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Re: AHRI-HRAI Comments on March 5, 2021 Technical Webinar Regarding Central Air Conditioners and Heat Pumps

Dear Ms. Chung,

We are writing to you on behalf of the Air Conditioning Heating and Refrigeration Institute (AHRI) and the Heating Refrigeration and Air Conditioning Institute of Canada (HRAI) collectively referred to as the "Joint Commenters." Our associations collectively represent the large majority of manufacturers of heating, refrigeration and air conditioning products and systems sold into the Canadian and U.S. markets.

These comments respond to requests made during the March 5, 2021, technical discussion with HRAI and AHRI regarding Central Air Conditioners and Heat Pumps on March 5, 2021.

The Joint Commenters support the proposed direction of harmonization with the U.S. Department of Energy (DOE) on the 10 CFR 430 Appendix M1 (Appendix M1) test procedure and adoption of the energy conservation standard for residential central air conditioners and heat pumps (CAC/HP) but note that only through complete alignment will end users in both countries reap the full benefits of lower cost and greater product availability. We think that it is possible for Canadian consumers to find products that perform well at colder climates – a state goal of NRCan – without imposing additional test and compliance burdens on the manufacturers.

Fundamentally, the Appendix M1 test procedure, while offering an option for testing at 5 ºF (-15 ºC) (H4), provides all the relevant information for the calculation of the capacity and performance of the products at 5 ºF (-15 ºC), without conducting the test at that temperature. Extrapolation of the slope of the line between 47 ºF (H1) and 17 ºF (H3), for both capacity and COP, down to 5 ºF will yield virtually the same outcome as testing the product at 5 ºF. The data set is limited but includes two tests of the same unit at different times to assess repeatability, as very few products have been tested to Appendix M1, however, AHRI has test data for a 5-ton single-stage unit. The data has been normalized based on capacity at 47 ºF. **The graphs, below, show there is minimal difference (around 3-percent) between performance and capacity derived through calculation or testing at 5 ºF.**

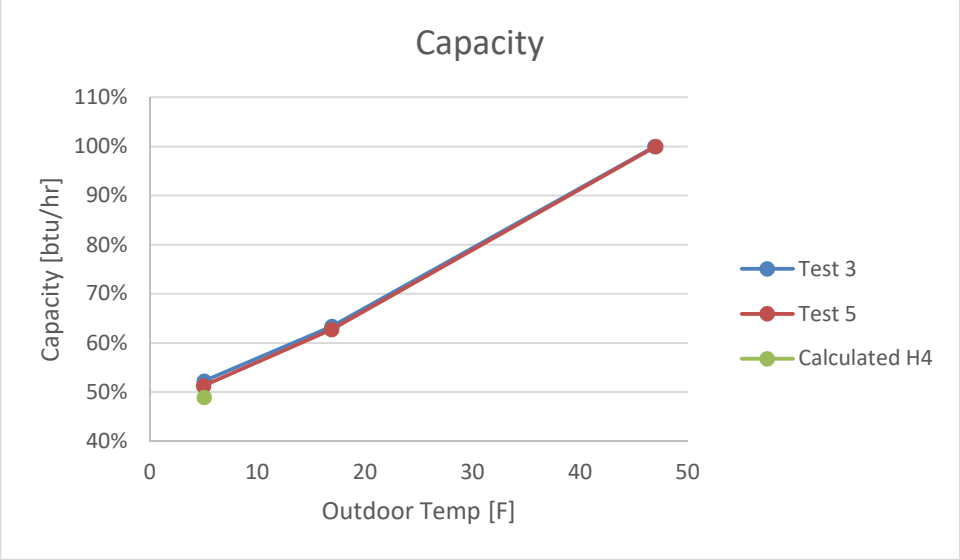

Figure 1 Normalized Tested Capacity and Calculated H4 of a 5-ton single-stage Heat Pump to Appendix M1

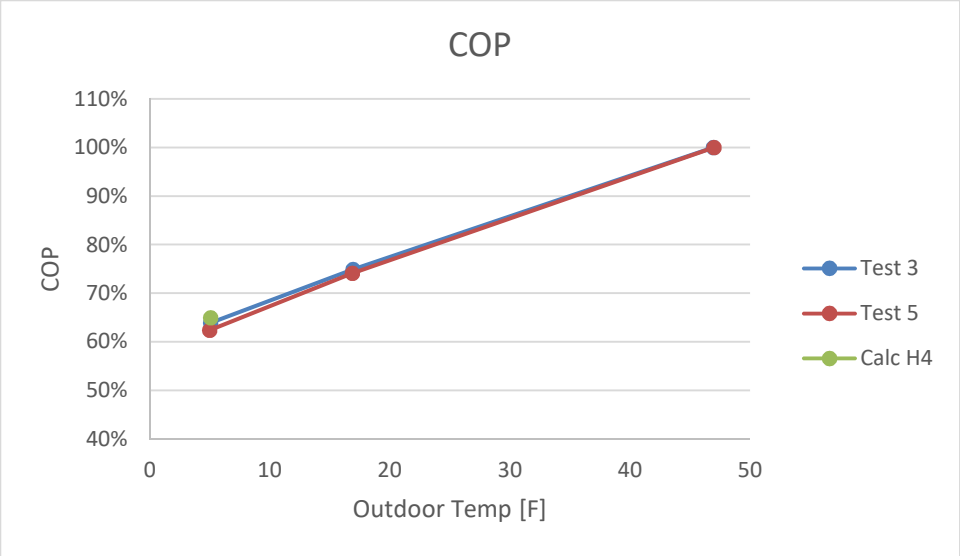

Figure 2 Normalized Tested COP and Calculated H4 of a 5-ton single-stage Heat Pump to Appendix M1

One would not expect to see significant difference between testing and calculation as Appendix M1 requires H4 testing to be conducted at the same compressor speed as H1 and H3 for single-speed, two-stage heat pumps. Appendix M1 requires that all heat pumps for which the 5 °F full-speed test is not conducted, the extrapolation approach using test results for 17 °F and 47 °F temperatures (or the standardized slope factors for variable-speed heat pumps which do not use the same speed for these tests) would be used to represent performance for all ambient temperatures below 17 °F. The 5 ºF test is optional because the limited data has shown there is only a small improvement in accuracy in exchange for a significant test burden increase.

The Joint Commenters note that slide 10 of the March 5th presentation included justification for the 5 ºF test, showing two performance lines – one labeled, "Assumed in HSPF2," and the other, "Beneficial for Canada." The "Beneficial for Canada" performance line assumes the performance from 35 °F to 5 ºF is linear; however, the true linear performance is the line from 47°F to 17°F (or 47°F to 5°F) for any system (when compressor speed does not change). In the 20ºF to 40ºF range, the performance (both capacity and efficiency) of a heat pump is degraded due to outdoor coil frosting. As temperature continues to decrease, so does moisture content in the air, so the defrost degradation goes to *a de minimus* value close to 20 ºF.[1] The assumption of performance in the "Beneficial to Canada" line from the defrost degradation curve is incorrect and not reflective of actual heat pump performance, regardless of compressor type (single-stage, two-stage or variable speed product staging).[2]

[1] The de minimus reduction is for heat pumps with demand defrost control. Heat pumps with time/temperature defrost control will still have some performance reduction.

[2] Refer to Table 4 in US DOE, Measured Performance of a Low Temperature Air Source Heat Pump, R.K. Johnson, September 2013. Accessible, here: https://www.nrel.gov/docs/fy13osti/56393.pdf

In summary, the Joint Commenters request NRCan revise the proposal to require testing at 5 ºF (-15 ºC) to calculate HSPF2 for Region V. Instead, the Joint Commenters suggest that the 5 ºF (-15 ºC) test point remain optional, and the efficiency report should permit the COP at 5 ºF (-15 ºC) and the rated capacity at 5 ºF (-15 ºC) to be reported based on calculation. This is a reasonable request, given that the entirety of the NEEP data used in NRCan's analysis is variable speed, therefore not representative of the market, and also derived exclusively through calculation.

Please feel free to contact us with any questions or concerns.

Sincerely,

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