ADVANCED WATER HEATING INITIATIVE™

September 30th, 2024

Mr./Ms. Abigail Daiken:

U.S. Environmental Protection Agency

Office of Air and Radiation

1200 Pennsylvania Avenue NW

Washington, DC 20460

Subject: AWHI supports NEEA's comments on the ENERGY STAR Draft 1 Test Method for Central Heat Pump Water Heater Systems

Dear Mr./Ms. Abigail Daiken:

The following comments are submitted on behalf of the Advanced Water Heating Initiative (AWHI). AWHI is a member-funded collaborative of building owners, utilities, federal agencies, state and local governments, manufacturers, engineers, installers, advocates, researchers, and building industry professionals from across the U.S.

AWHI supports EPA's Draft 1 Test Method for Central Heat Pump Water Heater Systems

AWHI fully endorses the EPA's initiative to develop a comprehensive test method for evaluating the performance of central heat pump water heater (CHPWH) systems.

AWHI supports collecting test results at multiple temperature points with certain modifications

We strongly support requiring product testing and results reporting at multiple temperature points. This data is crucial for designing a CHPWH system and modeling its energy use, which will significantly advance the field. We anticipate the standardizing testing and reporting data proposed in this CHPWH system specification will accelerate market adoption.

AWHI supports EPA's proposed evaporator testing conditions for air-source products at 5ºF and 95ºF dry bulb, and we recommend different intermediate points. The proposed EPA temperature points are sometimes closely spaced (e.g., 5ºF and 17ºF, or 80.6ºF and 95ºF); however, at other temperatures, the gaps are wider (e.g., 17ºF to 50ºF). We recognize that one of the primary purposes of data is to calculate the output capacity and efficiency under design conditions. Engineers will need to interpolate between data points. Consequently, AWHI suggests using an approach similar to the one outlined in the AWHS published by the Northwest Energy Efficiency Alliance. This method uses conditions spaced approximately 30ºF apart. See the table below for recommended dry and wet bulb conditions.

Label	Dry Bulb ºF	Wet Bulb ºF
Min	Mfr spec'd	Mfr spec'd DB minus 1
A	5	2
B	34	31
C	68	57
D	95	69

We acknowledge that minor changes may improve alignment with other industry standard test points and fully support those changes. For example, comparable standards typically set test condition B at 35ºF dry bulb / 33ºF wet bulb. Similarly, it may be logical for condition C to match the consumer water heater test conditions of 67.5ºF and 50% relative humidity. Additionally, the proposed conditions align with the optional test conditions specified by the U.S. Department of Energy (DOE) in its most recent test procedure for consumer water heaters. Therefore, aligning these conditions makes sense.

We recommend that the EPA adopt a minimum temperature condition labeled "Min," which manufacturers can select based on the equipment's capabilities. This value could be significantly below zero for some products. We propose that manufacturers test and report performance at the lowest operating conditions for products that do not function at the A or B

conditions (e.g., 47ºF dry bulb and 43ºF wet bulb). This approach would provide engineers and installers with critical information for accurately sizing heat pumps.

Lastly, we recommend that EPA collect and report the minimum and maximum operating ambient temperatures for the compressors, similar to its approach for residential water heaters.

AWHI recommends prioritizing a variety of ambient, entering, and leaving temperature conditions over a seasonal metric

The entering water temperature also strongly impacts performance. We support the EPA's proposal to differentiate condenser entering water temperature and temperature rise conditions for single-pass and multi-pass equipment.

Moreover, since groundwater temperatures correlate with air temperatures, we recommend varying supply water temperatures during test conditions.

In a return to primary CHPWH installation, the incoming mains water temperature will partially mix with hotter water in a tank or circulation loop. As a result, the water entering the heat pump is warmer than the mains. We recommend the approach taken by the AWHS, as shown in the table below. Multi-pass systems generally operate differently from single-pass systems, which results in more consistent entering water temperatures. Therefore, a single entering water temperature is appropriate. We support EPA's proposal for the outlet water temperature of 140 ºF. However, HPWHs designed for multipass typically do not target a specific outlet water temperature, so we recommend the test procedure provide instructions for manufacturers to manually balance the water flow through the HPWH to target 140°F. Additionally, we encourage EPA to consider an optional or alternative, higher temperature of 150ºF and/or 160ºF, to represent products used with swing tank system designs.

Label	Single Pass Entering Water Temperature ºF	Multi Pass Entering Water Temperature ºF	All Systems Outlet Water Temperature ºF
A	72	125	140
B	76	125	140
C	81	125	140
D	86	125	140

Recommended temperatures in the table above align with performance map temperature required in the NEEA PADS for Single Pass Return to Primary for Single Pass and Multi Pass Return to Primary for Multi Pass. These temperatures were proposed to the AHRI 1300 committee by NEEA with favorable acceptance from present members including CEE and many manufacturers.

AWHI recommends EPA add an ambient test in the mid-30sºF range and capture performance changes during defrost

AWHI encourages EPA to include an ambient test condition (for air-source products) at or near 34-35ºF. To adequately size the product, engineers and installers must know its output capacity and defrost derate at these temperatures.

AWHI recommends EPA include a market delivery structure

The AWHS outlines three Market Delivery Methods in section 3.4.3 which are meant to provide programmatic guidance for recommended performance validations steps. For example, a Custom Engineered market delivery is recommended to have a more involved performance validation process than a Fully-Packaged Skid-Mounted or Fully-Specific Built-Up system. AWHI recommends that EnergyStar include a similar market delivery structure, to categorize products and recommend steps for validating performance.

AWHI recommends EPA include an optional requirement for connectivity

Although the capability of CHPWH systems to participate in demand response programs is still under development, we encourage ENERGY STAR to include optional connected capability reporting requirements to encourage manufacturers, similar to those for residential HPWH manufacturers. AWHI encourages EnergyStar to require ANSI/CTA-2045 (EcoPort)[1] and certification through AHRI Standard 1530[2] or OpenADR[3] for compliance.

[1] "Customers and Installers Now Have a Choice." EcoPort, n.d. https://ecoport.openadr.org/

[2] We understand that the Demand-Flexible Commercial Electric Storage Water Heaters standard is in development.

[3] OpenADR Alliance. "Connecting Smart Energy to the Grid," n.d. https://www.openadr.org/

Additional miscellaneous recommendations:

We recommend defining HPWH specifically as air-to-water and water-to-water heat pumps

Narrowing this specification would eliminate many of the proposed requirements in Section 4. This change will remove the ground coupling and its test requirements, allowing for the expansion of the system boundary to include essential hot water system components in multifamily buildings.

Testing of the recirculation pump may not be necessary, but defining configuration is recommended

Energy used by the recirculation pump is too small to have a significant impact on overall SysCOP. Additionally, the energy used by the recirculation pump is highly dependent on the connected recirculation piping. However, CHPWH Version 1 can require manufacturers to provide guidance on recirculation pump controls and balancing of hot water distribution system.

Energy efficiency levels:

AWHI recommends that the CHPWH Version 1 specification set a reasonable minimum efficiency level achievable by a minimally compliant CHPWH system but not by an electric resistance water heater. As CHPWHs are still in the early stages of adoption, overly ambitious efficiency requirements could hinder their market acceptance.

List single- and multi- pass systems separately, and note if manufacturer recommends a swing tank for single-pass configurations:

AWHI recommends EPA test and list each CHPWH separately for single- or multi-pass configurations, as the test conditions and efficiency vary. For example, the Northwest Energy Efficiency Alliance (AWHI) Commercial/Multifamily HPWH Systems Qualified Products List includes separate listings based on the configuration for the same model number.[4]

[4] Northwest Energy Efficiency Alliance. *Commercial Heat Pump Water Heater Qualified Products List*. Retrieved from https://AWHI.org/img/documents/commercial-HPWH-qualified-products-list.pdf.

Consider hybrid system listings

Consider listing configurations which use a hybrid system that includes an electric heat pump with gas trim or gas swing tank. SysCOP calculations can assume some trim heat is required when temperatures are below some standard temperature such as 35°F.

Sincerely,

The Advanced Water Heating Initiative

This letter and the recommendations therein are supported by:

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