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United States Environmental Protection Agency
Washington, DC 20460

(Submitted via email to HVAC@energystar.gov)

Re: Comments in Response to ENERGY STAR® Final Draft Test Method for Central Heat Pump Water Heater Systems – Issued December 5, 2024

Rheem Manufacturing Company (Rheem) appreciates the opportunity to comment on the Environmental Protection Agency's (EPA) ENERGY STAR Final Draft Test Method for Central Heat Pump Water Heater Systems published on December 5, 2024.

Rheem is an industry leader in total heating, cooling, refrigeration, and water heating solutions, including pool heating, headquartered in Atlanta, Georgia. Rheem has U.S. based manufacturing facilities in Alabama, Arkansas, California, Connecticut, and North Carolina and distribution facilities throughout the U.S., Canada and around the world. Rheem is at the forefront of developing and commercializing products that advance the goals of emissions reduction at an affordable price to the customer, working cooperatively with environmental agencies and regulators.

Rheem supports the development of a central heat pump water heater (CHPWH) system test method and the planned product specification. DOE and EPA developing this test method as a national standard while utilizing a consensus process should ensure broad stakeholder participation. Further, a national specification and qualified products list (QPL) will help reduce the proliferation of competing specifications and QPLs that industry has been compelled to comply with. Unfortunately, the proposed Final Draft appears to be rushed, adding several completely new provisions that have not been publicly discussed or commented upon and leaves little time for review and comment. In particular, the proposed seasonal metric around only the heat pump component of the system will further embolden jurisdictions to favor component efficiency over the efficiency of the system and potentially increase energy consumption, total installation cost, and operating costs. To Rheem's knowledge, DOE and EPA have not addressed our concerns over the authority to regulate CHPWH systems within the DOE and EPA framework, along with the stated understanding of a heat pump water heater's (HPWH) role within a CHPWH system, as submitted in response to the Draft 1 test method. Also, Rheem is an active member of Air-Conditioning, Heating and Refrigeration Institute (AHRI) and supports their separately submitted comments.

3 DEFINITIONS

Circulator pump and water pump are used interchangeably throughout test method. Rheem requests that the same term be used throughout and clarification of the location of the pump be given. Rheem understands that the pump circulates water between the heat pump and the storage tank and does not refer to a circulator pump within a hot water recirculation loop (*i.e.,* that circulates water throughout a building).

Rheem recommends removing "using the national average temperature fractional bin hours" from the "Water Heating Energy Efficiency Ratio (WHEER)" definition. Referring to the section is all that is needed, and a description of the calculation methodology isn't necessary.

"UUT" is used in section 4.2(D) but isn't defined or listed in the acronyms.

4 TEST METHODS

4.1 Supplemental Test Instructions

Rheem supports reporting information that is required to perform the test correctly. However, reporting requirements are not typically included within a test method. This would more appropriately be housed in a Specification. Rheem notes that current reporting requirements are not part of Specifications either, rather reporting templates are published with information requests that have not been publicly commented on. In the past, confusion in reporting templates has caused delays in certification and resulted in questions from consumers.

Section 4.2(E)(1)(a) allows outdoor AS-HPWHs to be tested in either the ducted or non-ducted configuration. Rheem recommends adding to the list of supplemental test instructions whether the outdoor AS HPWH model was tested in the ducted or non-ducted configuration.

4.2 Heat Pump Unit Test Method

A) General

Rheem understands that WHEER for outdoor models is intended to be comparable to $COP_{80.6}$ for indoor models. However, Rheem is concerned that the metrics aren't comparable. An indoor model will see variable supply water temperatures depending on the time of the year, yet only one temperature is required. Also, "indoor" doesn't just mean boiler/mechanical room. It could be in a parking garage, which is "protected" from weather but will see lower ambient temperatures.

D) Outdoor Air Source Cut-out and Cut-In Temperatures

Rheem has not had enough time to review the Outdoor Air Source Cut-out and Cut-In Temperatures test, which is a completely new provision to the draft test method.

Rheem has concerns about the time to perform the test and the repeatability of the test method.

Rheem does understand the need to accurately determine the cut-in/cut-out temperatures at low ambient temperature and encourages EPA/DOE to also evaluate cut-in/cut-out temperatures at high ambient temperatures (*i.e.,* >95F).

Rheem requests clarification why T_L only appears to apply to the Type B model calculations.

F) Test Procedure

In paragraph (5) flow rate is in "gal/m," Rheem recommends "gal/min" or "gpm" be used.

In paragraph (6)(b)(iii) the language "water pump water pump" is used. Rheem recommends removing one instance of "water pump".

In the $Q_{H,y,n}$ equation, Rheem requests clarification on why "$1/(C_{fg} \times \upsilon)$" is used instead of density in gal/lb, which is a readily available value for water. Rheem also requests clarification why C_p does not change with temperature, like is required for υ. Finally, Rheem requests the temperature that should be used to find υ and C_p be clarified.

G) Defrost Test Procedure

Rheem has not had enough time to review the Defrost Test Procedure, which is a completely new provision to the draft test method.

4.3 WHEER Calculation

Rheem understands the utility of different metrics for different installation locations (*e.g.,* climate zones) and supports further evaluation of separate national average and cold climate metrics.

Rheem also understands the different metrics by heat pump type (*i.e.,* single and multi-pass) may appear useful to a consumer. However, Rheem is concerned that a seasonal metric around a component of a system misrepresents the efficiency and energy consumption of the system and is misleading to the consumer.

Due to the large temperature rise and low supply water temperatures, the efficiency of a single-pass HPWH is higher than a multi-pass HPWH. However, this component efficiency only

translates to a high system efficiency with careful system design. The component efficiency advantage of single-pass HPWHs quickly erodes when swing tanks and recirculation loops are included in a system.[1] Given the significant difference in component and system efficiency, Rheem encourages EPA/DOE to evaluate the effect that a single metric, which can easily be construed as a metric to compare system types, will have on HPWH adoption.[2] As the baseline, is electric resistance or gas-fired water heating, care should be taken to encourage, rather than restrict, HPWH adoption. A single metric that doesn't consider the system's energy use is, at a minimum, no improvement over the current situation where COP maps are published. Further, it legitimizes a manner of thinking of central HPWH systems, which Rheem understands to be false. Rheem does not support the inclusion of a seasonal "water heater only" metric at this time.

If EPA/DOE move forward with inclusion of the WHEER calculation, Rheem has the following preliminary comments, as this is a completely new provision to the draft test method.

All installed single-pass HPWH systems Rheem is aware of operate for a non-trivial amount of time at supply water temperatures that are most representative of multi-pass operation. The amount of single-pass system heating at multi-pass supply water temperatures varies based on a number of factors, including, but not limited to, system design and installation location. The proposed WHEER calculation does not appear to address this operating condition at all. Further, multi-pass HPWH systems will operate with supply water temperatures lower than is required by the test method. The result of the WHEER calculation appears to overestimate the efficiency of a single-pass HPWH and underestimate the efficiency of a multi-pass water heater.

Rheem requests further description of "BL(T_j)" the "value of the water heating demand". "T_j" is listed as an independent variable, yet none of the variables in equation 4.3-2 are dependent on T_j. Does BL mean "building load"?

Is BL an attempt to size the HPWH within a system? If so, Rheem understands that most HPWH systems are sized at a low temperature and agrees that the heating capacity calculated at the 47°F test condition (line 452) is reasonable for non-cold climate HPWHs. Rheem recommends further

[1] Rheem notes that many multifamily/hotel/motel buildings have recirculation loops and that these building types have a non-trivial amount of energy credits associated with HPWH system installation (*e.g.,* see section C406 of the 2024 IECC).

[2] For example, preference for single-pass HPWH systems is already finding its way into building codes (e.g., California's Title 24). An EPA/DOE "endorsed" metric that is not representative of in-field efficiency encourages further restriction on the use of multi-pass HPWH systems.

evaluation of a cold-climate HPWH representative heating capacity. Rheem also requests clarification on the derivation of the sizing factor (SF; line 456).

For clarity, Rheem recommends ", T_j" be added in the 3rd column of Table 4.10.

In all equations that have CD_{DF} the description points to "table 4" but should point to "Table 4.10." These equations also include the statement "35 test," which Rheem recommends being "H_{35} test."

From the Type C definition, T_{off} should be less than 17F, therefore, Rheem recommends changing "if the 35 test is not conducted and $T_{off} \leq T_j < 42°F$" to "if the 35 test is not conducted and $17°F \leq T_j < 42°F$" in the Type C equations.

The Q_h and E_h equations appear to mirror each other, but there appears to be an Eh equation missing from the Type C equation (the second Q_{H17} equation). Within this equation, there is a statement "$T_j < 2°F$," should this be "$T_j < 17°F$."

Within the Type D equations, the defrost degradation coefficient is included for T_j's <17F. Should defrost be accounted for in the Type C equations as well?

Thank you for the opportunity to provide these comments.

James Phillips
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CC: Karen Meyers, Joe Boros