Appliance Standards Awareness Project
American Council for an Energy-Efficient Economy

July 11, 2023

Mr. Lucas Adin
U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Building Technologies, EE-5B
1000 Independence Avenue SW, Washington, DC 20585

RE: Docket Number EERE-2019-BT-TP-0027: Notice of proposed rulemaking for test procedures for packaged terminal air conditioners and packaged terminal heat pumps

Dear Mr. Adin:

This letter constitutes the comments of the Appliance Standards Awareness Project (ASAP) and the American Council for an Energy-Efficient Economy (ACEEE) on the notice of proposed rulemaking (NOPR) for test procedures for packaged terminal air conditioners (PTACs) and packaged terminal heat pumps (PTHPs). 88 Fed. Reg. 30836 (May 12, 2023). We appreciate the opportunity to provide input to the Department.

We support DOE's proposal to update the energy efficiency metrics to capture the seasonal cooling and heating performance of PTACs and PTHPs. DOE has proposed to update the cooling efficiency metric from the full-load EER to seasonal cooling performance (SCP) and the heating efficiency metric from COP at 47°F to seasonal heating performance (SHP). We believe that seasonal metrics will provide more representative measures of the efficiency of a unit by capturing the total cooling (or heating) provided during the cooling (or heating) season divided by the energy consumed by the equipment during that period.

We support a bin-based method to calculate SCP and SHP, but encourage DOE to reexamine the heating load line used in the calculation of SHP. We think that DOE's proposal to adopt a temperature bin-based approach similar to that used for SEER2 and HSPF2 in Appendix M1, with an updated building load line based on the applications of PTACs/PTHPs, makes sense. However, we are concerned that the PTHP heating load line for the small hotel building type presented in the June 6 webinar may be unrepresentative because it reflects no heating hours above 30 °F.[1] We encourage DOE to verify that the heating zero-load outdoor temperature for this building type is appropriately defined to be 30 °F.

We encourage DOE to consider a default cyclic degradation coefficient (C_d) that represents the worst-performing unit and to allow manufacturers the option to demonstrate improved cycling performance. In the NOPR, DOE presented test data from four PTHPs to determine the default degradation coefficient for cooling. DOE averaged the C_d^c values (which had a large spread, ranging from

[1] https://www.regulations.gov/document/EERE-2019-BT-TP-0027-0020 p. 19.

0.12 to 0.47), which yielded 0.30. (DOE is proposing to also use this value for the heating coefficient, C_d^h.) We are concerned that the proposal does not incentivize manufacturers to reduce cycling losses. Therefore, we encourage DOE to set the default coefficient to a more conservative value, similar to the approach in Appendix M1. Manufacturers could elect to use the default, or test to demonstrate improved cycling performance.

We encourage DOE to adopt the nomenclature introduced in the test procedure term sheet for the CUAC/CUHP ASRAC working group for the heating mode tests. The naming convention used in the December 2022 CUAC/CUHP test procedure term sheet[2] replaces the subscripts 1, 3 and 4 with the corresponding outdoor air dry bulb temperatures (47°F, 17°F, and 5°F). We believe that this nomenclature is preferable for clarity and ease of understanding, and it would also align PTHPs with CUHPs, another type of commercial space conditioning equipment. For the H_L tests that do not have a counterpart in the CUHP test procedure , we recommend HLH, HLL, and HLM for the test designations.

Table 1. Proposed Appendix H1 heating test designations and CUHP test designations

Proposed Appendix H1 test designation	CUHP Test Designation	Outdoor Air Condition		Indoor Section Air Condition
		Dry Bulb (^{0}F)	Wet Bulb (^{0}F)	Dry Bulb/Max Wet Bulb (^{0}F)
$H_{1,full}$	**H47H**	47	43	70/max 60
$H_{3,full}$	**H17H**	17	15	70/max 60
$H_{L,full}$	–	†	††	
$H_{4,full}$	**H5H**	5	4(max)	70/max 60
$H_{1,low}$	**H47L**	47	43	70/max 60
$H_{3,low}$	**H17L**	17	15	70/max 60
$H_{L,low}$	–	†	††	
$H_{3,int}$	**H17M**	17	15	70/max 60
$H_{L,int}$	–	†	††	

L = low; H = high; M = medium
† Use the average of the cut-in and cut-out temperatures.
†† Use a wet-bulb temperature corresponding to a maximum 60% RH level.

[2] https://www.regulations.gov/document/EERE-2022-BT-STD-0015-0065 Recommendation #9.

We encourage DOE to consider edits to clarify the proposed regulatory language. In the attached Appendix A, we have provided some non-substantive suggestions intended to clarify elements of DOE's proposed regulatory text.

Thank you for considering these comments.

Sincerely,

Rachel Margolis
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Appliance Standards Awareness Project

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American Council for an Energy-Efficient Economy

Appendix A. Non-substantive recommendations
(recommended deletions are shown in strikethrough and additions in blue text)

§ 431.92 Definitions concerning commercial air conditioners and heat pumps.

1) "*Dehumidification efficiency, or DE*, means the quantity ~~ratio~~ of water removed from the air ~~by~~ divided by the energy consumed, measured in liters per kilowatt-hour (L/kWh)."

   This recommendation aligns the definition with that in Appendix H1, Section 2.

2) In definitions for seasonal cooling performance and seasonal heating performance, replace Btu's with Btus.

3) *"Seasonal heating performance or SHP* means the total heat added to the conditioned space during the heating season, expressed in Btu's, divided by the total electrical energy consumed by the package terminal ~~air conditioner or~~ heat pump during the same season, expressed in watt-hours. SHP is determined in accordance with appendix H1."

Appendix H1 to Subpart F of Part 431—Uniform Test Method for Measuring the Energy Consumption of Packaged Terminal Air Conditioners and Packaged Terminal Heat Pumps

Section 2. Definitions.

1) Consider a parallel construction for the definitions of make-up air PTAC and PTHP.

   "Make-up air PTAC means a PTAC for which a portion of the total airflow is drawn in from ~~the~~ outside ~~of~~ the conditioned space…"

   "*Make-up air PTHP* means a PTHP for which a portion of the total airflow is drawn in from outside the conditioned space…"

2) In definitions for seasonal cooling performance and seasonal heating performance, replace Btu's with Btus

3) Delete the hyphen in air-conditioner in the proposed variable speed PTAC/HP definition

Section 3.3 Compressor speeds

1) Consider adding clarity: "To operate the unit at full compressor speed, set the room thermostat at 75 °F for both heating and cooling tests, representing a 5 °F differential above the heating test air entering indoor unit temperature ~~test condition~~ and 5 °F below the cooling test air entering indoor unit temperature ~~test condition~~."

Section 3.4 Indoor Fan Settings

1) "If the fan control selections do not allow for the indoor fan to cycle with the compressor…"

2) “If needed, the manufacturer supplemental testing instructions must…”

3.5.3 Tests for a System with a Variable-Speed Compressor

1) “Table 3 specifies test conditions for the four required and one optional tests.”

3.6.2 Cut-out Temperature

1) “Reduce the outdoor chamber temperature…”

3.6.3 Cut-in Temperature

1) Hold the outdoor temperature constant for 5 minutes where the cut-out occurred—then increase the outdoor chamber temperature by…”

Section 3.7.1 Tests for a System with a Single-Speed Compressor

1) In the footnote to Table 4, consider defining ‘RH’, as RH is also used to denote resistance heating in equation 3.8.2-1.

Section 3.7.2 Tests for a System with a Two-Speed Compressor

1) “Conduct two low-load tests, at the H_1 and H_3 (or HL) conditions.”

2) “Table 5 specifies test conditions for the four required and one optional tests.”

Section 3.7.3 Tests for a System with a Variable-Speed Compressor

1) Consider consistently hyphenating ‘low-load’.

2) Consider changing the title of Table 6 to avoid use of the phrase ‘at any given outdoor temperature’.

Section 3.8.1 SCP Calculation

1) Consider using language in M1 to describe the outdoor bin temperature:

   Proposed T_j = the outdoor bin temperature, °F, which are binned in bins of 5°F with the 8 cooling season bin temperatures being 67,72,77,82,87,92,97 and 102°F.

M1 T_j = the outdoor bin temperature, °F. Outdoor temperatures are grouped or "binned." Use bins of 5 °F with the 8 cooling season bin temperatures being 67, 72, 77, 82, 87, 92, 97, and 102°F.

Section 3.8.1.1 Single-speed system

1) "Evaluate $q_c(T_j)/N$ and $e_c(T_j)/N$ using the equations below:"

2) Consider amending the $X_{low}(T_j)$ description to "the cooling mode, ~~load~~ low capacity load factor…"

Section 3.8.1.2 Two-speed systems

1) In equations 3.8.1.2–1,3.8.1.2–2, 3.8.1.2–3, 3.8.1.2–4, capitalize t_j.

Section 3.8.1.3.2

1) "Building load is ~~higher~~ greater than the low-stage capacity and less~~er~~ than the full-stage capacity and the unit operates at an intermediate speed to match capacity to the building load."

Section 3.8.1.3

1) "Calculate the space cooling capacity…of the test unit when operating at outdoor temperature T_j and ~~the~~ intermediate compressor speed ~~used during~~ using the following:"

Section 3.8.1.3.3

1) Consider changing "the electrical power input required by the test unit" to "electrical power consumption of the test unit".

2) "$EER_{full}(T_j)$ is the steady-state energy efficiency ratio of the test unit when operating at full compressor speed and temperature T_j, Btu/h per W, calculated using capacity $\dot{Q}_{c,full}(T_j)$ calculated using Equation 3.8.1.2–3 and electrical power consumption $E_{c,full}(T_j)$, calculated using Equation 3.8.1.2–4."

Section 3.8.1.3.3

1) "Building load is higher than the full-stage capacity ~~a~~"

Section 3.8.2 SHP Calculation

1) Consider replacing ‘heating building load’ with ‘building heating load’.

2) Consider using the language in M1 to describe the outdoor bin temperature

3) Consider expressing the bin temperature range in Table 8 from low to high temperatures (i.e., 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39)

Section 3.8.2.1 Single-speed system

1) In the equation for PLF, the bracketed text should read “1-X(T_j)”

2) Equations 3.8.2.1-6 and 3.8.2.1-7 refer to HL, considering specifying this is for the air entering outdoor unit temperature at HL; this may be accomplished by defining a new variable, instead of using the test designation (which encompasses multiple sets of temperatures)

Section 3.8.2.2.1

1) Remove ≤ in equation for PLF

2) In Section 3.8.2.1, the delta δ is referred to as cut-out factor, and here it is referred to as cutoff factor

Section 3.8.2.2.3

1) “Building load is higher than the full-stage capacity ~~ø~~”

Section 3.8.2.3.2

1) “For each temperature bin where $\dot{Q}_{h,low}(T_j) < BL(T_j) < \dot{Q}_{h,int}(T_j)$¥” there appears to be a character character that should be deleted

Section 3.8.2.3.3

1) “Building load is higher than the full-stage capacity ~~ø~~”

Section 4 Dehumidification Test Procedures

1) Consider the consistent hyphenation of *make-up air* in text and figures in the proposed regulatory text