[6450-01-P]

DEPARTMENT OF ENERGY

10 CFR Part 431 EERE–

2019–BT–TP–0027 RIN

1904-AE65

Energy Conservation Program: Test Procedures for Packaged Terminal Air Conditioners and Packaged Terminal Heat Pumps

AGENCY: Office of Energy Efficiency and Renewable Energy, Department of Energy.

ACTION: Request for information.

SUMMARY: The U.S. Department of Energy ("DOE") is undertaking the preliminary stages of a rulemaking to consider amendments to the test procedures for Packaged Terminal Air Conditioners ("PTACs") and Packaged Terminal Heat Pumps ("PTHPs")**.** Through this request for information ("RFI"), DOE seeks data and information regarding issues pertinent to whether amended test procedures would more accurately or fully comply with the requirement that the test procedure produces results that measure energy use during a representative average use cycle for the equipment without being unduly burdensome to conduct, or reduce testing burden. DOE welcomes written comments from the public on any subject within the scope of this document (including topics not raised in this RFI), as well as the submission of data and other relevant information.

DATES: Written comments and information are requested and will be accepted on or before **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**.

ADDRESSES: Interested persons are encouraged to submit comments using the Federal eRulemaking Portal at *http://www.regulations.gov*. Follow the instructions for submitting comments. Alternatively, interested persons may submit comments by email to the following address: *PTACHP2019TP0027@ee.doe.gov*. Include "Request for information" and docket number EERE-2019-BT-TP-0027 and/or RIN number 1904-AE65 in the subject line of the message. Submit electronic comments in WordPerfect, Microsoft Word, PDF, or ASCII file format, and avoid the use of special characters or any form of encryption.

Although DOE has routinely accepted public comment submissions through a variety of mechanisms, including the postal mail and hand delivery/courier, the Department has found it necessary to make temporary modifications to the comment submission process in light of the ongoing Covid-19 pandemic. DOE is accepting only electronic submissions at this time. If a commenter finds that this change poses an undue hardship, please contact Appliance Standards Program staff at (202) 586-1445 to discuss the need for alternative arrangements. Once the Covid-19 pandemic health emergency is resolved, DOE anticipates resuming all of its regular options for public comment submission, including postal mail and hand delivery/courier.

No telefacsimiles (faxes) will be accepted. For detailed instructions on submitting comments and additional information on the rulemaking process, see section III of this document.

*Docket***:** The docket for this activity, which includes *Federal Register* notices, comments, and other supporting documents/materials, is available for review at *http://www.regulations.gov*. All documents in the docket are listed in the *http://www.regulations.gov* index. However, some documents listed in the index, such as those containing information that is exempt from public disclosure, may not be publicly available.

The docket web page can be found at *https://www.regulations.gov/docket/EERE-2019-BT-TP-0027*. The docket web page contains instructions on how to access all documents, including public comments, in the docket. See section III for information on how to submit comments through *http://www.regulations.gov*.

FOR FURTHER INFORMATION CONTACT:

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For further information on how to submit a comment or review other public comments and the docket, contact the Appliance and Equipment Standards Program staff at (202) 287-1445 or by e-mail: *ApplianceStandardsQuestions@ee.doe.gov*.

SUPPLEMENTARY INFORMATION:

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I. Introduction

PTACs and PTHPs are included in the list of "covered equipment" for which DOE is authorized to establish and amend energy conservation standards and test procedures. (42 U.S.C. 6311(1)(I)) DOE's test procedures for PTACs and PTHPs are prescribed at title 10 of the Code of Federal Regulations ("CFR"), subpart F of part 431.

See 10 CFR 431.96. The following sections discuss DOE's authority to establish and amend test procedures for PTACs and PTHPs, as well as relevant background information regarding DOE's consideration of test procedures for this equipment.

A. Authority and Background

The Energy Policy and Conservation Act, as amended ("EPCA"),[1] authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. (42 U.S.C. 6291–6317) Title III, Part C of EPCA,[2] added by the National Energy Conservation Policy Act, Public Law 95-619 (Nov. 9, 1978), Title IV, §441(a) (42 U.S.C. 6311-6317 as codified), established the Energy Conservation Program for Certain Industrial Equipment, which sets forth a variety of provisions designed to improve industrial equipment energy efficiency. The equipment addressed under these provisions includes PTACs and PTHPs, the subjects of this RFI. (42 U.S.C. 6311(1)(I))

The energy conservation program under EPCA consists essentially of four parts: (1) testing, (2) labeling, (3) Federal energy conservation standards, and (4) certification and enforcement procedures. Relevant provisions of EPCA include definitions (42 U.S.C. 6311), test procedures (42 U.S.C. 6314), labeling provisions (42 U.S.C. 6315), energy conservation standards (42 U.S.C. 6313), and the authority to require information and reports from manufacturers (42 U.S.C. 6316).

[1] All references to EPCA in this document refer to the statute as amended through the Energy Act of 2020, Public Law 116-260 (Dec. 27, 2020).
[2] For editorial reasons, upon codification in the U.S. Code, Part C was redesignated Part A-1.

Federal energy efficiency requirements for covered equipment established under EPCA generally supersede State laws and regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6316(a) and 42 U.S.C. 6316(b); 42 U.S.C. 6297). DOE may, however, grant waivers of Federal preemption for particular State laws or regulations, in accordance with the procedures and other provisions of EPCA. (42 U.S.C. 6316(b)(2)(D)).

The Federal testing requirements consist of test procedures that manufacturers of covered equipment must use as the basis for: (1) certifying to DOE that their equipment complies with the applicable energy conservation standards adopted pursuant to EPCA (42 U.S.C. 6316(b); 42 U.S.C. 6296), and (2) making representations about the efficiency of that equipment (42 U.S.C. 6314(d)). Similarly, DOE uses these test procedures to determine whether the equipment complies with relevant standards promulgated under EPCA.

Under 42 U.S.C. 6314, EPCA sets forth the criteria and procedures DOE must follow when prescribing or amending test procedures for covered equipment. EPCA requires that any test procedures prescribed or amended under this section must be reasonably designed to produce test results that reflect the energy efficiency, energy use or estimated annual operating cost of a given type of covered equipment during a representative average use cycle and requires that test procedures not be unduly burdensome to conduct. (42 U.S.C. 6314(a)(2))

EPCA requires that the test procedures for PTACs and PTHPs be those generally accepted industry testing procedures or rating procedures developed or recognized by the Air-Conditioning, Heating, and Refrigeration Institute ("AHRI") or by the American Society of Heating, Refrigerating and Air-Conditioning Engineers ("ASHRAE"), as referenced in ASHRAE Standard 90.1, "Energy Standard for Buildings Except Low-Rise Residential Buildings" ("ASHRAE Standard 90.1"). (42 U.S.C. 6314(a)(4)(A)) If such an industry test procedure is amended, DOE must update its test procedure to be consistent with the amended industry test procedure, unless DOE determines, by rule published in the *Federal Register* and supported by clear and convincing evidence, that the amended test procedure would not meet the requirements in 42 U.S.C. 6314(a)(2) and (3) related to representative use and test burden. (42 U.S.C. 6314(a)(4)(B) and 42 U.S.C. 6314(a)(4)(C))

EPCA also requires that, at least once every 7 years, DOE review test procedures for all types of covered equipment, including PTACs and PTHPs, to determine whether amended test procedures would more accurately or fully comply with the requirements for the test procedures be reasonably designed to produce test results that reflect energy efficiency, energy use, and estimated operating costs during a representative average use cycle and to not be unduly burdensome to conduct. (42 U.S.C. 6314(a)(1)) In addition, if the Secretary determines that a test procedure amendment is warranted, the Secretary must publish proposed test procedures in the *Federal Register,* and afford interested persons an opportunity (of not less than 45 days' duration) to present oral and written data, views, and arguments on the proposed test procedures. (42 U.S.C. 6314(b)). If DOE determines that test procedure revisions are not appropriate, DOE must publish its

determination not to amend the test procedures. DOE is publishing this RFI to collect data and information to inform its decision in satisfaction of the 7-year review requirement specified in EPCA. (42 U.S.C. 6314(a)(1))

B. Rulemaking History

On December 8, 2020, DOE published an early assessment review RFI in which it sought data and information pertinent to whether amended test procedures would (1) more accurately or fully comply with the requirement that the test procedure produces results that measure energy use during a representative average use cycle for the equipment without being unduly burdensome to conduct, or (2) reduce testing burden. See 85 FR 78967 ("December 2020 Early Assessment RFI"). DOE received comments in response to the December 2020 Early Assessment RFI from the interested parties listed in Table I.1. A parenthetical reference at the end of a comment quotation or paraphrase provides the location of the item in the public record.[3]

[3] The parenthetical reference provides a reference for information located in DOE's test procedure rulemaking docket. (Docket No. EERE-2019-BT-TP-0027, which is maintained at *https://www.regulations.gov/docket/EERE-2019-BT-TP-0027*). The references are arranged as follows: (commenter name, comment docket ID number, page of that document).

Table I.1 Written Comments Received in Response to the December 2020 Early Assessment RFI

Commenter(s)	Reference in this NOPR	Commenter Type
Appliance Standards Awareness Project, American Council for an Energy-Efficient Economy, Natural Resources Defense Council	Joint Advocates	Efficiency Organizations
Air-Conditioning, Heating, and Refrigeration Institute	AHRI	Trade Association
California Investor-owned Utilities	CA IOUs	Utility Association
GE Appliances	GEA	Manufacturer
Northwest Energy Efficiency Alliance	NEEA	Efficiency Organization

Based on DOE's review of the test procedures for PTACs and PTHPs and the comments received, as discussed in the following sections, DOE has determined it is appropriate to continue the test procedure rulemaking after the early assessment process. Specific comments are discussed in the sections that follow.

II. Request for Information

In the following sections, DOE has identified a variety of issues on which it seeks input to determine whether, and if so how, an amended test procedure for PTACs and PTHPs would (1) more accurately or fully comply with the requirements in EPCA that test procedures be reasonably designed to produce test results which reflect energy use during a representative average use cycle, without being unduly burdensome to conduct, or (2) reduce testing burden. (42 U.S.C. 6314(a)(2))

Additionally, DOE welcomes comments on any aspect of the existing test procedures for PTACs and PTHPs that may not specifically be identified in this document.

A. Scope and Definitions

This RFI covers PTACs and PTHPs. "Packaged terminal air conditioner" is defined at 10 CFR 431.92 as a wall sleeve and a separate un-encased combination of heating and cooling assemblies specified by the builder and intended for mounting through the wall, and that is industrial equipment. It includes a prime source of refrigeration, separable outdoor louvers, forced ventilation, and heating availability by builder's choice of hot water, steam, or electricity. "Packaged terminal heat pump" is defined at 10 CFR 431.92 as a packaged terminal air conditioner that utilizes reverse cycle refrigeration as its prime heat source, that has a supplementary heat source available, with the choice of hot water, steam, or electric resistant heat, and that is industrial equipment. Further, relevant to PTACs and PTHPs, DOE defines "standard size" to mean a packaged terminal air conditioner or packaged terminal heat pump with wall sleeve dimensions having an external wall opening of greater than or equal to 16 inches high or greater than or equal to 42 inches wide, and a cross-sectional area greater than or equal to 670 square inches. 10 CFR 431.92. "Non-standard size" means a packaged terminal air conditioner or packaged terminal heat pump with existing wall sleeve dimensions having an external wall opening of less than 16 inches high or less than 42 inches wide, and a cross-sectional area less than 670 square inches. *Id.*

DOE notes that the current Federal test procedure and energy conservation standards at 10 CFR 431.96 and 431.97 apply to both standard size and non-standard size PTACs and PTHPs with cooling capacities less than 760,000 British thermal unit ("Btu")/hour. 10 CFR 431.96(b).

Issue 1: DOE requests comment on the definitions of PTACs and PTHPs and whether any of the terms should be amended, and if so, how the terms should be amended. In particular, DOE requests comment on whether the terms are sufficient to identify which equipment is subject to the test procedure and whether any test procedure amendments are required to ensure that all such equipment can be appropriately tested in accordance with the test procedure.

B. Dehumidification of Fresh Air

In a final rule published on July 21, 2015, DOE amended the energy conservation standards for PTACs and PTHPs. 80 FR 43161 ("July 2015 Final Rule"). Comments offered during the public meeting conducted for development of the July 2015 Final Rule indicate that the majority of PTAC and PTHP units are installed in hotel applications.[4] In hotel installations, the PTAC or PTHP unit provides cooling and heating to individual rooms or suites within the hotel; hotel hallways and common areas are usually serviced by a separate air conditioning system. In older building designs, fresh air ventilation is supplied to hotel rooms via the corridors to which the rooms are connected. In these designs, air is exhausted from each hotel room by a bathroom exhaust fan and is replaced by "make-up" air supplied via the corridor and conditioned by the heating, ventilation, and air conditioning ("HVAC") system that serves the corridor. Make-up air from the corridor enters the hotel rooms by passing through an undercut or grill in the hotel room door.

[4] See Docket No. EERE-2012-BT-STD-0029-0007 at p. 91.

Building designs that supply make-up air via corridors generally are no longer permissible under the building codes adopted in most U.S. states. Chapter 10, Section 1018.5 of the 2009 International Building Code ("IBC") states that, with some exceptions, "corridors shall not serve as supply, return, exhaust, relief or ventilation air ducts."[5] The International Code Council ("ICC") tracks the adoption of the IBC by state. The ICC reports that, as of January 2021, only seven states had not fully adopted the 2009 version or a more recent version of the IBC[6]. These IBC code requirements have precipitated the introduction of PTAC and PTHP models that are designed to draw outdoor air into the unit, dehumidify the outdoor air, and introduce the dehumidified air into the conditioned space. These models are commonly referred to as "make-up air PTACs" or "make-up air PTHPs." The following paragraphs discuss issues regarding the market size and energy consumption of make-up air PTACs and PTHPs.

1. Market Size of Make-up Air PTACs and PTHPs

DOE has identified two different designs of make-up air PTAC and PTHP units on the market. In the first design, the PTAC or PTHP includes a dehumidifier module situated in the outdoor portion of the unit between the unit's outdoor heat exchanger and the panel that divides the indoor and outdoor portions of the unit. The dehumidifier module contains a compressor and refrigerant loop that are separate from the main refrigerant loop that the PTAC or PTHP uses to provide cooling to the conditioned space.

[5] International Code Council. 2009 International Building Code. Available at: *https://codes.iccsafe.org/content/chapter/4641/*
[6] International Code Council (2021). "International Codes – Adoption by State." Available at: https://www.iccsafe.org/wp-content/uploads/Master-I-Code-Adoption-Chart-jan-2021.pdf

In this design, outdoor air flows through the dehumidifier module, which removes moisture from the air, and into the conditioned space.

In the second identified design, the make-up air PTAC or PTHP does not include a dehumidifier module. Instead, the unit incorporates a variable-speed compressor that can operate at speeds less than full speed. In this design, outdoor air is drawn through the unit and across the unit's primary evaporator coil; dehumidification is provided by the unit's main refrigerant loop; and the unit's variable-speed compressor adjusts its capacity to provide humidity control by matching compressor operation to the required load of sensible[7] or latent[8] cooling, such that the unit removes moisture from the air without cooling the air to a temperature well below the setpoint.

In the December 2020 Early Assessment RFI, DOE requested information on the need for DOE's test procedure for PTACs and PTHPs to specify how to measure the energy use associated with dehumidification of make-up air; whether any existing industry test procedures may be used to measure the energy use associated with make-up air operation; and how make-up air operation relates to a representative average use cycle for PTACs and PTHPs. 85 FR 78967, 78969-78970.

AHRI recommended that DOE not pursue changes to the test procedure to measure the energy use associated with dehumidification of make-up air, stating that the market for make-up air PTACs and PTHPs is very small (AHRI, No. 7 at p. 4). AHRI

[7] "Sensible cooling" refers to cooling that reduces air temperature without removing moisture from the air.
[8] "Latent cooling" refers to cooling that only removes moisture from the air.

estimated that only a small fraction of PTACs/PTHPs sold include outdoor air capabilities and of these, an even smaller percentage include dehumidification capabilities. (*Id.*)

The Joint Advocates stated that demand for make-up air units may be increasing (Joint Advocates, No. 4 at p. 1). The Joint Advocates cited marketing materials from two manufacturers that the Joint Advocates stated suggest an increase in the market for such equipment due to changes in the building codes and the purported cost benefits of such units. (*Id.*)

DOE notes that while the market for make-up air PTACs and PTHPs may be small currently, the new IBC code requirements may lead to increased demand for these units. To better understand the current and future market for these make-up air units, DOE is requesting information on the following issues.

Issue 2: DOE requests information on the market size for each of the PTAC and PTHP design options it has identified that provide dehumidification of fresh air.

Issue 3: DOE requests information on any other design pathways by which a PTAC or PTHP can provide dehumidification of outdoor air and, if alternative designs exist, the market size of these alternative designs.

Issue 4: DOE requests comment on how a "make-up air PTAC" and a "make-up air PTHP" could be defined, and what characteristics could be used to distinguish make-up air PTACs and PTHPs from other PTACs and PTHPs.

2. Dehumidification Energy Use

For PTACs and PTHPs, DOE currently specifies the energy efficiency ratio ("EER") as the energy efficiency descriptor for cooling efficiency. Table 1 to 10 CFR 431.96. EER is the ratio of the produced cooling effect of the PTAC or PTHP to its net work input, expressed in Btu/watt-hour, and measured at standard rating conditions. 10 CFR 431.92. For PTHPs, DOE specifies the coefficient of performance ("COP") as the energy efficiency descriptor for heating efficiency. Table 1 to 10 CFR 431.96. COP is the ratio of the produced heating effect of the PTHP to its net work input, expressed in watts/watts, and measured at standard rating conditions. 10 CFR 431.92

The test procedure for PTACs and PTHPs incorporates by reference certain provisions of the industry test standard AHRI Standard 310/380-2014, "Standard for Packaged Terminal Air-Conditioners and Heat Pumps" ("AHRI Standard 310/380–2014"). 10 CFR 431.96(g). Neither the current DOE test procedure nor the industry test procedure, AHRI Standard 310/380-2014, account for any additional energy associated with the dehumidification of make-up air traversing the unit. When a unit is operating in cooling mode, the dehumidification function may add heat to the room, thus increasing the cooling load on the unit. In addition, introducing make-up air to the room while the unit is operating in heating mode could increase a unit's energy consumption if the unit uses electric resistance heating to heat the make-up air. The amount of energy consumed by a dehumidification function depends on a variety of factors, including the airflow rate,

the amount of time the dehumidification function is engaged, how the dehumidification function is controlled, and the ambient air temperature, among others.

As stated, EPCA requires that test procedures prescribed by DOE be reasonably designed to produce test results which reflect energy efficiency during a representative average use cycle, and must not be unduly burdensome to conduct. (42 U.S.C. 6314(a)(2)). In the December 2020 Early Assessment RFI, DOE sought comment on make-up air operation as it relates to a representative average use cycle for PTACs and PTHPs. 85 FR 78967, 78970.

AHRI commented that multiple factors would need to be considered in evaluating the operational use of make-up units, such as the rate of airflow/CFM being brought into the indoor space from outside; whether the unit introduces the outside air as primary or supplementary air; and what dehumidification strategy was used (AHRI, No. 7 at p. 5-6). AHRI asserted that dehumidification of make-up air is not representative of an average use cycle for the vast majority of PTAC/PTHP equipment sold currently and will not contribute to significant energy consumption relative to the current EER and COP metrics. *Id.* at 6. AHRI noted the lack of an established test procedure that could be readily adopted to measure dehumidification associated with make-up air operation. *Id.* The Joint Advocates encouraged DOE to incorporate the additional energy use associated with PTACs and PTHPs that provide make-up air so that the test procedure is representative for these units (Joint Advocates, No. 4 at p. 1-2).

DOE recognizes the challenges identified by AHRI regarding the evaluation of the make-up air operation. DOE requests information on the following issues.

Issue 5: DOE requests data on the impacts on the energy consumption of PTACs and PTHPs that dehumidify incoming outdoor air for units that include a dehumidification module, a variable-speed compressor, or any other design that dehumidifies outdoor air and introduces it to the conditioned space, in both cooling and heating mode.

Issue 6: DOE requests comment on how to quantify the energy consumption associated with the dehumidification function of make-up air PTACs/PTHPs for an average use cycle and what indoor and outdoor temperature and humidity conditions might be appropriate for this characterization.

Issue 7: DOE requests data on the typical range of make-up air flowing through a make-up air PTAC/PTHP, and whether this airflow varies while the dehumidification function is engaged.

Issue 8: DOE requests comment on how make-up air flowing through the unit is heated while the unit is operating in heating mode.

Issue 9: DOE requests comment on how make-up air dehumidification is controlled for units with a dehumidifier module and units without a dehumidifier module. Specifically, what conditions trigger the unit to engage make-up air dehumidification and how do make-up air PTACs/PTHPs interact with variables like occupancy or exhaust fan controls.

Issue 10: DOE requests data on the typical amount of time that make-up air PTACs/PHTPs engage the dehumidification function.

Issue 11: DOE requests comment on how the cooling and dehumidification modes are coordinated for make-up air PTACs/PTHPs, whether dehumidification and cooling are typically performed simultaneously or separately, and the impact that any such coordination has on energy consumption.

Issue 12: DOE requests data on the range of dehumidification capacities (in pints of water/day) for make-up air PTACs/PTHPs in the market and the test conditions used to rate dehumidification capacity.

Issue 13: DOE requests data on the relative market share of make-up air PTACs/PTHPs within the three PTAC and PTHP capacity ranges: <7,000 Btu/h; ≥7,000 Btu/h and ≤15,000 Btu/h; and >15,000 Btu/h.

Issue 14: DOE requests comment on what instructions the test procedure should provide regarding how to prepare and setup a PTAC or PTHP makeup air unit for testing under the current DOE test procedure, which does not test the makeup air function of the unit.

C. Part Load Efficiency Metric

As stated, EPCA requires the test procedures for PTACs and PTHPs be the generally accepted industry testing procedures developed or recognized by AHRI or ASHRAE, as referenced in ASHRAE Standard 90.1. (42 U.S.C. 6314(a)(4)(A)) EPCA

also requires that test procedures prescribed by DOE be reasonably designed to produce test results which reflect energy efficiency during a representative average use cycle, and must not be unduly burdensome to conduct. (42 U.S.C. 6314(a)(2))

For PTACs and PTHPs, ASHRAE 90.1-2019 specifies minimum efficiency levels expressed in terms of the full-load metrics of EER and COP. "Full-load" refers to testing at a single test condition, under which the compressor is operated continuously at 100% of its full capacity. Full load performance is measured at the standard rating conditions in AHRI 310/380-2014. In contrast, for cooling, "part-load" refers to testing at a reduced-temperature test condition in which the cooling load of the space is less than the full cooling capacity of the compressor. Any temperatures below the standard rating condition could potentially be considered part-load cooling conditions. For heating, "part-load" refers to testing at a higher-temperature test condition in which the heating load of the space is less than the full heating capacity of the compressor. Any temperatures above the standard rating condition could potentially be considered part-load heating conditions. DOE's test procedures for PTACs and PTHPs do not measure unit performance at part-load conditions.

Under part-load operation, in which the cooling (or heating) load of the space is less than the full cooling (or heating) capacity of the compressor, a single-speed compressor cycles on and off. This cycling behavior introduces inefficiencies, *i.e.*, "cycling losses." More efficient part-load operation in PTACs and PTHPs can be enabled by the incorporation of two-stage, multi-stage, or variable-speed compressors, which can reduce or eliminate cycling losses.

1. Market Size of PTACs and PTHPs with Part-Load Operation Capability

In the December 2020 Early Assessment RFI, DOE requested information on the need for DOE's test procedure for PTACs and PTHPs to specify how to measure the energy use associated with part-load operation; whether any existing industry test procedures may be used to measure the energy use associated with part-load operation; and how part-load operation relates to a representative average use cycle for PTACs and PTHPs. 85 FR 78967, 78969-78970.

AHRI commented that very few PTACs or PTHPs with two- or variable-speed compressors are on the market, and that with the vast majority of the current market being single stage products, a full-load metric is completely appropriate for these products (AHRI, No. 7 at p. 4). GEA asserted that moving the entire industry to a part-load metric would have little benefit to consumers and would have little or no effect on energy efficiency, while creating substantial cost and testing burden for industry (GEA, No. 6 at p. 2).

The Joint Advocates and NEAA encouraged DOE to adopt an updated test procedure for PTACs and PTHPs that captures part-load performance (Joint Advocates, No. 4 at p. 2; NEEA, No. 8 at p. 1-2). CA IOUs commented that variable-speed compressors are now increasingly available and stated that this technology is expected to grow (CA IOUs, No. 5 at p. 2).

DOE is aware of several variable-speed PTAC and PTHP models on the market. DOE is requesting more specific information on the market size of these models.

Issue 15: DOE requests information on the market availability and market size for PTACs and PTHPs that incorporate two-stage, multi-stage, or fully variable-speed compressors that enable more efficient part-load operation.

2. Potential Part-Load Efficiency Metrics

To measure part-load performance, a part-load or seasonal efficiency metric for PTACs and PTHPs would need to be incorporated in the DOE test procedure. Several categories of air conditioning and heating equipment are already rated under DOE test procedures using metrics that account for part-load or seasonal performance. For example, commercial unitary air conditioners ("CUACs") are rated using the part-load metric integrated energy efficiency ratio ("IEER") (see appendix A to subpart F of part 431); and central air conditioners and heat pumps are rated using the seasonal energy efficiency ratio ("SEER") (see appendix M to subpart B of 10 CFR part 430). Room air conditioners are rated using the combined energy efficiency ratio ("CEER").[9] While the CEER metric is not a part-load or seasonal metric, amendments to the DOE test procedure provide for the application of a performance adjustment factor to a variable-

[9] CEER is an energy efficiency metric for room air conditioners that integrates standby/inactive and off mode energy use with the active mode energy use. 10 CFR 430.23(f)(3); Appendix F to subpart V of 10 CFR part 430 section 2 and 5.2.2.

speed model's CEER rating (*i.e.*, "performance-adjusted CEER") that reflects seasonal efficiency benefits (see appendix F to subpart B of 10 CFR part 430).[10]

In this RFI, DOE is requesting feedback on the appropriateness and potential applicability of these example part-load metrics for PTACs and PTHPs.

PTACs and PTHPs may be considered as an alternative to CUACs in some applications. IEER (applicable to CUACs) integrates the performance of the equipment when operating at part-load, as discussed in section 6.2 of AHRI Standard 340/360-2019. CUACs rated with IEER are generally installed in buildings with high internal loads (*e.g.*, offices, retail, restaurants, schools) resulting from electronic equipment and/or high occupant density. These high internal loads often require that CUACs operate in cooling mode even at low ambient outdoor air temperatures. IEER reflects seasonal performance by integrating test results from four different load points with varying outdoor conditions and load levels (*i.e.*, lower load levels for cooler conditions) in order to represent the equipment's average efficiency throughout the cooling season (see appendix A to subpart F of 10 CFR part 431). DOE notes that most PTACs and PTHPs are installed in a narrow range of building types (including hotels, lodging, and assisted living). As such, the IEER load points and weighting factors developed for CUAC equipment may not represent typical operating conditions for PTACs and PTHPs.

[10] DOE published a final rule on March 29, 2021 amending the test procedure for room air conditioners to establish test provisions for measuring the energy use of variable-speed units during a representative average use cycle. 86 FR 16446.

Products and equipment rated with SEER are generally used in residential or small commercial applications, often with smaller internal loads (in comparison to the internal loads of buildings typically served by CUAC equipment) that require minimal or no cooling at low ambient outdoor air temperatures. SEER (applicable to central air conditioning and heat pump systems) reflects seasonal performance by averaging test results from up to five different load points, depending on system configuration (single-speed, two-capacity, or variable-speed), with varying outdoor conditions and staging levels to represent the product's average efficiency throughout the cooling season (see appendix M to subpart B of 10 CFR part 430). The test procedure also includes optional cyclic testing to evaluate cycling losses.

Room air conditioners and PTACs and PTHPs are both packaged air conditioning and heating equipment and have similar ranges of cooling capacity. Performance-adjusted CEER (applicable to room air conditioners with variable speed compressors) reflects the relative performance improvement associated with variable speed operation, in relation to theoretical single-speed operation, across four different outdoor temperature rating conditions (see appendix F to subpart B of 10 CFR part 430). Products rated with CEER are typically used in residential or small commercial applications.

Issue 16: DOE requests feedback on how to best measure part-load cooling performance for PTACs and PTHPs. Specifically, DOE requests comment on the number of tests that are appropriate to represent the part-load capabilities of the unit; the outdoor ambient conditions that best represent real world performance; the averaging weights that should be applied to each condition; whether a cyclic

test component should be incorporated; and whether an optional test for multi-capacity rating should be incorporated.

Issue 17: DOE requests feedback on whether IEER, SEER or performance-adjusted CEER would be appropriate metrics for PTACs and PTHPs.

Issue 18: If IEER would be an appropriate metric, DOE requests information as to the outdoor temperature rating conditions appropriate for testing PTACs and PTHPs to produce test results representative of an average use cycle. DOE requests comment on what changes to the IEER test procedure for CUACs other that the temperature rating conditions would be necessary for testing PTACs and PTHPs. DOE requests information on the costs that would be associated with a test procedure that uses IEER as the metric for PTACs and PTHPs.

Issue 19: If SEER would be an appropriate metric, DOE requests feedback on whether a test procedure for PTACs and PTHPs that uses SEER as the metric would produce test results that reflect the energy efficiency of that equipment during a representative average use cycle. DOE requests information on the costs that would be associated with a test procedure that uses SEER as the metric for PTACs and PTHPs.

Issue 20: If performance-adjusted CEER would be an appropriate metric, DOE requests feedback on whether a test procedure for PTACs and PTHPs that uses performance-adjusted CEER as the metric would produce test results that reflect the energy efficiency of that equipment during a representative average use cycle. DOE requests information on the costs that would be associated with a test

procedure that uses performance-adjusted CEER as the metric for PTACs and PTHPs.

Issue 21: DOE requests comment on whether any other seasonal efficiency metrics that incorporate part-load performance would produce test results that reflect the energy efficiency of PTACs and PTHPs during a representative average use cycle, and if so, which outdoor temperature rating conditions would be appropriate for testing PTACs and PTHPs. DOE requests information on the costs that would be associated with use of any such metrics.

Issue 22: DOE requests comment on whether the distribution and weighting of rating conditions used for the measurement of IEER, SEER, or performance-adjusted CEER would be appropriate for rating the performance of PTAC and PTHP equipment.

DOE notes that, like the EER cooling metric, the COP heating metric measures performance only at full load operation. For the reasons described previously with regard to cooling efficiency, using a heating efficiency metric that accounts for only full-load operation does not measure the part-load operation in PTHPs that may be enabled by the incorporation of two-stage, multi-stage, or variable-speed compressors. Heating Season Performance Factor ("HSPF") (applicable to central heat pump products) is a metric that serves as a counterpart to SEER and accounts for seasonal performance in the heating season. It reflects seasonal performance by averaging test results from multiple load points, depending on system configuration (single-speed, two-capacity, or variable-speed), with varying outdoor conditions and staging levels to represent the product's

average efficiency throughout the heating season (see appendix M to subpart B of 10 CFR part 430).

Issue 23: DOE requests feedback on how to best measure part-load and seasonal heating performance for PTHPs. Specifically, DOE requests comment on the number of tests that are appropriate to represent the part-load capabilities of the unit; the outdoor ambient conditions that best represent real world performance; the averaging weights that should be applied to each condition; whether a cyclic test component should be incorporated; whether an optional test for multi-capacity rating should be incorporated; and whether a test to evaluate the PTHP in defrost cycles is required.

Issue 24: DOE requests feedback on whether HSPF would be an appropriate metric for PTHPs.

Issue 25: DOE requests information on any other seasonal heating efficiency metrics that would produce test results that reflect the energy efficiency of PTHPs during a representative average use cycle, and if so, which outdoor temperature rating conditions would be appropriate for testing PTHPs.

Issue 26: DOE requests information on the costs that would be associated with the use of any such seasonal heating efficiency metric to rate PTHP performance.

D. Fan-Only Mode

In response to the December 2020 Early Assessment RFI, NEAA commented that DOE should account for "fan-only" mode, which NEEA asserted can account for a large number of annual hours, resulting in significant energy use (NEAA, No. 8 at p. 5). NEAA recommended that DOE assess the number of hours spent in fan-only mode and account for the energy used during these hours in the test procedure. *Id*.

DOE interprets the "fan-only" mode discussed by NEAA as a mode in which the fan is operating and providing ventilation or air circulation without active cooling or heating. The current DOE test procedures for PTACs and PTHPs do not address energy consumption during "fan-only" mode. To better understand the power consumption associated with the "fan-only" mode and how it relates to a representative average use cycle, DOE is requesting information on the following issues.

Issue 27: DOE requests data and information related to the power consumption of PTAC and PTHP units during "fan-only" mode. Specifically, DOE requests comment on whether the indoor and outdoor fans are powered by the same source motor; whether the default fan control scheme dictates that the indoor fan cycles with the compressor or stays on; and whether the fan operates at a lower power if the fan remains on when the compressor cycles off.

Issue 28: DOE requests data and information on the annual number of hours PTAC and PTHP units operate in "fan-only" mode.

E. Low Ambient Heating and Cold Climate Heat Pumps

Heat pumps generally perform less efficiently at low ambient outdoor temperatures than they do at moderate ambient outdoor temperatures. DOE is aware of residential central heat pump models that are optimized for operation in cold climates and can operate at temperatures as low as -20 degrees Fahrenheit ("°F"). DOE expects that such cold climate optimization may be desirable for PTHP customers, and DOE is aware of at least one PTHP model that is optimized for cold climates and can operate at temperatures as low as -5 °F.

A conventional PTHP model switches its heat source from reverse-cycle vapor compression heating to electric resistance heating, which is less efficient than vapor compression heating, at an outdoor ambient temperature of around 32°F. A PTHP design that is optimized for operation in cold climates could provide energy savings compared to conventional PTHP models by enabling the use of the more efficient vapor compression heating, rather than electric resistance heating, at lower ambient temperatures. However, DOE's current test metric for heating efficiency, COP, requires testing only at the standard rating condition of 47 °F dry bulb for the outdoor side. Thus, DOE's COP metric does not account for the energy savings that could result from using reverse-cycle heating at low ambient temperatures.

In response to the December 2020 Early Assessment RFI, the Joint Advocates and NEAA commented that DOE should consider updating the test procedure to capture performance of PTHPs at low ambient temperatures, including energy used in defrost

(Joint Advocates, No. 4 at p. 2;NEAA, No. 8 at p. 4). The CA IOUs noted that AHRI 310/380–2004 specified 17°F as the standard rating condition for low-temperature heat pump heating, but that this test point is no longer included in the 2014 or 2017 versions of the standard (CA IOUs, No. 5 at p. 3).

DOE requests further information on the prevalence of PTHPs that can operate at low temperatures, and any test methods that may be appropriate to account for low temperature performance.

Issue 29: DOE request information on the comparison of the seasonal heating load and seasonable cooling load for a typical PTAC/PTHP installation.

Issue 30: DOE requests information on the range of low-temperature cutout for compressor operation of PTHPs. Specifically, DOE requests information on the percentage of PTHPs that continue to operate the compressor at outdoor temperatures below 32 °F, below 20 °F, and below 10 °F.

Issue 31: DOE requests information on the design changes necessary for a typical PTHP (that has a 32 °F low-temperature cutout) to be converted for satisfactory field performance operation at a 17 °F outdoor test condition.

Issue 32: DOE requests information on whether the design optimization of PTHPs for cold-climate operation impacts the COP as measured under the DOE test procedure.

Issue 33: DOE requests that model numbers be provided to identify any PTHP units available in the market that are optimized for operation in cold climates.

Issue 34: DOE requests feedback on any other test methods that would produce test results that reflect the energy efficiency of these units during a representative average use cycle, as well as information on the test burden associated with such test methods.

III. Submission of Comments

DOE invites all interested parties to submit in writing by the date specified under the **DATES** heading, comments and information on matters addressed in this RFI and on other matters relevant to DOE's consideration of amended test procedures for PTACs and PTHPs. These comments and information will aid in the development of a test procedure NOPR for PTACs and PTHPs if DOE determines that amended test procedures may be appropriate for this equipment.

Submitting comments via http://www.regulations.gov. The *http://www.regulations.gov* web page will require you to provide your name and contact information. Your contact information will be viewable to DOE Building Technologies staff only. Your contact information will not be publicly viewable except for your first and last names, organization name (if any), and submitter representative name (if any). If your comment is not processed properly because of technical difficulties, DOE will use this information to contact you. If DOE cannot read your comment due to technical difficulties and cannot contact you for clarification, DOE may not be able to consider your comment.

However, your contact information will be publicly viewable if you include it in the comment or in any documents attached to your comment. Any information that you do not want to be publicly viewable should not be included in your comment, nor in any document attached to your comment. Following this instruction, persons viewing comments will see only first and last names, organization names, correspondence containing comments, and any documents submitted with the comments.

Do not submit to *http://www.regulations.gov* information for which disclosure is restricted by statute, such as trade secrets and commercial or financial information (hereinafter referred to as Confidential Business Information ("CBI")). Comments submitted through *http://www.regulations.gov* cannot be claimed as CBI. Comments received through the website will waive any CBI claims for the information submitted. For information on submitting CBI, see the Confidential Business Information section.

DOE processes submissions made through *http://www.regulations.gov* before posting. Normally, comments will be posted within a few days of being submitted. However, if large volumes of comments are being processed simultaneously, your comment may not be viewable for up to several weeks. Please keep the comment tracking number that *http://www.regulations.gov* provides after you have successfully uploaded your comment.

Submitting comments via email. Comments and documents submitted via email also will be posted to *http://www.regulations.gov*. If you do not want your personal contact information to be publicly viewable, do not include it in your comment or any

accompanying documents. Instead, provide your contact information on a cover letter. Include your first and last names, email address, telephone number, and optional mailing address. The cover letter will not be publicly viewable as long as it does not include any comments.

Include contact information each time you submit comments, data, documents, and other information to DOE. Faxes will not be accepted.

Comments, data, and other information submitted to DOE electronically should be provided in PDF (preferred), Microsoft Word or Excel, WordPerfect, or text (ASCII) file format. Provide documents that are not secured, written in English and free of any defects or viruses. Documents should not contain special characters or any form of encryption and, if possible, they should carry the electronic signature of the author.

Campaign form letters. Please submit campaign form letters by the originating organization in batches of between 50 to 500 form letters per PDF or as one form letter with a list of supporters' names compiled into one or more PDFs. This reduces comment processing and posting time.

Confidential Business Information. According to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email two well-marked copies: one copy of the document marked confidential including all the information believed to be confidential, and one copy of the document marked "non-confidential" with the information believed

to be confidential deleted. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

It is DOE's policy that all comments may be included in the public docket, without change and as received, including any personal information provided in the comments (except information deemed to be exempt from public disclosure).

DOE considers public participation to be a very important part of the process for developing test procedures and energy conservation standards. DOE actively encourages the participation and interaction of the public during the comment period in each stage of this process. Interactions with and between members of the public provide a balanced discussion of the issues and assist DOE in the process. Anyone who wishes to be added to the DOE mailing list to receive future notices and information about this process should contact Appliance and Equipment Standards Program staff at (202) 287-1445 or via e-mail at *ApplianceStandardsQuestions@ee.doe.gov*.

Signing Authority

This document of the Department of Energy was signed on May 15, 2021, by Kelly Speakes-Backman, Principal Deputy Assistant Secretary and Acting Assistant Secretary for Energy Efficiency and Renewable Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register

Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the *Federal Register*.

Signed in Washington, D.C., on May 15, 2021

X Kelly Speakes-Backman

Digitally signed by Kelly Speakes-Backman
Date: 2021.05.15 08:00:09 -04'00'

Kelly Speakes-Backman
Principal Deputy Assistant Secretary and
Acting Assistant Secretary
Energy Efficiency and Renewable Energy