NATIONAL ARCHIVES AND RECORDS ADMINISTRATION
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1985

FEDERAL REGISTER

Vol. 80 Wednesday,
No. 37 February 25, 2015

Part II

Department of Energy

10 CFR Parts 429 and 430
Energy Conservation Program: Test Procedures for Portable Air Conditioners; Proposed Rule

DEPARTMENT OF ENERGY

10 CFR Parts 429 and 430

[Docket No. EERE–2014–BT–TP–0014]

RIN 1904–AD22

Energy Conservation Program: Test Procedures for Portable Air Conditioners

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

ACTION: Notice of proposed rulemaking.

SUMMARY: The U.S. Department of Energy (DOE) proposes to establish test procedures for portable air conditioners (ACs) in accordance with the guidance and requirements set forth by the Energy Policy and Conservation Act to establish technologically feasible, economically justified energy conservation standards for products identified by specific criteria to provide national energy savings through improved energy efficiency. The proposed test procedures are based upon industry methods to determine energy consumption in active modes, off-cycle mode, standby modes, and off mode, with certain modifications to ensure the test procedures are repeatable and representative. The proposed test procedure would create a new appendix CC, which would be used to determine capacities and energy efficiency metrics that could be the basis for any future energy conservation standards for portable ACs. DOE also proposes adding a sampling plan and rounding requirements for portable ACs, necessary when certifying capacity and efficiency of a basic model.

DATES: DOE will accept comments, data, and information regarding this notice of proposed rulemaking (NOPR) before and after the public meeting, but no later than May 11, 2015. See section V, ''Public Participation,'' for details.

DOE will hold a public meeting on Wednesday, March 18, 2015, from 9 a.m. to 12 p.m., in Washington, DC. The meeting will also be broadcast as a webinar. See section V, ''Public Participation,'' for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

ADDRESSES: The public meeting will be held at the U.S. Department of Energy, Forrestal Building, Room 8E–089, 1000 Independence Avenue SW., Washington, DC 20585. To attend, please notify Ms. Brenda Edwards at (202) 586–2945. See section V Public Participation for additional meeting information.

Any comments submitted must identify the NOPR for Test Procedures for Portable Air Conditioners, and provide docket number EERE–2014–BT–TP–0014 and/or regulatory information number (RIN) number 1904–AD22. Comments may be submitted using any of the following methods:

1. *Federal eRulemaking Portal: www.regulations.gov*. Follow the instructions for submitting comments.
2. *Email: PortableAC2014TP0014@ee.doe.gov*. Include the docket number and/or RIN in the subject line of the message.
3. *Mail:* Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, Mailstop EE–5B, 1000 Independence Avenue SW., Washington, DC 20585–0121. If possible, please submit all items on a CD. It is not necessary to include printed copies.
4. *Hand Delivery/Courier:* Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, 950 L'Enfant Plaza, SW., Suite 600, Washington, DC 20024. Telephone: (202) 586–2945. If possible, please submit all items on a CD. It is not necessary to include printed copies.

For detailed instructions on submitting comments and additional information on the rulemaking process, see section V of this document (Public Participation).

Docket: The docket, which includes **Federal Register** notices, public meeting attendee lists and transcripts, comments, and other supporting documents/materials, is available for review at regulations.gov. All documents in the docket are listed in the 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.

A link to the docket Web page can be found at: *http://www.regulations.gov/#!docketDetail;D=EERE-2014-BT-TP-0014*. This Web page will contain a link to the docket for this notice on the regulations.gov site. The regulations.gov Web page will contain simple instructions on how to access all documents, including public comments, in the docket. See section VII for information on how to submit comments through regulations.gov.

For further information on how to submit a comment, review other public comments and the docket, or participate in the public meeting, contact Ms. Brenda Edwards at (202) 586–2945 or by email: *Brenda.Edwards@ee.doe.gov*.

FOR FURTHER INFORMATION CONTACT: Mr. Bryan Berringer, U.S. Department of Energy, Office of Building Technology Programs, Appliance Standards Division, 950 L'Enfant Plaza SW. Room 603, Washington, DC 20585–0121. Telephone: 202–586–0371. Email: *Bryan.Berringer@ee.doe.gov*.

Ms. Sarah Butler, U.S. Department of Energy, Office of the General Counsel, Mailstop GC–33, 1000 Independence Ave. SW., Washington, DC 20585–0121. Telephone: 202–586–1777; Email: *Sarah.Butler@hq.doe.gov*.

SUPPLEMENTARY INFORMATION: DOE intends to incorporate by reference the following industry standards into 10 CFR part 430: Portable Air Conditioners AHAM PAC–1–2014, 2014.

Copies of AHAM PAC–1–2014 can be obtained from the Association of Home Appliance Manufacturers, 1111 19th Street NW., Suite 402, Washington, DC 20036, 202–872–5955, or by going to *http://www.aham.org/ht/d/ProductDetails/sku/PAC12009/from/714/pid/*.

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I. Authority and Background

Title III of the Energy Policy and Conservation Act (EPCA), as amended (42 U.S.C. 6291, *et seq.*; ''EPCA'' or, ''the Act'') sets forth various provisions designed to improve energy efficiency. Part A of title III of EPCA (42 U.S.C. 6291–6309) establishes the ''Energy Conservation Program for Consumer Products Other Than Automobiles,'' which covers consumer products and certain commercial products (hereinafter referred to as ''covered products'').[1] EPCA authorizes DOE to establish technologically feasible, economically justified energy conservation standards for covered products or equipment that would be likely to result in significant national energy savings. (42 U.S.C. 6295(o)(2)(B)(i)(I)–(VII)) In addition to specifying a list of covered consumer and industrial products, EPCA contains provisions that enable the Secretary of Energy to classify additional types of consumer products as covered products. (42 U.S.C. 6292(a)(20)) For a given product to be classified as a covered product, the Secretary must determine that:

(1) Classifying the product as a covered product is necessary for the purposes of EPCA; and

(2) The average annual per-household energy use by products of each type is likely to exceed 100 kilowatt-hours (kWh) per year. (42 U.S.C. 6292(b)(1))

To prescribe an energy conservation standard pursuant to 42 U.S.C. 6295(o) and (p) for covered products added pursuant to 42 U.S.C. 6292(b)(1), the Secretary must also determine that:

(1) The average household energy use of the products has exceeded 150 kWh per household for a 12-month period;

(2) The aggregate 12-month energy use of the products has exceeded 4.2 terawatt-hours (TWh);

(3) Substantial improvement in energy efficiency is technologically feasible; and

(4) Application of a labeling rule under 42 U.S.C. 6294 is unlikely to be sufficient to induce manufacturers to produce, and consumers and other persons to purchase, covered products of such type (or class) that achieve the maximum energy efficiency that is technologically feasible and economically justified. (42 U.S.C. 6295(l)(1))

Under EPCA, the energy conservation program consists essentially of four parts: (1) Testing, (2) labeling, (3) Federal energy conservation standards, and (4) certification and enforcement procedures. The testing requirements consist of test procedures that manufacturers of covered products must use as the basis for: (1) Certifying to DOE that their products comply with the applicable energy conservation standards adopted under EPCA, and (2) making representations about the efficiency of those products. Similarly, DOE must use these test procedures to determine whether the products comply with any relevant standards promulgated under EPCA.

A. General Test Procedure Rulemaking Process

Under 42 U.S.C. 6293, EPCA sets forth the criteria and procedures DOE must follow when prescribing or amending test procedures for covered products. EPCA provides in relevant part that any test procedures prescribed or amended under this section shall be reasonably designed to produce test results that measure energy efficiency, energy use or estimated annual operating cost of a covered product during a representative average use cycle or period of use and shall not be unduly burdensome to conduct. (42 U.S.C. 6293(b)(3))

In addition, if DOE determines that a test procedure should be prescribed or amended, it must publish proposed test procedures and offer the public an opportunity to present oral and written comments on them. (42 U.S.C. 6293(b)(2))

B. Test Procedure for Portable Air Conditioners

There are currently no DOE test procedures or energy conservation standards for portable ACs. On July 5, 2013, DOE issued a notice of proposed determination (NOPD) of coverage (hereinafter referred to as the ''July 2013 NOPD''), in which DOE announced that it tentatively determined that portable ACs meet the criteria under 42 U.S.C. 6292(b)(1) to be classified as a covered product. 78 FR 40403. DOE estimated that 973.7 thousand portable AC units were shipped in North America in 2012, with a projected growth to 1743.7 thousand units by 2018, representing nearly 80-percent growth in 6 years.[2] *Id.* at 40404. In addition, DOE estimated the average per-household electricity consumption by portable ACs to be approximately 650 kWh per year. *Id.*

In response to the July 2013 NOPD, DOE received comments from interested parties on several topics regarding appropriate test procedures for portable ACs that DOE should consider if it issues a final determination classifying portable ACs as a covered product.

On May 9, 2014, DOE published in the **Federal Register** a notice of data availability (NODA) (hereinafter referred to as the ''May 2014 NODA''), in which it agreed that a DOE test procedure for portable ACs would provide consistency and clarity for representations of energy use of these products. DOE evaluated available industry test procedures to determine whether such methodologies would be suitable for incorporation in a future DOE test procedure, should DOE determine to classify portable ACs as a covered product. DOE conducted testing on a range of portable ACs to determine typical cooling capacities and cooling energy efficiencies based on the existing industry test methods and other modified approaches for portable ACs. 79 FR 26639, 26640 (May 9, 2014).

As discussed above, DOE also recently initiated a separate rulemaking to consider establishing energy conservation standards for portable ACs. Any new standards would be based on the same efficiency metrics derived from the test procedure that DOE would adopt in a final rule in this rulemaking.

II. Summary of the Notice of Proposed Rulemaking

In this NOPR, DOE proposes to establish in Title 10 of the Code of Federal Regulations (CFR), section 430.2, the definition of portable AC that was initially proposed in the July 2013 NOPD, modified to distinguish from room ACs and dehumidifiers.

DOE also proposes to establish in 10 CFR part 430, subpart B, a test procedure for single-duct and dual-duct portable ACs that would provide an accurate representation of performance in active modes, standby modes, and off mode. Because spot cooler portable ACs do not provide net cooling to a conditioned space, DOE is not proposing test procedures for these products in this NOPR. The proposed active mode testing methodology would utilize the Association of Home

[1] For editorial reasons, upon codification in the U.S. Code, Part B was re-designated Part A.

[2] Transparency Media Research, ''Air Conditioning Systems Market—Global Scenario, Trends, Industry Analysis, Size, Share and Forecast, 2012–2018,'' January 2013.

Appliance Manufacturers (AHAM) portable AC test procedure (AHAM PAC–1) to measure cooling capacity and cooling energy efficiency ratio (EER_{cm}), with additional provisions to account for heat transferred to the indoor conditioned space from the case, ducts, and any infiltration air from unconditioned spaces. DOE also proposes to clarify for such active mode testing (1) test duct configuration; (2) instructions for condensate collection; (3) control settings for operating mode, fan speed, temperature set point, and louver oscillation; and (4) unit placement within the test chamber. DOE proposes to define this operating mode as ''cooling mode'' to distinguish it from other active modes, such as ''heating mode.''

For those single-duct and dual-duct portable ACs that incorporate a heating function, DOE proposes additional testing methodology for measuring energy use in heating mode similar to the methodology proposed for the measurement of cooling capacity and EER_{cm}, except that testing conditions would be specified that are representative of ambient conditions when portable ACs would be used for heating purposes. The proposed test procedure includes a measure of heating capacity and heating energy efficiency ratio (EER_{hm}).

The proposed single-duct and dual-duct portable AC test procedure also includes a measure of energy use in off-cycle mode, which occurs when the ambient dry-bulb temperature reaches the setpoint. This may include operation of the fan either continuously or cyclically without activating the refrigeration (or heating) system, or periods in standby mode when the fan is not operating.

In this NOPR, DOE identifies and discusses all relevant low-power modes, including bucket-full mode, delay-start mode, inactive mode, and off mode. DOE also proposes definitions for inactive mode and off mode, and proposes test procedures to determine energy consumption representative of each of these low-power modes based on the procedures outlined in the standard published by the International Electrotechnical Commission (IEC), titled ''Household electrical appliances—Measurement of standby power,'' Publication 62301, Edition 2.0 (2011–01) (hereinafter referred to as ''IEC Standard 62301'').

In addition, DOE proposes a combined energy efficiency ratio (CEER) metric to be used in reporting the overall energy efficiency of a single-duct and dual-duct portable AC. The CEER metric would represent energy use in all available operating modes. DOE also proposes to define a separate CEER metric for cooling mode that would also apply to units that include heating mode and would be a common metric used for comparison among portable ACs. DOE also proposes an EER metric to represent performance in cooling and heating modes that could be used to compare cooling and heating performance with other similar products.

Finally, DOE proposes adding a sampling plan and rounding requirements for portable ACs to a new section 10 CFR 429.62. These instructions are necessary when certifying capacity and efficiency of a basic model.

III. Discussion

A. Products Covered by the Proposed Test Procedure

A portable AC is a self-contained, refrigeration-based product that, similar to a room AC, removes latent and sensible heat from the ambient air in a single space such as a room. Similar to room ACs, portable ACs are standalone appliances designed to operate independently of any other air treatment devices, though they may also be used in conjunction with other pre-existing air treatment devices. However, unlike room ACs, portable ACs are not designed as a unit to be mounted in a window or through the wall. Portable ACs are placed in the conditioned space and may have flexible ducting, typically connected to a window to remove condenser outlet air from the conditioned space.

DOE is generally aware of 3 categories of portable ACs including single-duct models, dual-duct models, and spot coolers. Single-duct portable ACs utilize a single condenser exhaust duct to vent heated air to the unconditioned space. Other configurations include dual-duct, which intakes some or all condenser air from and exhausts to unconditioned space, and spot coolers, which have no ducting on the condenser side and may utilize small directional ducts on the evaporator exhaust. Spot coolers are often used in applications that require cooling in one localized zone and can tolerate exhaust heat outside of this zone.

In the July 2013 NOPD, DOE proposed to define ''portable air conditioner'' as:

A consumer product, other than a ''packaged terminal air conditioner'' which is powered by a single-phase electric current and which is an encased assembly designed as a portable unit that may rest on the floor or other elevated surface for the purpose of providing delivery of conditioned air to an enclosed space. It includes a prime source of refrigeration and may include means for ventilating and heating. 78 FR 40403, 40404 (July 5, 2013).

DOE maintained this proposed definition in the May 2014 NODA. In the July 2013 NOPD, DOE also stated that portable ACs are moveable units typically designed to provide 8,000 to 14,000 British thermal units per hour (Btu/h) of cooling capacity for a single room. *Id.*

In response to the proposed definition, Pacific Gas and Electric Company, Southern California Gas Company, San Diego Gas and Electric, and Southern California Edison (hereinafter referred to as the ''California Investor-Owned Utilities (IOUs)'') and Edison Electric Institute (EEI) stated that the requirement in the definition to be powered by a single-phase electric current may exclude some equipment designed for commercial applications. The California IOUs encouraged DOE to consider a large range of portable ACs, both residential and commercial, to ensure that all potential savings are examined and analyzed. In particular, the California IOUs recommended that DOE consider covering portable ACs with capacities above 14,000 Btu/h because there are units currently on the market with cooling capacities up to and above 65,000 Btu/h. (California IOUs, NOPD No. 5 at pp. 1–2;[3] EEI, NOPD No. 3 at p. 5) EEI also commented that DOE should consider revising the definition of ''portable air conditioner'' to ensure that three-phase electrical current units are covered, and to better reflect products that currently are on the market with and without heating capability. (EEI, NOPD No. 3 at p. 5)

Oceanaire Inc. (Oceanaire) commented that according to the EPCA definition, commercial spot coolers (portable ACs that do not have ducting attached to the condenser) are not covered products. According to Oceanaire, commercial spot coolers are mainly used in the rental market where emergencies create a need for immediate and focused cooling systems, with example applications including food and cosmetics processing plants,

[3] A notation in the form ''California IOUs, NOPD No. 5 at pp. 1–2'' identifies a written comment: (1) Made by Pacific Gas and Electric Company, San Diego Gas and Electric Company, and Southern California Edison (''the California IOUs''); (2) recorded in document number 5 that is filed in the docket of the rulemaking for determination of coverage of portable air conditioners as a covered consumer product (Docket No. EERE–2013– BT–STD–0033) and available for review at *www.regulations.gov*; and (3) which appears on pages 1–2 of document number 5.

outdoor entertainment venues, and steel processing factories. Oceanaire noted that the cooling capacity of these rental units range between 1 and 5 tons (12,000 to 60,000 Btu/h), where actual performance is determined by a wide range of operating environments, which may include high and low temperatures, high humidity, and corrosive conditions that are not experienced in household applications. Further, Oceanaire noted that its commercial product construction is robust, comprising mainly 18 gauge and thicker steel cabinetry and support structures. (Oceanaire, No. 2 at pp. 1–2 [4])

Portable ACs, most commonly in single-duct or dual-duct configuration, typically range in cooling capacity from 5,000 to 14,000 Btu/h when measured according to existing industry test methods. According to sizing charts provided by vendors, these portable ACs are intended to cool rooms of up to approximately 525 square feet in area,[5] are often heavier than 50 pounds, and so are designed with wheels to provide mobility from room to room. Spot coolers, a category of portable ACs under DOE's proposed definition, are typically intended for larger spaces and harsher applications. Most have cooling capacities greater than 14,000 Btu/h, when measured according to existing industry test methods, and are typically larger than single-duct and dual-duct portable ACs, often weighing more than 100 pounds. Because they are frequently moved from site to site, spot coolers are more rugged in construction, although they also have wheels to maintain portability. During interviews, manufacturers indicated that spot cooler shipments represent no more than approximately 1.5 percent of the total portable AC market in the United States, and that only about half of those shipments are for spot coolers with single-phase, 120-volt, and 60-Hertz power supply requirements (the power supply appropriate for consumer products). Additionally, manufacturers noted that the spot coolers typically incorporate more powerful and louder blowers, condensate collection without auto-evaporation, and larger case sizes than typical single-duct and dual-duct portable ACs. Manufacturer interviews confirmed that spot coolers are often rented on a seasonal or emergency basis, unlike other portable ACs, which are generally purchased for regular use on a seasonal or occasional basis. Based on these considerations, DOE is not considering a test procedure for spot coolers at this time even though DOE believes spot coolers would meet the proposed definition of portable AC if DOE finalizes the coverage determination as proposed.

DOE recognizes that certain portable ACs also include options for operating as a dehumidifier and/or heater, with heating means provided by either an electric resistance heater or by modifying internal refrigerant flow to operate the unit as a heat pump. The dehumidification function may be achieved in some units by decreasing fan speeds, removing the condenser duct(s), and for some units, disabling the self-evaporative feature by draining the condensate before it reaches the condenser coils or deactivating the condensate slinger fan when the controls are set to dehumidification mode. In all of these cases, the air flow pattern and psychrometrics differ fundamentally from those of a dehumidifier, resulting in different energy efficiencies during dehumidification operation, even though both products may use a refrigeration system to remove moisture from the air.

DOE also recognizes that although room ACs and portable ACs share many of the same components that operate similarly to provide cooled air to a conditioned space, a portable AC, unlike a room AC, may be entirely located within the conditioned space so that some or all of the condenser air may be drawn from that space, and some heat from the refrigeration system and ducting is transferred to the conditioned space as well. These differences would lead to differing cooling mode energy efficiencies between room ACs and portable ACs, even if the products were to incorporate the same components. In addition, operation of the portable AC without activation of the refrigeration system may be more accurately characterized as ''air circulation'' rather than ''ventilation'' because the portable AC may be operated without drawing air from outside the conditioned space. Thus, DOE proposes to clarify in the definition of ''portable air conditioner'' that the primary function of the product is to provide cooled, conditioned air to the space in addition to other functions such as air circulation or heating, and that it is a product other than a room AC or dehumidifier. DOE also proposes to restructure the portable AC definition to align with both the room AC and dehumidifier definitions. In sum, DOE proposes to add to 10 CFR 430.2 the following definition for ''portable air conditioner.''

An encased assembly, other than a ''packaged terminal air conditioner,'' ''room air conditioner,'' or ''dehumidifier,'' designed as a portable unit for delivering cooled, conditioned air to an enclosed space, that is powered by single-phase electric current, which may rest on the floor or other elevated surface. It includes a source of refrigeration and may include additional means for air circulation and heating.

Although this proposed definition differs from the definition presented in the July 2013 NOPD, DOE maintains its tentative determination that portable ACs qualify as a covered product under Part A of Title III of EPCA, as amended. A product may be added as a covered product, pursuant to 42 U.S.C. 6292(b)(1), if (1) classifying products of such type as covered products is necessary and appropriate to carry out the purposes of EPCA; and (2) the average per-household energy use by products of such type is likely to exceed 100 kWh (or its Btu equivalent) per year. As discussed in the July 2013 NOPD, DOE determined that portable ACs meet the first requirement because: Shipments are projected to increase 80 percent over a 6-year period from 2012 to 2017, coverage of portable ACs would allow for conservation of energy through labeling programs and the regulation of portable AC energy efficiency, and there is significant variation in the annual energy consumption of different portable AC models currently available on the market. 78 FR 40403, 40404 (July 5, 2013). For the second requirement, DOE determined that a typical portable AC uses approximately 650 kWh/year, well above the 100 kWh/year threshold. 78 FR 40403, 40404–40405 (July 5, 2013). The updated portable AC definition proposed in this NOPR only includes additional clarification to differentiate portable ACs from dehumidifiers and room ACs, it does not alter the intended scope of the definition. Accordingly, the determinations from the July 2013 NOPD remain valid for the revised proposed portable AC definition.

DOE also proposes to include in the new test procedure at appendix CC the following definitions for different portable AC configurations to clarify the testing provisions to be used to obtain representative results for cooling capacity, heating capacity (where applicable), and CEER:

''Single-duct portable air conditioner'' means a portable air conditioner that

[4] A notation in the form ''Oceanaire, No. 2 at pp. 1–2'' identifies a written comment: (1) Made by Oceanaire, Inc. (Oceanaire); (2) recorded in document number 2 that is filed in the docket of the portable air conditioner test procedure rulemaking (Docket No. EERE–2014– BT–TP–0014) and available for review at *www.regulations.gov*; and (3) which appears on pages 1–2 of document number 2.

[5] For example: *www.air-n-water.com/portable-ac-size.htm*.

draws all of the condenser inlet air from the conditioned space without the means of a duct, and discharges the condenser outlet air outside the conditioned space through a single duct.

''Dual-duct portable air conditioner'' means a portable air conditioner that draws some or all of the condenser inlet air from outside the conditioned space through a duct, and may draw additional condenser inlet air from the conditioned space. The condenser outlet air is discharged outside the conditioned space by means of a separate duct.

DOE is also proposing a definition for ''spot cooler'' as a portable air conditioner that draws condenser inlet air from and discharges condenser outlet air to the conditioned space, and draws evaporator inlet air from and discharges evaporator outlet air to a localized zone within the conditioned space. DOE is proposing such a definition in this NOPR to clarify that testing these products would not be required at this time, as discussed previously in this section.

DOE requests comment on these proposed definitions for portable ACs and their specific configurations, including the proposal that spot coolers not be addressed in this rulemaking.

B. Determination, Classification, and Testing Provisions for Operational Modes

1. Active Modes

Portable ACs are typically purchased by consumers to provide cooled air to a conditioned space, although certain models provide additional functions such as heating, dehumidification, and air circulation. Because room ACs and dehumidifiers share many of the same internal components and incorporate some of the same operating modes as portable ACs, DOE considered the mode definitions for these products to develop applicable mode definitions for portable ACs.

Appendix F of title 10, part 430, subpart B of the CFR defines ''active mode'' for room ACs as a mode in which the room AC is connected to a mains power source, has been activated and is performing the main function of cooling or heating the conditioned space, or circulating air through activation of its fan or blower, with or without energizing active air-cleaning components or devices such as ultraviolet (UV) radiation, electrostatic filters, ozone generators, or other air-cleaning devices. Appendix X within that same subpart of the CFR defines ''active mode'' for dehumidifiers as a mode in which a dehumidifier is connected to a mains power source, has been activated, and is performing the main functions of removing moisture from air by drawing moist air over a refrigerated coil using a fan, or circulating air through activation of the fan without activation of the refrigeration system.

Portable ACs provide the same main functions as room ACs: (1) Cooling with activation of the refrigeration system and blower or fan; (2) for certain models, heating by means of activation of a blower or fan and either the refrigeration system and a reverse-cycle solenoid valve or a resistance heater; or (3) air circulation by activating only the blower or fan. As with dehumidifiers, a portable AC evaporator may also experience frosting and may need to perform a defrost operation. DOE, therefore, proposes the following definition for portable AC active mode:

''Active mode'' means a mode in which the portable air conditioner is connected to a mains power source, has been activated, and is performing the main functions of cooling or heating the conditioned space, circulating air through activation of its fan or blower without activation of the refrigeration system, or defrosting the refrigerant coil.

DOE proposes to designate active mode functions performed when the temperature setpoint is not yet reached as either ''cooling mode'' or ''heating mode,'' depending upon the user-selected function.

Portable ACs may also operate in ''off-cycle mode,'' during which the fan or blower may operate without activation of the refrigeration system after the temperature setpoint has been reached. Under these conditions, the fan may be operated to ensure that air is drawn over the thermostat to monitor ambient conditions, or for air circulation in the conditioned space. It is also possible that immediately following a period of cooling or heating, fan operation may be initiated to remove any remaining frost or moisture from the evaporator. Although the periods of fan operation would classify those periods of off-cycle mode as an active mode, DOE notes that the portable AC may also enter one or more periods of a standby mode during off-cycle mode, in which the fan or blower does not operate. Therefore, DOE proposes to define off-cycle mode to include all periods of fan operation and standby mode that occur when the temperature set point has been reached, and further proposes to measure the energy consumption during off-cycle mode according to methodology discussed in section III.B.2 of this NOPR.

Portable ACs may also operate in a consumer-selected mode during which the blower is operated with all other cooling or heating components disabled. The blower may operate cyclically or continuously to circulate air in the conditioned space. DOE refers to this consumer-selected, active mode as ''air-circulation mode.'' DOE does not currently have information on the usage of this consumer-initiated air circulation feature and, therefore is not proposing to measure energy usage during ''air-circulation mode.'' However, DOE seeks information on annual hours associated with this mode.

Some portable ACs also include a dehumidification or ''dry'' function. DOE learned through manufacturer interviews that portable AC operation in this mode is adjusted to maximize latent rather than sensible heat removal, typically by decreasing the evaporator fan or blower speed. Though not always specified in the user manual, when operating in dry mode, the installation may be modified to direct condenser exhaust into the conditioned space. In this case, a drain setup is necessary to remove condensate before it passes over the condenser to be re-evaporated into the condenser exhaust. Though the evaporator and condenser outlet air streams are not fully mixed, the net effect is minimal heating or cooling within the conditioned space and a reduction in relative humidity. DOE considered addressing dehumidification performance as part of this test procedure proposal, and determined that it is not technically feasible to combine dehumidification performance, in units of liters per kWh, with a cooling or heating performance, in units of Btu/Wh. Because dehumidification is not the primary mode of operation for portable ACs, DOE does not believe that the annual operating hours in dehumidification mode would be significant and would therefore not substantially impact a metric that considers the combined annual energy consumption of each operating mode. DOE's tentative conclusion is supported by a recent field study conducted by Burke, *et al.,* (hereinafter referred to as the Burke Portable AC Study), in which portable ACs were monitored over multiple summer months in 19 locations in New York and Pennsylvania.[6] No users in this study reported operating their portable AC in dehumidification mode. DOE also notes

[6] T. Burke, *et al.,* Using Field-Metered Data to Quantify Annual Energy Use of Portable Air Conditioners, Lawrence Berkeley National Laboratory, Report No. LBNL–6868E (December 2014). Available at: *www.osti.gov/scitech/servlets/purl/1166989.*

that including dehumidification mode in a portable AC test procedure would significantly and disproportionately increase test burden. Therefore, DOE does not propose to include dehumidification mode as an operating mode to be addressed in a portable AC test procedure.

In summary, DOE proposes to include the following definitions in new appendix CC to clarify the types of portable AC operation within active mode:

''Cooling mode'' means an active mode in which a portable air conditioner has activated the main cooling function according to the thermostat or temperature sensor signal, including activating the refrigeration system, or the fan or blower without activation of the refrigeration system.

''Heating mode'' means an active mode in which a portable air conditioner has activated the main heating function according to the thermostat or temperature sensor signal, including activating a resistance heater, the refrigeration system with a reverse refrigerant flow valve, or the fan or blower without activation of the resistance heater or refrigeration system.

Further discussion of off-cycle mode, including a proposed definition, is included in section III.2 of this NOPR.

a. Cooling Mode

As discussed in the May 2014 NODA, DOE identified three industry test procedures that measure portable AC performance in cooling mode and that are applicable to products sold in North America:

(1) AHAM PAC–1–2009 ''Portable Air Conditioners'' (AHAM PAC–1–2009) specifies cooling mode testing conducted in accordance with American National Standards Institute (ANSI)/American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 37–2005 ''Methods of Testing for Rating Electrically Driven Unitary Air-Conditioning and Heat Pump Equipment'' (ANSI/ASHRAE Standard 37–2005).[7] The metrics incorporated in AHAM PAC–1–2009 include capacity and energy efficiency ratio (EER) for the following configurations: Single-Duct, Dual-Duct, Spot Cooling, and Water Cooled Condenser.

(2) Canadian Standards Association (CSA) C370–2013 ''Cooling Performance of Portable Air Conditioners'' (CSA C370–2013) is harmonized with AHAM PAC–1–2009, and thus also incorporates testing provisions from ANSI/ASHRAE Standard 37–2009.

(3) ANSI/ASHRAE Standard 128–2011 ''Method of Rating Unitary Spot Air Conditioners'' (ANSI/ASHRAE Standard 128–2011) is adapted from the previous 2009 version of CSA C370. It too references ANSI/ASHRAE Standard 37–2009. The previous version of ANSI/ASHRAE Standard 128, published in 2001, is required by California regulations to be used to certify spot cooler performance for such products sold in that State. A key difference between ANSI/ASHRAE Standard 128–2011 and ANSI/ASHRAE Standard 128–2001 is that the older version specifies a higher indoor ambient testing temperature, which increases measured cooling capacity and EER. 79 FR 26639, 26640–26641 (May 9, 2014).

DOE found no significant differences that would produce varying results among the three test procedures. The aforementioned versions of the AHAM, CSA, and ASHRAE test procedures each measure cooling capacity and EER based on an air enthalpy approach that measures the airflow rate, dry-bulb temperature, and water vapor content of air at the inlet and outlet of the indoor (evaporator) side. In addition, for air-cooled portable ACs with cooling capacity less than 135,000 Btu/h, which include the products that are the subject of this NOPR, the indoor air enthalpy results must be validated by measuring cooling capacity by either an outdoor air enthalpy method or a compressor calibration method. As explained in the May 2014 NODA, DOE selected the outdoor air enthalpy method for its investigative testing to minimize test burden because it only requires additional metering components, similar to those used for the indoor air enthalpy method. DOE conducted initial testing according to AHAM PAC–1–2009 to establish baseline capacities and efficiencies of a preliminary sample of test units according to the existing industry test procedures. 79 FR 26639, 26641 (May 9, 2014).

To investigate the contribution of operational factors on the apparent reduction in cooling capacity observed for units in the field, DOE compared the results of AHAM PAC–1–2009 testing with the results of additional testing with a test room calorimeter approach based on ANSI/ASHRAE Standard 16–1983 (RA 99), ''Method of Testing for Rating Room Air Conditioners and Packaged Terminal Air Conditioners'' (ANSI/ASHRAE Standard 16–1983), with certain modifications to allow testing of portable ACs. The room calorimeter approach allowed DOE to determine the cooling capacity of a portable AC that accounts for any air infiltration effects and heat transfer to the conditioned space through gaps in the product case and seams in the duct connections, along with an associated EER. Values of these performance metrics measured accordingly may more accurately reflect real-world portable AC operation. In that test series, DOE also investigated cooling capacity and EER as a function of the infiltration air temperature for single-duct and dual-duct units, and the effect of condenser exhaust air entrainment at the intake for dual-duct portable ACs. DOE presented the results of this preliminary testing in the May 2014 NODA. 79 FR 26639, 26643–26648 (May 9, 2014).

Although AHAM PAC–1–2009, CSA C370–2013, and ANSI/ASHRAE Standard 128–2011, all reference the test setup and methodology from ANSI/ASHRAE Standard 37, AHAM PAC–1–2009 did not specify the particular sections in ANSI/ASHRAE Standard 37 that are to be used. However, AHAM recently published an updated version of its portable AC test procedure, AHAM PAC–1–2014, that references specific sections in ANSI/ASHRAE Standard 37 for equipment setup, cooling capacity determination, power input determination, data recording, and results reporting, consistent with the approach in CSA C370–2013 and ANSI/ASHRAE Standard 128–2011. These clarifications will likely improve testing reproducibility by eliminating different possible interpretations of the provisions to reference from ANSI/ASHRAE Standard 37. AHAM also slightly revised the evaporator inlet and condenser inlet temperatures for its standard rating conditions in AHAM PAC–1–2014, in order to harmonize with the temperatures specified in CSA C370–2013 and ANSI/ASHRAE Standard 128–2011. Conditions that had been specified as 80 degrees Fahrenheit (°F) dry-bulb temperature and 67 °F wet-bulb temperature were adjusted to 80.6 °F/66.2 °F, and conditions that had been specified as 95 °F/75 °F were adjusted to 95 °F/75.2 °F. DOE did not identify other substantive changes between the 2009 and 2014 versions of AHAM PAC–1 that would affect testing results.

For the May 2014 NODA, DOE conducted an initial round of performance testing on a preliminary sample of test units representative of products available at that time on the U.S. market. The test sample included a total of eight portable ACs (four single-duct, two dual-duct, and two spot coolers), covering a range of rated cooling capacities (8,000–13,500 Btu/h) and EERs (7.0–11.2 Btu per watt-hour (Btu/Wh)). Following publication of the May 2014 NODA, DOE performed additional testing on a larger set of test units. This second test sample included a total of eighteen portable ACs; thirteen

[7] ANSI/ASHRAE Standard 37 was updated in 2009. DOE reviewed the 2005 and 2009 versions and concluded there would be no measurable difference in portable air conditioner results obtained from each. Therefore, DOE utilized ANSI/ASHRAE Standard 37–2009 when testing according to AHAM PAC–1–2009.

single-duct and 5 dual-duct[8] units, expanding the range of rated cooling capacities (5,000–14,000 Btu/h) and the maximum rated EER to 12.1 Btu/Wh. DOE did not include any spot coolers in the second test sample because it is not proposing testing provisions for them at this time for reasons discussed in section IIII.A of this NOPR.

Because DOE does not currently regulate portable ACs, manufacturers may advertise or market their products using any available test procedure. For those models that are included in the California Energy Commission (CEC) product database and that are sold in California, however, manufacturers must report cooling capacity and EER according to ANSI/ASHRAE Standard 128–2001. DOE notes that the cooling capacities and EERs obtained from using ANSI/ASHRAE Standard 128–2001 are higher than those obtained using the current ANSI/ASHRAE Standard 128–2011, primarily due to higher temperature evaporator inlet air in the 2001 version of the test procedure.[9]

Due to the consistent method of reporting performance required by the CEC, DOE selected units for its test sample largely from cooling capacities and EERs listed in the CEC product database. However, due to the difference in testing temperature, DOE expected that these values would differ from the cooling capacities and EERs that would be obtained using any of the three current industry test methods. For additional products not listed in the CEC product database, DOE utilized information from manufacturer literature to inform its selection.

The 24 test units[10] (comprising the samples from the May 2014 NODA testing and testing for this proposal) and their key features are presented in Table III.1, with cooling capacity expressed in Btu/h and EER expressed in Btu/Wh.

TABLE III.1—PORTABLE AC TEST SAMPLE

Test unit	Duct type	Rated cooling capacity (*Btu/h*)	Rated EER (*Btu/Wh*)
SD1[1]	Single	8,000	7.0
SD2[1]	Single	9,500	9.6
SD3[1]	Single	12,000	8.7
SD4[1]	Single	13,000	9.7
SD5	Single	8,000	10.2
SD6	Single	14,000	8.9
SD7	Single	12,000	8.1
SD8	Single	9,000	9.2
SD9	Single	9,000	10.3
SD10	Single	10,000	9.5
SD11	Single	12,000	12.6
SD12	Single	10,000	8.8
SD13	Single	12,500	[3] N/A
SD14	Single	12,000	10.0
SD15	Single	5,000	8.6
SD16	Single	11,000	9.2
SD17	Single	12,000	[3] N/A
DD1[1]	Dual	9,500	9.4
DD2[1]	Dual	13,000	8.9
DD3	Dual	11,600	8.8
DD4[2]	Dual	14,000	[3] N/A
DD5	Dual	9,000	9.2
DD6	Dual	14,000	9.5
DD7	Dual	13,500	9.5

[1] These units were tested and discussed in the May 2014 NODA. This table does not include the two spot coolers that were tested in support of the May 2014 NODA.

[2] This test unit shipped with the capabilities of operating in both single-duct and dual-duct configuration. Therefore, it was tested according to both configurations.

[3] No rated value was published in the CEC database or in manufacturer documentation.

Baseline Testing

DOE first performed testing in accordance with AHAM PAC–1–2009[11] to determine baseline performance according to industry standards. This baseline performance was then compared to performance measured according to modified or alternate test approaches to determine an optimal approach.

AHAM PAC–1–2009 requires two-chamber air enthalpy testing for single-duct and dual-duct units, and a single-chamber setup for spot coolers. For each ducted configuration, the portable AC and any associated ducting is located entirely within a chamber held at ''indoor'' standard rating conditions at the evaporator inlet of 80 °F dry-bulb temperature and 67 °F wet-bulb temperature, which correspond to 51-

[8] One of the dual-duct units was shipped with a conversion kit to enable testing in single-duct configuration. DOE performed all tests on this ''convertible'' unit in both single-duct and dual-duct configurations.

[9] ANSI/ASHRAE Standard 128–2011 specifies 80.6 degrees °F dry-bulb temperature and 66.2 °F wet-bulb temperature for the standard rating conditions for the evaporator inlet of dual-duct portable ACs and both the evaporator and condenser inlets of single-duct units. It also specifies standard rating conditions of 95 °F dry-bulb temperature and 75.2 °F wet-bulb temperature for the condenser inlet side of dual-duct portable ACs and both the evaporator and condenser inlets of spot coolers. ANSI/ASHRAE Standard 128–2001 specifies 95 °F dry-bulb temperature and 83 °F wet-bulb temperature for the standard rating conditions for both the evaporator and condenser inlets of all portable ACs, including spot coolers.

[10] DOE also tested two spot coolers for the May 2014 NODA. However, because DOE is not proposing testing provisions for these units at this time, the results for those units are not considered further in this analysis.

[11] DOE's testing and analysis was completed prior to the publication of AHAM PAC–1–2014. Because, as discussed earlier, DOE concludes that the differences between the 2009 and 2014 versions of the test standard would not affect testing results substantively, DOE proposes a test procedure in this rule that would referenece certain provisions of the current versions of the standard (AHAM PAC–1–2014).

percent relative humidity. For the condenser-side exhaust on single-duct and dual-duct units, the manufacturer-supplied or manufacturer-specified flexible ducting connects the unit under test to a separate test chamber maintained at ''outdoor'' standard rating conditions. The outdoor conditions specify 95 °F dry-bulb temperature and 75 °F wet-bulb temperature (40-percent relative humidity) at the condenser inlet for dual-duct units. The outdoor conditions for single-duct units, however, are not explicitly specified. AHAM PAC–1–2009 only requires that the condenser inlet conditions, which would be set by air intake from the indoor side chamber, be maintained at 80 °F dry-bulb temperature and 67 °F wet-bulb temperature. Because the single-duct condenser air is discharged to the outdoor side with no intake air from that location, DOE does not believe that the results obtained using AHAM PAC–1–2009 would be measurably affected by the conditions in the outdoor side chamber. Nonetheless, for consistency with the testing of dual-duct units, DOE chose to maintain the outdoor side conditions, measured near to the condenser exhaust but not close enough to be affected by that airflow, at 95 °F dry-bulb temperature and 75 °F wet-bulb temperature.

Section 6.1 of AHAM PAC–1–2009, ''Method of Test,'' instructs that the details of testing are as specified in ANSI/ASHRAE Standard 37–2005, but does not identify particular provisions to be used other than noting that references in Section 8.5.1 of ANSI/ASHRAE Standard 37–2005 refer to the indoor side (the cooling, or evaporator side) and the outdoor side (the heat rejection, or condenser, side) of the portable AC under test. DOE determined that additional relevant sections to incorporate would include those referring to test setup, test conduct, cooling capacity and power input determination, data recording, and test result reporting. The following paragraphs describe the equivalent clauses from ANSI/ASHRAE Standard 37–2009 that DOE decided were appropriate for conducting its baseline tests for both the May 2014 NODA and this proposal.

The test apparatus (*i.e.,* ducts, air flow-measurement nozzle, and additional instrumentation) were adjusted according to Section 8.6, ''Additional Requirements for the Outdoor Air Enthalpy Method,'' of ANSI/ASHRAE Standard 37–2009, which ensures that air flow rate and static pressure in the condenser exhaust air stream, and condenser inlet air stream for dual-duct units, are representative of actual installations. The test room conditioning apparatus and the units under test were then operated until steady-state performance was achieved according to the specified test tolerances in Section 8.7, ''Test Procedure for Cooling Capacity Tests,'' of ANSI/ASHRAE Standard 37–2009. Airflow rate, dry-bulb temperature, and water vapor content were recorded to evaluate cooling capacity at equal intervals that spanned 5 minutes or less until readings over one-half hour were within the same tolerances, as required by that section.

These collected data were then used to calculate total, sensible, and latent indoor cooling capacity based on the equations in Section 7.3.3, ''Cooling Calculations,'' of ANSI/ASHRAE Standard 37–2009. This section provides calculations to determine indoor cooling capacity based on both the indoor and outdoor air enthalpy methods. As described in Section 7.3.3.3 of ANSI/ASHRAE Standard 37–2009, the indoor air enthalpy cooling capacity calculation was adjusted for heat transferred from the surface of the duct(s) to the conditioned space. DOE estimated a convective heat transfer coefficient of 4 Btu/h per square foot per °F, based on a midpoint of values for forced convection and free convection as recommended by the test laboratory for this specific test and setup. Four thermocouples were placed in a grid on the surface of the condenser duct(s). The heat transfer was determined by multiplying the estimated heat transfer coefficient by the surface area of each component and by the average temperature difference between the duct surface and test chamber air.

Although AHAM PAC–1–2009 specifies in Section 5.1 that the evaporator circulating fan heat shall be included in the total cooling capacity by means of fan power measurement, DOE selected an alternate calculation that it concluded would provide a more accurate measure of overall heat transfer to the conditioned space. DOE estimated this heat transferred to the conditioned space by monitoring the temperature differential between the case surfaces and the indoor room, with measurements and calculations similar to those used for the ducts. This estimate was made by placing four thermocouples on each surface of the case and measuring the surface area to determine the total heat transfer through the case. This approach directly estimates the heating contribution of all internal components within the case to the cooling capacity, while making no assumption regarding whether the heat from individual components is transferred to the cooling or heat rejection side.

Based on the provisions discussed above, DOE used the following equation when calculating the cooling capacity and EER for portable ACs according to AHAM PAC–1–2009:

$$Cooling\ Capacity = Q_{indoor} - Q_{duct} - Q_{case}$$

Where:

Q_{indoor} is the evaporator air enthalpy cooling capacity, in Btu/h, as calculated according to Section 7.3.3.1 of ANSI/ASHRAE 37–2009.

Q_{duct} is the heat transferred from the condenser exhaust duct (and condenser inlet duct for dual-duct units) to the conditioned space, in Btu/h, as calculated according to Section 7.3.3.3 of ANSI/ASHRAE 37–2009.

Q_{case} is the heat transferred from the portable AC case to the conditioned space, in Btu/h, also calculated using the methodology in 7.3.3.3 of ANSI/ASHRAE 37–2009, but using temperature measurements located on the case surfaces rather than the ducts.

From the calculated evaporator air enthalpy cooling capacity, DOE determined the associated EER consistent with the definitions in Sections 3.8 and 3.9 and ratings requirements in Sections 5.3 and 5.4 of AHAM PAC–1–2009. Table III.2 shows the results of the baseline testing for all test units according to AHAM PAC–1–2009, including results from testing for the May 2014 NODA and this proposal.

TABLE III.2—BASELINE TEST RESULTS

Test unit	Duct type	Cooling capacity (*Btu/h*)	EER (*Btu/Wh*)
SD1	Single	5,850	6.8
SD2	Single	6,600	7.4
SD3	Single	10,950	7.5
SD4	Single	9,500	6.6
SD5	Single	5,600	8.3

TABLE III.2—BASELINE TEST RESULTS—Continued

Test unit	Duct type	Cooling capacity (*Btu/h*)	EER (*Btu/Wh*)
SD6	Single	10,250	8.0
SD7	Single	8,550	6.4
SD8	Single	6,750	5.9
SD9	Single	6,700	6.9
SD10	Single	8,100	8.1
SD11	Single	5,700	5.7
SD12	Single	8,050	7.3
SD13	Single	10,350	8.6
SD14	Single	9,250	8.1
SD15	Single	4,250	8.2
SD16	Single	8,200	7.3
SD17	Single	5,800	6.8
SD18 [1]	Single	7,200	5.4
DD1	Dual	8,600	7.4
DD2	Dual	7,200	5.5
DD3	Dual	5,950	4.8
DD4 [1]	Dual	5,900	4.1
DD5	Dual	5,250	5.3
DD6	Dual	7,450	6.0
DD7	Dual	7,300	5.7

[1] This test unit shipped with the capabilities of operating in both single-duct and dual-duct configuration. Therefore, it was tested according to both configurations.

Calorimeter Method Testing

For the May 2014 NODA and this proposal, DOE further investigated heat transfer effects not currently captured in available portable AC test procedures, through additional testing according to the room calorimeter approach described in the May 2014 NODA. 79 FR 26639, 26644 (May 9, 2014). This approach, adapted from ANSI/ASHRAE Standard 16–1983, used two test chambers, one maintained at the indoor conditions and the other adjusted to maintain the outdoor conditions as specified below. The portable AC under test was located within the indoor test room with the condenser duct(s) interfacing with the outdoor test room by means of the manufacturer-supplied or manufacturer-recommended mounting fixture, unless otherwise noted. Infiltration air from the outdoor chamber at 95 °F dry-bulb and 75 °F wet-bulb (40-percent relative humidity) was introduced by means of a pressure-equalizing device to the indoor chamber, which was maintained at 80 °F dry-bulb and 67 °F wet-bulb (51-percent relative humidity). The pressure-equalizing device maintained a static pressure differential of less than 0.005 inches of water between the chambers, as specified in Section 4.2.3 of ANSI/ASHRAE Standard 16–1983.

DOE measured all energy consumed by the indoor chamber components to maintain the required ambient conditions while the portable AC under test operated continuously at its maximum fan speed during a 1-hour stable period following a period of no less than 1 hour with stabilized conditions. All heating and cooling contributions to the indoor chamber were summed, including: Chamber cooling, heat transferred through the chamber wall, air-circulation fans, dehumidifiers, humidifiers, and scales. The net indoor chamber cooling was recorded as the portable AC's cooling capacity. This approach encompasses all cooling and heating effects generated by the portable AC, including air infiltration effects that are not captured or estimated by the air enthalpy approach.

The test units were installed with the manufacturer-provided ducting, duct attachment collar, and mounting fixture. This test approach included the impacts of heat transfer from the ducts and air leaks in the duct connections and mounting fixture, in addition to heat leakage through the case and infiltration air. Table III.3 shows the measured net cooling capacities and EER values for all units tested according to the calorimeter approach when the infiltration air dry-bulb temperature was 95 °F. Also included are the results for the rated and baseline values. Figure III.1 also presents the comparison of baseline and calorimeter testing results.

TABLE III.3—RATED, BASELINE, AND CALORIMETER RESULTS

Test unit	Cooling capacity (*Btu/h*)			EER (*Btu/Wh*)		
	Rated	Baseline	Calorimeter	Rated	Baseline	Calorimeter
SD1	8,000	5,850	-450	7.0	6.8	-0.5
SD2	9,500	6,600	-650	9.6	7.4	-0.7
SD3	12,000	10,950	3,500	8.7	7.5	2.3
SD4	13,000	9,500	1,850	9.7	6.6	1.3
SD5	8,000	5,600	150	10.2	8.3	0.2
SD6	14,000	10,250	3,000	8.9	8.0	2.3
SD7	12,000	8,550	2,850	8.1	6.4	2.1
SD8	9,000	6,750	900	9.2	5.9	0.8
SD9	9,000	6,700	1,050	10.3	6.9	1.1
SD10	10,000	8,100	1,900	9.5	8.1	1.9
SD11	12,000	5,700	1,100	12.6	5.7	1.1
SD12	10,000	8,050	1,600	8.8	7.3	1.5

TABLE III.3—RATED, BASELINE, AND CALORIMETER RESULTS—Continued

Test unit	Cooling capacity (*Btu/h*)			EER (*Btu/Wh*)		
	Rated	Baseline	Calorimeter	Rated	Baseline	Calorimeter
SD13	12,500	10,350	3,900	[1] N/A	8.6	3.2
SD14	12,000	9,250	2,300	10.0	8.1	2.0
SD15	5,000	4,250	-2,450	8.6	8.2	-4.7
SD16	11,000	8,200	1,700	9.2	7.3	1.5
SD17	12,000	5,800	-650	[1] N/A	6.8	-0.7
SD18 [2]	14,000	7,200	850	[1] N/A	5.4	0.6
DD1	9,500	8,600	3,400	9.4	7.4	2.9
DD2	13,000	7,200	3,450	8.9	5.5	2.6
DD3	11,600	5,950	3,100	8.8	4.8	2.5
DD4 [2]	14,000	5,900	2,400	[1] N/A	4.1	1.7
DD5	9,000	5,250	2,700	9.2	5.3	2.8
DD6	14,000	7,450	2,800	9.5	6.0	2.2
DD7	13,500	7,300	4,000	9.5	5.7	3.0

[1] No rated value was published in the CEC database or on manufacturer documentation.
[2] This test unit shipped with the capabilities of operating in both single-duct and dual-duct configuration. Therefore, it was tested according to both configurations.

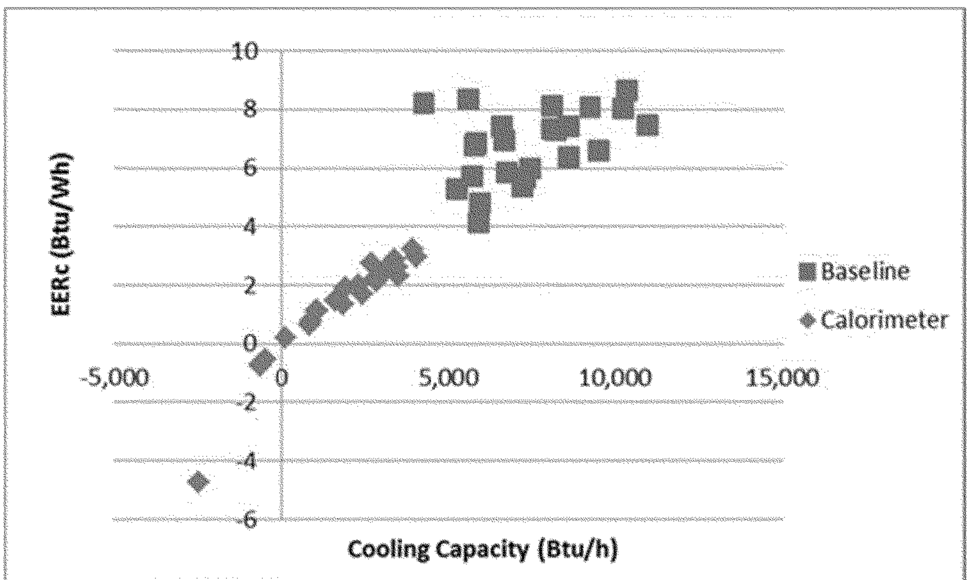

Figure III.1 Baseline and Calorimeter Results

Figure III.1 demonstrates that there is little correlation between EER and cooling capacity for the baseline results when the effects of air infiltration and heat losses are not accounted for. When such effects are included, the values of both EER and cooling capacity are reduced for a given test unit, but the data evidence a clear relationship between EER and cooling capacity. Figure III.1 also demonstrates that the net cooling of portable ACs may be significantly lower than an air enthalpy measurement would suggest, due to the effects of infiltration air. Thus, DOE determined that the existing representations of capacity and EER, which are based on air enthalpy methods, are likely to be inconsistent and may not represent true portable AC performance. Further, the varying differences between the calorimeter and baseline results indicate that varying infiltration air flow rates and heat losses would preclude a fixed translation factor that could be applied to the results of an air enthalpy measurement to account for the impact of these effects. For these reasons, DOE determined that a DOE test procedure for portable ACs that includes a measure of infiltration air effects and heat losses would provide consistency and clarity for representation of capacity and energy use for these products. Specific proposals for such a test procedure are discussed in the following sections.

i. General Test Approach

As discussed in the previous section, the results from baseline testing according to AHAM PAC–1–2009 and investigative testing according to the calorimeter approach suggest that the calorimeter approach most accurately represents portable AC performance by accounting for the effects of air infiltration and heat losses.

DOE considered comments received in response to the initial baseline and calorimeter approach results presented in the May 2014 NODA. Appliance Standards Awareness Project, Alliance to Save Energy, American Council for an Energy-Efficient Economy, Consumers Union, Natural Resources Defense Council, and Northwest Energy Efficiency Alliance (hereinafter referred to as the ''Joint Commenters'') and the California IOUs observed that the current industry test procedures do not capture the effects of infiltration air and duct heat loss and leakage, which would lead to an overestimation of portable AC performance in real-world settings. In addition, according to the Joint Commenters, the current industry test procedures do not provide an accurate relative ranking of portable AC units, such that single-duct units appear to be more efficient than dual-duct units. Therefore, the Joint Commenters and the California IOUs urged DOE to adopt a test procedure for portable ACs based on the calorimeter approach, which would align with the current test procedures for room ACs and would better reflect real-world cooling capacities and EERs of both single-duct and dual-duct configurations. The California IOUs commented that because portable ACs can be used as a substitute for room ACs, they support the adoption of a test procedure for portable ACs that would allow consumers to make realistic comparisons of capacity and efficiency between comparable product types. (California IOUs, No. 5 at pp. 2–3; Joint Commenters, No. 6 at pp. 1–2)

AHAM supports the incorporation by reference of AHAM PAC–1–2014, which is harmonized with CSA C370–2013, in a DOE test procedure for portable ACs. AHAM indicated that AHAM PAC–1–2014 best measures representative performance for each portable AC configuration, in comparison to other approaches. AHAM commented that, unlike other air conditioning products, portable ACs are intended to be easily relocated from one room to another and therefore the compressor and condenser are both inside the conditioned room, as opposed to a room AC, where the compressor and condenser are outside the room. Because a portable AC does not operate in between the conditioned and unconditioned space as room ACs do, and instead is located solely in the conditioned space, AHAM believes that the calorimeter approach, intended for room ACs, may not be as representative as the enthalpy approach for portable ACs. AHAM also commented that ANSI/ASHRAE 128–2011 instructs that it is not to be used for portable ACs with cooling capacities less than 65,000 Btu/h, and ANSI/AHAM 128–2001 does not address all portable AC configurations. AHAM noted that Canada may promulgate portable AC standards using CSA C370–2013, and stated that North American harmonization will provide consistency and clarity for regulated parties and consumers in both countries. (AHAM, No. 4 at p. 2) AHAM acknowledged the differences between rated values and baseline test results obtained using AHAM PAC–1–2009, and stated that a conversion factor between rated values and results obtained using its recommended test procedure, AHAM PAC–1–2014, is not feasible due to the wide range of differences between these values. (AHAM, No. 4 at p. 3)

De' Longhi Appliances s.r.l. (De' Longhi) indicated that the air enthalpy method and a calorimeter method with no air infiltration would ensure levels of reproducibility and repeatability required for regulated products. Further, De' Longhi stated that AHAM PAC–1–2009 and CSA C370–2013 are more suitable for representing performance of all the categories of portable ACs. (De' Longhi, No. 3 at p. 5)

AHAM and De' Longhi also stated that the calorimeter approach is much more burdensome than the air enthalpy approach, requiring more expensive test equipment and longer test times. AHAM believes that adoption of the calorimeter method for testing portable ACs would also require many laboratories to build new test facilities because portable ACs are not currently tested using a calorimeter approach, representing a significant burden. AHAM is also concerned that there are few third-party test laboratories that have the capability to test using a calorimeter approach, which would impact choice and availability for testing. Therefore, AHAM urged DOE to adopt the test approach of AHAM PAC–1–2014 to produce representative test results that are not unduly burdensome to conduct. (AHAM, No. 4 at p. 4) De' Longhi stated that the test burden associated with a test method should be proportionate to the amount of energy consumed by a certain product category. According to De' Longhi, because portable ACs are a small fraction of the air conditioning market with a unique usage pattern, being operated generally for short period of time, the test burden should be minimized. De' Longhi commented that the calorimeter method would result in an unreasonably large burden for this product category, and therefore, the air enthalpy method is preferable due to the higher availability of testing apparatus and lower cost of testing. (De' Longhi, No. 3 at p. 3)

The results presented in Table III.3 and displayed in Figure III.1 demonstrate that the calorimeter method provides a measure of net portable AC cooling capacity and EER across different product configurations and varying air infiltration rates that is comparable to the performance trends obtained according to AHAM PAC–1–2009. However, DOE found in its testing that, although equipment setup is simpler for the calorimeter approach as based on ANSI/ASHRAE Standard 16 requirements, maintaining the conditions in a calorimeter chamber can be difficult, particularly at higher test unit cooling capacities. In those cases, additional climate control components may be necessary, all of which must be monitored to measure the heat transfer to and from the indoor side test room. These additional components may include air circulating fans to ensure conditions are uniform throughout the test room, humidifiers and dehumidifiers to maintain the necessary relative humidity, and scales to measure the evaporated or condensed moisture during testing. Incorporating the heating and cooling effects from each of these components proved to be complex, with potential uncertainties in the net cooling capacity accumulating with each additional component. After considering the burdens and complexity of the calorimeter approach, DOE determined the air enthalpy approach provided in AHAM PAC–1–2009 and AHAM PAC–1–2014 to be a less burdensome approach. Although AHAM PAC–1–2014 requires comprehensive instrumentation to monitor air stream enthalpies and specific measures to ensure that this instrumentation has no impact on performance, it also provides a straight-forward calculation for determining indoor-side cooling based on a well-defined set of variables. Many of the instruments required for the air enthalpy approach, as specified in ANSI/ASHRAE Standard 37, are used in testing central ACs and heat pumps, and ANSI/ASHRAE Standard 37 is also referenced in the DOE test procedure to determine energy consumption of furnace fans. Thus, DOE believes that many commercial laboratories have the capability to perform the air enthalpy test, while few laboratories in the United States have the test chamber and instrumentation required to test according to the calorimeter approach. In addition, the air enthalpy approach, as specified in ANSI/ASHRAE Standard 37 with additional guidance in AHAM PAC–1–2014, is specifically applicable for testing portable ACs, while the calorimeter approach requires modifications from the room AC test procedure specified in ANSI/ASHRAE 16 to accommodate portable ACs.

Therefore, if DOE determines that portable ACs are covered products and establishes a test procedure for them, DOE proposes that AHAM PAC–1–2014 be the basis of the DOE test procedure to ensure that multiple labs are capable of performing the test, to minimize added test burden, and to align with current industry practices. However, as described in the remaining subsections of section III.1.a, DOE believes that additional provisions and clarifications would be necessary to incorporate AHAM PAC–1–2014 into a DOE portable AC test procedure.

ii. Infiltration Air Effects and Cooling Capacity

Infiltration from outside the conditioned space in which the portable AC is located occurs due to the negative pressure induced as condenser air is exhausted to the outdoor space. Although this effect is most pronounced for single-duct units, which draw all of their condenser air from within the conditioned space, dual-duct units also draw a portion of their condenser air from the conditioned space. In its testing, DOE estimated the infiltration air flow rate as equal to the condenser exhaust flow rate to the outdoor chamber minus any condenser intake flow rate from the outdoor chamber because it had determined that air leakage from the outdoor chamber to locations other than the indoor chamber was negligible.

For a single-duct unit, the air balance equation results in the infiltration air flow rate being equal to the condenser exhaust air flow rate. For dual-duct units, the condenser exhaust duct flow rate may be higher than the inlet duct flow rate. This is due to some intake air being drawn from the indoor chamber via louvers or leakage through the case, duct connections, or between the evaporator and condenser sections. Table III.4 presents the estimated infiltration air flow rates for the full test sample.

TABLE III.4—INFILTRATION AIR FLOW RATE

Test unit	Condenser outlet air flow rate (CFM)	Condenser inlet air flow rate (CFM) *	Net infiltration air flow rate (CFM)
SD1	268.03		268.03
SD2	262.59		262.59
SD3	285.45		285.45
SD4	254.30		254.30
SD5	217.77		217.77
SD6	228.43		228.43
SD7	221.83		221.83
SD8	224.61		224.61
SD9	229.09		229.09
SD10	220.80		220.80
SD11	175.07		175.07
SD12	237.37		237.37
SD13	247.39		247.39
SD14	262.52		262.52
SD15	278.89		278.89
SD16	250.69		250.69
SD17	249.37		249.37
SD18	246.48		246.48
Average of Single-Duct			242.26
DD1	271.85	170.79	101.06
DD2	214.83	128.05	86.78
DD3	234.87	146.29	88.58
DD4	251.67	126.60	125.07
DD5	207.85	113.15	94.71
DD6	272.43	76.61	195.82
DD7	244.47	107.49	136.99
Average of Dual-Duct			118.43

* Condenser inlet air flow rate is only applicable for dual-duct units.

As discussed in the May 2014 NODA, DOE investigated various infiltration air temperatures. In its initial calorimeter tests, DOE maintained the outdoor test chamber conditions at 95 °F dry-bulb temperature and 75 °F wet-bulb temperature, which would be representative of outdoor air being drawn directly into the conditioned space to replace any condenser inlet air from that same conditioned space. However, it is possible that some or all of the replacement air is drawn from a location other than the outdoors directly, such as a basement, attic, garage, or a space that is conditioned by other equipment. Because varying infiltration air temperature would have a significant impact on cooling capacity and EER, DOE performed additional testing over a range of dry-bulb temperatures for the infiltration air that spanned 78 °F to 95 °F, all at the 40-percent relative humidity specified at the 95 °F condition. 79 FR 26639, 26646 (May 9, 2014).

In response to the May 2014 NODA, the Joint Commenters and California IOUs stated that the current industry standard outdoor air conditions (95 °F dry-bulb temperature and 75 °F wet-bulb temperature) are appropriate for infiltration air. (Joint Commenters, No. 6 at p. 3; California IOUs, No. 5 at p. 3) The Joint Commenters added that although some or all of the infiltration air may be drawn from a location other than the outdoors directly, such as a basement, attic, garage, or a space that is conditioned by other equipment, all infiltration air is ultimately coming from the outdoors and adding heat to the home where the portable AC is installed. (Joint Commenters, No. 6 at p. 3)

AHAM stated that in the field, there is a mixture of indoor and outdoor air, and infiltration air will be at different temperature and humidity levels in every home, due to varying home designs. Therefore, AHAM does not believe there is an ''average'' condition that DOE could select to replicate in a test procedure condition and would not support an approach that utilizes existing test procedures with numerical adjustments for infiltration air. (AHAM, No. 4 at p. 5) De' Longhi concurred, stating that the effect of air infiltration would be complex to standardize. De' Longhi commented that air infiltration flow pathways are determined by the path of minimum air flow resistance, and therefore it is not possible to determine the amount of infiltration air that originates from adjacent indoor rooms versus from outdoors. De' Longhi believes that in most situations, unconditioned outdoor air is just a small portion of the total infiltration air. Accordingly, De' Longhi stated that the standard outdoor air conditions of 95 °F dry-bulb temperature and 75 °F wet-bulb temperature are not representative of the infiltration air temperatures. De' Longhi suggested that if DOE determines to include portable ACs as a covered product, the heat transfer effects of infiltration air should not be taken into account in a DOE test procedure. (De' Longhi, No. 3 at p. 4)

DOE agrees that, as for all covered products, real-world installations experience varying ambient conditions. The test procedure must thus consider the most representative operation in selecting appropriate specifications for those conditions. Recognizing that in some cases the infiltration air enters the conditioned space directly from outdoors, and that any air infiltrating from other conditioned spaces likely also originated from outdoors before being conditioned by other cooling equipment, DOE concludes that 95 °F dry-bulb temperature and 75 °F wet-bulb temperature is most representative for infiltration air conditions, in accordance with the outdoor conditions specified in AHAM PAC–1–2014, and proposes to specify these conditions in the portable AC test procedure. Such conditions would also produce comparable results for single-duct and dual-duct configurations.

DOE also developed methodology for the May 2014 NODA that would adjust the results obtained from an air enthalpy method to account for the total heat added to the room by the infiltration air. The infiltration air mass flow rate of dry air would be calculated as:

$$\dot{m}_{sd} = \frac{V_{co} \times \rho_{co}}{(1 + \omega_{co})}$$

$$\dot{m}_{dd} = \left[\frac{V_{co} \times \rho_{co}}{(1 + \omega_{co})}\right] - \left[\frac{V_{ci} \times \rho_{ci}}{(1 + \omega_{ci})}\right]$$

Where:

$\dot{m}_{sd}$ is the dry air mass flow rate of infiltration air for a single-duct unit, in pounds per minute (lb/m).

$\dot{m}_{dd}$ is the dry air mass flow rate of infiltration air for a dual-duct unit, in lb/m.

V_{co} is the volumetric flow rate of the condenser outlet air, in cubic feet per minute (cfm).

V_{ci} is the volumetric flow rate of the condenser inlet air, in cfm.

ρ_{co} is the density of the condenser inlet air, in pounds mass per cubic feet (lb_m/ft^3).

ρ_{ci} is the density of the condenser inlet air, in lb_m/ft^3.

ω_{co} is the humidity ratio of condenser outlet air, in pounds mass of water vapor per pounds mass of dry air (lb_w/lb_{da}).

ω_{ci} is the humidity ratio of condenser inlet air, in lb_w/lb_{da}.

The sensible heat contribution of the infiltration air would be calculated as follows:

$$Q_s = \frac{\dot{m} \times \left[\left(c_{p\_da} \times (T_{ia} - T_{ei})\right) + c_{p\_wv} \times (\omega_{ia} \times T_{ia} - \omega_{ei} \times T_{ei})\right]}{60}$$

Where:

Q_s is the sensible heat added to the room by infiltration air, in Btu/h;

$\dot{m}$ is the dry air mass flow rate of infiltration air for a single-duct or dual-dual duct unit, in lb/m;

c_{p_da} is the specific heat of dry air, 0.24 Btu/lb_m- °F.

c_{p_wv} is the specific heat of water vapor, 0.444 Btu/lb_m- °F.

ω_{ia} is the humidity ratio of the infiltration air, 0.0141 lb_w/lb_{da}.

ω_{ei} is the humidity ratio of the evaporator inlet air, in lb_w/lb_{da}.

60 is the conversion factor from minutes to hours.

T_{ei} is the indoor chamber dry-bulb temperature measured at the evaporator inlet, in °F.

T_{ia} is the infiltration air dry-bulb temperature, 95 °F.

DOE used the following equation for the latent heat contribution of the infiltration air:

$$Q_l = \frac{\dot{m} \times H_{fg} \times (\omega_{ia} - \omega_{ei})}{60}$$

Where:

Q_l is the latent heat added to the room by infiltration air, in Btu/h.

$\dot{m}$ is the mass flow rate of infiltration air for a single-duct or dual-dual duct unit, in lb/m.

ω_{ia} is the humidity ratio of the infiltration air, 0.0141 lb_w/lb_{da}.

ω_{ei} is the humidity ratio of the evaporator inlet air, in lb_w/lb_{da}.

H_{fg} is the latent heat of vaporization for water vapor, 1061 Btu/lb_m.

60 is the conversion factor from minutes to hours.

The total heat contribution of the infiltration air is the sum of the sensible and latent heat.

$Q_{infiltration} = Q_s + Q_l$

Where:

$Q_{infiltration}$ is the total infiltration air heat, in Btu/h.

Q_s is the sensible heat added to the room by infiltration air, in Btu/h.

Q_l is the latent heat added to the room by infiltration air, in Btu/h.

Table III.5 displays the cooling capacity as determined by the baseline air enthalpy testing approach of AHAM PAC–1–2009, and the modified air enthalpy approach that subtracts the estimated infiltration air heat input from the cooling capacity measurement.

TABLE III.5—MODIFIED AIR ENTHALPY PERFORMANCE

Test unit	Cooling capacity (*Btu/h*)		EER_{cm} (*Btu/Wh*)	
	Baseline	Modified AHAM	Baseline	Modified AHAM
SD1	5,850	−900	6.8	−1.0
SD2	6,600	200	7.4	0.2
SD3	10,950	4,050	7.5	2.8

TABLE III.5—MODIFIED AIR ENTHALPY PERFORMANCE—Continued

Test unit	Cooling capacity (*Btu/h*)		EER_{cm} (*Btu/Wh*)	
	Baseline	Modified AHAM	Baseline	Modified AHAM
SD4	9,500	4,000	6.6	2.8
SD5	5,600	400	8.3	0.6
SD6	10,250	4,750	8.0	3.7
SD7	8,550	3,500	6.4	2.6
SD8	6,750	1,500	5.9	1.3
SD9	6,700	1,150	6.9	1.2
SD10	8,100	2,750	8.1	2.7
SD11	5,700	1,350	5.7	1.4
SD12	8,050	2,250	7.3	2.0
SD13	10,350	4,450	8.6	3.7
SD14	9,250	2,800	8.1	2.4
SD15	4,250	−2,900	8.2	−5.6
SD16	8,200	2,200	7.3	2.0
SD17	5,800	−850	6.8	−1.0
SD18	7,200	1,300	5.4	1.0
DD1	8,600	6,550	7.4	5.6
DD2	7,200	5,500	5.5	4.2
DD3	5,950	4,150	4.8	3.4
DD4	5,900	3,100	4.1	2.2
DD5	5,250	3,200	5.3	3.2
DD6	7,450	2,800	6.0	2.2
DD7	7,300	4,200	5.7	3.3

The data above show the significant reduction in cooling capacity and EER_{cm} caused by infiltration air heat input, which is greater for single-duct units than for dual-duct units. For three of the single-duct units, the impacts of infiltration air were so great that they produced net heating in the conditioned space, as indicated by the negative cooling capacity values.

In response to this approach, which was presented in the May 2014 NODA, the Joint Commenters stated that this modified air enthalpy testing approach is not a suitable alternative to the proposed calorimeter approach. According to the Joint Commenters, the alternate testing approach would provide a significant improvement over the current industry test procedures by addressing the impact of infiltration air with a numerical adjustment, but the alternate testing approach fails to capture additional impacts on portable AC performance such as leakage through gaps in the ducts and duct connections and heat transfer through the ducts. The Joint Commenters expressed concern that DOE found no consistent difference between the calorimeter approach and the alternate test approach, and therefore believe the alternate test approach would not necessarily provide a good indication of real-world portable AC performance. Although the alternate testing approach may represent a lower testing burden compared to the calorimeter approach, the Joint Commenters reminded DOE that the current room AC test procedure is based on a calorimeter approach, and stated that the calorimeter approach is also appropriate for portable ACs. (Joint Commenters, No. 6 at p. 3)

DOE recognizes that the modified air enthalpy approach and calorimeter approach both greatly reduce the cooling capacity and EER_{cm} when compared with the results from AHAM PAC–1–2014 and other current industry-accepted test procedures that do not address infiltration air. Based on the data presented above and comments received from interested parties and manufacturer interviews, DOE believes that any portable AC test procedure must include the heat transfer effects of infiltration air, in addition to the effects of duct and case heat transfer, discussed later in this NOPR. DOE also recognizes that the results produced by the calorimeter and modified air enthalpy approaches do not align. However, as discussed earlier in this section, DOE found it difficult to maintain the test chamber conditions for the calorimeter approach, particularly for higher-capacity portable ACs. Due to significant infiltration of air at conditions substantially different than the required indoor-side test chamber conditions, additional air conditioning equipment is required to maintain the indoor-side test chamber conditions, all of which must be accounted for in determining the net heating or cooling effect in the test chamber. DOE believes the cumulative uncertainty related to incorporating the heating and cooling effects from each of these components may have been significant enough to have resulted in the inconsistency between the calorimeter and modified air enthalpy approaches. The modified air enthalpy approach accounts for the major heating and cooling effects of the portable AC with direct measurements of the product air streams and temperature measurements of the case and ducts. Therefore, DOE is confident in the accuracy of the results from this test approach.

Based on the significant heat input from infiltration air seen from testing, DOE determined that applying such a numerical adjustment for infiltration air to the results of testing with AHAM PAC–1–2014 would accurately reflect portable AC performance. Therefore, DOE proposes the adjusted cooling capacity be determined as follows:

$$\textit{Adjusted Cooling Capacity} = \textit{Capacity}_{cm} - Q_{infiltration} - Q_{misc}$$

Where:

Capacity_{cm} is the cooling capacity as determined in accordance with AHAM PAC–1–2014.

$Q_{infiltration}$ is the sum of sensible (Q_s) and latent (Q_l) heat transfer from infiltration air, as calculated above.

Q_{misc} is the impact of other heat transfer effects, discussed in the following sections.

iii. Test Conditions

AHAM PAC–1–2014 requires two-chamber air enthalpy testing in which the ''indoor'' standard rating conditions are maintained at the evaporator inlet of 80.6 °F dry-bulb temperature and 66.2

°F wet-bulb temperature, which correspond to approximately 46-percent relative humidity. For single-duct units, the condenser inlet conditions are the same as the evaporator inlet. For dual-duct units, the outdoor conditions, as monitored at the interface between the condenser inlet duct and outdoor test room, must be maintained at 95 °F dry-bulb temperature and 75.2 °F wet-bulb temperature (40-percent relative humidity). Because these conditions are close to those required by the DOE room air conditioner test procedure (80 °F dry-bulb temperature and 67 °F wet-bulb temperature on the indoor side, and 95 °F dry-bulb temperature and 75 °F wet-bulb temperature on the outdoor side), test results obtained for portable ACs under the proposed test procedure would be comparable to those for room ACs, which would allow consumers to directly compare these product types. Therefore, DOE proposes to utilize the following ambient conditions presented in

Table III.6 below, based on those test conditions specified in Table 3, ''Standard Rating Conditions,'' of AHAM PAC–1–2014. The test configurations in

Table III.6 refer to the test configurations referenced in Table 2 of AHAM PAC–1–2014, with Test Configuration 3 applicable to dual-duct portable ACs and Test Configuration 5 applicable to single-duct portable ACs.

TABLE III.6—STANDARD RATING CONDITIONS—COOLING MODE

Test configuration	Evaporator inlet air, °F (°C)		Condenser inlet air, °F (°C)	
	Dry bulb	Wet bulb	Dry bulb	Wet bulb
3	80.6 (27)	66.2 (19)	95.0 (35)	75.2 (24)
5	80.6 (27)	66.2 (19)	80.6 (27)	66.2 (19)

For single-duct units, AHAM PAC–1–2014 specifies identical evaporator and condenser inlet conditions, with the same allowable tolerances on the dry-bulb and wet-bulb temperatures. Depending upon the airflow and unit configuration, the evaporator and condenser inlet may be directly adjacent to one another or on opposite faces of the test unit case. Thus, although both evaporator and condenser inlets intake air from the same conditioned space, it is possible that the two inlet air conditions may not simultaneously meet the requirements in AHAM PAC–1–2014 due to slight non-homogeneity in the test chamber, even if one or the other inlet is within tolerance.

Table 2b in Section 8.7 of ANSI/ASHRAE Standard 37–2009, referenced by AHAM PAC–1–2014, specifies that both condenser inlet and evaporator inlet dry-bulb temperatures must be maintained within a range of 2.0 °F and an average within 0.5 °F of the nominal values. However, test chambers may experience varying levels of homogeneity in test conditions and test laboratories may differently prioritize maintaining conditions at either the condenser inlet or evaporator inlet. Therefore, to ensure repeatability and reproducibility, DOE proposes in this NOPR to specify a more stringent tolerance for the evaporator inlet dry-bulb that is consistent with the evaporator inlet wet-bulb temperature tolerance, within a range of 1.0 °F with an average difference of 0.3 °F. The condenser inlet dry-bulb temperature would be maintained within the test tolerance as specified in Table 2b of ANSI/ASHRAE Standard 37–2009. This tolerance modification will ensure that all test laboratories employ the same approach in testing, to first maintain the evaporator inlet test conditions and then ensure that condenser inlet conditions satisfy the tolerance requirements.

As discussed in the May 2014 NODA, portable AC manufacturers typically provide a single mounting fixture for dual-duct units that houses both the condenser inlet and exhaust ducts to minimize installation time and optimize the use of window space. However, this approach typically positions the condenser inlet and exhaust directly adjacent to one another. During operation when installed in the field, short-circuiting may occur between some of the condenser exhaust air and the outdoor ambient air. DOE investigated the effects of potential condenser inlet and exhaust mixing and results indicated that there was minimal mixing between the condenser exhaust and inlet air flows. 79 FR 26639, 26648 (May 9, 2014).

In response to the May 2014 NODA, De' Longhi commented that the condenser inlet and exhaust mixing only has a minimal influence as reported by DOE results. (De' Longhi, No. 3 at p. 4) AHAM agreed with DOE's conclusion that condenser exhaust air and inlet air mixing in dual-duct units need not be addressed or measured in a portable AC test procedure. (AHAM, No. 4 at p. 5)

iv. Duct Heat Transfer and Leakage

In response to the May 2014 NODA, the California IOUs commented that it is unclear if there is a standard test set-up in regards to length of ducting and distance from the portable AC to the outdoor chamber. They suggested that DOE should address alignment of the portable AC and the associated ducting, in relation to the outdoor chamber, including distance, duct length, duct insulation, and duct configuration (*e.g.,* inclusion of bends). (California IOUs, No. 5 at p. 3) Section 7.3.7 and Figure 2 of AHAM PAC–1–2014 address the required ducting arrangement and specifies the duct height, duct length, and spacing of the test unit in relation to the chamber walls. Additionally, duct insulation and unit placement are further discussed in this section and section III.B.1.a.viii of this NOPR.

DOE also received comments from AHAM and De' Longhi expressing concern about including in a portable AC test procedure the effects of heat loss through minimally insulated ducts. They commented that there is no standardized method to account for such heat loss and that incorporating duct heat loss and leakage would impact test reproducibility and repeatability. AHAM stated that the approach DOE used in its investigative testing for estimating duct heat transfer is overly complicated and unnecessary. Accordingly, AHAM and De' Longhi suggested that the DOE test procedure should not address these factors. (AHAM, No. 4 at pp. 3–4; De' Longhi, No. 3 at p. 3)

As discussed in the May 2014 NODA, DOE investigated cooling performance impacts of uninsulated ducts and any air leakage at the duct connections or mounting fixtures. To quantify the heat transfer to the conditioned space through the minimally insulated condenser duct(s) and from any leaks at the duct connections or mounting fixture, DOE repeated the calorimeter testing with insulation surrounding the condenser ducts to benchmark results without this heat transfer for the initial four single-duct and two dual-duct test units. DOE used insulation having a nominal R value of 6 (in units of hours-°F-square feet per Btu), with seams around the duct, adapter, and mounting bracket sealed with tape to minimize air leakage. To determine duct losses and air leakage effects, DOE compared results from these tests to the results from the initial calorimeter approach tests with no insulation. DOE found that uninsulated ducts and leaks in duct connections contribute anywhere from 460 to 1,300 Btu/h, which correlate to percentages of uninsulated cooling capacity that range from 18 to 199 percent. 79 FR 26639, 26645 (May 9, 2014). Therefore, DOE determined that duct heat losses and air leakage are non-negligible effects, and that duct configurations during the DOE test must be representative of actual usage. In addition, DOE notes that Section 7.3.3 of AHAM PAC–1–2014 states that ''the portable AC shall be tested with clean filters in place as supplied by the manufacturer. Other equipment recommended as part of the air conditioner shall be in place, as well.'' DOE proposes, therefore, that all ducting components (*e.g.,* duct, duct connections, and mounting bracket) as supplied by the manufacturer would be used for determining performance and would be installed in accordance with the manufacturer instructions. No additional sealing or insulation would be applied.

Section 7.3.3.3 of ANSI/ASHRAE Standard 37, as referenced by AHAM PAC–1–2014, specifies that the indoor cooling capacity shall be adjusted for heat transferred from the surface of ducts to the conditioned space. DOE recognizes that additional guidance may be necessary to determine such an adjustment, and for this reason proposes to account for heat transferred from the duct surface to the conditioned space in a portable AC test procedure methodology.

DOE proposes that four equally spaced thermocouples be adhered to the side of the entire length of the condenser exhaust duct for single-duct units and to each of the condenser inlet and exhaust ducts for dual-duct units. To ensure accurate heat transfer estimates, DOE proposes that temperature measurements would be required to have an accuracy to within ±0.5 °F. DOE proposes to average the four surface temperatures measurements to obtain T_{duct} for each duct. DOE further proposes that a convection heat transfer coefficient of 4 Btu/h per square foot per °F be used, based on an average of values for forced convection and free convection. The surface area of each duct would be calculated as follows:

$$A_{duct\_j} = \pi \times d_j \times L_j$$

Where:

d_j is the outer duct diameter of duct ''j''.
L_j is the extended length of duct ''j'' while under test.
j represents the condenser exhaust duct and, for dual-duct units, condenser inlet duct.

Heat transferred from the surface of the duct(s) to the indoor conditioned space while operating in cooling mode shall be calculated as follows:

$$Q_{duct\_cm} = \Sigma_j\{h \times A_{duct\_j} \times (T_{duct\_j} - T_{ei})\}$$

Where:

Q_{duct_cm} is the total heat transferred from the duct(s) to the indoor conditioned space in cooling mode.
h is the convection coefficient, 4 Btu/h per square foot per °F.
A_{duct_j} is the surface area of duct ''j'', in square feet.
T_{duct_j} is the average surface temperature for duct ''j'', in °F.
j represents the condenser exhaust duct and, for dual-duct units, condenser inlet duct.
T_{ei} is the average evaporator inlet dry-bulb temperature, in °F.

v. Case Heat Transfer

As discussed previously in section III.B.1.a, DOE baseline testing incorporated a case heat transfer calculation, similar to that required to determine the heat transfer from the duct to the conditioned space in ANSI/AHAM Standard 37–2009, in lieu of the evaporator circulating fan heat measurement specified in AHAM PAC–1–2014. To determine case heat transfer, DOE placed four thermocouples on each face of the case to calculate average surface temperatures throughout the cooling mode test period. Table III.7 shows the average surface temperatures during the baseline testing for all single-duct and dual-duct test units.

TABLE III.7—COOLING MODE CASE SURFACE TEMPERATURES

Test unit	Average surface temperature during AHAM test (°F)						Average
	Top	Front	Right	Back	Left	Bottom	
SD1	79.4	81.6	81.5	81.3	81.9	84.2	81.7
SD2	79.6	79.0	80.9	89.2	91.5	88.5	84.8
SD3	76.6	82.3	80.0	82.3	84.9	83.0	81.5
SD4	73.0	85.3	92.2	82.9	82.7	84.8	83.5
SD5	77.9	81.3	82.3	83.6	82.4	89.8	82.9
SD6	72.8	80.5	78.5	81.7	81.9	86.0	80.2
SD7	73.2	82.8	82.7	81.4	78.2	87.7	81.0
SD8	88.6	79.7	84.2	91.2	87.8	77.3	84.8
SD9	78.2	85.0	77.8	86.0	80.5	93.3	83.5
SD10	76.8	91.4	84.3	84.5	85.0	97.4	86.6
SD11	79.8	87.7	85.4	84.5	87.6	90.6	85.9
SD12	72.7	82.2	80.8	81.8	80.3	81.2	79.8
SD13	72.8	79.7	81.1	81.8	82.2	83.7	80.2
SD14	75.6	78.9	79.2	84.1	81.5	81.8	80.2
SD15	79.9	83.7	81.1	81.4	85.9	80.6	82.1
SD16	75.5	88.1	88.1	80.3	81.7	84.5	83.0
SD17	80.3	80.0	83.4	94.9	91.0	95.1	87.4
SD18	76.4	78.8	79.1	81.4	78.9	87.2	80.3
DD1	75.1	78.0	80.2	82.7	80.5	81.4	79.7
DD2	80.8	75.9	80.6	86.7	81.0	87.7	82.1
DD3	76.7	80.2	80.7	86.4	81.8	81.4	81.2
DD4	78.2	79.8	80.3	85.2	79.9	89.2	82.1
DD5	75.7	77.0	82.2	84.6	83.2	85.1	81.3
DD6	76.7	78.3	81.0	85.1	79.0	78.1	79.7
DD7	74.4	83.3	79.6	88.0	76.9	80.3	80.4

TABLE III.7—COOLING MODE CASE SURFACE TEMPERATURES—Continued

Test unit	Average surface temperature during AHAM test (°F)						Average
	Top	Front	Right	Back	Left	Bottom	
Average	77.1	81.6	81.9	84.5	82.7	85.6	

As shown in Table III.7, surface temperature varies significantly among different case surfaces of a given test unit during cooling mode, and that variation is a function of the particular test unit. For example, temperatures on test unit SD1 ranged from a top surface temperature of 79.4 °F to a bottom side temperature of 84.2 °F, a range of 4.8 °F, while test unit SD10 had a top surface temperature of 76.8 °F and a bottom side temperature of 97.4 °F, a range of 20.7 °F. Because each surface on a given test unit has a unique surface area and average surface temperature, DOE proposes that the heat transfer from the case to the ambient indoor space be calculated individually for each surface.

In response to the same methodology proposed in the May 2014 NODA, AHAM commented that this approach for estimating case heat transfer is overly complicated and unnecessary. AHAM believes that the approach in AHAM PAC–1–2014, which directly measures the evaporator circulating fan heat, is easier and simpler. AHAM also stated that DOE's method would introduce unnecessary variation in test results. (AHAM, No. 4 at p. 3)

DOE acknowledges that the proposed case heat transfer approach would require additional instrumentation. However, DOE believes that the testing burden imposed by the use of multiple thermocouples to measure surface temperatures is likely outweighed by the benefit of addressing the heat transfer effects of all internal heating components. In contrast, AHAM PAC–1–2014 only considers the evaporator fan heat, which is just one of the components that generates heat internally. Further, the proposed surface temperature approach would provide a direct measure of the overall heat transfer of heat-contributing components within the case to the room, without assuming the proportion of heat transferred to either the cooling or heat rejection side.

Therefore, DOE proposes in this NOPR that cooling mode testing include case surface heat transfer measured by means of four evenly spaced thermocouples placed on each case surface. The thermocouples would be positioned such that the case surface, when divided into quadrants, contains at least one thermocouple in each quadrant. If even spacing would result in a thermocouple being placed on an air inlet or exhaust grille, the thermocouple would be placed adjacent to the inlet or exhaust grille, maintaining the even spacing as closely as possible. To ensure accurate heat transfer estimates, DOE proposes to specify that temperature measurements be accurate to within ±0.5 °F. DOE further proposes to average the four surface temperatures measurements on each side to obtain T_{case} for that side.

The surface area of each case side, A_{case}, would be calculated as the product of the two primary surface dimensions, as follows:

$$A_{case\_k} = D_{1\_k} \times D_{2\_k}$$

Where:

D_1 and D_2 are the two primary dimensions of the case side "k" exposed to ambient air.

k represents the case sides including, front, back, right, left, top, and bottom.

Heat transferred from all case sides to the indoor conditioned space would be calculated according to the following:

$$Q_{case\_cm} = \Sigma_k\{h \times A_{case\_k} \times (T_{case\_k} - T_{ei})\}$$

Where:

Q_{case_cm} is the total heat transferred from all case sides to the indoor conditioned space in cooling mode.

h is the convection coefficient, 4 Btu/h per square foot per °F.

k represents the case sides including: front, back, right, left, top, and bottom.

A_{case_k} is the surface area of case side "k", in square feet.

T_{case_k} is the average surface temperature of case side "k", in °F.

T_{ei} is the average evaporator inlet air dry-bulb temperature, in °F.

vi. Condensate Collection

Many portable ACs include a feature to re-evaporate the condensate and remove it from the indoor space through the condenser exhaust air stream. This feature is performed by slinging or directing condensate that collects and drips off of the evaporator on to one or multiple condenser coil surfaces. All units in DOE's test sample included this feature. In the event that the condensate collection rate exceeds the removal rate of the auto-evaporation feature and the internal condensate collection bucket fills, all of the units provide a drain option to remove the collected condensate. Portable ACs typically ship with this drain sealed with a temporary plug, although a consumer-supplied drain line may also be installed. Manufacturer setup instructions typically do not specify that a drain line be installed during normal operation, relying primarily instead on the auto-evaporative condensate removal feature.

In response to the May 2014 NODA, the California IOUs confirmed DOE's research and indicated that there are different methods of handling condensate. Units may include an internal reservoir with a fill sensor to interrupt operation until the reservoir is emptied, a heater to re-evaporate the water into the exhaust air stream, or slingers that pass the condensate over the condenser to re-evaporate condensate and improve heat transfer. The California IOUs recommended that DOE address the different means of condensate handling. (California IOUs, No. 5 at p. 4) DOE agrees that a portable AC test procedure should recognize various methods of condensate removal to ensure comparable results among units with different condensate removal approaches.

DOE's investigative testing was conducted with a drain line attached to simplify condensate draining if necessary, but the line was elevated to simulate testing with the drain plug in place. Nonetheless, DOE observed that the auto-evaporation feature was effective for all test units under testing conditions so that no unit cycled off due to a full condensate bucket. Therefore, DOE proposes that the portable AC under test be set up in accordance with manufacturer instructions. If an auto-evaporative feature is provided along with a condensate drain, and the drain setup is unspecified, the drain plug would remain in place as shipped and no means of condensate removal would be installed for the duration of cooling mode testing. If the internal bucket fills during testing, the test would be invalid and halted, the drain plug would be removed, means would be provided to drain the condensate from the unit, and the test would be started from the beginning.

Section 7.1.2 of AHAM PAC–1–2014 contains provisions for portable ACs that incorporate condensate pumps that cycle to dispose condensate collected by the unit. DOE found through market research and by investigating units in its test sample that units that include a condensate pump typically include an auto-evaporative feature. However, the activation of the condensate pump may differ in different operating modes. For example, one unit in DOE's sample activated the condensate pump only in heating mode, with condensate removed solely via auto-evaporation in cooling mode. DOE did not observe any units in its test sample that depended upon only a condensate pump for removing condensate during cooling mode.

Section 6.3.3 of AHAM PAC–1–2014 states that ''. . . equipment recommended as part of the air conditioner shall be in place.'' Therefore, DOE proposes that portable AC cooling mode testing would be performed in accordance with manufacturer installation and setup instructions, unless otherwise specified in the DOE test procedure. In addition, where available and as instructed by the manufacturer, DOE proposes that the auto-evaporation feature would be utilized for condensate removal during cooling mode testing. If no auto-evaporative feature is available, the gravity drain would be used. If no auto-evaporative feature or gravity drain is available, or if the manufacturer specifies the use of an included condensate pump during cooling mode operation, then DOE proposes that the portable AC would be tested with the condensate pump enabled. For these units, DOE also proposes to require the use of Section 7.1.2 of AHAM PAC–1–2014 if the pump cycles on and off.

vii. Control Settings

Portable ACs typically incorporate electronic controls that allow selection of the fan speed during cooling or heating mode. The highest fan speed will produce the most rapid rate of cooling or heating, while the lower fan speeds may be provided to reduce noise. Section 7.3.1 of AHAM PAC–1–2014 states that all adjustable settings, including fan speed, shall be set to achieve maximum capacity. Although the fan speed setting is clearly specified, it is not clear what setting should be selected for the cooling or heating setpoint. Many portable ACs have controls that allow consumers to select a target temperature, for example by setting the desired temperature or by adjusting a dial to a more or less cool setting. When the cooling setpoint temperature is lower than the ambient temperature, or higher than the ambient temperature in heating mode, the portable AC will operate continuously. AHAM PAC–1–2014 requires that the test chamber be maintained at 80.6 °F throughout the cooling mode test period, during which the unit must operate continuously, but does not specify a particular cooling setpoint temperature. To ensure that the test unit does not enter off-cycle mode, the test operator must select a control setting that corresponds to a temperature lower than 80.6 °F, particularly because no portable ACs in DOE's test sample included a ''continuous on'' setting. Because DOE acknowledges the potential for a unit to operate differently when cooling controls are set to different target temperatures below 80.6 °F, DOE proposes during cooling mode testing that the fan be set at the maximum speed if the fan speed is user adjustable and the temperature controls be set to the lowest available value. Similarly, as discussed in section III.B.1.b.i, DOE proposes during heating mode testing that the fan be set at the maximum speed if the fan speed is user adjustable and the temperature controls be set to the highest available value. These settings would likely best represent the settings that a consumer would select to achieve the primary function of the portable AC, which is to cool or heat the desired space as quickly as possible and then to maintain these conditions.

A number of test units in DOE's test sample included the option to oscillate the evaporator exhaust louvers to help circulate air throughout the conditioned space. Although AHAM PAC–1–2014 does not directly address louver oscillation, Section 7.3.1 of AHAM PAC–1–2014 states that all adjustable setting such as louvers, fan speed, and special functions must be set for maximum capacity. Accordingly, if there is a setting that automatically opens and closes the louvers, this feature would be disabled for the entirety of the rating test period, and the louvers would be opened to allow maximum capacity. If there is a manual setting to control louver direction and opening size, in accordance with section 7.3.1 of AHAM PAC–1–2014, the louvers shall be fully open to provide maximum airflow and capacity, and be positioned parallel to the air flow. However, this provision does not address an oscillating louver function that maintains constant and maximum louver exhaust area while redirecting the evaporator exhaust air flow. DOE does note, though, that AHAM PAC–1–2014 requires a constant external static pressure that is consistent with typical operation. The static pressure is initially affected by the test instrumentation that is placed over the evaporator exhaust grille to capture and measure the air flow rate, temperature, and humidity, such that a variable speed fan is required to adjust the external static pressure to ensure it is representative of normal operation. If the louvers were oscillating during the test period, the external static pressure measured at the evaporator exhaust would vary cyclically and thus the test would no longer be compliant with the required conditions. Also, oscillating louvers may interfere with the temperature and humidity instrumentation and possibly dislodge them, which could impact the measured performance and the integrity of the test procedure. In addition, DOE lacks information on the percentage of time that this feature is selected among those units equipped with oscillating louvers. Therefore, to provide comparable testing results in cooling mode for products with and without a louver oscillation feature, DOE proposes that portable AC cooling mode testing be conducted with any louver oscillation feature disabled. If the feature is included but there is no option to disable it, testing shall proceed with the louver oscillation enabled, without altering the unit construction or programming. DOE requests feedback on the proposal to disable louver oscillation where available and to maximize louver opening, either manually or by disabling an automatic feature.

viii. Test Unit Placement

Section 8.1.3 of ANSI/ASHRAE Standard 37 states that the outdoor condition test room must be of sufficient volume and circulate air in a manner that does not change the normal air-circulation patterns of the unit under test. Specifically, the dimensions of the room must be sufficient to ensure that the distance from any room surface to any equipment surface where air is discharged is not less than 6 feet and the distance to all other equipment surfaces must be no less than 3 feet. However, no comparable requirements are specified for the indoor test room. When tested according to AHAM PAC–1–2014 and ANSI/ASHRAE Standard 37, a portable AC is set up entirely within the indoor condition test room with the evaporator exhaust connected to instrumentation and ducted away from the test unit, and the condenser exhaust ducted with instrumentation to the outdoor test room. In that case, the requirements in Section 8.1.3 of ASNI/ASHRAE Standard 37 are not applicable, as no part of the case is within the outdoor condition test room. Instead, the portable AC is placed in the indoor condition test room, where walls and other obstructions may impede air flow for the evaporator inlet for all configurations, and the condenser inlet for single-duct units. Therefore, to ensure performance is as repeatable and representative as possible, DOE concludes that the same distance requirements included in Section 8.1.3 of ANSI/ASHARE Standard 37 would be applicable to the indoor condition test room when testing portable ACs. DOE proposes that for all portable AC configurations, there must be no less than 6 feet from the evaporator inlet to any chamber wall surfaces, and for single-duct units, there must be no less than 6 feet from the condenser inlet surface to any other wall surface. Additionally, there must be no less than 3 feet between the other surfaces of the portable AC with no air inlet or exhaust (other than the bottom of the unit) and any wall surfaces.

ix. Electrical Supply

Section 7.3.2 of AHAM PAC–1–2014 does not require a specific test voltage, but rather states that the nameplate voltage shall be used. DOE notes that its dehumidifier test procedure requires a test voltage of either 115 or 230 volts (V), and these voltages would be comparable to those required for portable ACs, which are similar consumer products. To maintain repeatability and reproducibility for portable AC testing, DOE proposes that for active mode testing, the input standard voltage would be maintained at 115 V ±1 percent. DOE also proposes that the electrical supply be set to the nameplate listed rated frequency, maintained within ±1 percent.

b. Heating Mode

In response to the May 2014 NODA, DOE received a comment from the California IOUs suggesting that any future DOE test procedure for portable ACs include a measure of heating mode energy consumption. They stated that about 25 percent of models for sale at a major home improvement retailer include a heating function, and all of these models were marketed as a portable AC. The California IOUs suggested that DOE should ensure that the scope of a proposed test procedure that covers any products marketed as a portable AC also include testing the product's heating performance. (California IOUs, No. 5 at pp. 3–4)

DOE is aware that certain portable ACs, including some of the units in DOE's test sample, incorporate a heating function in addition to cooling and air-circulation modes. During teardowns, DOE found that there are two primary approaches to implement a heating function for portable ACs. The first, and most common, is a reverse-cycle heat pump, which requires a four-way reversing solenoid valve in the refrigerant loop that reroutes the refrigerant flow and converts the cooling air conditioning system to a heat pump. The second type of heating that DOE observed during teardowns was a resistance heater installed adjacent to the evaporator and in line with the evaporator exhaust air stream.

In consideration of the comment received and DOE's market and teardown observations, DOE conducted additional research to determine whether it could incorporate appropriate test methodology to measure heating mode energy consumption in a DOE portable AC test procedure.

i. General Test Approach

ANSI/ASHRAE Standard 37, the basis for DOE's proposed air enthalpy cooling mode test procedure, is intended for heat pump equipment in addition to air conditioning equipment. Section 1.1 of ANSI/ASHRAE Standard 37 states that the purpose of the standard is, in addition to determining cooling capacity of air conditioning equipment, providing methods to determine cooling and heating capacities of heat pump equipment. DOE reviewed ANSI/ASHRAE Standard 37 and determined that the same test chamber and instrumentation requirements and capacity calculations would apply to portable AC heating mode testing as for the proposed cooling mode testing. Further, as with the cooling mode test, the unit configurations included in AHAM PAC–1–2014 would be applicable to a heating mode test. Therefore, DOE proposes that the test unit be set up for a heating mode energy consumption test in accordance with the unit and duct setup requirements of AHAM PAC–1–2014, including those in Table 2 and Figure 1 of that standard. DOE also proposes to specify the same test requirements as for cooling mode, including infiltration air, duct heat transfer, case heat transfer, control settings, and test unit placement, discussed in the subsections of section III.B.1.a of this NOPR. However, DOE proposes that the temperature setpoint for heating mode be at the highest available temperature setting to ensure continuous operation.

ii. Ambient Test Conditions

ANSI/ASHRAE Standard 37 specifies the test setup, instrumentation, and test conduct, but does not specify the ambient test conditions for testing. For cooling mode, AHAM PAC–1–2014 provides the ambient test conditions for testing. To determine appropriate test conditions for a heating mode test, DOE reviewed ANSI/Air-Conditioning, Heating, and Refrigeration Institute (AHRI) 210/240—2008, ''Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment'' (ANSI/AHRI 210/240), which provides test conditions for determining performance of ACs and heat pumps. Table 4 of Section 6.1.4.2 of ANSI/AHRI 210/240 provides three test conditions in heating mode for a heat pump with a single-speed compressor and a fixed-speed indoor fan. The indoor air temperatures are the same for all three tests, 70 °F dry-bulb and 60 °F wet-bulb. For the outdoor air inlet temperatures, the high-temperature test, ''H1,'' requires 47 °F dry-bulb and 43 °F wet-bulb, while the frost accumulation test, ''H2,'' requires 35 °F dry-bulb and 33 °F wet-bulb, and the low-temperature test, ''H3,'' specifies 17 °F dry-bulb and 15 °F wet bulb.

DOE believes that the test conditions for H1 are the most representative of typical heating mode use for portable ACs, which are likely used as supplemental or low-capacity heaters when a central heating system is not necessary or operating. Therefore, DOE proposes the following ambient air test conditions as shown in Table III.8 below, with the test configurations referring to the test configurations referenced in Table 2 of AHAM PAC–1–2014. Test Configuration 3 is applicable to dual-duct portable ACs, and Test Configuration 5 is applicable to single-duct portable ACs. DOE notes that the terms ''Evaporator'' and ''Condenser'' refer to the heat exchanger configuration in cooling mode, not the reverse-cycle heating mode. This terminology maintains consistency with the cooling mode test conditions specification and would still be applicable for portable ACs that incorporate a resistance heater.

TABLE III.8—STANDARD RATING CONDITIONS—HEATING MODE

Test configuration	Evaporator inlet air, °F (°C)		Condenser inlet air, °F (°C)	
	Dry LBulb	Wet LBulb	Dry bulb	Wet bulb
3	70.0 (21.1)	60.0 (15.6)	47.0 (8.33)	43.0 (6.11)
5	70.0 (21.1)	60.0 (15.6)	70.0 (21.1)	60.0 (15.6)

iii. Adjusted Heating Capacity Calculation

Under the proposed heating mode testing conditions, DOE expects that the calculations provided by AHAM PAC–1–2014 would result in negative cooling (*i.e.,* heating) capacity values because the outdoor side temperature is lower than the indoor side temperature. Therefore, DOE proposes to multiply the resulting capacity by −1 to produce a positive value that would represent the amount of heating produced rather than cooling. Further, because heat transfer from the ducts and the case to the room would decrease the net heating in the conditioned space, these negative heating values must be added to the heating capacity in the adjusted capacity calculation. For the infiltration air heat transfer, the lower temperature of the infiltration air compared to the evaporator inlet temperature results in a negative temperature differential in the heat transfer calculation, which would result in a negative value for the heat contribution to the conditioned space. Thus, the infiltration air provides net cooling, and the resulting negative value would also be added to the heating capacity to obtain the adjusted heating capacity (AHC) in the heating mode, expressed in Btu/h, according to the following:

$$AHC = Capacity_{hm} + Q_{duct\_hm} + Q_{case\_hm} + Q_{infiltration\_hm}$$

Where:

$Capacity_{hm}$ is the heating capacity measured in section 4.1.2 of this appendix.
Q_{duct_hm} is the duct heat transfer while operating in heating mode, measured in section 4.1.2 of this appendix.
Q_{case_hm} is the case heat transfer while operating in heating mode, measured in section 4.1.2 of this appendix.
$Q_{infiltration\_hm}$ is the infiltration air heat transfer while operating in heating mode, measured in section 4.1.2 of this appendix.

2. Off-Cycle Mode

Certain portable ACs maintain blower operation without activation of the compressor after the temperature setpoint has been reached, rather than entering standby mode or off mode, or may operate with a combination of periods of blower operation and standby mode after reaching the setpoint. The fan-only operation may be intended to draw air over the internal thermostat to monitor ambient conditions, or may occur immediately following a period of cooling mode to defrost and dry the evaporator coil (or the condenser coil when operating in reverse-cycle heating mode). The blower may operate continuously, or may cycle on and off intermittently. In addition, some units allow the consumer to select operation of the blower continuously for air circulation purposes, without activation of the refrigeration system.

The existing industry portable AC test procedures do not presently contain provisions to measure energy use during this fan-only operation. However, DOE recently proposed a method for determining fan-only mode energy use in DOE's test procedure for dehumidifiers based on existing methodologies for measuring power consumption in standby mode and off mode (hereinafter referred to as the ''dehumidifier test procedure NOPR''). 79 FR 29272 (May 21, 2014). In the dehumidifier test procedure NOPR, DOE proposed measuring fan-only mode average power by adjusting the setpoint to a relative humidity that is higher than the ambient relative humidity to ensure that the refrigeration system does not cycle on. To minimize testing burden, DOE proposed that the testing may be conducted immediately after the conclusion of dehumidification mode testing while maintaining the same ambient conditions, or may be conducted separately under the test conditions specified for standby mode and off mode testing. *Id.* at 29291.

In the dehumidifier test procedure NOPR, DOE observed that the period of cyclic fan operation was approximately 10 minutes for dehumidifiers with cyclical fan-operation in fan-only mode. In addition, DOE's research indicated that some units may cycle on for a period of a few minutes per hour. In order to obtain a representative average measure of fan-only mode power consumption, DOE proposed that the fan power be measured and averaged over a period of 1 hour for fan-only mode in which the fan operates continuously. For fan-only mode in which the fan operates cyclically, the average fan-only mode power would be measured over a period of 3 or more full cycles for no less than 1 hour. DOE also clarified that units with adjustable fan speed settings would be set to the maximum fan speed during fan-only mode testing, because the maximum speed is typically recommended to consumers as the setting that produces the maximum moisture removal rate. *Id.*

DOE subsequently published a supplemental notice of proposed rulemaking (SNOPR) on February 4, 2015, that modified the proposal in the dehumidifier test procedure NOPR based on feedback from interested parties and further research (hereinafter referred to as the ''dehumidifier test procedure SNOPR''). 80 FR 5994. DOE withdrew the fan-only mode definition proposed in the dehumidifier test procedure NOPR and instead modified the proposed ''off-cycle mode'' definition to encompass all operation when dehumidification mode has cycled off after the humidity setpoint has been reached. DOE proposed to define off-cycle mode as a mode in which the dehumidifier:

(1) Has cycled off its main moisture removal function by humidistat, humidity sensor, or control setting;

(2) May or may not operate its fan or blower; and

(3) May reactivate the main moisture removal function according to the humidistat or humidity sensor signal.

(*Id.*)

During investigative testing for this rulemaking, DOE found that all portable ACs in its test sample operate the fan in off-cycle mode, similar to dehumidifiers, once cooling mode operation reduces the ambient temperature below the set point. DOE investigated the approach for measuring this fan operation as a part of off-cycle mode, as was proposed in the dehumidifier test procedure SNOPR, and found that it was applicable to portable ACs. Table III.9 shows the results from this portable AC off-cycle mode investigative testing.

TABLE III.9—POWER IN OFF-CYCLE MODE *

Single-duct		Dual-duct	
Unit	Unit power (W)	Unit	Unit power (W)
SD1	175.0	DD1	69.3
SD3	60.4	DD2	76.9
SD4	85.1	DD4	224.9
SD5	109.6	DD5	47.6
SD6	80.14	DD6	76.3
SD7	77.0	DD7	74.8
SD8	211.0		
SD9	91.2		
SD10	108.3		
SD11	87.9		
SD12	49.7		
SD13	50.0		
SD14	55.4		
SD15	38.9		
SD16	95.1		

* Data for units SD2 and DD3 were not available

Due to the similarity between dehumidifiers and portable ACs, and to maintain harmonization among similar test procedures, DOE proposes in this NOPR that off-cycle mode for portable ACs be defined as proposed in the dehumidifier test procedure SNOPR, modified for portable AC operation in either cooling or heating mode. Specifically, DOE proposes to define off-cycle mode as a mode in which the portable air conditioner:

(1) Has cycled off its main heating or cooling function by thermostat or temperature sensor;

(2) May or may not operate its fan or blower; and

(3) Will reactivate the main cooling or heating function according to the thermostat or temperature sensor signal.

In the dehumidifier test procedure SNOPR, DOE proposed that off-cycle mode measurement begin immediately following compressor operation for the dehumidification mode test to ensure sufficient condensation on the evaporator to initiate fan operation for those units that dry the evaporator coil. DOE asserted that conducting the off-cycle mode test subsequent to the dehumidification mode test would capture all energy use of the dehumidifier under conditions that meet the newly proposed off-cycle mode definition, including fan operation intended to dry the evaporator coil, sample the air, or circulate the air. 80 FR 5994.

In this NOPR, DOE proposes that portable AC off-cycle mode energy use be measured five minutes after the termination of compressor operation in cooling mode. Because the evaporator is still cool at the end of compressor operation in cooling mode, additional room cooling is possible through continued fan operation at relatively low energy consumption. Therefore, DOE proposes the 5-minute delay before the start of off-cycle mode testing to prevent penalizing manufacturers for utilizing the cooling potential of the evaporator following the compressor cycle. Continued fan operation once that cooling potential is no longer available would be included as off-cycle mode energy consumption and factored into the CEER measurement.

In the dehumidifier test procedure SNOPR, DOE determined, based on data from its testing, that 2 hours is a typical off-cycle duration and would therefore be a representative test duration for off-cycle mode. 80 FR 5994. In lieu of field data for portable AC operation in off-cycle mode, and due to the similarity between typical portable dehumidifiers and portable ACs, DOE believes that the analysis conducted for dehumidifiers is representative for portable ACs. Therefore, DOE proposes that the off-cycle mode test begin 5 minutes after the completion of the cooling mode test and end after a period of 2 hours. DOE further proposes that the electrical supply be the same as specified for cooling mode, as discussion section III.B.1.a.ix, and that this measurement be made using the same power meter specified for standby mode and off mode, as discussed in section III.3.

DOE further proposes to require that, for units with adjustable fan speed settings, the fan be set at the maximum speed during fan-only mode testing, because the maximum speed is typically recommended to consumers as the setting that produces the maximum rate of cooling or heating.

DOE estimates that off-cycle mode energy consumption is similar for periods following both heating mode and cooling mode because the fan speed setting is selected by the same controls and all other significantly energy consumptive components are disabled. Therefore, to minimize testing burden, DOE proposes that off-cycle mode testing be conducted only after cooling mode. Annual hours for off-cycle mode would be allocated for the total hours in this mode following either cooling mode or heating mode.

3. Standby Mode and Off Mode

Section 310 of the Energy Independence and Security Act of 2007 (EISA 2007), Public Law 110–140, amended EPCA to require DOE to amend the test procedures for covered products to address standby mode and off mode energy consumption. Specifically, the amendments require DOE to integrate standby mode and off mode energy consumption into the overall energy efficiency, energy consumption, or other energy descriptor for each covered product unless the current test procedures already fully account for such consumption or integration of such test procedure is technically infeasible. If integration is technically infeasible, DOE must prescribe a separate standby mode and off mode energy use test procedure, if technically feasible. (42 U.S.C. 6295(gg)(2)(A)) Any such amendment must consider the most current versions of IEC Standard 62301, ''Household electrical appliances—Measurement of standby power,'' and IEC Standard 62087, ''Methods of measurement for the power consumption of audio, video, and related equipment.'' *Id.*

In addition, these amendments direct DOE to incorporate standby mode and off mode energy use into any final rule establishing or revising an energy conservation standard for a covered product adopted after July 1, 2010. If it is not feasible to incorporate standby mode and off mode into a single amended or new standard, then the statute requires DOE to prescribe a separate standard to address standby mode and off mode energy consumption. (42 U.S.C. 6295(gg)(3))

a. Mode Definitions

Should DOE determine to classify portable ACs as a covered product, DOE would be required to promulgate energy conservation standards that incorporate energy use in active mode, standby mode, and off mode into a single metric, if feasible, in accordance with EISA 2007. (42 U.S.C. 6295 (gg)(3)) In addition, a DOE test procedure for portable ACs would be required to measure and, if feasible, integrate standby mode and off mode energy consumption into the overall energy descriptor. (42 U.S.C. 6295 (gg)(2)) Therefore, DOE is proposing the following definitions and methods to measure standby mode and off mode energy consumption for portable ACs. Based on the similar components and primary function to room ACs and dehumidifiers, DOE proposes standby mode and off mode definitions for portable ACs that are similar to those included in the room AC and dehumidifier test procedures found in appendix F and appendix X, respectively, codified at 10 CFR part 430, subpart B.

''Standby mode'' would mean any mode where a portable air conditioner is connected to a mains power source and offers one or more of the following user-oriented or protective functions which may persist for an indefinite time:

(a) To facilitate the activation of other modes (including activation or deactivation of active mode) by remote switch (including remote control), internal sensor, or timer; or

(b) Continuous functions, including information or status displays (including clocks) or sensor-based functions. A timer is a continuous clock function (which may or may not be associated with a display) that provides regular scheduled tasks (*e.g.,* switching) and that operates on a continuous basis.

DOE is aware of two relevant modes that would meet the proposed definition of standby mode for portable ACs: (1) Inactive mode and (2) bucket-full mode.

Portable ACs often include a digital control board with switches or a remote control device to modify settings and initiate or disable cooling, heating, or air circulation. When the unit is plugged in and awaiting a signal to initiate one of the active modes, it would be considered to be in ''inactive mode.'' That is, inactive mode would be defined as a standby mode that facilitates the activation of active mode by remote switch (including remote control), internal sensor, or timer, or that provides continuous status display.

Unlike room ACs, portable ACs are installed and operated entirely within the conditioned space, and thus do not have a means to discharge any liquid condensate directly outdoors. Although many portable ACs incorporate a feature to re-evaporate the condensate and exhaust it in the condenser outlet air stream, under certain ambient conditions this moisture removal rate may not be high enough to exhaust all of the condensate. Thus, portable ACs may enter a ''bucket-full mode'' when the condensate level in the internal collection container reaches a manufacturer-specified threshold or the collection container is removed; any cooling, heating, or air-circulation functions are disabled; and an indication is provided to the consumer that the container is full. The portable AC will reactivate the main cooling, heating, or air-circulation function once the collection container is drained or emptied and is in place in the unit.

DOE is also aware of an additional low-power mode for portable ACs with power consumption levels comparable to inactive mode and bucket-full modes. ''Delay-start mode'' facilitates activation of an active mode by a timer. Due the similarity in power consumption levels between delay-start mode and inactive mode, DOE proposes to consider the power consumption in inactive mode as representative of delay-start mode and to include the operating hours for delay-start mode in the estimate for inactive mode operating hours for the purposes of calculating a combined metric. In other words, DOE is not proposing to measure delay-start mode. DOE believes that this approach will minimize test burden and simplify testing and determination of overall performance.

Although all units in DOE's test sample had electronic controls and therefore default to inactive mode when connected to a power source, DOE recognizes that some portable ACs may instead utilize electromechanical controls, and therefore may employ an ''off mode,'' in which a portable AC is connected to a mains power source and is not providing any active mode or standby mode function, and where the mode may persist for an indefinite time. An indicator that only shows the user that the product is in the off position is included within the classification of an off mode.

b. Determination of Standby Mode and Off Mode Power Consumption

In accordance with the requirements of EISA 2007, DOE is proposing to specify testing equipment and conditions for measuring standby mode and off mode power consumption in the portable AC test procedure based on the provisions from IEC Standard 62301. (42 U.S.C. 6295 (gg)(1)(B)) The measured wattages would then be used in calculations to determine standby mode and off mode energy consumption. DOE has reviewed IEC Standard 62301, and tentatively concluded that it is generally applicable to portable ACs, with certain clarifications, and notes that a similar determination has already been made for the DOE test procedures for closely-related covered products, such as dehumidifiers and room air conditioners. AHAM PAC–1–2014 also references IEC Standard 62301 for portable AC standby power measurements.

In examining portable AC operation, DOE recognizes that there is a certain commonality between inactive mode and bucket-full mode, in that there are no major energy-consuming components energized and there is typically only a display to the consumer that provides information as to product status. Therefore, DOE expects that the power consumption these two modes is comparable.

In the interest of reducing testing burden, DOE proposes not to require the power consumption in both of these modes be measured individually. Rather, DOE proposes that the power consumption in just inactive mode would be measured, and the annual hours assigned to that power measurement would be the sum of annual hours for inactive mode and bucket-full mode. DOE requests comment on this proposed simplification of testing, including whether the resulting calculation would adequately represent product energy use and whether it would instead be appropriate to measure each mode separately.

DOE proposes that the test room ambient air temperatures for standby mode and off mode testing would be specified in accordance with Section 4, Paragraph 4.2 of IEC Standard 62301. The IEC standard specifies a temperature range of 73.4 ± 9 °F, while the proposed DOE test procedure for portable ACs would specify an indoor-side test room ambient temperature of 80.6 ± 0.5 °F dry-bulb temperature for the cooling mode test and 70.0 ± 0.5 °F dry-bulb temperature for the heating mode test. This proposed test procedure would allow manufacturers of portable ACs to conduct active mode efficiency testing and standby mode and off mode power consumption testing simultaneously in the same room on multiple portable ACs, as long as the temperature and setup requirements (*e.g.,* duct setup, instrumentation, unit placement) for both tests are met. Alternatively, the proposed temperature specifications taken from IEC Standard 62301 would allow a manufacturer that opts to conduct standby mode and off mode testing separately from active mode testing to use the ambient temperature requirements of 73.4 ± 9 °F. DOE requests comment on the appropriateness of this proposed test room ambient temperature range. DOE further proposes that the portable AC would be installed in accordance with the unit installation and preparation instructions in Section 5.2 of IEC 62301, while disregarding the provisions regarding batteries and the determination, classification, and testing of relevant modes. DOE is not aware of any portable ACs that incorporate batteries other than in remote controls.

For the duration of standby-mode and off-mode testing, DOE proposes that the electrical supply voltage shall be maintained at 115 V ±1 percent and supply frequency would be maintained at the rated frequency within ±1 percent. DOE notes that these requirements are consistent with those proposed for cooling mode, and the tolerances are in accordance with Section 4, Paragraph 4.3.1 of IEC Standard 62301. The supply voltage waveform and wattmeter would comply with the requirements in Section 4, Paragraphs 4.3.2 and 4.4 of IEC Standard 62301, respectively.

DOE is aware that some portable ACs may reduce power consumption after a period of user inactivity after entering standby mode or off mode. For products whose power consumption in standby mode or off mode varies in this manner during testing, DOE proposes that the test for inactive mode and off mode be conducted after the power level has dropped to its lowest level, as discussed in Note 1 in Section 5.1 of IEC Standard 62301. DOE further proposes that the test procedure in Section 5, Paragraph 5.3.2 of IEC Standard 62301 then be followed for inactive mode, off-cycle mode, and off mode, as available on the test unit.

4. Combined Energy Efficiency Ratio

In accordance with the requirements of EISA 2007, DOE is required for covered products to establish a single energy conservation standard metric that incorporates standby mode and off mode energy use, if feasible, for standards adopted after July 1, 2010. (42 U.S.C. 6295(gg)(3)(A)) For certain products, including dehumidifiers and room ACs, DOE has combined the energy use for active modes, off-cycle mode, standby modes, and off mode into a single efficiency metric using a weighted average based on annual operating hours in each mode. DOE proposes a similar approach for portable ACs based on operating hours per mode which may be available on the unit, including cooling mode, heating mode, off-cycle mode (with and without fan operation), inactive mode (including bucket-full mode), and off mode. As discussed previously in section III.B.1 of this NOPR, DOE is not addressing dehumidification mode for portable ACs in this proposal because the annual operating hours are likely small and it is not technically feasible to integrate the efficiency descriptor with an EER metric.

a. CEER Calculations

DOE proposes the following approach to combine energy use in each of the considered modes into a single integrated efficiency metric, CEER. Average power in each mode would be measured according to the proposals in section III.B.1.a through section III.B.1.2 and section III.B.3 of this NOPR, and then individually multiplied by the annual operating hours for each respective mode, discussed in section III.4.b of this NOPR.

$$AEC_m = P_m \times t_m \times k$$

Where:

AEC_m is the annual energy consumption in each mode, in kWh/year.
P_m is the average power in each mode, in watts (W).
t_m is the number of annual operating hours in each mode.
m designates the operating mode (''cm'' cooling, ''hm'' heating, ''oc'' off-cycle, and ''im'' inactive or ''om'' off mode).
k is 0.001 kWh/Wh conversion factor for watt-hours to kilowatt-hours.

Total annual energy consumption in all modes except cooling and heating would be calculated as follows.

$$AEC_T = \Sigma_m AEC_m$$

Where:

AEC_T is the total annual energy consumption attributed to all modes except cooling and heating, in kWh/year.
AEC_m is the annual energy consumption in each mode, in kWh/year.
m represents the operating modes included in AEC_T (''oc'' off-cycle, and ''im'' inactive or ''om'' off mode).

In this NOPR, DOE proposes in 10 CFR 430.23 that the annual energy consumption in cooling mode, AEC_{cm} and the total annual energy consumption in all modes except cooling and heating, AEC_T, would be utilized in calculating the estimated annual operating cost. The sum of the two annual energy consumption metrics would then be multiplied by a representative average unit cost of electrical energy in dollars per kilowatt-hour as provided by the Secretary to obtain the estimated annual operating cost.

For units with only cooling mode, a combined cooling mode EER ($CEER_{cm}$) can be calculated. For purposes of comparison, DOE proposes calculating a $CEER_{cm}$ for units that also include heating mode. In this case, the metric would be calculated assuming heating mode is not used and therefore, the operating hours that would have been attributed to heating mode and other associated operating modes during the heating season would be apportioned as for portable ACs without a heating mode. DOE believes that the resulting $CEER_{cm}$ is a meaningful metric for portable ACs without a heating function, a basis for comparing cooling mode efficiency for units that include heating function, as well as a metric that could be compared to other cooling products, such as room ACs.

$$CEER_{cm} = \frac{ACC}{\left(\frac{AEC_{cm} + AEC_T}{k \times t}\right)}$$

Where:

$CEER_{cm}$ is the combined energy efficiency ratio in cooling mode, in Btu/Wh.
ACC is the adjusted cooling capacity, in Btu/h.
AEC_{cm} is the annual energy consumption in cooling mode, in kWh/year.
AEC_T is the total annual energy consumption attributed to all modes except cooling and heating, in kWh/year.
t is the number of hours per year, 8,760.
k is 0.001 kWh/Wh conversion factor for watt-hours to kilowatt-hours.

For portable ACs without a heating function, the overall energy efficiency metric, or CEER, would be equal to the $CEER_{cm}$. However, for units with both cooling and heating mode, the overall CEER, a weighted average of the cooling and heating mode capacities and energy consumption in all applicable modes, would be calculated as follows.

$$CEER = \frac{ACC \times \left(\frac{h_{cm}}{h_{cm} + h_{hm}}\right) + AHC \times \left(\frac{h_{hm}}{h_{cm} + h_{hm}}\right)}{\left(\frac{AEC_{cm} + AEC_{hm} + AEC_{T}}{k \times t}\right)}$$

Where:

CEER is the combined energy efficiency ratio, in Btu/Wh.

ACC is the adjusted cooling capacity, in Btu/h.

AHC is the adjusted heating capacity, in Btu/h.

h_{cm} and h_{hm} are the cooling and heating mode operating hours, respectively.

AEC_{cm} is the annual energy consumption in cooling mode, in kWh/year.

AEC_{hm} is the annual energy consumption in heating mode, in kWh/year.

AEC_{T} is the total annual energy consumption attributed to all modes except cooling and heating, in kWh/year.

t is the number of hours per year, 8,760.

k is 0.001 kWh/Wh conversion factor for watt-hours to kilowatt-hours.

b. Mode Annual Operating Hours

DOE developed several estimates of portable AC annual operating mode hours for cooling, heating, off-cycle, and inactive or off modes. DOE proposes the CEER calculations and proposes one of the estimates of annual mode hours that would be used to obtain an integrated measure of energy use in all operating modes. DOE requests comment on the proposed CEER calculation and estimates.

Because the primary function of portable ACs and room ACs is similar, DOE considered the room AC annual operating hours presented in the room AC test procedure NOPR (hereinafter referred to as ''the room AC test procedure NOPR'') [12] as a proxy for portable AC usage in this analysis. In the room AC test procedure NOPR, DOE estimated that half of all room ACs are unplugged for half of the year. 73 FR 74639, 74648. Averaging this estimated unplugged time over all units resulted in a total 2,190 unplugged hours per unit in which no energy is consumed, leaving 6,570 hours in which the unit is plugged in. DOE further estimated that the primary cooling season is 90 days per year, or 2,160 hours. *Id.* Portable ACs, however, are likely to be unplugged for a greater number of hours per year during the cooling season because, portable ACs are readily moveable products that are simpler to install and uninstall than room ACs. Additionally, because a portable AC and associated ducting extend into the room, consumers would be more likely to unplug and store a portable AC than a room AC, which does not extend far into the room. Therefore, DOE estimated that three quarters of all portable ACs are unplugged for all annual hours outside of the cooling season (6,600 hours per unit), and that the remaining one quarter of portable ACs are unplugged for half of the annual hours outside the cooling season (3,300 hours per unit). Based on the weighted average presented above, portable ACs would spend 5,775 unplugged hours and 825 plugged-in hours outside of the cooling season.

However, DOE notes that these calculations consider use of portable ACs only during the cooling season. As discussed above in section III.1.b, certain portable ACs may provide a heating function and therefore may be operated during the heating season. Although DOE believes that the room AC cooling season length is relevant and representative of the portable AC cooling season due to the similar function provided to the consumer, DOE does not believe that the 2,160 hours estimated for cooling season would be representative of the heating season length. Therefore, DOE researched portable AC heating season length. As a starting point, DOE looked to the furnace test procedure located at appendix N of 10 CFR part 430, which identifies the heating season length as 4,160 hours.

To refine this estimate for portable ACs, DOE performed a climate analysis using 2012 hourly ambient temperature data from the National Climatic Data Center (NCDC) of the National Oceanic and Atmospheric Administration (NOAA), collected at weather stations in 44 representative states. DOE first calculated the number of annual hours per state associated with each temperature (in 1 °F intervals) from the NCDC data. DOE then reviewed data from the 2009 *Residential Energy Consumption Survey* (*RECS*) [13] to identify room AC use in the different geographic regions. Because no portable AC-specific usage data were available through *RECS,* DOE assumed this data would be representative of portable AC use. DOE found that of the 25.9 million homes that reported using room ACs, the majority were in the Northeast region (9.6 million homes), though significant usage was recorded in the remaining regions: Midwest (5.8 million), South (6.5 million), and West (4 million). DOE observed that all sub-regions in the survey showed room AC use; therefore, all sub-regions were included in DOE's analysis, along with data for individual states or combinations of small numbers of states within these sub-regions where provided in *RECS.*

Based on the *RECS* ownership data, DOE used a weighted-average approach to combine the individual states' total number hours per year at or below a certain temperature to determine the average number of hours at or below any given temperature for each sub-region represented by the *RECS* data. DOE used a similar weighted average to combine the sub-region data for each region and subsequently combine the regional data into a single representative number of hours per year at or below any given temperature. DOE found, on average, 4,388 hours per year with ambient temperatures at or below 55 °F. DOE selected 55 °F as a threshold for determining heating season based on a New York City regulation that requires buildings to be heated when the outdoor temperature drops below that level.[14] However, DOE notes that portable ACs are typically not used as the primary heating appliance in a home, and therefore may be utilized to supplement the home's heating system. Because this supplemental heating is likely only necessary at low outdoor temperatures, DOE determined, as a third estimate, the number of hours in 2012 that average national ambient temperatures were at or below 45 °F—2,903 hours. DOE then calculated the number of plugged in and unplugged hours outside of heating and cooling season for each of the three estimates presented above for portable ACs with heating mode. Table III.10 shows the operating season hourly breakdowns for four cases: Cooling Only Estimate, Cooling/Heating Estimate 1 (the furnace fan heating season length), Cooling/Heating Estimate 2 (heating season based on hours at or below 55 °F), and Cooling/Heating Estimate 3 (heating season based on hours at or below 45 °F).

[12] *See* 73 FR 74639 (Dec.9, 2008).

[13] *RECS* data are available at: *http://www.eia.gov/consumption/residential/data/2009/*''*www.eia.gov/consumption/residential/data/2009/.*

[14] More information can be found at: *www.nyc.gov/html/hpd/html/tenants/heat-and-hot-water.shtml.*

TABLE III.10—SEASONAL AND REMAINING UNPLUGGED/PLUGGED-IN HOURS

	Cooling only	Cooling/heating estimate 1	Cooling/heating estimate 2	Cooling/heating estimate 3
Annual Hours	8,760	8,760	8,760	8,760
Cooling Season	2,160	2,160	2,160	2,160
Heating Season	0	4,160	4,388	2,903
Remaining Annual Unplugged Hours	5,775	2,135	1,936	3,235
Remaining Annual Plugged-In Hours	825	305	277	462

DOE further estimated the hours associated with each operating mode within the cooling and heating seasons. Because the primary cooling function is similar between portable ACs and room ACs, DOE believes that the mode hours in cooling season would be apportioned similarly for both products. In its room AC analysis, DOE determined that, for units capable of all operating modes, 750 operating hours would be in cooling mode, 440 hours would be in off-cycle mode, 440 hours would be in fan-only mode, 90 hours would be in delay-start mode, and 440 hours would be in inactive mode and/or off mode during the cooling season. 73 FR 74639, 74648–74649 (December 9, 2008). In the room AC analysis, fan-only mode was defined as ''an active mode in which the compressor shuts down when operating in constant-fan mode or user selection of fan-only operation.'' As discussed above, fan operation when the compressor has cycled off is considered as off-cycle mode for the purposes of this NOPR. Also, because DOE is not proposing to measure or allocate hours to air circulation mode, any hours associated with that mode would be attributed to off-cycle mode. For portable ACs, DOE also proposes to allocate any bucket-full and other low-power mode hours to inactive/off mode hours. For portable ACs with a heating function, DOE estimated that the same ratio of mode hours to season length for the cooling season would be applicable for the available modes during heating season. The operating hours in off mode and inactive mode include operation during heating and cooling season as well as the plugged-in hours during the remainder of the year. Applying all of these apportionments, DOE developed estimates for the hourly operation in each mode, shown in Table III.11, based on the three approaches described above for estimating heating season length.

TABLE III.11—PROPOSED ANNUAL OPERATING HOURS BY MODE

Modes	Cooling only	Cooling/heating estimate 1	Cooling/heating estimate 2	Cooling/heating estimate 3
Cooling Mode	750	750	750	750
Heating Mode	0	1,444	1,524	1,008
Off-Cycle Mode	880	2,575	2,668	2,063
Off/Inactive Mode	1,355	1,856	1,883	1,704

DOE proposes that the annual operating mode hours in the ''Cooling Only'' scenario presented in Table III.11 be used when calculating $CEER_{cm}$ for all portable ACs. For the reasons discussed above regarding use of portables ACs for heating, DOE also proposes assigning the annual operating mode hours in the ''Cooling/Heating Estimate 3'' scenario in the CEER calculation for units with both cooling and heating modes. For portable ACs with no heating mode, CEER would equal $CEER_{cm}$.

DOE requests feedback on these proposed annual operating mode hours to be used in the $CEER_{cm}$ and CEER calculations, and on any alternate season durations and operating hour estimates.

To provide further insight on these annual operating mode hours and explore possible alternate scenarios for operating mode allocations during the cooling season, DOE considered the analysis presented in the Burke Portable AC Study. In that study, metered data for 19 portable ACs were analyzed to develop models that estimate the percent of time spent in cooling, fan-only, and standby modes as a function of the outdoor temperature. DOE notes that these modes as defined in the Burke Portable AC Study are not entirely consistent with the mode definitions proposed in this NOPR; however, DOE expects that they would align reasonably well with cooling mode, off-cycle mode, and inactive or off mode, respectively. The models in the Burke Portable AC Study were developed for two applications for portable ACs: (1) Residential use, which DOE expects to represent daily consumer interaction with the portable AC (*e.g.,* turning the unit off and on when leaving or entering the house, respectively, or turning the unit on only while sleeping); and (2) commercial use (*i.e.,* a portable AC unit used in an office or similar environment), which DOE expects to represent units that are installed and turned on at a given temperature setpoint with minimal additional consumer interaction. Because the first application represents intermittent use and the second application represents continuous use of a portable AC, DOE expects that the model results for these two applications provide a minimum and maximum estimate for time spent in cooling mode for a typical portable AC, from which the corresponding variations in the annual operating hours for other modes could be calculated. DOE presents this sensitivity analysis in addition to its proposed annual mode hour allocation listed in Table III.11 because the variation in results for the different applications can be significant. For example, the model suggests that the percent of time spent in cooling mode for each application differs by 50 percentage points when the outdoor temperature is 80 °F.

Because these two models present mode operation in cooling season as a function of outdoor temperature, DOE conducted further analysis based on consumer and climate data to determine the most representative average cooling season outdoor temperature for portable AC usage. To do so, DOE used the same analytical approach as it used to determine heating season length, based on the 2009 *RECS* and 2012 NCDC data. From the NCDC data, DOE calculated the average monthly outdoor temperature for each of the 44 states from June through September. DOE selected these months as those with primary portable AC usage based on New York City Season Guidelines that identify the cooling season as running from the end of May through September 24.[15] DOE also notes, for example, that utilities may define the cooling season as June through September.[16] DOE welcomes input from interested parties on whether these are the most representative months for the portable AC cooling season.

DOE combined the individual states' average outdoor temperatures from June through September using a weighted-average approach based on the *RECS* ownership data to determine an average cooling season ambient temperature for each sub-region represented by the *RECS* data. DOE used a similar weighted average to combine the sub-region data for each region and subsequently combine the regional data into a single representative average cooling season temperature of 70 °F for the United States as a whole.

DOE used this outdoor temperature with the models developed in the Burke Portable AC Study to calculate the estimated percent of time spent in cooling, off-cycle, and off or inactive modes during the cooling season. The operating mode time as a percentage of cooling season hours for both residential applications (low-use Scenario 1) and commercial applications (high-use Scenario 2) are shown in Table III.12. DOE also presents a third scenario that is an average of the low-use and high-use scenarios to estimate overall typical portable AC usage patterns.

TABLE III.12—ANNUAL OPERATING MODE HOUR SENSITIVITY ANALYSIS—PERCENTAGE OF TIME IN EACH MODE DURING THE COOLING SEASON

Modes	Scenario 1—residential application (low-use) (percent)	Scenario 2—commercial application (high-use) (percent)	Scenario 3—Average-use (percent)
Cooling Mode	5.9	41.1	23.5
Off-Cycle Mode	2.2	21.7	12.0
Off/Inactive Mode	91.9	37.9	64.9

For comparison with DOE's proposed cooling mode annual hour estimate of 750 hours, DOE applied these percentages to the estimated cooling season length of 2,160 hours. This results in cooling mode operating hours of 126, 887, and 507, for the usage patterns modeled in Scenario 1, Scenario 2, and Scenario 3, respectively. Note that if DOE were to use one of these model scenarios as the basis for all operating mode hours in cooling season, the proposed total annual off-cycle mode and total off/inactive mode hours would also be adjusted to account for the cooling season percentages in Table III.12. DOE notes that the cooling season mode operating hour percentages in these scenarios differ from the proposed approach that utilizes the room AC cooling season mode operating hour estimates.

DOE requests feedback on the alternative scenarios presented in this NOPR or other data that may inform the allocation of annual operating hours in each mode.

C. Sampling Plan and Rounding Requirements

DOE is proposing the following sampling plan and rounding requirements for portable ACs to enable manufacturers to make representations of energy consumption or efficiency metrics. The sampling requirements would be included in the proposed 10 CFR 429.62. Specifically, DOE is proposing that the general sampling requirements of 10 CFR 429.11 for selecting units to be tested be applicable to portable ACs. In addition, DOE is proposing that for each portable AC basic model, a sufficient sample size must be randomly selected to ensure that a representative value of energy consumption for a basic model is greater than or equal to the higher of the mean of the sample or upper 95 percent confidence limit (UCL) of the true mean divided by 1.10. For EER_{cm}, EER_{hm}, CEER, or other measure of energy consumption where a higher value is preferable to the consumer, the representative value shall be less than or equal to the lower of the mean of the sample or the lower 95 percent confidence limit (LCL) of the true mean divided by 0.90. The mean, UCL, and LCL are calculated as follows:

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

$$UCL = \bar{x} + t_{0.95}\left(\frac{s}{\sqrt{n}}\right)$$

$$LCL = \bar{x} - t_{0.95}\left(\frac{s}{\sqrt{n}}\right)$$

Where:

$\bar{x}$ is the sample mean;
x_i is the i^{th} sample;
s is the sample standard deviation;
n is the number of units in the test sample; and
$t_{0.95}$ is the t statistic for a 95% one-tailed confidence interval with $n-1$ degrees of freedom.

This proposed sampling plan for portable ACs is consistent with sampling plans already established for dehumidifiers and other similar products. DOE notes that certification requirements for portable ACs, which would also be located at 10 CFR part 429, would be proposed in the concurrent energy conservation standards rulemaking.

DOE also proposes that all calculations be performed with the unrounded measured values, and that the reported cooling or heating capacity

[15] New York City Season Guidelines are available online at: *http://www.nyc.gov/html/dem/downloads/pdf/NYC_Cooling_Season_Guidelines_2014.pdf.*

[16] For example, see: *https://www.dom/com/residential/dominion-virginia-power/ways-to-save/energy-conservation-programs/smart-cooling-rewards/smart-cooling-rewards-terms-conditions.*

be rounded in accordance with Table 1 of PAC–1–2014, ''Multiples for reporting Dual Duct Cooling Capacity, Single Duct Cooling Capacity, Spot Cooling Capacity, Water Cooled Condenser Capacity and Power Input Ratings.'' DOE further proposes that EER_{cm}, EER_{hm}, $CEER_{cm}$, CEER, or other energy efficiency metrics would be rounded to the nearest 0.1 Btu/Wh, in accordance with section 6.2.2 of AHAM PAC–1–2014 and consistent with the rounding instructions provided for room ACs at 10 CFR 430.23(f)(2). DOE notes that these rounding instructions would be included in the proposed sampling plan for portable ACs. The rounding instruction proposal would be updated to reference the certification and reporting requirements, which would be proposed as part of the energy conservation standards rulemaking for portable ACs.

D. Compliance With Other Energy Policy and Conservation Act Requirements

1. Test Burden

EPCA requires that any test procedures prescribed or amended shall be reasonably designed to produce test results which measure energy efficiency, energy use, or estimated annual operating cost of a covered product during a representative average use cycle or period of use, and shall not be unduly burdensome to conduct. (42 U.S.C. 6293(b)(3)) For the reasons that follow, DOE has tentatively concluded that establishing a DOE test procedure to measure the energy consumption of portable ACs in active mode, standby mode, and off mode would produce the required test results and would not result in any undue burdens.

As discussed in section IV.B of this NOPR, the proposed test procedure would require testing equipment and facilities that are not substantially different than those that manufacturers are currently using for testing in order to report portable AC ratings to the CEC and likely already using for certifying to DOE the performance of packaged terminal ACs (PTACs), which many of the portable AC manufacturers also produce. Thus, these manufacturers are likely already equipped to test portable ACs, or are testing their products in third-party laboratories that are similarly equipped. Therefore, the proposed test procedure would not require these manufacturers to make a significant investment in test facilities and new equipment.

In addition, DOE carefully considered testing burden in proposing a modified air enthalpy method for measuring energy use in cooling mode and heating mode that is significantly less burdensome than the calorimeter method. DOE is also proposing an approach for measuring low-power mode energy use that would preclude testing of each possible mode individually and instead would require only testing modes in which the portable AC may consume significant amounts of energy, thereby reducing burden further.

Therefore, DOE determined that the proposed portable AC test procedure would produce test results that measure energy consumption during representative use, and that the test procedure would not be unduly burdensome to conduct.

2. Potential Incorporation of International Electrotechnical Commission Standard 62087

Under 42 U.S.C. 6295(gg)(2)(A), EPCA directs DOE to consider IEC Standard 62087 when amending test procedures for covered products to include standby mode and off mode power measurements. DOE reviewed IEC Standard 62087, ''Methods of measurement for the power consumption of audio, video, and related equipment'' (Edition 3.0 2011–04), and has tentatively determined that it would not be applicable to measuring power consumption of electrical appliances such as portable ACs. Therefore, DOE determined that referencing IEC Standards 62087 is not necessary for the proposed test procedure that is the subject of this rulemaking.

IV. Procedural Issues and Regulatory Review

A. Review Under Executive Order 12866

The Office of Management and Budget (OMB) has determined that test procedure rulemakings do not constitute ''significant regulatory actions'' under section 3(f) of Executive Order 12866, Regulatory Planning and Review, 58 FR 51735 (Oct. 4, 1993). Accordingly, this action was not subject to review under the Executive Order by the Office of Information and Regulatory Affairs (OIRA) in the OMB.

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of an initial regulatory flexibility analysis (IFRA) for any rule that by law must be proposed for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by Executive Order 13272, ''Proper Consideration of Small Entities in Agency Rulemaking,'' 67 FR 53461 (August 16, 2002), DOE published procedures and policies on February 19, 2003, to ensure that the potential impacts of its rules on small entities are properly considered during the DOE rulemaking process. 68 FR 7990. DOE has made its procedures and policies available on the Office of the General Counsel's Web site: *http://energy.gov/gc/office-general-counsel.*

DOE reviewed this proposed rule under the provisions of the Regulatory Flexibility Act and the procedures and policies published on February 19, 2003. The proposed rule prescribes the test procedure to measure the energy consumption of portable ACs in active modes, standby modes, and off mode. DOE tentatively concludes that this proposed rule would not have a significant impact on a substantial number of small entities. The factual basis for this certification is as follows:

The Small Business Administration (SBA) considers a business entity to be small business, if, together with its affiliates, it employs less than a threshold number of workers specified in 13 CFR part 121. These size standards and codes are established by the North American Industry Classification System (NAICS). The threshold number for NAICS classification code 333415, ''Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing,'' which includes manufacturers of portable ACs, is 750 employees.

DOE surveyed the AHAM member directory to identify manufacturers of residential portable ACs. DOE then consulted publicly available data, purchased company reports from vendors such as Dun and Bradstreet, and contacted manufacturers, where needed, to determine if the number of manufacturers with manufacturing facilities located within the United States that meet the SBA's definition of a ''small business manufacturing facility.'' Based on this analysis, DOE estimates that there is one small business that manufactures portable ACs.

This proposed rule would establish a DOE test procedure for portable ACs, which would require testing units according to an industry standard, AHAM PAC–1–2014, with additional calculations. Although there are no current DOE energy conservation standards for portable ACs, many manufacturers have reported cooling capacity and EER of these products to the CEC, which requires testing according to ANSI/ASHRAE Standard 128–2001. The testing equipment and methodology for ANSI/ASHRAE Standard 128–2001 are similar to those required by AHAM PAC–1–2014, although the temperature conditions are different.

The small business mentioned above does not list any portable AC models in the CEC product database, so DOE is uncertain whether it is currently testing portable ACs according to ANSI/ASHRAE Standard 128–2001. However, DOE notes that the small business also manufactures and markets PTACs that must be certified to DOE according to ANSI/AHRI Standard 310/380–2004, ''Standard for Packaged Terminal Air-Conditioners and Heat Pumps'' (ANSI/AHRI 310/380–2004). (10 CFR 430.96) Section 4.2.1 of ANSI/AHRI 310/380–2004 specifies that standard cooling ratings shall be verified by tests conducted in accordance with either ANSI/ASHRAE Standard 16–1999 or ANSI/ASHRAE Standard 37–1998. Due to the complexity of testing facilities required to implement the calorimeter method specified in ANSI/ASHRAE 16–1999, DOE believes that it is likely that the small business currently conducts compliance testing using the air enthalpy methods in ANSI/ASHRAE Standard 37–1998, which require comparable testing facilities and equipment as the methods proposed in this NOPR. In addition, the small business provides performance data in the literature for its portable AC model which indicates that testing was conducted at 80 °F and 50-percent relative humidity. This testing would likely have required air enthalpy measurements equivalent to those specified in AHAM PAC–1–2014 at 80 °F and 49-percent relative humidity, and the same air enthalpy measurements would be made when testing at 70 °F and 57-percent relative humidity according to the proposed method for portable AC heating mode. Therefore, DOE believes that no small businesses would require purchasing new equipment or modifying existing equipment in order to conduct the proposed test methods for measuring energy use in portable AC cooling mode and heating mode.

The proposed rule would also require the measurement of power input during standby mode, off mode, and off-cycle mode. These tests could be conducted either in the same facilities used for the cooling mode and heating mode testing of these products, or in facilities that meet the requirements for testing conditions specified in IEC Standard 62301, which could consist of any space with temperature control typically found in an office or living space. Therefore, DOE does not expect that the small business would incur additional facilities costs required by the proposed rule. In addition, in the event that the manufacturer would be required to purchase a wattmeter for measuring power input in standby mode, off mode, and off-cycle mode, the investment required would likely be relatively modest. An Internet search of equipment that specifically meets the proposed requirements reveals a cost of approximately $2,000.

The costs described above are small compared to the overall financial investment needed to undertake the business enterprise of developing and testing consumer products, which involves facilities, qualified staff, and specialized equipment. Based on its review of industry data,[17] DOE estimates that the small portable AC business has annual revenues of approximately $20 million.

For these reasons, DOE concludes and certifies that the proposed rule would not have a significant economic impact on a substantial number of small entities. Accordingly, DOE has not prepared a regulatory flexibility analysis for this rulemaking. DOE will transmit the certification and supporting statement of factual basis to the Chief Counsel for Advocacy of the SBA for review under 5 U.S.C. 605(b).

C. Review Under the Paperwork Reduction Act of 1995

All collections of information from the public by a Federal agency must receive prior approval from OMB. DOE has established regulations for the certification and recordkeeping requirements for covered consumer products and industrial equipment. 10 CFR part 429, subpart B. DOE published a notice of proposed determination regarding portable air conditioners on July 5, 2013. 78 FR 40403. In an application to renew the OMB information collection approval for DOE's certification and recordkeeping requirements, DOE included an estimated burden for manufacturers of portable air conditioners in case DOE ultimately issues a coverage determination and sets energy conservation standards for these products. OMB has approved the revised information collection for DOE's certification and recordkeeping requirements. 80 FR 5099 (January 30, 2015). DOE estimated that it will take each respondent approximately 30 hours total per company per year to comply with the certification and recordkeeping requirements based on 20 hours of technician/technical work and 10 hours clerical work to actually submit the Compliance and Certification Management System (CCMS) templates. This rulemaking would include recordkeeping requirements on manufacturers that are associated with executing and maintaining the test data for these products. DOE notes that the certification requirements would be established in a final rule establishing energy conservation standards for portable ACs. DOE recognizes that recordkeeping burden may vary substantially based on company preferences and practices. DOE requests comment on this burden estimate.

D. Review Under the National Environmental Policy Act of 1969

In this proposed rule, DOE proposes test procedure amendments that it expects will be used to develop and implement future energy conservation standards for portable ACs. DOE has determined that this rule falls into a class of actions that are categorically excluded from review under the National Environmental Policy Act of 1969 (42 U.S.C. 4321 *et seq.*) and DOE's implementing regulations at 10 CFR part 1021. Specifically, this proposed rule would amend the existing test procedures without affecting the amount, quality or distribution of energy usage, and, therefore, would not result in any environmental impacts. Thus, this rulemaking is covered by Categorical Exclusion A5 under 10 CFR part 1021, subpart D, which applies to any rulemaking that interprets or amends an existing rule without changing the environmental effect of that rule. Accordingly, neither an environmental assessment nor an environmental impact statement is required.

E. Review Under Executive Order 13132

Executive Order 13132, ''Federalism,'' 64 FR 43255 (August 4, 1999) imposes certain requirements on agencies formulating and implementing policies or regulations that preempt State law or that have Federalism implications. The Executive Order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive Order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that

[17] Annual revenue estimates are based on financial reports obtained from Hoover's, Inc., available online at: *www.hoovers.com.*

have Federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. DOE has examined this proposed rule and has determined that it would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the products that are the subject of this proposed rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297(d)) No further action is required by Executive Order 13132.

F. Review Under Executive Order 12988

Regarding the review of existing regulations and the promulgation of new regulations, section 3(a) of Executive Order 12988, ''Civil Justice Reform,'' 61 FR 4729 (Feb. 7, 1996), imposes on Federal agencies the general duty to adhere to the following requirements: (1) Eliminate drafting errors and ambiguity; (2) write regulations to minimize litigation; (3) provide a clear legal standard for affected conduct rather than a general standard; and (4) promote simplification and burden reduction. Section 3(b) of Executive Order 12988 specifically requires that Executive agencies make every reasonable effort to ensure that the regulation: (1) Clearly specifies the preemptive effect, if any; (2) clearly specifies any effect on existing Federal law or regulation; (3) provides a clear legal standard for affected conduct while promoting simplification and burden reduction; (4) specifies the retroactive effect, if any; (5) adequately defines key terms; and (6) addresses other important issues affecting clarity and general draftsmanship under any guidelines issued by the Attorney General. Section 3(c) of Executive Order 12988 requires Executive agencies to review regulations in light of applicable standards in sections 3(a) and 3(b) to determine whether they are met or it is unreasonable to meet one or more of them. DOE has completed the required review and determined that, to the extent permitted by law, this proposed rule meets the relevant standards of Executive Order 12988.

G. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA) requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Public Law 104–4, sec. 201 (codified at 2 U.S.C. 1531). For a proposed regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed ''significant intergovernmental mandate,'' and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect small governments. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820; also available at *energy.gov/gc/office-general-counsel*. DOE examined this proposed rule according to UMRA and its statement of policy and determined that the rule contains neither an intergovernmental mandate, nor a mandate that may result in the expenditure of $100 million or more in any year, so these requirements do not apply.

H. Review Under the Treasury and General Government Appropriations Act, 1999

Section 654 of the Treasury and General Government Appropriations Act, 1999 (Pub. L. 105–277) requires Federal agencies to issue a Family Policymaking Assessment for any rule that may affect family well-being. This proposed rule would not have any impact on the autonomy or integrity of the family as an institution. Accordingly, DOE has concluded that it is not necessary to prepare a Family Policymaking Assessment.

I. Review Under Executive Order 12630

DOE has determined, under Executive Order 12630, ''Governmental Actions and Interference with Constitutionally Protected Property Rights'' 53 FR 8859 (March 18, 1988) that this proposed rule would not result in any takings that might require compensation under the Fifth Amendment to the U.S. Constitution.

J. Review Under Treasury and General Government Appropriations Act, 2001

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516 note) provides for agencies to review most disseminations of information to the public under guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). DOE has reviewed this proposed rule under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

K. Review Under Executive Order 13211

Executive Order 13211, ''Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use,'' 66 FR 28355 (May 22, 2001), requires Federal agencies to prepare and submit to OMB, a Statement of Energy Effects for any proposed significant energy action. A ''significant energy action'' is defined as any action by an agency that promulgated or is expected to lead to promulgation of a final rule, and that: (1) Is a significant regulatory action under Executive Order 12866, or any successor order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (3) is designated by the Administrator of OIRA as a significant energy action. For any proposed significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use should the proposal be implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

This regulatory action to establish the test procedure for measuring the energy efficiency of portable ACs is not a significant regulatory action under Executive Order 12866. Moreover, it would not have a significant adverse effect on the supply, distribution, or use of energy, nor has it been designated as a significant energy action by the Administrator of OIRA. Therefore, it is not a significant energy action, and, accordingly, DOE has not prepared a Statement of Energy Effects.

L. Review Under Section 32 of the Federal Energy Administration Act of 1974

Under section 301 of the Department of Energy Organization Act (Pub. L. 95–91; 42 U.S.C. 7101), DOE must comply with section 32 of the Federal Energy Administration Act of 1974, as amended by the Federal Energy Administration Authorization Act of 1977. (15 U.S.C. 788; FEAA) Section 32 essentially provides in relevant part that, where a proposed rule authorizes or requires use of commercial standards, the notice of proposed rulemaking must inform the public of the use and background of such standards. In addition, section 32(c) requires DOE to consult with the Attorney General and the Chairman of the Federal Trade Commission (FTC) concerning the impact of the commercial or industry standards on competition.

As discussed in this NOPR, the proposed rule incorporates testing methods contained in the following commercial standards: AHAM PAC–1–2014, Portable Air Conditions; and IEC 62301, Household Electrical Appliances—Measurement of Standby Power. DOE has evaluated these standards and is unable to conclude whether they fully comply with the requirements of section 32(b) of the FEAA, (*i.e.*, that they were developed in a manner that fully provides for public participation, comment, and review). DOE will consult with the Attorney General and the Chairwoman of the FTC concerning the impact of these test procedures on competition, prior to prescribing a final rule.

M. Description of Materials Incorporated by Reference

In this NOPR, DOE proposes to incorporate by reference the test standard published by AHAM, titled ''Portable Air Conditioners,'' AHAM PAC–1–2014. AHAM PAC–1–2014 is an industry accepted test procedure that measures portable AC performance in cooling mode and is applicable to products sold in North America. AHAM PAC–1–2014 specifies testing conducted in accordance with other industry accepted test procedures (already incorporated by reference) and determines energy efficiency metrics for various portable AC configurations. The test procedure proposed in this NOPR references various sections of AHAM PAC–1–2014 that address test setup, instrumentation, test conduct, calculations, and rounding. AHAM PAC–1–2014 is readily available on AHAM's Web site at *http://www.aham.org/ht/d/ProductDetails/sku/PAC12009/from/714/pid/*.

V. Public Participation

A. Attendance at Public Meeting

The time, date and location of the public meeting are listed in the **DATES** and **ADDRESSES** sections at the beginning of this document. If you plan to attend the public meeting, please notify Ms. Brenda Edwards at (202) 586–2945 or *Brenda.Edwards@ee.doe.gov*.

Please note that foreign nationals participating in the public meeting are subject to advance security screening procedures which require advance notice prior to attendance at the public meeting. If a foreign national wishes to participate in the public meeting, please inform DOE of this fact as soon as possible by contacting Ms. Regina Washington at (202) 586–1214 or by email: *Regina.Washington@ee.doe.gov* so that the necessary procedures can be completed.

DOE requires visitors with laptop computers and other devices, such as tablets, to be checked upon entry into the building. Any person wishing to bring these devices into the Forrestal Building will be required to obtain a property pass. Visitors should avoid bringing these devices, or allow an extra 45 minutes to check in. Please report to the visitor's desk to have devices checked before proceeding through security.

Due to the REAL ID Act implemented by the Department of Homeland Security (DHS), there have been recent changes regarding ID requirements for individuals wishing to enter Federal buildings from specific states and U.S. territories. Driver's licenses from the following states or territory will not be accepted for building entry and one of the alternate forms of ID listed below will be required. DHS has determined that regular driver's licenses (and ID cards) from the following jurisdictions are not acceptable for entry into DOE facilities: Alaska, American Samoa, Arizona, Louisiana, Maine, Massachusetts, Minnesota, New York, Oklahoma, and Washington. Acceptable alternate forms of Photo-ID include: U.S. Passport or Passport Card; an Enhanced Driver's License or Enhanced ID-Card issued by the states of Minnesota, New York or Washington (Enhanced licenses issued by these states are clearly marked Enhanced or Enhanced Driver's License); a military ID or other Federal government issued Photo-ID card.

In addition, you can attend the public meeting via webinar. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's Web site *http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/79*. Participants are responsible for ensuring their systems are compatible with the webinar software.

B. Procedure for Submitting Prepared General Statements for Distribution

Any person who has plans to present a prepared general statement may request that copies of his or her statement be made available at the public meeting. Such persons may submit requests, along with an advance electronic copy of their statement in PDF (preferred), Microsoft Word or Excel, WordPerfect, or text (ASCII) file format, to the appropriate address shown in the **ADDRESSES** section at the beginning of this N. The request and advance copy of statements must be received at least one week before the public meeting and may be emailed, hand-delivered, or sent by mail. DOE prefers to receive requests and advance copies via email. Please include a telephone number to enable DOE staff to make a follow-up contact, if needed.

C. Conduct of Public Meeting

DOE will designate a DOE official to preside at the public meeting and may also use a professional facilitator to aid discussion. The meeting will not be a judicial or evidentiary-type public hearing, but DOE will conduct it in accordance with section 336 of EPCA (42 U.S.C. 6306). A court reporter will be present to record the proceedings and prepare a transcript. DOE reserves the right to schedule the order of presentations and to establish the procedures governing the conduct of the public meeting. After the public meeting and until the end of the comment period, interested parties may submit further comments on the proceedings and any aspect of the rulemaking.

The public meeting will be conducted in an informal, conference style. DOE will present summaries of comments received before the public meeting, allow time for prepared general statements by participants, and encourage all interested parties to share their views on issues affecting this rulemaking. Each participant will be allowed to make a general statement (within time limits determined by DOE), before the discussion of specific topics. DOE will permit, as time permits, other participants to comment briefly on any general statements.

At the end of all prepared statements on a topic, DOE will permit participants to clarify their statements briefly and comment on statements made by others. Participants should be prepared to answer questions by DOE and by other participants concerning these issues. DOE representatives may also ask questions of participants concerning other matters relevant to this rulemaking. The official conducting the public meeting will accept additional comments or questions from those attending, as time permits. The presiding official will announce any further procedural rules or modification of the above procedures that may be needed for the proper conduct of the public meeting.

A transcript of the public meeting will be included in the docket, which can be viewed as described in the *Docket* section at the beginning of this notice. In addition, any person may buy a copy of the transcript from the transcribing reporter.

D. Submission of Comments

DOE will accept comments, data, and information regarding this proposed rule before or after the public meeting, but no later than the date provided in the **DATES** section at the beginning of this proposed rule. Interested parties may submit comments using any of the methods described in the **ADDRESSES** section at the beginning of this notice.

Submitting comments via www.regulations.gov. The 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. 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 *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 regulations.gov cannot be claimed as CBI. Comments received through the Web site 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 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 regulations.gov provides after you have successfully uploaded your comment.

Submitting comments via email, hand delivery, or mail. Comments and documents submitted via email, hand delivery, or mail also will be posted to 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. If you submit via mail or hand delivery, please provide all items on a CD, if feasible. It is not necessary to submit printed copies. No facsimiles (faxes) will 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, postal mail, or hand delivery 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. Submit these documents via email or on a CD, if feasible. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

Factors of interest to DOE when evaluating requests to treat submitted information as confidential include: (1) A description of the items; (2) whether and why such items are customarily treated as confidential within the industry; (3) whether the information is generally known by or available from other sources; (4) whether the information has previously been made available to others without obligation concerning its confidentiality; (5) an explanation of the competitive injury to the submitting person which would result from public disclosure; (6) when such information might lose its confidential character due to the passage of time; and (7) why disclosure of the information would be contrary to the public interest.

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).

E. Issues on Which DOE Seeks Comment

Although DOE welcomes comments on any aspect of this proposal, DOE is particularly interested in receiving comments and views of interested parties concerning the following issues:

1.The description and definition for residential and commercial portable ACs, different configurations, and the clarification that commercial portable ACs are not considered a covered product. (See section III.A.)

2.The definitions for active mode, cooling mode, and heating mode. DOE also seeks information on annual hours associated with the consumer initiated air-circulation mode. (See section III.B.1.)

3.The proposal that AHAM PAC–1–2014 be used as the basis for the test procedure proposed in this NOPR (See section III.B.1.a.i.)

4.The proposal to modify the cooling capacity equation as included in AHAM PAC–1–2014 to address the effects of infiltration air. In addition, DOE welcomes input on the proposed infiltration air conditions of 95 °F dry-bulb temperature and

75.2 °F wet-bulb temperature. (See section III.B.1.a.ii.)

5.The proposal to specify a more stringent evaporator inlet air stream dry-bulb temperature tolerance for single-duct units and to not consider the effects of condenser exhaust air and inlet air mixing for dual-duct units. (See sectionIII.B.1.a.iii.)

6.The proposal to use the manufacturer-supplied ducting components during performance testing and the approach to characterize and determine the condenser duct(s) heat transfer to the conditioned space. (See section III.B.1.a.iv.)

7.The proposal and approach to include case heat transfer effects instead of the evaporator fan heat, based on the average case surface temperature and temperature. (See section III.B.1.a.v.)

8. The test setup for portable ACs with and without means for auto-evaporation to remove the collected condensate, including the use of any internal pump only if it is specified by the manufacturer for use during typical cooling operation. (See section III.B.1.a.vi.)

9. The proposed control settings for cooling mode and heating mode testing, which would require selecting the highest fan speed, for units with user-adjustable fan speed, and the lowest and highest available temperature settings for cooling mode and heating mode, respectively. Also, the proposed clarification that all portable AC performance testing be conducted with the maximum louver opening and, where applicable, with the louver oscillation feature disabled throughout testing. (See section III.B.1.a.vii.)

10. The proposed minimum clearance between the test unit and chamber wall surfaces. (See section III.B.1.a.viii.)

11. The proposed test setup, standard rating conditions, and conduct for determining heating mode performance for portable ACs. (See section III.B.1.b.)

12. The provisions for measuring energy consumption in off-cycle mode, including the use of the maximum speed setting for those units with adjustable fan speed settings, the measurement period specifications. DOE seeks comment on whether off-cycle mode energy consumption is independent of ambient conditions. (See section III.B.2.)

13. The proposed definitions and provisions for measuring energy consumption in various standby modes and off mode. (See section III.B.3.)

14. The proposed equation for calculating individual cooling combined energy efficiency ratio ($CEER_{cm}$) and an overall CEER that incorporates performance in both cooling and heating modes, in addition to other low power modes. DOE also seeks comment on the proposed annual operating hours and their implementation for calculating the $CEER_{cm}$ and CEER. (See section III.B.4.)

15. The proposed reporting requirements including the sampling plan and rounding instructions. (See section III.C.)

16. The testing burden, including DOE's determination that the test would not be unduly burdensome to conduct. (See section III.D.1.)

VI. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of this proposed rule.

List of Subjects

10 CFR Part 429

Administrative practice and procedure, Buildings and facilities, Business and industry, Energy conservation, Grant programs-energy, Housing, Reporting and recordkeeping requirements, Technical assistance.

10 CFR Part 430

Administrative practice and procedure, Confidential business information, Energy conservation, Household appliances, Imports, Incorporation by reference, Intergovernmental relations, Small businesses.

Issued in Washington, DC, on February 12, 2015.

Kathleen B. Hogan,

Deputy Assistant Secretary for Energy Efficiency, Energy Efficiency and Renewable Energy.

For the reasons stated in the preamble, DOE proposes to amend parts 429 and 430 of Chapter II of Title 10, Code of Federal Regulations as set forth below:

PART 429—CERTIFICATION, COMPLIANCE, AND ENFORCEMENT FOR CONSUMER PRODUCTS AND COMMERCIAL AND INDUSTRIAL EQUIPMENT

■ 1. The authority citation for part 429 continues to read as follows:

Authority: 42 U.S.C. 6291–6317.

■ 2. Add § 429.62 to read as follows:

§ 429.62 Portable Air Conditioners.

(a) *Sampling plan for selection of units for testing.* (1) The requirements of § 429.11 are applicable to portable air conditioners; and

(2) For each basic model of portable air conditioner, a sample of sufficient size shall be randomly selected and tested to ensure that—

(i) Any represented value of energy consumption or other measure of energy consumption of a basic model for which consumers would favor lower values shall be greater than or equal to the higher of:

(A) The mean of the sample:

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

Where:

$\bar{x}$ is the sample mean;
x_i is the i^{th} sample; and
n is the number of units in the test sample.

Or,

(B) The upper 95 percent confidence limit (UCL) of the true mean divided by 1.10:

$$UCL = \bar{x} + t_{0.95}\left(\frac{s}{\sqrt{n}}\right)$$

Where:

$\bar{x}$ is the sample mean;
s is the sample standard deviation;
n is the number of units in the test sample; and
$t_{0.95}$ is the t statistic for a 95% one-tailed confidence interval with n − 1 degrees of freedom.

And,

(ii) Any represented value of the cooling or heating energy efficiency ratio, combined energy efficiency ratio, or other measure of energy consumption of a basic model for which consumers would favor higher values shall be less than or equal to the lower of:

(A) The mean of the sample:

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

Where:

$\bar{x}$ is the sample mean;
x_i is the i^{th} sample; and
n is the number of units in the test sample.

Or,

(B) The lower 95 percent confidence limit (LCL) of the true mean divided by 0.90:

$$LCL = \bar{x} - t_{0.95}\left(\frac{s}{\sqrt{n}}\right)$$

Where:

$\bar{x}$ is the sample mean;
s is the sample standard deviation;
n is the number of units in the test sample; and
$t_{0.95}$ is the t statistic for a 95% one-tailed confidence interval with n − 1 degrees of freedom.

And,

(3) The value of cooling or heating mode capacity of a basic model shall be the mean of the capacities for each tested unit of the basic model. Round the mean capacity value to the nearest 50, 100, 200, or 500 Btu/h, depending on the value being rounded, in accordance with Table 1 of PAC–1–2014, ''Multiples for reporting Dual Duct Cooling Capacity, Single Duct Cooling Capacity, Spot Cooling Capacity, Water Cooled Condenser Capacity and Power Input Ratings.''

(4) The value of energy efficiency ratio or combined energy efficiency ratio of a basic model shall be the mean of the efficiency metric for each tested unit of

the basic model. Round energy efficiency ratio or combined energy efficiency ratio to the, to the nearest 0.1 Btu/Wh.

(b) [Reserved]

PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS

■ 3. The authority citation for part 430 continues to read as follows:

Authority: 42 U.S.C. 6291–6309; 28 U.S.C. 2461 note.

■ 4. Section 430.2 is amended by adding the definition of ''portable air conditioner'' in alphabetical order to read as follows:

§ 430.2 Definitions.

* * * * *

Portable air conditioner means an encased assembly, other than a ''packaged terminal air conditioner,'' ''room air conditioner,'' or ''dehumidifier,'' designed as a portable unit for delivering cooled, conditioned air to an enclosed space, that is powered by single-phase electric current, which may rest on the floor or other elevated surface. It includes a source of refrigeration and may include additional means for air circulation and heating.

* * * * *

■ 5. Section 430.3 is amended by adding paragraph (h)(8) and revising paragraph (o)(4) to read as follows:

§ 430.3 Materials incorporated by reference.

* * * * *

(h) * * *

(8) AHAM PAC–1–2014, Portable Air Conditioners, 2014, IBR approved for appendix CC to subpart B.

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(4) IEC 62301 (''IEC 62301''), Household electrical appliances—Measurement of standby power, (Edition 2.0, 2011–01), IBR approved for appendices C1, D1, D2, G, H, I, J2, N, O, P, X, and CC to subpart B.

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■ 6. Section 430.23 is amended by adding paragraph (dd) to read as follows:

§ 430.23 Test procedures for the measurement of energy and water consumption.

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(dd) *Portable air conditioners.* (1) The adjusted cooling capacity, expressed in British thermal units per hour (Btu/h), the combined energy efficiency ratio in cooling mode, expressed in British thermal units per Watts per hour (Btu/W-h), and, for units equipped with a heating function, the adjusted heating capacity, expressed in Btu/h, and the total combined energy efficiency ratio, expressed in Btu/W-h, for portable air conditioners, shall be measured in accordance with section 5 of appendix CC of this subpart.

(2) The estimated annual operating cost for portable air conditioners in cooling mode, expressed in dollars per year, shall be determined by multiplying the following two factors:

(i) The sum of the AEC_{cm} and AEC_T as measured using the ''Cooling Only'' operating hours in accordance with section 5.4 of appendix CC of this subpart, and

(ii) A representative average unit cost of electrical energy in dollars per kilowatt-hour as provided by the Secretary, the resulting product then being rounded off to the nearest dollar per year.

■ 7. Add appendix CC to read as follows:

Appendix CC to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Portable Air Conditioners

1. Scope

This appendix covers the test requirements used to measure the energy performance of single-duct and dual-duct portable air conditioners. It does not contain testing provisions for measuring the energy performance of spot coolers at this time.

2. Definitions

2.1 *Active mode* means a mode in which a portable air conditioner is connected to a mains power source, has been activated, and is performing the main functions of cooling or heating the conditioned space, circulating air through activation of its fan or blower without activation of the refrigeration system, or defrosting the refrigerant coil.

2.2 *AHAM PAC–1* means the test standard published by the Association of Home Appliance Manufacturers, titled ''Portable Air Conditioners,'' AHAM PAC–1–2014 (*incorporated by reference; see § 430.3*).

2.3 *Cooling mode* means an active mode in which a portable air conditioner has activated the main cooling function according to the thermostat or temperature sensor signal, including activating the refrigeration system or the fan or blower without activation of the refrigeration system.

2.4 *Dual-duct portable air conditioner* means a portable air conditioner that draws some or all of the condenser inlet air from outside the conditioned space through a duct, and may draw additional condenser inlet air from the conditioned space. The condenser outlet air is discharged outside the conditioned space by means of a separate duct.

2.5 *Energy efficiency ratio for portable air conditioners* means a measure of energy efficiency of a portable air conditioner calculated by dividing the cooling mode or heating mode capacity by the power consumption in that mode, measured in Btu per watt-hours (Btu/Wh).

2.6 *Heating mode* means an active mode in which a portable air conditioner has activated the main heating function according to the thermostat or temperature sensor signal, including activating a resistance heater, the refrigeration system with a reverse refrigerant flow valve, or the fan or blower without activation of the resistance heater or refrigeration system.

2.7 *IEC 62301* means the test standard published by the International Electrotechnical Commission, titled ''Household electrical appliances–Measurement of standby power,'' Publication 62301 (Edition 2.0 2011–01) (*incorporated by reference; see § 430.3*).

2.8 *Inactive mode* means a standby mode that facilitates the activation of active mode by remote switch (including remote control), internal sensor, or timer, or that provides continuous status display.

2.9 *Off-cycle mode* means a mode in which a portable air conditioner:

(1) Has cycled off its main heating or cooling function by thermostat or temperature sensor signal;

(2) May or may not operate its fan or blower; and

(3) Will reactivate the main cooling or heating function according to the thermostat or temperature sensor signal.

2.10 *Off mode* means a mode in which a portable air conditioner is connected to a mains power source and is not providing any active mode or standby mode function, and where the mode may persist for an indefinite time. An indicator that only shows the user that the portable air conditioner is in the off position is included within the classification of an off mode.

2.11 *Product capacity for portable air conditioners* means a measure of either the cooling or heating, measured in Btu/h, provided to the indoor conditioned space, measured under the specified ambient conditions for each active mode. Separate product capacities are calculated for cooling and heating modes.

2.12 *Single-duct portable air conditioner* means a portable air conditioner that draws all of the condenser inlet air from the conditioned space without the means of a duct, and discharges the condenser outlet air outside the conditioned space through a single duct.

2.13 *Spot cooler* means a portable air conditioner that draws condenser inlet air from and discharges condenser outlet air to the conditioned space, and draws evaporator inlet air from and discharges evaporator outlet air to a localized zone within the conditioned space.

2.14 *Standby mode* means any mode where a portable air conditioner is connected to a mains power source and offers one or more of the following user-oriented or protective functions which may persist for an indefinite time:

(1) To facilitate the activation of other modes (including activation or deactivation of active mode) by remote switch (including remote control), internal sensor, or timer; or

(2) Continuous functions, including information or status displays (including clocks) or sensor-based functions. A timer is a continuous clock function (which may or may not be associated with a display) that provides regular scheduled tasks (*e.g.,* switching) and that operates on a continuous basis.

3. Test Apparatus and General Instructions

3.1 Active mode.

3.1.1 *Test conduct.* The test apparatus and instructions for testing portable air conditioners in cooling mode and heating mode shall conform to the requirements specified in Section 4, ''Definitions'' and Section 7, ''Tests,'' of AHAM PAC–1–2014 (*incorporated by reference; see § 430.3*), except as otherwise specified in this appendix. Measure duct heat transfer, case heat transfer, and infiltration air heat transfer according to section 4.1.1.1, section 4.1.1.2, and section 4.1.1.3 of this appendix, respectively.

3.1.1.1 *Duct setup.* Use ducting components provided by the manufacturer during active mode testing, including, where provided by the manufacturer, ducts, connectors for attaching the duct(s) to the test unit, and window mounting fixtures. Do not apply additional sealing or insulation.

3.1.1.2 *Single-duct evaporator inlet test conditions.* When testing single-duct units, maintain the evaporator inlet (or condenser inlet for heating mode) dry-bulb temperature within a range of 1.0 °F with an average difference of 0.3 °F.

3.1.1.3 *Condensate Removal—Cooling Mode.* Setup the test unit in accordance with manufacturer instructions. If the unit has an auto-evaporative feature, keep any provided drain plug installed as shipped and do not provide other means of condensate removal. If the internal condensate collection bucket fills during the test, halt the test, remove the drain plug, install a gravity drain line, and start the test from the beginning. If no auto-evaporative feature is available, remove the drain plug and install a gravity drain line. If no auto-evaporative feature or gravity drain is available and a condensate pump is included, or if the manufacturer specifies the use of an included condensate pump during cooling mode operation, then test the portable air conditioner with the condensate pump enabled. For units that shall be tested with a condensate pump, apply the provisions in Section 7.1.2 of AHAM PAC–1–2014 (*incorporated by reference; see § 430.3*) if the pump cycles on and off.

3.1.1.4 *Unit Placement.* The evaporator inlet (condenser inlet in heating mode) must be no less than 6 feet from any test chamber wall surface. For single-duct units, the condenser inlet (evaporator inlet in heating mode) must be no less than 6 feet from any other wall surface. Additionally, there must be no less than 3 feet between any wall surfaces and the other surfaces of the portable air conditioner with no air inlet or exhaust.

3.1.1.5 *Electrical supply.* For active mode testing, maintain the input standard voltage at 115 V ±1 percent. Test at the rated frequency, maintained within ±1 percent.

3.1.2 *Control settings.* Set the controls to the lowest available temperature setpoint for cooling mode and the highest available temperature setpoint for heating mode. If the portable air conditioner has a user-adjustable fan speed, select the maximum fan speed setting. If the portable air conditioner has an automatic louver oscillation feature, disable that feature throughout testing. If the louver oscillation feature is included but there is no option to disable it, testing shall proceed with the louver oscillation enabled. If the portable air conditioner has adjustable louvers, position the louvers parallel with the airflow to maximize air flow and minimize static pressure loss.

3.1.3 *Measurement resolution and rounding.* Record measurements at the resolution of the test instrumentation. Round the final cooling and heating capacity values in accordance with Table 1 of AHAM PAC–1–2014 (*incorporated by reference; see § 430.3*). Round EER_{cm}, EER_{hm}, $CEER_{cm}$, and CEER, as calculated in section 5 of this appendix, to the nearest 0.1 Btu/Wh.

3.2 Standby mode and off mode.

3.2.1 *Installation requirements.* For the standby mode and off mode testing, install the portable air conditioner in accordance with Section 5, Paragraph 5.2 of IEC 62301 (*incorporated by reference; see § 430.3*), disregarding the provisions regarding batteries and the determination, classification, and testing of relevant modes.

3.2.2 Electrical energy supply.

3.2.2.1 *Electrical supply.* For the standby mode and off mode testing, maintain the input standard voltage at 115 V ±1 percent. Maintain the electrical supply at the rated frequency ±1 percent.

3.2.2.2 *Supply voltage waveform.* For the standby mode and off mode testing, maintain the electrical supply voltage waveform indicated in Section 4, Paragraph 4.3.2 of IEC 62301 (*incorporated by reference; see § 430.3*).

3.2.3 *Standby mode and off mode wattmeter.* The wattmeter used to measure standby mode and off mode power consumption must meet the requirements specified in Section 4, Paragraph 4.4 of IEC 62301 (*incorporated by reference; see § 430.3*).

3.2.4 *Standby mode and off mode ambient temperature.* For standby mode and off mode testing, maintain room ambient air temperature conditions as specified in Section 4, Paragraph 4.2 of IEC 62301 (*incorporated by reference; see § 430.3*).

3.2.5 *Duct temperature measurements.* Measure the surface temperatures of each duct using four equally spaced thermocouples per duct, adhered to the outer surface of the entire length of the duct. Temperature measurements must be accurate to within ±0.5 °F.

3.2.6 *Case temperature measurements.* Measure case surface temperatures using four equally spaced thermocouples adhered to each of the six case surfaces: front, right, left, back, top, and bottom. Place the thermocouples in a configuration that ensures that the case surface, when divided into quadrants, contains at least one thermocouple in each quadrant. If an evenly spaced case surface temperature thermocouple would otherwise be placed on an air inlet or exhaust grille, place the thermocouple adjacent to the inlet or exhaust grille, as close as possible to even spacing with the other thermocouples on that surface. Temperature measurements must be accurate to within ±0.5 °F.

4. Test Measurement

4.1 Active mode.

4.1.1 *Cooling mode.* Measure the indoor room cooling capacity, $Capacity_{cm}$, in accordance with Section

7.1.b of AHAM PAC–1–2014 (*incorporated by reference; see § 430.3*). Measure the overall power input in cooling mode, P_{cm}, in Watts, in accordance with Section 7.1.c of AHAM PAC–1–2014 (*incorporated by reference; see § 430.3*).

4.1.1.1 *Duct Heat Transfer.* Measure the surface temperature of the condenser exhaust duct and condenser inlet duct, where applicable, calculating the average temperature on each duct (T_{duct_j}) from the average of the four temperature measurements taken on that duct. Calculate the surface area (A_{duct_j}) of each duct according to the following:

$A_{duct\_j} = \pi \times d_j \times L_j$

Where:

d_j is the outer diameter of duct "j".
L_j is the extended length of duct "j" while under test.
j represents the condenser exhaust duct and, for dual-duct units, condenser inlet duct.

Calculate the total heat transferred from the surface of the duct(s) to the indoor conditioned space while operating in cooling mode as follows.

$Q_{duct\_cm} = \Sigma j\{h \times A_{duct\_j} \times (T_{duct\_j} - T_{ei})\}$

Where:

Q_{duct_cm} is the total heat transferred from the duct(s) to the indoor conditioned space in cooling mode.
h is the convection coefficient, 4 Btu/h per square foot per °F.
A_{duct_j} is the surface area of duct "j", in square feet.
T_{duct_j} is the average surface temperature for duct "j", in °F.
j represents the condenser exhaust duct and, for dual-duct units, condenser inlet duct.
T_{ei} is the average evaporator inlet air dry-bulb temperature, in °F.

4.1.1.2 *Case Heat Transfer.* Determine the average surface temperature, T_{case_k}, for each side of the test unit case by averaging the four temperature measurements on that side.

Calculate the surface area of each case side as the product of the two primary surface dimensions. Calculate the surface area of the case side according to the following:

$A_{case\_k} = D_{1\_k} \times D_{2\_k}$

Where:

D_{1_k} and D_{2_k} are the two primary dimensions of the case side "k" exposed to ambient air.

Calculate the heat transferred from all case sides to the indoor conditioned space according to the following:

$Q_{case\_cm} = \Sigma k\{h \times A_{case\_k} \times (T_{case\_k} - T_{ei})\}$

Where:

Q_{case_cm} is the total heat transferred from all case sides to the indoor conditioned space in cooling mode.
h is the convection coefficient, 4 Btu/h per square foot per °F.
k represents the case sides, including front, back, right, left, top, and bottom.
A_{case_k} is the surface area of case side "k", in square feet.
T_{case_k} is the average surface temperature of case side "k", in °F.
T_{ei} is the average evaporator inlet air dry-bulb temperature, in °F.

4.1.1.3 *Infiltration Air Heat Transfer.* Measure the heat contribution from infiltration air for single-duct units and dual-duct units that draw at least part of the condenser air from the conditioned space. The dry air mass flow rate of infiltration air shall be calculated according to the following.

$$\dot{m}_{sd} = \frac{V_{co} \times \rho_{co}}{(1 + \omega_{co})}$$

$$\dot{m}_{dd} = \left[\frac{V_{co} \times \rho_{co}}{(1 + \omega_{co})}\right] - \left[\frac{V_{ci} \times \rho_{ci}}{(1 + \omega_{ci})}\right]$$

Where:

$\dot{m}_{sd}$ is the dry air mass flow rate of infiltration air for a single-duct unit, in pounds per minute (lb/m).
$\dot{m}_{dd}$ is the dry air mass flow rate of infiltration air for a dual-duct unit, in lb/m.
V_{co} is the volumetric flow rate of the condenser outlet air, in cubic feet per minute (cfm).
V_{ci} is the volumetric flow rate of the condenser inlet air, in cfm.
ρ_{co} is the density of the condenser outlet air, in pounds mass per cubic foot (lb_m/ft^3).
ρ_{ci} is the density of the condenser inlet air, in lb_m/ft^3.
ω_{co} is the humidity ratio of condenser outlet air, in pounds mass of water vapor per pounds mass of dry air (lb_w/lb_{da}).
ω_{ci} is the humidity ratio of condenser inlet air, in lb_w/lb_{da}.

Calculate the sensible component of infiltration air heat contribution according to the following:

$$Q_s = \frac{\dot{m} \times \left[\left(c_{p\_da} \times (T_{ia} - T_{ei})\right) + c_{p\_wv} \times (\omega_{ia} \times T_{ia} - \omega_{ei} \times T_{ei})\right]}{60}$$

Where:

Q_s is the sensible heat added to the room by infiltration air, in Btu/h.
$\dot{m}$ is the dry air mass flow rate of infiltration air,
$\dot{m}_{SD}$ or
$\dot{m}_{DD}$, in lb/m.
c_{p_da} is the specific heat of dry air, 0.24 Btu/lb_m-°F.
c_{p_wv} is the specific heat of water vapor, 0.444 Btu/lb_m-°F.
ω_{ia} is the humidity ratio of the infiltration air, 0.0141 lb_w/lb_{da}.
ω_{ei} is the humidity ratio of the evaporator inlet air, in lb_w/lb_{da}.
60 is the conversion factor from minutes to hours.
T_{ei} is the indoor chamber dry-bulb temperature measured at the evaporator inlet, in °F.
T_{ia} is the infiltration air dry-bulb temperature, 95 °F.

Calculate the latent heat contribution of the infiltration air according to the following::

$$Q_l = \frac{\dot{m} \times H_{fg} \times (\omega_{ia} - \omega_{ei})}{60}$$

Where:

Q_l is the latent heat added to the room by infiltration air, in Btu/h.
$\dot{m}$ is the mass flow rate of infiltration air,
$\dot{m}_{SD}$ or
$\dot{m}_{DD}$, in lb/m.
ω_{ia} is the humidity ratio of the infiltration air, 0.0141 lb_w/lb_{da}.
ω_{ei} is the humidity ratio of the evaporator inlet air, in lb_w/lb_{da}.
H_{fg} is the latent heat of vaporization for water vapor, 1061 Btu/lb_m.
60 is the conversion factor from minutes to hours.

The total heat contribution of the infiltration air is the sum of the sensible and latent heat:

$Q_{infiltration\_cm} = Q_s + Q_l$

Where:

$Q_{infiltration\_cm}$ is the total infiltration air heat in cooling mode, in Btu/h.
Q_s is the sensible heat added to the room by infiltration air, in Btu/h.
Q_l is the latent heat added to the room by infiltration air, in Btu/h.

4.1.2 *Heating Mode.* Measure the indoor room heating capacity, $Capacity_{hm}$, overall power input in heating mode, P_{hm}, duct heat transfer, Q_{duct_hm}, case heat transfer, Q_{case_hm}, and infiltration air heat transfer, $Q_{infiltration\_hm}$, as for cooling in section 4.1.1 of this appendix, except that: (1) The terms "Evaporator" and "Condenser" shall refer to the heat exchanger configuration in cooling mode, not the reverse cycle heating mode; (2) the resulting $Capacity_{hm}$ shall be multiplied by −1 to convert from cooling capacity to heating capacity; and (3) the temperatures provided in the table below shall be used in place of the standard rating conditions found in Table 2 of AHAM PAC–1–2014 (*incorporated by reference; see § 430.3*).

Test Configuration from table 2 in AHAM PAC–1–2014	Evaporator inlet air, °F (°C)		Condenser inlet air, °F (°C)	
	Dry-bulb	Wet-bulb	Dry-bulb	Wet-bulb
3	70.0 (21.1)	60.0 (15.6)	47.0 (8.33)	43.0 (6.11)
5	70.0 (21.1)	60.0 (15.6)	70.0 (21.1)	60.0 (15.6)

4.2 *Off-cycle mode.* Establish the test conditions specified in section 3.1.1 of this appendix, except that the wattmeter specified in section 3.2.3 of this appendix shall be used. Begin the off-cycle mode test period 5 minutes following the cooling mode test period. Adjust the setpoint higher than the ambient temperature to ensure the product will not enter cooling mode and begin the test 5 minutes after the compressor cycles off due to the change in setpoint. The off-cycle mode test period shall be 2 hours in duration, during which the power consumption is recorded at the same intervals as recorded for cooling mode testing. Measure and record the average off-cycle mode power of the portable air conditioner, P_{oc}, in watts.

4.3 *Standby mode and off mode.* Establish the testing conditions set forth in section 3.2 of this appendix, ensuring that the portable air conditioner does not enter any active modes during the test. For portable air conditioners that take some time to enter a stable state from a higher power state as discussed in Section 5, Paragraph 5.1, Note 1 of IEC 62301, (*incorporated by reference; see § 430.3*), allow sufficient time for the portable air conditioner to reach the lowest power state before proceeding with the test measurement. Follow the test procedure specified in Section 5, Paragraph 5.3.2 of IEC 62301 (*incorporated by reference; see § 430.3*) for testing in each possible mode as described in sections 4.2.1 and 4.2.2 of this appendix.

4.3.1 If the portable air conditioner has an inactive mode, as defined in section 2.8 of this appendix, but not an off mode, as defined in section 2.10 of this appendix, measure and record the average inactive mode power of the portable air conditioner, P_{ia}, in watts.

4.3.2 If the portable air conditioner has an off mode, as defined in section 2.10 of this appendix, measure and record the average off mode power of the portable air conditioner, P_{om}, in watts.

5. Calculation of Derived Results From Test Measurements

5.1 *Adjusted Cooling Capacity.* Calculate the adjusted cooling capacity for portable air conditioners, ACC, expressed in Btu/h, according to the following:

$$ACC = Capacity_{cm} - Q_{duct\_cm} - Q_{case\_cm} - Q_{infiltration\_cm}$$

Where:

$Capacity_{cm}$ is the cooling capacity measured in section 4.1.1 of this appendix.

Q_{duct_cm} is the duct heat transfer while operating in cooling mode, measured in section 4.1.1.1 of this appendix.

Q_{case_cm} is the case heat transfer while operating in cooling mode, measured in section 4.1.1.2 of this appendix.

$Q_{infiltration\_cm}$ is the infiltration air heat transfer while operating in cooling mode, measured in section 4.1.1.3 of this appendix.

5.2 *Adjusted Heating Capacity.* Calculate the adjusted heating capacity for portable air conditioners, AHC, expressed in Btu/h, according to the following:

$$AHC = Capacity_{hm} + Q_{duct\_hm} + Q_{case\_hm} + Q_{infiltration\_hm}$$

Where:

$Capacity_{hm}$ is the heating capacity measured in section 4.1.2 of this appendix.

Q_{duct_hm} is the duct heat transfer while operating in heating mode, measured in section 4.1.2 of this appendix.

Q_{case_hm} is the case heat transfer while operating in heating mode, measured in section 4.1.2 of this appendix.

$Q_{infiltration\_hm}$ is the infiltration air heat transfer while operating in heating mode, measured in section 4.1.2 of this appendix.

5.3 *Energy Efficiency Ratio.* Calculate the cooling energy efficiency ratio, EER_{cm}, and heating energy efficiency ratio, EER_{hm}, both expressed in Btu/Wh, according to the following:

$$EER_{cm} = \frac{ACC}{P_{cm}}$$

$$EER_{hm} = \frac{AHC}{P_{hm}}$$

Where:

ACC is the adjusted cooling capacity, in Btu/h, calculated in section 5.1 of this appendix.

AHC is the adjusted heating capacity, in Btu/h, calculated in section 5.2 of this appendix.

P_{cm} is the overall power input in cooling mode, in watts, measured in section 4.1.1 of this appendix.

P_{hm} is the overall power input in heating mode, in watts, measured in section 4.1.2 of this appendix.

5.4 *Annual Energy Consumption.* Calculate the annual energy consumption in each operating mode, AEC_m, expressed in kilowatt-hours per year (kWh/year). The annual hours of operation in each mode are estimated as follows:

Operating mode	Annual operating hours for calculating:	
	Cooling only	Cooling and heating
Cooling	750	750
Heating	0	1,008
Off-Cycle	880	2,063
Inactive or Off	1,355	1,704

$$AEC_m = P_m \times t_m \times k$$

Where:

AEC_m is the annual energy consumption in each mode, in kWh/year.

P_m is the average power in each mode, in watts.

t is the number of annual operating time in each mode, in hours.

m represents the operating mode (''cm'' cooling, ''hm'' heating, ''oc'' off-cycle, and ''ia'' inactive or ''om'' off mode).

k is 0.001 kWh/Wh conversion factor from watt-hours to kilowatt-hours.

Total annual energy consumption in all modes except cooling and heating, is calculated according to the following:

$$AEC_T = \Sigma_m AEC_m$$

Where:

AEC_T is the total annual energy consumption attributed to all modes except cooling and heating, in kWh/year;

AEC_m is the total annual energy consumption in each mode, in kWh/year.

m represents the operating modes included in AEC_T (''oc'' off-cycle, and ''im'' inactive or ''om'' off mode).

5.5 *Combined Energy Efficiency Ratio in Cooling Mode.* Using the annual operating hours for cooling only, as outlined in section 5.4 of this appendix, calculate the cooling mode combined energy efficiency ratio, $CEER_{cm}$, expressed in Btu/Wh, according to the following:

$$CEER_{cm} = \frac{ACC}{\left(\frac{AEC_{cm} + AEC_T}{k \times t}\right)}$$

Where:

$CEER_{cm}$ is the combined energy efficiency ratio in cooling mode, in Btu/Wh.

ACC is the adjusted cooling capacity, in Btu/h, calculated in section 5.1 of this appendix.

AEC_{cm} is the annual energy consumption in cooling mode, in kWh/year, calculated in section 5.4 of this appendix.

AEC_T is the total annual energy consumption attributed to all modes except cooling and heating, in kWh/year, calculated in section 5.4 of this appendix.

t is the number of hours per year, 8,760.

k is 0.001 kWh/Wh conversion factor for watt-hours to kilowatt-hours.

5.6 *Total Combined Energy Efficiency Ratio.* For units with heating and cooling modes, use the annual operating hours for cooling and heating, as outlined in section 5.4 of this appendix to calculate the total combined energy efficiency ratio, CEER, expressed in Btu/Wh. For units with no heating mode, CEER shall be equal to $CEER_{cm}$, calculated as described in section 5.5 of this appendix.

$$CEER = \frac{ACC \times \left(\frac{h_{cm}}{h_{cm} + h_{hm}}\right) + AHC \times \left(\frac{h_{hm}}{h_{cm} + h_{hm}}\right)}{\left(\frac{AEC_{cm} + AEC_{hm} + AEC_T}{k \times t}\right)}$$

Where:

ACC is the adjusted cooling capacity, in Btu/h, calculated in section 5.1 of this appendix.

AHC is the adjusted heating capacity, in Btu/h, calculated in section 5.2 of this appendix.

h_{cm} and h_{hm} are the cooling and heating mode operating hours, respectively.

AEC_{cm} is the annual energy consumption in cooling mode, in kWh/year, calculated in section 5.4 of this appendix.

AEC_{hm} is the annual energy consumption in heating mode, in kWh/year, calculated in section 5.4 of this appendix.

AEC_T is the total annual energy consumption attributed to all modes except cooling and heating, in kWh/year, calculated in section 5.4 of this appendix.

t is the number of hours per year, 8,760.

k is 0.001 kWh/Wh conversion factor for watt-hours to kilowatt-hours.

[FR Doc. 2015–03589 Filed 2–24–15; 8:45 am]

BILLING CODE 6450–01–P