA.[2] Guidelines are certainly subject to change as we learn more and as technology evolves.

1. IHPWHS IN APARTMENTS

Each apartment has its own iHPWH located within the apartment itself.

- Specify iHPWH with a NEEA Tier 3 rating or higher.[i]
- Specify equipment with sound pressure ratings of 45 dBA or less.[ii]
- Provide means to remove condensate by drain and/or pump.
- iHPWHs located so controls are accessible, filters can easily be cleaned/replaced, and condensate drainage can be checked.
- Design and install iHPWH within the thermal envelope of the apartment.
- If located in a closet or smaller space, ducting is preferred to ensure there is adequate warm air for the iHPWH to operate efficiently. If not ducted, iHPWH must be:
  - in a room with at least 60 ft^2 floor area, OR
  - in a room with louvers or grilles connecting to conditioned space. Louvers/grilles must have at least 300 in^2 of free area with either:
    - at least 150 in^2 low in the wall, at least 150 in^2 high in the wall, OR
    - Full-height louvered door with at least 300 in^2 free area.

[1] https://neea.org/resources/heat-pump-water-heaters-in-small-spaces-lab-testing-the-amazing-shrinking-room
[2] https://energizect.com/sites/default/files/documents/RNC%20-%202022%20HPWH%20Guidelines_0.pdf

- If in a room/closet that does not meet the above requirements, at least one side of iHPWH (intake or discharge) must be ducted to/from outside of the room/closet.
    - If only one side of the iHPWH is ducted, a transfer grille or louver must be installed with free area of at least 60 in^2 between the iHPWH room and the conditioned area to/from which the duct is run
    - Ducts must not be run to or from outdoors[iii], hallways, or other common areas.[3]
- Ensure the cold air discharge is located where it will not cause comfort problems.
- iHPWH air intake (ducted or non-ducted) should be at least 10 feet away from cooking appliances and clothes dryers.
- iHPWH exhaust air should not be near or directed at a heating/cooling thermostat.
- Areas containing iHPWH or to/from which iHPWH air is ducted should not be heated with electric resistance.

2. IHPWH IN CLOSET OFF CORRIDOR (OR OTHER COMMON SPACE)

Each apartment – or small group of apartments – has a dedicated iHPWH that is located in a closet accessed from a corridor or other common space.

- Walls separating this closet from any/all apartments must be sealed and fire rated as per other dwelling unit walls.
- Specify iHPWH with NEEA Tier 3 rating or higher.[i]
- Recommend equipment with sound pressure ratings of 45 dBA or less.[ii]
- Provide means to remove condensate by drain and/or pump.
- iHPWHs located so controls are accessible, filters can easily be cleaned/replaced, and condensate drainage can be checked.
- Design and install iHPWH within the thermal envelope of the building.
- If located in a closet or smaller space, ducting is preferred to ensure there is adequate warm air for the iHPWH to operate efficiently. If not ducted, iHPWH must be in a room:
    - with at least 60 ft^2 floor area, OR
    - with louvers or grilles connecting to corridor or other conditioned, common space. Louvers/grilles must have at least 300 in^2 of free area with either:
        - at least 150 in^2 low in the wall, at least 150 in^2 high in the wall, OR
        - full-height louvered door with at least 300 in^2 free area.
- If one side of iHPWH is ducted (intake or exhaust), a transfer grille or louver must be installed with free area of at least 60 in^2 between the iHPWH room and space to/from which ducts are run
- Each iHPWH must effectively draw air from and deliver air back to the same space (e.g. the same hallway).
- Ducts must not deliver air directly to dwelling units or areas where cold air is likely to cause comfort problems.
- Ducts must not be run to or from outdoors.[iii]
- The space from which the iHPWH draws air/heat must be maintained at 50°F or higher. Design heating capacity for the corridor/space must include cooling impacts from iHPWH(s). Resistance heat should not be used to heat this space.

3. IHPWHS LOCATED IN MECHANICAL ROOM OR OTHER REMOTE LOCATION

Several iHPWHs may be installed in parallel to serve as a central DHW plant or each apartment (or small group of apartments) may have a dedicated iHPWH located remotely.

- Provide means to remove condensate by drain and/or pump.

[3] See following section for iHPWHs located outside of the apartment, e.g. in corridors.

- iHPWHs located so controls are accessible, filters can easily be cleaned/replaced, and condensate drainage can be checked.
- iHPWHs must be within the conditioned, thermal envelope of the building.
- Each iHPWH must effectively draw air from and deliver air back to the same room/space.
- If ducted, cold air from iHPWH exhaust must not be delivered directly to dwelling units or areas where cold air is likely to cause comfort problems.
- Ducts must not be run to or from outdoors.[iii]
- If one side of iHPWH is ducted (intake or exhaust), transfer grilles or louvers must be installed with free area of at least 60 in^2 between the iHPWH room and space to/from which ducts are run
- iHPWH air intake registers must not be in the line of cold air discharge from other iHPWHs.
- The space from which the iHPWH draws air/heat must be maintained at 50°F or higher. Design heating capacity for the space must include cooling impacts from iHPWH(s). Resistance heat must not be used to heat this space.
- If multiple iHPWHs operate in parallel as a central DHW plant, equipment should be sized using the capacity of the heat pumps only. Do not include capacity of electric resistance in iHPWHs. Use guidelines in ASHRAE Applications Handbook or comparable method.

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[i] NEEA iHPWH specification has 5 tiers (5 being highest performance). Higher tiers have higher efficiency requirements as well as other required features (such as sound ratings, ducting capabilities, air filter management). As of this writing, there are not yet any products listed in tier 5. Tier 4 products started becoming available after 2020. The NEEA spec is a good resource, but listing is not absolutely required.

Specification:
https://neea.org/img/documents/Advanced-Water-Heating-Specification.pdf
Product list:
https://neea.org/img/documents/residential-HPWH-qualified-products-list.pdf

[ii] NEEA Tier 4 and 5 water heaters need to have a sound pressure rating ≤50 dBA. While quieter is generally better, 45 dBA may not be necessary in every application. It's also unclear if manufacturers determine sound pressure ratings in a consistent manner. As of this writing, we are aware of four manufacturers with iHPWHs models that list sound pressure ≤45 dBA.

- AO Smith (and rebranded products like State, American Water Heater, Lochinvar, Reliance, U.S. Craftmaster; R134A).
- GE (R1234yf)
- Ariston (R513A)
- LG publishes a range of sound pressures (unclear what is typical, R134A)

Note that not all iHPWH models from these manufacturers are necessarily quiet.

[iii] There are three challenges to ducting iHPWHs outdoors:

- For 30-60% of the year in colder climates, outdoor air is too cold for current iHPWHs to operate efficiently in heat pump mode.
- If only one side of the iHPWH is ducted outdoors, this introduces pressure and air flow imbalances to the building. Exhausting 100-200 cfm results in forced infiltration of 100-200 cfm for each iHPWH operating. This leads to significant heating/cooling loads, possible IAQ issues, and potentially other challenges.
- Exterior penetrations for iHPWH ducts can result in significant infiltration. In very cold weather, there is risk of cold air coming in contact with potable water plumbing. If equipment fails or there is a power outage, there may be freeze risks.