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August 7, 2023

Ms. Abigail Daken
Manager, ENERGY STAR HVAC Program
United States Environmental Protection Agency
Washington, DC 20460

Re: AHRI and HRAI Comments to ENERGY STAR® Air-to-Water Heat Pump Discussion Guide

Dear Ms. Daken:

The Air-Conditioning, Heating, and Refrigeration Institute (AHRI) and the Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI) (collectively, the "Joint Commenters") are submitting these comments in response to the U.S. Environmental Protection Agency (EPA) ENERGY STAR® discussion guide for a new specification for air-to-water heat pumps (ATWHP), issued on June 5, 2023.

AHRI appreciates EPA staff agreeing to our request for a 30-day extension for comments on this topic. As was relayed at the June 21, 2023 webinar and in comments relating to the proposed boilers specification sunset, questions surrounding a new test procedure and specification for ATWHPs are complex and warrant significant further conversations. During the 30-day extension, affected members have spent many hours discussing the discussion guide and recommendations regarding industry consensus test procedures and performance rating standards for ATWHPs. Herein, initial industry consensus positions are presented, but further discussion is required. AHRI's ATWHP Task Force is making progress on recommending a scope test procedure development. At that time, AHRI will convene a consensus committee to develop test and ratings procedures for ATWHPs. We welcome EPA and U.S. Department of Energy (DOE)'s participation in the standards development process.¹

¹ AHRI is an accredited Standards Development Organization. The AHRI standards process is accredited by both the American National Standards Institute (ANSI) and Standards Council Canada (SCC). Information on the process and the approved *AHRI Standards Committee Policy and Procedure* document is available, here:

Currently, there are three areas of member consensus: (1) Complexity of the product category; (2) the appropriateness of “Heat Pump Boilers” as the name for the product category; and (3) that AHRI 550/590 does not fully capture the performance of ATWHPs. The Joint Commenters will also provide some initial feedback on certain questions within the Discussion Guide.

Complexity of the product category

ATWHPs are installed in both commercial and residential applications, in both new and existing buildings. ATWHPs can provide space heating, space heating and cooling, space heating and domestic hot water, or space heating, cooling and domestic hot water.² There are a variety of space heating applications, including in-floor (radiant) heating, heating through radiators, pre-heating domestic hot water using an indirect tank with hydronic coil, and heating using hydronic air handlers. The temperature of water for end-uses can be high, medium, or low temperature, depending on the application. The two main configurations of ATWHPs are monobloc or split systems. A monobloc heat pump heats the water, and rejects cold air outside, while a split system, heats water and rejects cold air within the building. Each of these aspects impacts use patterns, energy consumption, and ultimately energy efficiency. Installation type, application, and conditions have implications regarding comparisons to competitive products. Because of the complexity of the product category, AHRI recommends additional meetings with EPA and DOE prior to issuance of draft specifications.

Appropriateness of “Heat Pump Boilers” as the name of the product category

To name the product category “heat pump boilers” would be misleading to consumers. ATWHPs can serve many applications beyond what a conventional boiler provides. There is also concern that current technology ATWHPs are unable to serve as a drop-in replacement for many conventional boilers. Maximum water temperature an ATWHP or conventional boiler can deliver is dictated by the relevant safety standard. ATWHPs must comply to UL 60335-2-40, which in the currently published 4th edition, only allows 85C (185°F) leaving water temperature after refrigerant circuit max water outlet.³ Conventional boilers comply with the ANSI Z21.13 safety standard. The maximum outlet temperature per ANSI Z21.13 for hot water supply and steam boilers is 250°F at 160 psi. Boilers can provide the output temperature regardless of climatic conditions whereas some ATWHPs configurations are

<https://www.ahrinet.org/standards#:~:text=AHRI%20Standards%20Overview&text=The%20stages%20of%20development%20and,Committee%20or%20Standards%20Work%20Group>

² For example, air-to-water units designed exclusively to heat potable water as covered by either AHRI Standard 1300 or [Appendix E to Subpart B of Part 430 – Uniform Test Method for Measuring the Energy Consumption of Water Heaters](#), should be out of scope for any ATWHP specification.

³ Amendment 1 to the 4th edition of UL 60335-2-40 will be released for public review shortly. Maximum outlet water temperature is not expected to change with Amendment 1. Work on the 5th edition is expected to begin next.

dependent on outdoor air conditions.

Generally, the name ATWHP can serve as a broad umbrella term for the equipment type, but for a product category with many end-uses and configurations, more detailed product terminology may be appropriate, depending on the scope of industry consensus test procedures, and ultimately products EPA wishes to include in a specification.⁴

AHRI Standard 550/590 does not fully capture the performance of ATWHPs

As EPA acknowledges in the discussion guide, [ANSI/AHRI Standard 550/590-2023 \(I-P\), Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle](#) is intended for chillers. While air-to-water heat pumps are within scope of AHRI 550/590, heating part-load ratings for heat pump water-heating packages and heat recovery water-chilling packages can only be calculated at individual part load points. Per the standard, neither Integrated Part-Load Value (IPLV.IP) nor Non-Standard Part-Load Value (NPLV.IP) shall be calculated for such points. Within AHRI 550/590, the Part-load Value (PLV) metric is a single number figure of merit expressing part-load efficiency for equipment based on weighted operation at various partial load capacities for the equipment.

Air-to-water heat pumps can be optionally certified but only for cooling performance under the AHRI Air-Cooled Water-Chilling Packages Using the Vapor Compression Cycle (ACCL) Certification Program.⁵ Work is ongoing within the cognizant AHRI Committee to add heating certification to ACCL, but there is a current lack of testing capabilities, so a timeline has not been determined. There are provisions within the ACCL Certification to optionally certify to EN Standards 14511:2022, *Air conditioners, liquid chilling packages and heat pumps for space heating and cooling and process chillers, with electrically driven compressors*, and EN Standard 14825:2022, *Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling, commercial and process cooling - Testing and rating at part load conditions and calculation of seasonal performance; however, heating performance however*; heat rejection capacity is excluded from the program scope.⁶

For full-load heating performance, AHRI 550/590 defines performance with 110°F leaving water temperature. While this temperature may be appropriate for closed-loop radiant floor heating systems, the Joint Commentors agree with EPA and this will not provide sufficient heat when used in legacy heat exchangers, typically designed for much higher water temperatures.

⁵ AHRI ACCL Certification Program Resources are available, here: <https://www.ahrinet.org/certification/ahri-certification-programs/air-cooled-water-chilling-packages-using-vapor-compression-cycle-accl>

⁶ Refer to Table 1 of the [AHRI ACCL Operations Manual](#) for program scope.

The AHRI ATWHP Task Force is examining whether AHRI 550/590 should continue to be the test procedure for ATWHPs, or if a different approach should be recommended. If AHRI 550/590 is identified, test procedure modifications to include a part-load heating metric for ATWHPs may also be recommended. Part-load (or seasonal) heating is important to accurate representations of performance for ATWHPs using multiple speed, variable speed, or inverter-driven compressors. Also, considering the broad range of products that may fall under the ATWHP umbrella, further discussion is required to ensure appropriate representation for the many categories (or a subset of products, whichever is recommended for test procedure development).

Initial Feedback to EPA's Questions:

- **Question 2:** Are there broadly accepted industry definitions of air-to-water heat pumps or heat pump boilers?

Response: There are no broadly accepted industry definitions of air-to-water heat pumps in the U.S. The AHRI ATWHP Task Force is developing a draft product classification table, which may aid in the development of industry definitions. AHRI will make the draft public after members have achieved consensus.

- **Question 3:** Is there any need to distinguish boilers that are used with hydronic coils in a forced air distribution system from those used with hydronic distribution? Are the same products used in both situations?

Response: During discussions, members have discussed a need to differentiate based on temperature. Low, medium, and high temperature applications exist, and a single product may not serve all applications. The Joint Commentors note that specific temperature ranges will need to be assigned to "low, medium, and high" temperature products, and these ranges will likely be unique to the U.S. For example, a European ATWHP used for hydronic distribution may deliver water temperatures around 140°F, while an ATWHP for a drop-in conventional boiler replacement may need to deliver water between 180°F to 210°F.

- **Question 7:** Many hydronically-heated homes are in cold climates in the US. Is there a need for separate criteria for cold climate ATWHPs?

Response: The Joint Commentors note that conditions and energy use may be very location and application specific. For example, there are many hydronic-heated systems in cold-climates and many radiant floor installations in temperate climates. These uses and locations would have very different energy consumption and use profiles.

Heat pump technology has improved over the past several years to operate with greater capacity and efficiency at low outdoor temperatures (below 32°F).⁷ Several organizations have been working to develop definitions and testing methodologies for these products; however, to date, there is no consensus on either definition or testing methodology. Even DOE's CCHP challenge methodology does not include methodology to test non-ducted, multi-split, and hybrid/dual fuel products. Efforts involving all stakeholders will be necessary to overcome the shortcomings of previous efforts and this work is progressing through the AHRI Standards Technical Committee, which has met regularly, in person to further the test procedure. Joint Commentors are committed to this endeavor as there should be a uniform federal definition and test method for products specifically engineered to provide comfort heating at low ambient conditions.

- **Question 17:** Are there any other considerations about the implementation of an air-to-water heat pumps specification that EPA should be aware of?

Response: The Joint Commentors note that at lower water temperatures (i.e., 110°F), water management systems may be needed to control legionellosis. ASHRAE has dedicated standards and guidelines, but further discussion will be required during the development of test procedures and specifications.⁸

Conclusion

The Joint Commentors support ENERGY STAR programs predicated on meeting reasonable performance requirements that consumers can afford. ENERGY STAR programs should be based on industry consensus test procedures, and AHRI welcomes EPA and DOE's participation to develop such procedures for ATWHPs. We invite EPA and DOE to meet with AHRI staff prior to the AHRI ATWHP Task Force finalizing a recommended scope for test procedure development. A collaborative and informed stakeholder process is critical to ENERGY STAR's success.

We appreciate the opportunity to provide these comments. If you have any questions regarding this submission, please do not hesitate to contact Laura Petrillo-Groh, lpetrillo-groh@ahrinet.org.

⁷ DOE CCHP Presentation. September 19, 2022. https://unece.org/sites/default/files/2022-09/Ashley_Armstrong_EERE%E2%80%8B.pdf

⁸ ANSI/ASHRAE Standard 188-2018, *Legionellosis: Risk Management for Building Water Systems* establishes minimum legionellosis risk management requirements for building water systems. ASHRAE Guideline 12-2020 - *Minimizing the Risk of Legionellosis Associated with Building Water Systems*, when used in conjunction with Standard 188-2018, Guideline 12 can provide prescriptive guidance for operators of water management systems to control of legionellosis in building water systems.

Sincerely,

Martin Luymes


Samantha Slater



HRAI

Vice President, Government
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cc: Holly Tapani, EPA
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