DEPARTMENT OF ENERGY

10 CFR Parts 429 and 430

[EERE–2020–BT–TP–0029]

RIN 1904–AF03

Energy Conservation Program: Test Procedure for Portable Air Conditioners

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

ACTION: Notice of proposed rulemaking and request for comment.

SUMMARY: The U.S. Department of Energy (''DOE'') proposes to amend the test procedure for portable air conditioners (''portable ACs'') to incorporate a measure of variable-speed portable AC performance and make minor clarifying edits. DOE also proposes a new test procedure to improve representativeness for all configurations of portable ACs, which relies on a substantively different measure of cooling capacity and energy consumption compared to the current portable AC test procedure. DOE is seeking comment from interested parties on the proposal.

DATES:

Comments: DOE will accept comments, data, and information regarding this proposal no later than August 8, 2022. See section V, ''Public Participation,'' for details.

Meeting: DOE will hold a webinar on Wednesday, July 13, 2022, from 1:00 p.m. to 4:00 p.m. See section V, ''Public Participation,'' for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

ADDRESSES: Interested persons are encouraged to submit comments using the Federal eRulemaking Portal at *www.regulations.gov.* Follow the instructions for submitting comments. Alternatively, interested persons may submit comments, identified by docket number EERE–2020–BT–TP–0029, by any of the following methods:

1. *Federal eRulemaking Portal: www.regulations.gov.* Follow the instructions for submitting comments.

2. *Email: PortableAC2020TP0029@ee.doe.gov.* Include the docket number EERE–2020–BT–TP–0029 in the subject line of the message.

3. *Postal Mail:* Appliance and Equipment Standards Program, U.S. Department of Energy, Building Technologies Office, Mailstop EE–5B, 1000 Independence Avenue SW, Washington, DC 20585–0121. Telephone: (202) 287–1445. If possible, please submit all items on a compact disc (''CD''), in which case it is not necessary to include printed copies.

4. *Hand Delivery/Courier:* Appliance and Equipment Standards Program, U.S. Department of Energy, Building Technologies Office, 950 L'Enfant Plaza SW, 6th Floor, Washington, DC, 20024. Telephone: (202) 287–1445. If possible, please submit all items on a CD, in which case it is not necessary to include printed copies.

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

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

The docket web page can be found at *www.regulations.gov/docket/EERE-2020-BT-TP-0029.* The docket web page contains instructions on how to access all documents, including public comments, in the docket. See section V for information on how to submit comments through *www.regulations.gov.*

FOR FURTHER INFORMATION CONTACT:

Mr. Lucas Adin, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Office, EE–5B, 1000 Independence Avenue SW, Washington, DC 20585–0121. Telephone: (202) 287–5904. Email *ApplianceStandardsQuestions@ee.doe.gov.*

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

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

SUPPLEMENTARY INFORMATION: DOE proposes to incorporate by reference the following draft industry standard into part 430:

Association of Home Appliance Manufacturers (''AHAM'') PAC–1–2022 Draft, (''AHAM PAC–1–2022 Draft''), ''Portable Air Conditioners''. AHAM PAC–1–2022 Draft is in draft form and its text was provided to the Department for the purposes of review only during the drafting of this NOPR. DOE intends to update the reference to the final published version of AHAM PAC–1–2022 Draft in the Final Rule, unless there are substantive changes between the draft and published versions, in which case DOE may adopt the substance of the AHAM PAC–1–2022 Draft or provide additional opportunity for comment on the changes to the industry consensus test procedure.

A copy of AHAM PAC–1–2022 Draft is attached in this docket for review.

DOE proposes to maintain and update the previously approved incorporations by reference for the following industry standards in part 430:

ANSI/ASHRAE Standard 37–2009, (''ASHRAE 37–2009''), Methods of Testing for Rating Electrically Driven Unitary Air-Conditioning and Heat Pump Equipment, ANSI approved June 25, 2009.

IEC 62301 (''IEC 62301''), Household electrical appliances—Measurement of standby power, (Edition 2.0, 2011–01).

DOE proposes to incorporate by reference the following industry standards into part 430:

ANSI/ASHRAE 51–1999/ANSI/AMCA 210–99 (''ANSI/ASHRAE 51''), Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating, ANSI approved December 2, 1999; ASHRAE approved June 23, 1999.

ANSI/ASHRAE 41.1–1986 (Reaffirmed 2006), Standard Method for Temperature Measurement, approved February 18, 1987.

ANSI/ASHRAE Standard 41.6–1994 (RA 2006), (''ASHRAE 41.6–1994''), Standard Method for Measurement of Moist Air Properties, ANSI reaffirmed on January 27, 2006.

Copies of ANSI/ASHRAE Standard 51–1999, ANSI/ASHRAE Standard 41.1–1986, and ANSI/ASHRAE Standard 41.6–1994 can be obtained from the American National Standards Institute at *https://webstore.ansi.org/.*

For a further discussion of these standards see section IV.M of this document.

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I. Authority and Background

DOE's test procedures for portable ACs are currently prescribed at title 10 of the Code of Federal Regulations (''CFR''), part 430, subpart B appendix CC (''appendix CC''). The DOE test procedure measures portable AC efficiency in terms of a combined energy efficiency ratio (''CEER''), which is the ratio of the amount of cooling provided by the portable AC to the amount of power it consumes to provide that cooling. The current portable AC test procedure calculates this using a weighted average of performance at two different test conditions. The following sections discuss DOE's authority to establish test procedures for portable ACs and relevant background information regarding DOE's consideration of test procedures for this product.

A. Authority

The Energy Policy and Conservation Act, as amended (''EPCA''),[1] authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. (42 U.S.C. 6291–6317) Title III, Part B [2] of EPCA established the Energy Conservation Program for Consumer Products Other Than Automobiles, which sets forth a variety of provisions designed to improve energy efficiency. In addition to specifying a list of covered products, EPCA enables the Secretary of Energy to classify additional types of consumer products as covered products under EPCA. (42 U.S.C. 6292(a)(20)) In a final determination of coverage published in the **Federal Register** on April 18, 2016, DOE classified portable ACs as covered products under EPCA. 81 FR 22514.

The energy conservation program under EPCA consists essentially of four parts: (1) testing, (2) labeling, (3) Federal energy conservation standards, and (4) certification and enforcement procedures. Relevant provisions of EPCA specifically include definitions (42 U.S.C. 6291), test procedures (42 U.S.C. 6293), labeling provisions (42 U.S.C. 6294), energy conservation standards (42 U.S.C. 6295), and the authority to require information and reports from manufacturers (42 U.S.C. 6296).

The Federal 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 pursuant to EPCA (42 U.S.C. 6295(s)), and (2) making representations about the efficiency of those consumer products (42 U.S.C. 6293(c)). Similarly, DOE must use these test procedures to determine whether the products comply with relevant standards promulgated under EPCA. (42 U.S.C. 6295(s))

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

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 requires that any test procedures prescribed or amended under this section 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 not be unduly burdensome to conduct. (42 U.S.C. 6293(b)(3))

In addition, EPCA requires that DOE amend its test procedures for all covered products to integrate measures of standby mode and off mode energy consumption. (42 U.S.C. 6295(gg)(2)(A)) Standby mode and off mode energy consumption must be incorporated into the overall energy efficiency, energy consumption, or other energy descriptor for each covered product unless the current test procedures already account for and incorporate standby and off mode energy consumption or such integration is technically infeasible. If an integrated test procedure is technically infeasible, DOE must prescribe a separate standby mode and off mode energy use test procedure for the covered product, if technically feasible. (42 U.S.C. 6295(gg)(2)(A)(ii)) Any such amendment must consider the most current versions of the International Electrotechnical Commission (''IEC'') Standard 62301 [3] and IEC Standard 62087 [4] as applicable. (42 U.S.C. 6295(gg)(2)(A))

EPCA also requires that, at least once every 7 years, DOE evaluate test procedures for each type of covered product, including portable ACs, to determine whether amended test procedures would more accurately or fully comply with the requirements for the test procedures to not be unduly burdensome to conduct and be reasonably designed to produce test results that reflect energy efficiency, energy use, and estimated operating costs during a representative average use cycle or period of use. (42 U.S.C. 6293(b)(1)(A))

If the Secretary determines, on her own behalf or in response to a petition by any interested person, that a test procedure should be prescribed or amended, the Secretary shall promptly publish in the **Federal Register** proposed test procedures and afford interested persons an opportunity to

[1] All references to EPCA in this document refer to the statute as amended through the Energy Act of 2020, Public Law 116–260 (Dec. 27, 2020), which reflect the last statutory amendments that impact Parts A and A–1 of EPCA.

[2] For editorial reasons, upon codification in the U.S. Code, Part B was redesignated Part A.

[3] IEC 62301, *Household electrical appliances—Measurement of standby power* (Edition 2.0, 2011–01).

[4] IEC 62087, *Methods of measurement for the power consumption of audio, video, and related equipment* (Edition 3.0, 2011–04).

present oral and written data, views, and arguments with respect to such procedures. The comment period on a proposed rule to amend a test procedure shall be at least 60 days and may not exceed 270 days. In prescribing or amending a test procedure, the Secretary shall take into account such information as the Secretary determines relevant to such procedure, including technological developments relating to energy use or energy efficiency of the type (or class) of covered products involved. (42 U.S.C. 6293(b)(2)) If DOE determines that test procedure revisions are not appropriate, DOE must publish its determination not to amend the test procedures. DOE is publishing this notice of proposed rulemaking (''NOPR'') in satisfaction of the 7-year review requirement specified in EPCA. (42 U.S.C. 6293(b)(1)(A))

B. Background

As stated, DOE's existing test procedures for portable ACs appear at appendix CC. DOE established the test procedure for portable ACs on June 1, 2016 (''June 2016 Final Rule''), to ensure it is representative of typical use and to improve accuracy and repeatability without undue test burden. 81 FR 35241. The June 2016 Final Rule established provisions for measuring the energy consumption of single-duct and dual-duct portable ACs in active, standby, and off modes. The June 2016 Final Rule also established provisions for certification, compliance, and enforcement for portable ACs in 10 CFR part 429.

On June 2, 2020, DOE published a Decision and Order granting a waiver to LG Electronics USA, Inc. (''LG'') for basic models of single-duct variable-speed portable ACs to account for variable-speed portable AC performance under multiple outdoor temperature operating conditions, thus yielding more representative results. 85 FR 33643 (Case No. 2018–004, ''LG Waiver'').

On November 5, 2020, DOE published in the **Federal Register** an early assessment review request for information (''RFI'') (''November 2020 RFI'') in which it sought data and information pertinent to whether amended test procedures would (1) more accurately or fully comply with the requirement that the test procedure produces results that measure energy use during a representative average use cycle or period of use for the product without being unduly burdensome to conduct, or (2) reduce testing burden. 85 FR 70508.

On April 6, 2021, DOE published a notice of interim waiver for GD Midea Air Conditioning Equipment Co. LTD. (''Midea''), which issued a similar alternate test procedure to that from the LG Waiver with additional specifications to accommodate the combined-duct configurations of the specified Midea basic models. 86 FR 17803 (Case No. 2020–006, ''Midea Interim Waiver'').

On April 16, 2021, DOE published in the **Federal Register** an RFI (''April 2021 RFI'') seeking data and information regarding issues pertinent to whether amended test procedures would more accurately or fully comply with the requirement that the test procedure produces results that measure energy use during a representative average use cycle or period of use for the product without being unduly burdensome to conduct, or reduce testing burden. In the April 2021 RFI, DOE requested comments, information, and data about a number of issues, including (1) updates to industry test standards, (2) test harmonization, (3) energy use measurements, (4) representative average period of use, (5) test burden, 6) heat transfer measurements and calculations, (7) heating mode, fan-only mode, and dehumidification mode, (8) network connectivity, (9) part-load performance and load-based testing, (10) spot coolers, and (11) test procedure waivers. 86 FR 20044.

DOE received comments in response to the April 2021 RFI from the interested parties listed in Table I.1.

TABLE I.1—WRITTEN COMMENTS RECEIVED IN RESPONSE TO APRIL 2021 RFI

Commenter(s)	Reference in this NOPR	Commenter type
Association of Home Appliance Manufacturers	AHAM	Trade Association.
Keith Rice	Rice	Individual.
Northwest Energy Efficiency Alliance	NEEA	Efficiency Organization.
Appliance Standards Awareness Project, Consumer Federation of America, Natural Resources Defense Council.	Joint Commenters	Efficiency Organizations.
Pacific Gas and Electric Company, Southern California Gas Company, Southern California Edison, and San Diego Gas and Electric Company (collectively, the California Investor-Owned Utilities).	California IOUs	Utility.

A parenthetical reference at the end of a comment quotation or paraphrase provides the location of the item in the public record.[5]

A list of additional abbreviations and acronyms for terms defined in this document are provided in Table I.2.

TABLE I.1—LIST OF ABBREVIATIONS AND ACRONYMS

Abbreviation/acronym	Term in this NOPR
AC	Air conditioner.
ACC	Adjusted cooling capacity.
AEC	Annual energy consumption.
AEER	Annualized energy efficiency ratio.
AHRI	Air-Conditioning, Heating, and Refrigeration Institute.
ANSI	American National Standard Institute.
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers.
Btu/h	British thermal units per hour.

[5] The parenthetical reference provides a reference for information located in the docket of DOE's rulemaking to develop test procedures for portable ACs. (Docket No. EERE–2020–BT–TP0029, which is maintained at *www.regulations.gov*). The references are arranged as follows: (commenter name, comment docket ID number, page of that document).

TABLE I.1—LIST OF ABBREVIATIONS AND ACRONYMS—Continued

Abbreviation/acronym	Term in this NOPR
Btu/h-ft²-°F	British thermal units per hour-square foot-degree Fahrenheit.
Btu/Wh	British thermal units per watt-hour.
CBI	Confidential business information.
Cd	Cooling degradation coefficient.
CEER	Combined energy efficiency ratio.
CF	Cycling factor.
CFR	Code of Federal Regulations.
COVID–19	Coronavirus 2019.
DOE	U.S. Department of Energy.
°F	Degrees Fahrenheit.
E.O.	Executive order.
EPCA	Energy Policy and Conservation Act.
FEAA	Federal Energy Administration Authorization Act of 1977.
FTC	Federal Trade Commission.
IEC	International Electrotechnical Commission.
IRFA	Initial regulatory flexibility analysis.
ISO	International Organization for Standardization.
kWh	Kilowatt-hours.
LBNL	Lawrence Berkeley National Laboratory.
MAEDbS	Modernized Appliance Efficiency Database System.
NAFTA	North American Free Trade Agreement.
NAICS	North American Industry Classification System.
NOPR	Notice of proposed rulemaking.
OEM	Original equipment manufacturer.
OIRA	Office of Information and Regulatory Affairs.
OMB	Office of Management and Budget.
PAF	Performance adjustment factor.
RECS	Residential Energy Consumption Survey.
RFI	Request for information.
SACC	Seasonally adjusted cooling capacity.
SBA	Small Business Administration.
UMRA	Unfunded Mandates Reform Act of 1995.
USMCA	Agreement between the United States of America, the United Mexican States, and Canada

II. Synopsis of the Notice of Proposed Rulemaking

In this NOPR, DOE proposes to (1) amend 10 CFR 429.4 ''Materials incorporated by reference'' and 10 CFR 429.62, ''Portable air conditioners;'' (2) update 10 CFR 430.2, ''Definitions'' and 10 CFR 430.23, ''Test procedures for the measurement of energy and water consumption'' to address combined-duct portable ACs; (3) amend appendix CC, ''10 CFR Appendix CC to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Portable Air Conditioners;'' and (4) adopt a new appendix CC1, ''appendix CC1 to subpart B of part 430—Uniform Test Method for Measuring the Energy Consumption of Portable Air Conditioners,'' as summarized in Tables II.1 through II.4 of this document, respectively.

In this NOPR, DOE proposes to amend 10 CFR 429.4 ''Materials incorporated by reference'' and 10 CFR 429.62, ''Portable air conditioners'' as follows:

(1) Incorporate by reference AHAM PAC–1–2022 Draft, ''Portable Air Conditioners'' (''AHAM PAC–1–2022 Draft'') which includes an industry-accepted method for testing variable-speed portable ACs, in 10 CFR 429.4; and

(2) Add rounding instructions for the seasonally adjusted cooling capacity (''SACC'') and annualized energy efficiency ratio (''AEER'') in 10 CFR 429.62;

DOE's proposed actions in 10 CFR 429.4 and 429.62 are summarized in Table II.1 compared to the current 10 CFR 429.4 and 429.62, as well as the reason for the proposed change.

TABLE II.1—SUMMARY OF CHANGES IN PROPOSED 10 CFR 429.4 AND 429.62 RELATIVE TO CURRENT 10 CFR 429.4 AND 429.62

Current 10 CFR 429.4 and 429.62	Proposed 10 CFR 429.4 and 429.62	Attribution
10 CFR 429.4 incorporates by reference American National Standard Institute (''ANSI'')/ AHAM PAC–1–2015.	Adds incorporation by reference in 10 CFR 429.4 of AHAM PAC–1–2022 Draft.	Updated industry test procedure.
10 CFR 429.62 requires rounding based on AHAM PAC–1–2015.	Adds to 10 CFR 429.62 rounding instructions for SACC and AEER when using appendix CC1.	To increase the reproducibility of the test procedure.

In this NOPR, DOE also proposes to update 10 CFR 430.2, ''Definitions'' and 10 CFR 430.23, ''Test procedures for the measurement of energy and water consumption'' as follows:

(1) Add a definition for the term ''combined-duct'' to 10 CFR 430.2; and

(2) Add requirements to determine estimated annual operating cost for single-duct and dual-duct variable-speed portable ACs in 10 CFR 430.23.

DOE's proposed actions in 10 CFR 430.2 and 430.23 are summarized in Table II.2 compared to the current 10 CFR 430.2 and 430.23, as well as the reason for the proposed change.

TABLE II.2—SUMMARY OF CHANGES IN PROPOSED 10 CFR 430.2 AND 430.23 RELATIVE TO CURRENT 10 CFR 430.2 AND 430.23

Current 10 CFR 430.2 and 430.23	Proposed 10 CFR 430.2 and 430.23	Attribution
10 CFR 430.2 does not define combined-duct portable ACs.	Adds a definition to 10 CFR 430.2 for combined-duct pertaining to portable ACs.	Test procedure waiver.
10 CFR 430.23 does not have a method to estimate annual operating cost for single-duct and dual-duct variable-speed portable ACs.	Adds a method to 10 CFR 430.23 to estimate annual operating cost for single-duct and dual-duct variable-speed portable ACs.	Test procedure waiver.

In this NOPR, DOE also proposes to amend appendix CC to subpart B of part 430—Uniform Test Method for Measuring the Energy Consumption of Portable Air Conditioners'' as follows:

(1) Add definitions in section 2 for ''combined-duct,'' ''single-speed,'' ''variable-speed,'' ''full compressor speed (full),'' ''low compressor speed (low),'' and ''theoretical comparable single-speed;''

(2) Divide section 4.1 into two sections, 4.1.1 and 4.1.2, for single-speed and variable-speed portable ACs, respectively, and detail configuration-specific cooling mode testing requirements for variable-speed portable ACs;

(3) Add a requirement in section 4.1.2 that, for variable-speed portable ACs, the full compressor speed at the 95 degree Fahrenheit (''°F'') test condition be achieved with user controls, and the low compressor speed at the 83 °F test condition be achieved with manufacturer-provided settings or controls;

(4) Add a cycling factor (''CF'') in section 5.5.1;

(5) Add a requirement to calculate SACC with full compressor speed at the 95 °F test condition and low compressor speed at the 83 °F test condition in sections 5.1 and 5.2, consistent with the LG waiver and Midea interim waiver, with an additional requirement for variable-speed portable ACs to represent SACC with full compressor speed for both test conditions (''SACCFull''), and;

(6) Add a requirement in section 3.1.2 that, if a portable AC has network functions, all network functions must be disabled throughout testing if such settings can be disabled by the end-user and the product's user manual provides instructions on how to do so. If the network functions cannot be disabled by the end-user, or the product's user manual does not provide instruction for disabling network settings, test the unit with the network settings in the factory default configuration for the duration of the test.

DOE's proposed actions in appendix CC are summarized in Table II.3 compared to the current appendix CC, as well as the reason for the proposed change.

TABLE II.3—SUMMARY OF CHANGES IN PROPOSED APPENDIX CC TO CURRENT APPENDIX CC

Current appendix CC	Proposed appendix CC	Attribution
Does not specify compressor type or include variable-speed portable ACs.	Adds definitions for single-speed and variable-speed pertaining to portable ACs and additional compressor speed definitions.	Test procedure waiver.
Specifies cooling mode requirements and subsequent calculations for single-speed portable ACs.	Adds cooling mode requirements and subsequent calculations for variable-speed portable ACs.	Test procedure waiver.
Does not specify requirements to achieve compressor speeds.	Adds a requirement that the full compressor speed at the 95 °F test condition be achieved with user controls and the low compressor speed at the 83 °F test condition be achieved with manufacturer settings.	Test procedure waiver.
Does not include a CF	Adds a CF to determine a theoretical single-speed portable AC cooling capacity.	Test procedure waiver.
Calculates SACC for single-speed portable ACs	Adds equations to calculate SACC for variable-speed portable ACs. Requires that the full compressor speed be used to determine capacity at the 95 °F test and the low compressor speed be used to determine capacity at the 83 °F test condition. Requires additional representation of new metric, $SACC_{Full}$, using the full compressor speed at the 83 °F test condition.	Test procedure waiver and ensure comparability between single-speed and variable-speed capacity ratings.
Does not specify address portable ACs with network functions.	Adds a requirement that, if a portable AC has network functions, all network functions must be disabled throughout testing.	To ensure reproducibility of the test procedure.

In this NOPR, DOE additionally proposes to adopt a new ''appendix CC1 to subpart B of part 430—Uniform Test Method for Measuring the Energy Consumption of Portable Air Conditioners'' which would:

(1) Incorporate by reference parts of AHAM PAC–1–2022 Draft, which includes an industry-accepted method for testing variable-speed portable ACs;

(2) Adopt a new efficiency metric, AEER, to calculate more representatively the efficiency of both

variable-speed and single-speed portable ACs;

(3) Amend the annual operating hours;

(4) Update the SACC and CEER equations for both single-speed and variable-speed portable ACs;

(5) Apply a CF to single-speed portable AC efficiency; and

(6) Add a requirement that, if a portable AC has network functions, all network functions must be disabled throughout testing. If the network functions cannot be disabled by the end-user, or the product's user manual does not provide instruction for disabling network settings, then test the unit with the network function settings in the factory default configuration for the duration of the test.

Key aspects of DOE's proposed new appendix CC1 are described in Table II.4 compared to the current appendix CC, as well as the reason for the proposed new appendix CC1.

TABLE II.4—SUMMARY OF PROPOSED NEW APPENDIX CC1 TO CURRENT APPENDIX CC

Current appendix CC	Proposed new appendix CC1	Attribution
Incorporates by reference ANSI/AHAM PAC–1–2015	Incorporates by reference AHAM PAC–1–2022 Draft	Updated industry test procedure.
Specifies cooling mode requirements and subsequent calculations for single-speed portable ACs.	Adds cooling mode requirements, operating hours, and a new efficiency metric.	To improve representativeness of the test procedure.
Calculates SACC and CEER for single-speed portable ACs.	Adds equations to calculate SACC and CEER for variable-speed portable ACs and updates the SACC and CEER equations for single-speed portable ACs.	To improve representativeness of the test procedure.
Does not include a CF	Applies a CF to single-speed portable AC efficiency	To improve representativeness of the test procedure.
Does not specify address portable ACs with network functions.	Adds a requirement that, if a portable AC has network functions, all network functions must be disabled throughout testing.	To ensure reproducibility of the test procedure.

Under 42 U.S.C. 6293(e)(1), DOE is required to determine whether an amended test procedure will alter the measured energy use of any covered product. If an amended test procedure does alter measured energy use, DOE is required to make a corresponding adjustment to the applicable energy conservation standard to ensure that minimally compliant covered products remain compliant. (42 U.S.C. 6293(e)(2)) DOE has tentatively determined that the proposed amendments described in section III of this NOPR would not alter the measured efficiency of single-speed portable ACs that are rated using the test procedure that is currently required for testing, *i.e.,* appendix CC. DOE has also tentatively determined that the proposed amendments to appendix CC described in section III and Table II.2 of this NOPR, if made final, could alter the measured efficiency and capacity of variable-speed portable ACs that are currently subject to waivers. Appendix CC does not currently have separate provisions for variable-speed portable ACs. DOE is proposing to establish a test method for such units that would address the ability of variable-speed compressors to adjust their operating speed based on the demand load of the conditioned space. Although the measured efficiency could change for variable-speed portable ACs that are currently subject to waivers, DOE has tentatively determined that this proposal would not require an adjustment to the energy conservation standard for portable ACs to ensure that minimally compliant portable ACs would remain compliant. DOE reached this conclusion because variable-speed portable ACs currently on the market are not representative of minimally compliant units.

DOE also has tentatively determined that the proposed adoption of a new appendix CC1 described in section III and Table II.3 of this NOPR would alter the measured efficiency of portable ACs. DOE proposes that testing according to the proposed new appendix CC1, if made final, would not be required until compliance is required with amended energy conservation standards that are based on the proposed new appendix CC1, should such standards be established. Additionally, DOE has tentatively determined that the proposed amendments, if made final, would not increase the cost of testing. Discussion of DOE's proposed actions are addressed in detail in section III of this NOPR.

III. Discussion

A. Scope of Applicability

DOE defines a ''portable air conditioner'' as a portable encased assembly, other than a packaged terminal air conditioner, room air conditioner, or dehumidifier, that delivers cooled, conditioned air to an enclosed space, and is powered by single-phase electric current. 10 CFR 430.2. The definition also states that a portable AC includes a source of refrigeration and may include additional means for air circulation and heating. *Id.*

DOE has established definitions for two portable AC configurations: ''single-duct portable air conditioner'' and ''dual-duct portable air conditioner.'' A ''single-duct portable air conditioner'' is a portable AC 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 attached to an adjustable window bracket. 10 CFR 430.2. A ''dual-duct portable air conditioner'' is a portable AC that draws some or all of the condenser inlet air from outside the conditioned space through a duct attached to an adjustable window bracket, may draw additional condenser inlet air from the conditioned space, and discharges the condenser outlet air outside the conditioned space by means of a separate duct attached to an adjustable window bracket. *Id.*

In the April 2021 RFI, DOE sought comment on whether the current definitions of ''portable air conditioner,'' ''single-duct portable air conditioner,'' and ''dual-duct portable air conditioner'' require amendment, and if so, how the terms should be defined. 86 FR 20044, 20046 (Apr. 17, 2021). DOE specifically requested comment on whether the existing definitions specified in 10 CFR 430.2 for portable ACs require amendments to distinguish further between single-duct and dual-duct units, or to address any unique configurations that are not clearly addressed in the existing definitions; if amendments were recommended, DOE sought information on what identifying characteristics may be included in potential amended or new definitions.

DOE received no comments related to the definitions in response to the April 2021 RFI. In the Midea Interim Waiver, DOE specified a definition for ''combined-duct portable air conditioner'' as part of the alternate test procedure. 86 FR 17803, 17808. Since this duct configuration was not previously defined, DOE proposes to define ''combined-duct'' in 10 CFR 430.2 specifically as ''for a portable air conditioner, the condenser inlet and outlet air streams flow through separate ducts housed in a single duct structure.''

DOE is not proposing amendments to the definitions for ''portable air conditioner,'' ''single-duct portable air conditioner,'' and ''dual-duct portable air conditioner'' as codified in 10 CFR 430.2, at this time. DOE requests comment on the proposed definition of ''combined duct.''

In the April 2021 RFI, DOE also discussed a comment received in which NEEA stated that ''spot coolers'' are not currently covered by the portable AC test procedure, and that these products do not provide net cooling, but rather move heat from one area to another in a space (*i.e.,* they reject condenser air to the cooled space). 86 FR 20044, 20051. NEEA stated that some portable AC products may meet this description of a spot cooler, and recommended that DOE continue to monitor the market to ensure that market characterization of a product as a ''spot cooler'' is not utilized as a means to circumvent portable AC standards. *Id.* In response, DOE sought information regarding the availability of any portable ACs that provide cooling in a similar manner to single-duct and dual-duct portable ACs but that do not meet either of the definitions for a single-duct or dual-duct portable AC at 10 CFR 430.2. *Id.*

DOE received no comments providing additional information regarding spot coolers. In the 2016 Final Rule, DOE identified the presence of an adjustable window mounting bracket as a primary feature of single-duct and dual-duct portable ACs. 81 FR 35245 (Jun. 1, 2016). In that final rule and in subsequent market reviews, DOE found no spot coolers with an adjustable window mounting bracket. These flexible mounting brackets for condenser inlet and exhaust ducts are required for the portable AC configurations addressed by the portable AC test procedure. Therefore, in this NOPR, DOE is not proposing any amendments to the scope or definitions related to spot coolers.

B. Test Procedure

Portable ACs are currently tested in accordance with appendix CC, which incorporates by reference American National Standard Institute (''ANSI'')/AHAM PAC–1–2015 ''Portable Air Conditioners'' (''ANSI/AHAM PAC–1–2015''), ANSI/American Society of Heating, Refrigerating and Air-Conditioning Engineers (''ASHRAE'') Standard 37–2009 ''Methods of Testing for Rating Electrically Driven Unitary Air-Conditioning and Heat Pump Equipment'' (''ANSI/ASHRAE Standard 37–2009''), and IEC Standard 62301 ''Household electrical appliances—Measurement of standby power'' (Edition 2.0 2011–01) (''IEC Standard 62301''), with modifications. Regarding dual-duct portable ACs, the DOE test procedure specifies provisions in addition to ANSI/AHAM PAC–1–2015. Specifically, the DOE test procedure specifies an additional test condition for dual-duct portable ACs (83 °F dry-bulb and 67.5 °F wet-bulb outdoor temperature) and additionally accounts for duct heat transfer, infiltration air heat transfer, and off-cycle mode energy use. *See* Sections 4.1, 4.1.1, 4.1.2, and 4.2 of appendix CC. Appendix CC also includes instructions regarding tested configurations, duct setup, inlet test conditions, condensate removal, unit placement, duct temperature measurements, and control settings. *See* Sections 3.1.1, 3.1.1.1, 3.1.1.2, 3.1.1.3, 3.1.1.4, 3.1.1.6, and 3.1.2 of appendix CC.

Under the current test procedure, a unit's SACC, in British thermal units per hour (''Btu/h''), is calculated as a weighted average of the adjusted cooling capacity measured at two representative operating conditions. The adjusted cooling capacity is the measured indoor room cooling capacity while operating in cooling mode under the specified test conditions, adjusted based on the measured and calculated duct and infiltration air heat transfer. *See* Sections 4.1, 4.1.1, 4.1.2, 5.1, and 5.2 of appendix CC. The CEER represents the efficiency of the unit, in Btu per watt-hours (''Btu/Wh''), based on the adjusted cooling capacity at the two operating conditions; the annual energy consumption in cooling mode, off-cycle mode, and inactive or off mode; and the number of cooling mode hours per year; with weighting factors applied for the two operating conditions. *See* Sections 4.2, 4.3, 5.3, and 5.4 of appendix CC.

In response to the April 2021 RFI, DOE received a comment from AHAM stating that there is no immediate need to amend the portable AC test procedure, given the backlog of other overdue rules and the fact that the applicable energy conservation standards compliance date is not until 2025. In addition, AHAM stated that it does not believe the existing test procedure needs to be revised other than to make updates to incorporate the existing waivers. AHAM recommended collaborating with AHAM and other stakeholders on this test procedure through the consensus process so that the rulemaking process can be streamlined. (AHAM, No. 8 at p. 2) DOE notes that, at the time of the comment, AHAM and its working group were still working on an update to AHAM PAC–1–2015.

As stated, DOE is conducting this rulemaking in accordance with the periodic review provision in EPCA that requires ''at least once every 7 years, the Secretary shall review test procedures for all covered products including portable ACs and (i) amend test procedures with respect to any covered product, if the Secretary determines that amended test procedures would more accurately or fully comply with the requirements of paragraph (3); or (ii) publish notice in the **Federal Register** of any determination not to amend a test procedure.'' (42 U.S.C. 6293, (b)(1)(A)) In addition, DOE's regulations at 10 CFR 430.27(l) require that as soon as practicable after the granting of any waiver, DOE will publish in the **Federal Register** a NOPR to amend its regulations so as to eliminate any need for the continuation of such waiver. As soon thereafter as practicable, DOE will publish in the **Federal Register** a final rule. 10 CFR 430.27(l).

AHAM further commented that, as DOE evaluates potential changes, it should be mindful that it will take time before many new features, designs, and technologies lend themselves to a ''representative average'' consumer use. AHAM therefore stated that DOE should ensure that the portable AC test procedure does not prematurely address new designs which may not yet have an average use or be in common use by measuring their energy use, asserting that doing so could stifle innovation. (AHAM, No. 8 at p. 4)

DOE notes an important distinction between the requirements of EPCA and AHAM's comment regarding ''representative average'' consumer use as measured by the test procedure. AHAM's comment suggests that testing new features, designs, or technologies is not necessary because, according to AHAM, such features may not yet be in common use on the market. However, under EPCA, DOE is not required to develop a test procedure for the ''average'' portable AC on the market. Instead, DOE is required to develop a test procedure that measures energy use or efficiency for all models of portable ACs during a representative average use cycle or period of use (among other considerations). (42 U.S.C. 6293(b)(3))

1. Updates to Industry Standards

In the November 2020 RFI, DOE sought comment on the availability of industry-accepted consensus-based test procedures for measuring the energy use of portable ACs that could be adopted without modification and more accurately or fully comply with the requirement that the test procedure produces results that measure energy use during a representative average use cycle for the product, and not be unduly burdensome to conduct. 85 FR 70508, 70511.

AHAM stated that the existing test procedure need not be significantly revised, and that the primary changes necessary are those that incorporate the LG Waiver and Midea Interim Waiver. AHAM commented that its PAC–1 task force is discussing broader issues for potential consideration and will add the issues raised in the April 2021 RFI to that discussion. AHAM stated that the PAC–1 task force is actively pursuing an update to ANSI/AHAM PAC–1–2015 that would account for variable-speed products and is discussing some of the issues DOE raised in the April 2021 RFI, such as definitions, usage data, repeatability and reproducibility, test burden, infiltration air and duct heat transfer, variable-speed product testing, and spot coolers. AHAM further stated that this test procedure development is on a fast track and urged DOE to allow the process to complete before taking additional rulemaking steps and, so long as the test procedure is consistent with the EPCA requirements, as they expect it will be, to adopt the resulting procedure per the Process Rule, section 8(c).[6] AHAM stated it will update the docket when the procedure is complete. (AHAM, No. 8 at pp. 1–2)

A new draft version of ANSI/AHAM PAC–1 has begun development since the publication of the current DOE test procedure; *i.e.,* AHAM PAC–1–2022 Draft. DOE assessed this draft version to determine if any updates to the DOE test procedure were warranted. As discussed in later sections in this NOPR, DOE is proposing to adopt AHAM PAC–1–2022 Draft in a new appendix CC1, including a new efficiency metric, AEER, and a capacity metric, SACC, that is comparable for both single-speed and variable-speed models. If AHAM publishes a final version of PAC–1–2022 Draft prior to DOE publishing a final rule, DOE intends to update the referenced industry test standard in the DOE test procedure to reference the latest version of AHAM PAC–1. If a finalized version of AHAM PAC–1–2022 Draft is not published before the final rule or if there are substantive changes between the draft and published versions of AHAM PAC–1–2022, DOE may adopt the substance of the AHAM PAC–1–2022 Draft or provide additional opportunity for comment on the final version of that industry consensus standard. Due to the substantive difference in measures of capacity and energy efficiency, DOE proposes to continue referencing ANSI/AHAM PAC–1–2015 in appendix CC, with amendments to include the variable-speed waiver approaches as discussed below. Until appendix CC1 takes effect, DOE proposes to add to appendix CC a capacity metric for variable-speed models, $SACC_{Full}$, that is comparable to SACC for single-speed models.

Both ANSI/AHAM PAC–1–2015 and AHAM PAC–1–2022 Draft reference ANSI/ASHRAE Standard 37–2009, which references certain industry test standards in specifying test conditions, measurements, and setup. DOE is also proposing to incorporate those industry standards specified in the relevant sections of ANSI/ASHRAE Standard 37–2009. Specifically, DOE is proposing to incorporate by reference ANSI/ASHRAE Standard 51–1999 (also referred to as ANSI/AMCA 210–1999), as referenced in section 6.2, ''Nozzle Airflow Measuring Apparatus,'' of ANSI/AHAM PAC–1–2015 and AHAM PAC–1–2022 Draft, for static pressure tap placement. DOE is also proposing to incorporate by reference ANSI/ASHRAE Standard 41.1–1986 and ANSI/ASRHAE Standard 41.6–1994 (RA 2006), as referenced in section 5.1, ''Temperature Measuring Instruments,'' of AHAM PAC–1–2022 Draft, for measuring dry-bulb temperature and humidity, respectively. Incorporating these standards will clarify which versions of the standards are required to conduct tests according to the procedure in appendices CC and CC1.

Appendix CC Proposal: DOE is not proposing any amendments to revise the ANSI/AHAM PAC–1–2015 reference in appendix CC. DOE proposes to amend appendix CC to account for the difference in efficiency resulting from the ability of variable-speed models to adjust their compressor operating speed based on the demand load of the conditioned space, as addressed in the LG waiver and Midea interim waiver. DOE is also proposing to incorporate by reference ANSI/ASHRAE Standard 51–1999. This proposal would otherwise generally maintain the existing test procedure approach, which is the basis for the energy conservation standards for which compliance is required beginning in 2025, established in the energy conservation standards final rule published by DOE on January 10, 2020 (''January 2020 Final Rule''). 85 FR 1378.

DOE requests comment on the proposal to incorporate by reference ANSI/ASHRAE Standard 51–1999 in appendix CC, with modifications to address comparability and representativeness.

Appendix CC1 Proposal: DOE proposes to adopt a new appendix CC1 that would incorporate by reference AHAM PAC–1–2022 Draft, with some modifications as discussed in section III.B.5 of this document. DOE is also proposing to incorporate those industry standards specified in the relevant sections of ANSI/ASHRAE Standard 37–2009. Specifically, DOE is proposing to incorporate by reference: ANSI/ASHRAE Standard 41.1–1986, ANSI/ASRHAE Standard 41.6–1994 (RA 2006), ANSI/ASHRAE Standard 51–1999. The newly proposed appendix CC1 would simplify the portable AC test procedure for variable-speed portable ACs and improve representativeness and comparability among different portable AC configurations.

DOE requests comment on the proposal to incorporate by reference AHAM PAC–1–2022 Draft in a new appendix CC1, with modifications to address comparability and representativeness and to incorporate ANSI/ASHRAE Standard 41.1–1986, ANSI/ASRHAE Standard 41.6–1994 (RA 2006), ANSI/ASHRAE Standard 51–1999 in appendix CC1.

2. Harmonization With Other AC Product Test Procedures

In the April 2021 RFI, DOE requested further information and usage data regarding setpoints, operating conditions, seasonal use, and installation time for portable ACs to inform the issue of harmonization of the test procedures for room ACs, portable ACs, and central ACs. 86 FR 20044, 20047.

NEEA stated that portable ACs and room ACs are potential substitutes for

[6] Section 8(c) of appendix A of 10 CFR part 430 subpart C, The Procedures, Interpretations, and Policies for Consideration in New or Revised Energy Conservation Standards and Test Procedures for Consumer Products and Commercial/Industrial Equipment (''appendix A'') provides guidelines on the adoption of industry test methods as DOE test procedures for covered products and equipment. DOE updated appendix A in a final rule published in the **Federal Register** on December 13, 2021. 86 FR 70892. The updates included allowance for the adoption of industry test methods with modifications or the use of test methods crafted by DOE as necessary to ensure compatibility with the relevant statutory requirements, as well as DOE's compliance, certification, and enforcement requirements.

one another and may be evaluated side-by-side by consumers, but that more data are needed to fully understand the usage characteristics and applications of each product category. NEEA expressed particular concern that, under the current test procedures for each product, portable ACs may appear more efficient in comparison to room ACs, whereas, as asserted by NEEA, the opposite is generally the case. NEEA recommended that DOE further evaluate the typical applications and operational hours for both portable ACs and room ACs and update the test procedures as necessary to ensure that consumers are provided with accurate information. (NEEA, No. 12 at p. 2)

The California IOUs commented that DOE should align the portable AC test procedure with that of room ACs and central ACs to provide consumers with a direct energy performance comparison between products that provide similar utility. The California IOUs noted that the International Organization for Standardization (''ISO'') states that ''the operational mode and features of such appliances [single duct portable ACs and heat pumps] are quite different from those of the well-known non-ducted ACs and heat pumps largely diffused worldwide and covered by ISO 5151.'' [7] The California IOUs stated that considering how portable, room, and central AC test procedures have evolved over time and how they have been evaluated globally, they understand why DOE is unable to harmonize these test procedures. They noted, however, that the DOE room AC and portable AC energy conservation standards are both based on a metric named CEER. They encouraged DOE to consider changing the name of the reported energy efficiency metric for portable ACs to clarify to consumers that the portable AC and room AC metrics are not comparable. (California IOUs, No. 10 at pp. 2–4)

DOE recognizes that consumers may consider portable ACs and room ACs for the same applications, and that it would be helpful to consumers for the portable AC and room AC ratings to be comparable. However, as discussed in a NOPR published on February 25, 2015, DOE also expects that portable ACs and room ACs have different operating hours and are likely utilized differently by consumers. 80 FR 10211, 10235. Accordingly, the portable AC and room AC test procedures have different operating hours and test conditions, and the resulting CEER metric for each test procedure measures the efficiency of the tested product during its representative period of use. In this NOPR, DOE is not proposing specific amendments to appendix CC or the proposed new appendix CC1 for the purpose of achieving harmonization with the test procedures for other AC products. Rather, DOE is proposing amendments in this rulemaking to address and improve the representativeness of the test procedure for portable ACs, as required by EPCA. (*See* 42 U.S.C. 6293(b)(3)) In the future, DOE will continue to consider EPCA requirements and consumer usage data when amending both the portable AC and room AC test procedures. With respect to changing the name of the metric, DOE is proposing a new metric name for portable ACs, as discussed in section III.B.5.f of this document.

3. Variable-Speed Technology

Portable ACs with variable-speed compressors have been introduced to the market since the last portable AC test procedure rulemaking. As compared to a portable AC with a single-speed compressor, a variable-speed portable AC can use an inverter-driven variable-speed compressor to maintain the desired temperature without cycling the compressor motor and fans on and off. The unit responds to surrounding conditions by adjusting the compressor rotational speed based on the cooling demand. At reduced speeds, variable-speed compressors typically operate more efficiently than a single-speed compressor would under the same conditions. The current portable AC test procedure does not account for improved efficiency from the ability of variable-speed portable ACs to automatically adjust their compressor operating speed and overall performance based on the cooling load of the conditioned space.

DOE has issued a test procedure waiver and an interim waiver that specify alternate test procedures for certain basic models of variable-speed portable ACs. 85 FR 33643; 86 FR 17803.

As discussed, DOE granted LG a test procedure waiver from specified portions of the DOE test procedure for determining the energy efficiency of listed portable AC basic models, under which LG is required to test and rate the listed basic models of its portable ACs in accordance with the alternate test procedure specified in the Decision and Order. 85 FR 33643, 33647 (June 2, 2020). LG asserted that the current DOE test procedure for single-duct portable ACs does not take into account the specific performance and efficiency benefits associated with the specified basic models, which are single-duct variable-speed portable ACs, under part-load conditions. *Id.* In granting the LG Waiver, DOE determined that the alternate test procedure in the Decision and Order produces efficiency results for variable-speed portable ACs which are comparable with the results for single-speed units. *Id.* The alternate test procedure accomplishes this by adjusting the efficiency rating of the variable-speed portable AC by the amount the variable-speed unit would outperform a theoretical comparable single-speed unit in a representative period of use. *Id.*

On July 16, 2020, DOE received a petition for waiver and application for interim waiver from Midea, consistent with the approach used for variable-speed compressors in the LG Waiver, with modifications to account for dual-duct models incorporating Midea's combined-duct technology.[8] Midea stated the current test procedure prevents the testing of its combined-duct technology because the condenser inlet and outlet air streams are incorporated into the same structure. (Midea Petition, EERE–2020–BT–WAV–0023 No. 2 at pp. 4–5) Midea further stated that, since the airflow both into and out of the condenser must be measured simultaneously, modifications are needed to adapt Midea's combined-duct technology to DOE's test procedure and standard airflow measurement apparatuses. (Midea Petition, EERE–2020–BT–WAV–0023 No. 2 at p. 5) Midea stated the DOE test procedure does not take into account a specially designed adapter that is needed for measuring the airflows. *Id.* DOE granted the Midea Interim Waiver on April 6, 2021, under which Midea is required to test and rate the listed basic models of its portable ACs in accordance with the alternate test procedure specified in the interim waiver. This alternate test procedure adjusts the efficiency rating of Midea's variable-speed portable ACs in a manner similar to that of the alternate test procedure in the LG Waiver, with provisions to allow testing of the combined-duct technology. 86 FR 17803.

Upon the compliance date of the test procedure provisions proposed in this NOPR to appendix CC, should they be adopted, the LG Waiver and Midea Interim Waiver would be terminated, as the proposed amendments to appendix

[7] ISO 5151: 2017 specifies performance testing, the standard conditions, and the test methods for determining the capacity and efficiency ratings of air-cooling air conditioners and air-to-air heat pumps.

[8] The Midea Petition for Waiver from Portable Air Conditioners Test Procedures (EERE–2020–BT–WAV–0023) is available at *www.regulations.gov/docket/EERE–2020–BT–WAV–0023.*

CC address the issues addressed by the waiver and interim waiver. 10 CFR 430.27(h)(3).

In the April 2021 RFI, DOE requested comment on potential amendments to the test procedure to address variable-speed portable ACs. 86 FR 20044.

NEEA, the California IOUs, and the Joint Commenters noted that variable-speed portable ACs have become available on the market since the January 2020 Final Rule, pointing to the LG Waiver and Midea Interim Waiver as evidence of variable-speed portable AC market prevalence. (NEEA, No. 12 at p. 2; California IOUs, No. 10 at pp. 1–2; Joint Commenters, No. 9 at p. 2) The California IOUs further stated that these models are growing in popularity, citing prevalence on retail websites of one of the portable ACs that is subject to a waiver. (California IOUs, No. 10 at pp. 1–2) The California IOUs recommended that DOE update the portable AC test procedure to establish a uniform approach for accurately representing the energy performance benefits of variable-speed technology to provide consumers with the best information so they can make informed purchasing decisions. (California IOUs, No. 10 at pp. 1–2) NEEA recommended that DOE modify the portable AC test procedure to include variable-speed products in a way that accurately reflects their energy use and that testing be conducted at user-selected speeds to the maximum extent possible, as compared to proprietary manufacturer settings, to better reflect field performance. NEEA further stated that, given the potential for variable-speed products to save energy through increased efficiency at low loads and reduced cycling, it is important to capture this energy use accurately in the test procedure so that it can be evaluated in future standards rulemakings. (NEEA, No. 12 at p. 2) The California IOUs noted that amending the test procedure to account for variable-speed technology would allow DOE to remove the existing test procedure waivers, stating that amending the test procedure would make the waivers no longer necessary for an accurate representation of the products in question. (California IOUs, No. 10 at pp. 1–2) In incorporating the current test procedure waivers for variable-speed portable ACs into the DOE test procedure, the Joint Commenters and the California IOUs encouraged DOE to require that the ''full speed'' test be conducted using user controls to achieve the maximum cooling capacity to improve representativeness. (Joint Commenters, No. 9 at p. 2; California IOUs, No. 10 at pp. 1–2)

As noted, DOE has issued a waiver and an interim waiver addressing the ability of variable-speed portable ACs to automatically adjust their compressor operating speed based on the cooling load of the conditioned space. Pursuant to DOE's waiver regulations, as soon as practicable after the granting of any waiver, DOE will publish in the **Federal Register** a NOPR to amend its regulations to eliminate any need for the continuation of such waiver. 10 CFR 430.27(l). As soon thereafter as practicable, DOE will publish in the **Federal Register** a final rule. *Id.*

In accordance with the requirements of 10 CFR 430.27(l), DOE is proposing to amend appendix CC to adopt test methods and SACC and CEER calculations for variable-speed units, consistent with those in the LG and Midea Waivers. These test methods involve testing variable-speed portable ACs at three conditions: the two test conditions used for single-speed units and one additional low-compressor-speed test condition conducted at 83 °F. The low compressor speed would be achieved and maintained using instructions provided by the manufacturer as supplemental test information.

Additionally, DOE is proposing changes to ensure comparability of metrics. Under the current appendix CC, SACC captures the reduced capacity at low outdoor temperature (83 °F) for variable-speed units but not for single-speed units, because the procedure does not allow single-speed units to cycle, as they would in normal operation. Under the proposed appendix CC, the represented value of both variable-speed and single-speed unit capacities at the low temperature would be based on full speed, with a new $SACC_{Full}$ metric for variable-speed units. Although it does not reflect normal operation, this approach creates a fair comparison and does not affect the current metric for single-speed units. Under appendix CC1, SACC would reflect the reduced capacity at low outdoor temperature for both types.

DOE proposes to require variable-speed portable AC manufacturers to make capacity representations with a new capacity metric, $SACC_{Full}$, while appendix CC is used. As described in the following detail, the $SACC_{Full}$ metric would allow consumers to compare single-speed portable AC and variable-speed portable AC capacities on a like-for-like basis, when a manufacturer certifies in accordance with appendix CC. Upon the effective date and universal use of appendix CC1, this $SACC_{Full}$ metric would no longer be necessary, as the SACC metric in appendix CC1 would take into account the reduced cooling capacity provided by both single-speed and variable-speed basic models. DOE would consider reporting requirements necessary for certifying compliance with energy conservation standards of covered appliances in a separate rulemaking, and would address reporting requirements for $SACC_{Full}$ at that time.

In the LG Waiver, DOE required that the ''full speed'' 95 °F outdoor temperature test be conducted using a maximum compressor speed achieved using instructions provided by the portable AC manufacturer. 85 FR 33643, 33651. In the Midea Interim Waiver, DOE altered this requirement to require that the maximum compressor speed be reached by adjusting user controls such that the compressor runs continuously under a full cooling load. 86 FR 17803, 17809. DOE made this change based on its own test data and the advice of commenters. Achieving full compressor speed with user controls (*i.e.,* native controls) rather than manufacturer-specified codes ensures that the maximum speed tested is representative of real-world performance. Accordingly, DOE proposes to amend appendix CC to adopt the test procedure provisions specified in the Midea Interim Waiver. DOE is also proposing to include such provisions in the proposed new appendix CC1.

DOE is also proposing to amend the SACC calculations in appendix CC and in the proposed new appendix CC1. In the LG Waiver and Midea Interim Waiver, the alternate test procedures require the use of the low compressor speed at the 83 °F test condition as the basis for the SACC calculation. 85 FR 33643, 33650 (June 2, 2020); 86 FR 17803, 17811 (Apr. 6, 2021). The alternate test procedures require the use of the low compressor speed, as it would be the best representation of typical performance and cooling provided at the 83 °F test condition. Therefore, as discussed in section III.B.5.c of this document, DOE proposes to adopt the waiver and interim waiver alternate test procedure approach and use the low compressor speed when determining variable-speed portable AC capacity at the 83 °F test condition. However, DOE recognizes that cooling capacity is one of the primary metrics that manufacturers advertise to consumers, and that, when using appendix CC, the comparatively lower SACC values for variable-speed models resulting from using the low compressor speed at the 83 °F test condition relative to comparable single-speed units (which do not operate continuously at a reduced speed but typically cycle at that low temperature condition), may create an unwarranted competitive disadvantage for single-speed models in the market and confusion for consumers. Therefore, DOE is proposing to require manufacturers, when testing a variable-speed portable AC using appendix CC, to represent capacity using a new metric, $SACC_{Full}$, using the full compressor speed at the 83 °F test condition. DOE does not propose to define $SACC_{Full}$ in appendix CC1, nor require the use of such a metric for representations until the compliance date of any amended standards for portable ACs, when the use of appendix CC1 would be required. The proposed new appendix CC1 addresses single-speed portable AC performance at part-load under the low temperature condition (see the discussion of cycling losses and part-load operation in section III.5.e of this document), such that when using the proposed new appendix CC1, no such comparability issues would arise between the SACC values for single-speed and variable-speed AC units.

The reduced cooling load typically observed at the 83 °F test condition is not currently accounted for in appendix CC for either single-duct or dual-duct portable ACs. In the proposed new appendix CC1, DOE is proposing to adopt the most representative SACC calculation for all portable ACs. For a variable-speed portable AC, this value would be the measured cooling capacity for the unit operating with a low compressor speed at the 83 °F test condition. For a single-speed unit, this value would be the unit's cooling capacity measured at the 83 °F test condition multiplied by a load factor—0.6 for single-duct units and 0.5363 for dual-duct units. This change would provide the most representative cooling capacity for both single-speed and variable-speed units, as would reflect the expected average rate of cooling when operating at the 83 °F test condition, as indicated by the Air-Conditioning, Heating, and Refrigeration Institute (''AHRI'') Standard 210/240, ''Performance Rating of Unitary Air-conditioning & Air-source Heat Pump Equipment'' (''AHRI 210/240'') Building Load Calculation, found in section 11.2.1.2 of that standard. Both adjustments are discussed in section III.B.5.c of this document.

In this NOPR, DOE proposes to amend appendix CC to adopt the CEER calculation from the LG Waiver and Midea Interim Waiver alternate test procedures for variable-speed portable ACs, with an updated cycling factor based on new test data (as discussed in section III.B.5.e of this document) to address the efficiency benefits associated with a variable-speed portable AC relative to a single-speed portable AC when operating at reduced test conditions. To maintain compatibility with the existing portable AC standards, DOE is not proposing to amend the CEER calculation in appendix CC for single-speed portable ACs.

However, DOE is proposing to change the CEER calculation for both single-speed and variable-speed portable ACs in the proposed new appendix CC1 to account for cyclic behavior of single-speed portable ACs and to improve representativeness. This proposed approach entails changing the operating hours for all portable ACs, namely how off-cycle mode hours are allocated (see section III.4 of this document) and to include a cycling factor in the CEER equation for single-speed portable ACs to account for cycling efficiency losses outside of off-cycle mode. For detailed discussion of these changes, see section III.5.f of this document.

4. Representative Average Period of Use

a. Operational Modes

The measured energy performance of a portable AC includes energy use associated with cooling mode and off-cycle mode during the cooling season, and inactive mode and off mode energy use for the entire year. In the April 2021 RFI, DOE sought comment regarding whether any of the currently considered modes in the DOE test procedure should no longer be addressed, or whether any representative modes that are not currently considered should be addressed in future test procedure amendments. DOE also sought comment regarding whether the performance and energy use for these operational modes are appropriately addressed and captured in the DOE test procedure. 86 FR 20044, 20047–20048.

DOE received comments on air circulation mode, dehumidification mode, and heating mode, which are discussed below in sections III.B.6, III.B.7, and III.B.8 of this document, respectively.

b. Hours of Operation

As discussed in this section, DOE is proposing a revised set of annual operating hours for portable ACs, shown in Table III.2 of this document.

To determine the energy use during a representative period of use, the current DOE test procedure assigns the following hours of operation for each mode: 750 hours for cooling mode, 880 hours for off-cycle mode, and 1,355 hours for inactive or off mode. Section 5.3 of appendix CC. These operating hours were established in the June 2016 Final Rule. Because as at that time there was insufficient data for portable AC use, DOE derived these values from the existing operating hours for room ACs. DOE adjusted the room AC usage data to reflect portable ACs usage; for example, inactive mode and off mode estimates outside of the cooling season were decreased because portable ACs are more likely to be unplugged outside of the cooling season as compared to room ACs, which are less portable.[9] 81 FR 35241, 35258–35259. In the April 2021 RFI, DOE stated it was unaware of any portable AC usage data sufficient to characterize representative consumer usage in a manner more representative than considered in the previous test procedure rulemaking, noted that no such data or data sources had been provided by commenters to date, and requested data regarding annual operating hours for all representative modes of operation for portable ACs. 86 FR 20044, 20048.

AHAM urged DOE not to rely on room AC data to determine annual operating hours for portable ACs, stating that portable and room ACs may be similar in some ways, but that usage of the products differs, as DOE recognized in the April 2021 RFI. AHAM stated that DOE should refrain from using room AC data to support rulemaking activity for portable ACs unless there is evidence that the data are a sufficient surrogate. (AHAM, No. 8 at p. 3) AHAM also asserted that, to establish or amend representative average use cycles or periods of use, DOE must have national, statistically significant, field use data (not surveys) on consumer use. Without such data, AHAM claimed that it is impossible and inappropriate for DOE to determine or change the average use cycle in a test procedure. AHAM asserted that EPCA does not contemplate test procedures that measure every possible cycle, combination of options, or use pattern; and that EPCA instead requires test procedures measure only a ''representative average use cycle or period of use.'' AHAM further stated that test procedures will inevitably become unduly burdensome to conduct if, to measure every possible kilowatt-hour, test procedures are amended to account for every possible cycle or pattern. AHAM urged DOE to focus on

[9] Further information regarding the development of the operating hours is provided in the February 25, 2015 NOPR and November 27, 2015 supplemental NOPR, available at *www.regulations.gov/docket/EERE-2014-BT-TP-0014-0009* and *www.regulations.gov/docket/EERE-2014-BT-TP-0014-0021,* respectively.

representative, average use cycles. (AHAM, No. 8 at p. 3) AHAM did not provide data or identify data sources for portable AC use.

DOE has been unable to identify nationally representative data and information regarding annual operating hours specifically for portable ACs independent from estimates based on room AC operating hours. DOE also considered whether operating hours for other air conditioning equipment could be relevant but found no evidence that changing the current portable AC operating hours that are based on room AC usage would be more representative. Therefore, DOE is not proposing to amend the operating hours in appendix CC.

As discussed, DOE is proposing to address cycling behavior of single-speed portable ACs in the proposed new appendix CC1. When a single-speed portable AC setpoint is reached, the compressor automatically turns off and the unit enters off-cycle mode until the compressor reactivates according to the thermostat or temperature sensor signal. Whereas when a variable-speed portable AC setpoint is reached, the compressor continues to run, but at a lower speed to match the load, avoiding cycling and off-cycle mode operation entirely. As part of the proposal to address cycling behavior, DOE has assessed the annual operating hours for portable ACs in the proposed new appendix CC1 to more representatively account for cooling mode and off-cycle mode operation. For single-duct portable ACs, the current appendix CC specifies 750 annual operating hours for cooling mode. For dual-duct portable ACs, the current appendix CC specifies a total of 750 cooling mode hours apportioned between the two specified test conditions (95 °F and 83 °F), with weighting factors of 0.2 and 0.8 applied to the 95 °F and 83 °F tests, respectively. In assigning these hours to cooling mode, the current portable AC test procedure does not account for the relationship between cyclic behavior and off-cycle mode as it relates to single-speed portable ACs in typical operation.

To better represent and measure the effects of cyclic behavior in the proposed new appendix CC1, DOE reassessed and reallocated the existing 750 cooling mode operating hours to the 95 °F and 83 °F test conditions, taking in to account the expected off-cycle mode hours that correspond to the cooling mode hours at the 83 °F test condition. To do so, DOE divided the 750 ''compressor on'' cooling mode hours between the two test conditions based on the Temperature Bin Hours from Table 16, titled ''Fractional Bin Hours to Be Used in Calculation of SEER'' in AHRI 210/240. DOE considered the AHRI 210/240 fractional bin hours allocation because it is widely accepted by industry as applicable for air conditioning equipment and because it is the source of the building load calculation that DOE proposes to use to calculate the expected cooling load for portable ACs. DOE summed the fractional hours for the closest temperature bins to each cooling mode test condition—bins 6, 7, and 8 for the 95 °F test condition, and bins 4 and 5 for the 83 °F cooling mode test condition—and then normalized the weighting factors by dividing those fractional hours by the total number of fractional hours used from the table. This resulted in weighting factors of 14 percent and 86 percent (see section III.5.c of this document) for the 95 °F and 83 °F cooling mode test conditions, respectively. DOE excluded bins 1–3 because these bins fall below the indoor test condition temperature of 80 °F, indicating that they are outside of the most representative use period for portable ACs. Multiplying these weighting factors by 750 hours yielded a split of those cooling mode hours into 164 hours and 586 hours for the 95 °F and 83 °F cooling mode test conditions, respectively, for single-speed units.

TABLE III.1—CALCULATION OF WEIGHTING FACTORS FROM AHRI 210/240 FRACTIONAL BIN HOURS

Bin No.	Bin temperature	Fractional bin hours	Sum of fractional hours	Percent of total used fractional hours (weighting factors)
1	67	0.214	Not Used	N/A
2	72	0.231		
3	77	0.216		
4	82	0.161	0.265	78
5	87	0.104		
6	92	0.052	0.074	22
7	97	0.018		
8	102	0.004		

DOE estimated off-cycle mode hours for single-speed units as follows: Based on the AHRI 210/240 Building Load Calculation found in section 11.2.1.2 of that standard, single-speed units operate under a reduced load equal to 60 percent of the full cooling load. Therefore, at the reduced load, a single-speed unit would be expected to operate in cooling mode (*i.e.,* compressor on) for 60 percent of that time and off-cycle mode (*i.e.,* compressor off) for the remaining 40 percent of that time. Accordingly, because the 586 cooling mode (compressor on) hours assigned to the 83 °F cooling mode test condition represent 60 percent of the total operating hours in reduced load conditions, DOE estimates that there are 977 total operating hours at the 83 °F cooling mode test condition (*i.e.,* including both cooling mode and off-cycle mode). This is the sum of the 586 cooling mode hours at the 83 °F cooling mode test condition, calculated above, and 391 hours, representing the off-cycle mode hours (calculated as 977 hours × 0.40). Because variable-speed portable ACs are not expected to enter off-cycle mode at the 83 °F test condition, the proposed cooling mode hours at the 83 °F test condition represent the total variable-speed operating hours at the 83 °F test condition (*i.e.,* 977 hours).

Appendix CC currently allocates 1,355 hours to off and inactive modes. To account for cyclic behavior, or the avoidance of it, DOE proposes to increase this to reflect hours currently considered as part of off-cycle mode. DOE estimated updated off/inactive mode hours for the proposed new appendix CC1 as follows: appendix CC currently allocates 880 hours to off-cycle mode. As described previously, under the proposed new appendix CC1, DOE proposes to allocate 391 hours to off-cycle mode for single-speed units based on estimates derived from the AHRI 210/240 Building Load

Calculation.[10] In the May 2015 NOPR, DOE determined that portable ACs spend 2,985 hours per year plugged in. Because the total number of hours spent plugged in would not change with the revised number of off-cycle mode hours, DOE proposes to re-allocate the difference between the current and proposed off-cycle mode hours—489 hours—to off/inactive mode in the proposed new appendix CC1, yielding a total of 1,844 hours for off/inactive mode (*i.e.,* the sum of 1,355 and 489). DOE maintains that the analysis used for the appendix CC was based on the best available data for portable AC operation, although it does not take into account cyclic behavior. DOE is proposing these changes to the operating hours in the new appendix CC1 to account for cyclic behavior (or the avoidance of it) in all units, which would improve test procedure representativeness overall.

Table III.2 summarizes the annual operating hours for portable ACs under current appendix CC and the proposed new appendix CC1.

TABLE III.2—ANNUAL OPERATING HOURS FOR PORTABLE ACS

Operating mode	Appendix CC	Proposed new appendix CC1
Cooling Mode, 95 °F	[1] 750	164.
Cooling Mode, 83 °F	[1] 750	586 (Single-Speed). 977 (Variable-Speed).
Off-Cycle Mode	880	391 (Single-Speed). 0 (Variable-Speed).
Off/Inactive Mode	1,355	1,844.

[1] These operating mode hours are for the purposes of calculating annual energy consumption under different ambient conditions and are not a division of the total cooling mode operating hours. The total dual-duct cooling mode operating hours are 750 hours.

Appendix CC

As discussed previously, DOE is not proposing to change the annual operating hours in appendix CC.

Appendix CC1

DOE proposes to adopt in the new appendix CC1 the operating hours shown in Table III.2 of this document.

DOE requests comment on the proposal to amend the operating hours in the proposed new appendix CC1 as shown in Table III.2 of this document.

c. Configurations

The current portable AC test procedure in appendix CC addresses two configurations of portable ACs: dual-duct and single-duct. Appendix CC currently requires that portable ACs able to operate as both a single-duct and dual-duct portable AC, as distributed in commerce by the manufacturer, must be tested and rated for both duct configurations. Section 3.1.1 of appendix CC.

In the April 2021 RFI, DOE requested feedback regarding single-duct and dual-duct portable AC test requirements and any other relevant considerations to ensure that the test procedures produce representative results for both configurations, including products that operate in both configurations, as distributed in commerce by the manufacturer. 86 FR 20044, 20048–20049.

NEEA recommended that DOE maintain the requirement for products that can operate as both dual-duct and single-duct portable ACs to be tested in both configurations. NEEA stated that, given the difference in performance between single-duct and dual-duct products, if a product can be configured as single duct, it should be tested in this configuration. (NEEA, No. 12 at p. 3)

In this NOPR, DOE is not proposing any amendments to the configurations addressed by the test procedure in appendix CC and proposes to adopt the same requirements in the new appendix CC1.

DOE requests comment on the proposal to adopt in the new appendix CC1 the requirement that portable ACs able to operate as both a single-duct and dual-duct portable AC, as distributed in commerce by the manufacturer, must be tested and rated for both duct configurations.

5. Cooling Mode

a. Test Conditions

Section 4 of appendix CC measures cooling capacity and overall power input in cooling mode using one test condition for single-duct units and two test conditions for dual-duct units. For single-duct units, the test procedure specifies an 80 °F dry-bulb/67 °F wet-bulb condenser (''outdoor'') inlet air test condition. For dual-duct units, configuration A specifies a 95 °F dry-bulb/75 °F wet-bulb outdoor test condition and configuration B specifies an 83 °F dry-bulb/67.5 °F wet-bulb outdoor test condition. *See* Section 4.1 of appendix CC.

The California IOUs commented that the portable AC test procedure is the only test procedure that uses a low-load, outdoor test condition of 83 °F dry-bulb/67.5 °F wet-bulb; all other residential AC test procedures use a low-load condition of 82 °F dry-bulb/65 °F wet-bulb. The California IOUs suggested that DOE change the low-load condition for the portable AC test procedure to 82 °F dry-bulb/65 °F wet-bulb. (California IOUs, No. 10 at p. 4)

Rice suggested that DOE consider dry-bulb temperature conditions of 82, 87, and 95 °F, instead of the current 83 and 95 °F conditions, to represent temperature bins of 80 to 85 °F, 85 to 90 °F, and 90 to 100 °F, respectively, along with suitable AHRI 210/240 fractional hours and cooling loads at these three temperatures. According to Rice, this would provide more comparability with the room AC test procedure conditions and would better represent the performance non-linearity with ambient conditions for variable-speed products. To avoid the need to retest single-speed portable AC units to these new conditions, Rice asserted that performance at 82 and 87 °F could be extrapolated and interpolated from existing 83 and 95 °F single-speed portable AC test data. (Rice, No. 11 at pp. 2–3)

As described in the supplemental NOPR published November 27, 2015, and confirmed in the June 2016 Final Rule, the low-load test condition of 83 °F dry-bulb/67.5 °F wet-bulb reflects the national weighted-average temperature and humidity observed during the hottest 750 hours (the hours during which DOE expects portable ACs to operate in cooling mode). DOE

[10] As discussed, for variable-speed units, these 391 hours are allocated to cooling mode hours at the 83 °F test condition.

determined these values based on its analysis of hourly ambient temperature data from the National Climatic Data Center of the National Oceanic and Atmospheric Administration collected at weather stations in 44 representative states, combined with its analysis of the 2009 Residential Energy Consumption Survey (''RECS'') to identify room AC ownership [11] in the different geographic regions. Based on the RECS ownership data and weather data, DOE used a weighted-average approach to combine the average temperature and humidity for each individual state into sub-regional, regional, and finally, the representative national average temperature and humidity for the hottest 750 hours in each state. DOE found that the national average dry-bulb temperature and relative humidity associated with the hottest 750 hours are 83 °F and 45 percent, respectively (corresponding to a wet-bulb temperature of 67.5 °F). 80 FR 74020, 74026; 81 FR 35241, 35250. DOE maintains that this analysis yields the most representative operating periods for portable ACs.

In response to Rice's suggestions, the addition of a third test condition would increase test burden by 50 percent for all models. This increase in test burden would not be justifiable, as the additional test condition between the two current test conditions would not provide significantly more information on the performance of portable ACs. Based on past modeling that explored the impact of adjusted outdoor test conditions on air conditioner performance, DOE expects that performance at intermediate temperatures is relatively linear between the two temperature data points, resulting in minimal difference in weighted-average performance if an intermediate temperature data point is included. Furthermore, an additional test condition would not provide full comparability with the room AC test procedure, which, as previously discussed, has four test conditions for variable-speed units and one test condition for single-speed units. Extrapolating/interpolating performance at three test conditions based on the existing test conditions increases the complexity of the test procedure without benefit, as the extrapolated/interpolated data points would be based on the same data currently being used in the portable AC test procedure.

AHAM PAC–1–2022 Draft specifies the same test conditions for single-speed units as the current appendix CC and, for variable-speed units, AHAM PAC–1–2022 Draft specifies the same test conditions as the test procedure waivers and as proposed in this NOPR.

DOE proposes to adopt AHAM PAC–1–2022 Draft in the new appendix CC1, and, by extension, the test conditions contained therein. In revisions to the appendix CC, DOE is not proposing to change the test conditions for single-speed portable ACs. Consistent with the LG Waiver and Midea Interim Waiver, DOE is proposing to adopt multiple test conditions for variable-speed portable ACs: two for single-duct models and three for dual-duct models.

DOE requests comment on the proposal to add variable-speed test conditions in appendix CC consistent with the LG Waiver and Midea Interim Waiver while otherwise retaining the current test conditions, and to adopt the AHAM PAC–1–2022 Draft test conditions in the proposed new appendix CC1.

b. Achieving Compressor Speeds

The alternate test procedure specified in the LG Waiver requires both the full and low compressor speeds to be achieved using special instructions and settings provided by the manufacturer to DOE and laboratories. 85 FR 33643, 33651. The alternate test procedure specified in the Midea Interim Waiver requires the full compressor speed to be achieved by using user controls (''native controls'') with the thermostat setpoint set at 75 °F, and the low compressor speed to be achieved using manufacturer settings. 86 FR 17803, 17808–17809. Consistent with that approach, AHAM PAC–1–2022 Draft specifies using native controls to achieve the full compressor speed, and using instruction and settings provided by the manufacturer to laboratories to achieve the low compressor speed.

Using native controls to achieve the full compressor speed would ensure that the measured full speed is representative of real-world operation but is impractical. The only way to reach reduced compressor speeds using native controls during testing would be with load-based tests, which DOE has tentatively concluded are impractical for portable ACs at this time, as discussed in section III.5.g of this document. Therefore, to improve representativeness, DOE is proposing that for variable-speed portable ACs, in both appendix CC and the proposed new appendix CC1, the full compressor speed be achieved by using native controls with the thermostat setpoint set at 75 °F and the low compressor speed to be achieved using instructions and settings provided by the manufacturer to DOE and laboratories. This proposal is consistent with the alternate test procedure specified in the Midea Interim Waiver and with AHAM PAC–1–2022 Draft. This is a change from the procedure specified in the LG Waiver and would require retesting of the models listed in that waiver.

DOE proposes to adopt AHAM PAC–1–2022 Draft in the new appendix CC1, and, by extension, the compressor speed requirements contained therein. In revisions to the appendix CC, DOE is proposing to adopt the native control and manufacturer setting approach set forth in the Midea Interim Waiver.

DOE requests comment on the proposal to add compressor speed requirements in appendix CC consistent with the Midea Interim Waiver, and to adopt the AHAM PAC–1–2022 Draft compressor speed requirements in the proposed new appendix CC1.

c. Seasonal Adjusted Cooling Capacity

Under the current test procedure, a unit's SACC, in Btu/h, is calculated as a weighted average of the adjusted cooling capacity measured at the two specified operating conditions (*i.e.,* 95 °F and 83 °F). Under appendix CC, full-load operation is used to measure each test condition,[12] such that the SACC reflects full-load operation at both test conditions. The LG Waiver and Midea Interim Waiver change the operating condition at the 83 °F condition to use the ''low'' compressor speed (*i.e.,* part-load performance) instead. Accordingly, the SACC for the models subject to the LG Waiver and Midea Interim Waiver reflects full-load operation at the 95 °F condition and part-load operation at the 83 °F condition. DOE required this approach in the test procedure waivers because it yields a more representative measure of capacity. However, DOE proposes in this NOPR to test variable-speed portable ACs at full-load operation at

[11] DOE uses room AC data because RECS has no portable AC data. DOE has previously stated that room ACs and portable ACs differ from each other in that they have different installation means, and that they induce different amounts of outdoor air infiltration heat and other unwanted heat transfer to the conditioned space. 86 FR 20044, 20047. However, room ACs and portable ACs have similar use cases (*i.e.,* both products provide seasonal cooling) such that in the absence of data for portable ACs, the ownership data and weather data for room ACs is sufficiently applicable to analysis of portable AC cooling mode.

[12] Appendix CC is a constant temperature test, in which the portable AC begins cooling the ''indoor'' chamber of a psychrometric chamber with the thermostat setpoint set to the lowest possible value. Reconditioning equipment maintains the indoor chamber temperature at 80 °F, such that the portable AC is never able to cool the room to the thermostat set temperature. In this test setup, the portable AC will run at full compressor speed indefinitely, it will not reduce compressor speed or cycle the compressor off.

each test condition for the purpose of measuring SACC, which would differ from the alternate test procedure required under the LG Waiver and the Midea Interim Waiver, for the reasons that follow.

In response to the Midea Interim Waiver, Midea reiterated its recommendation to determine Adjusted Cooling Capacity (''ACC'') at the 83 °F test condition with the compressor operating at full speed, which Midea asserted should be used to calculate SACC in accordance with Section 5.2 of appendix CC. Midea suggested that if the ACC at the 83 °F test condition with the compressor operating at low speed is used in calculating SACC, the SACC would be underreported compared to single-speed units that would be used in the same applications. Midea requested that the full compressor speed be specified for both test conditions for the purposes of calculating SACC. (Midea, Midea Petition for Waiver, No. 9 at pp. 1–4) [13]

Currently, SACC for single-speed portable ACs is based in appendix CC on full-load operation at the low (83 °F) test condition, while the LG Waiver and Midea Interim Waiver require SACC for the specified basic models of variable-speed portable ACs to be based on part-load operation (*i.e.,* low compressor speed) at the low test condition. As a result, DOE agrees with Midea that the SACC values for the variable-speed models tested using the waiver test procedure are not directly comparable to the SACC values of single-speed units tested pursuant to appendix CC. Generally, operating at part-load yields a lower measured capacity; therefore, the SACC values for the subject variable-speed models are lower than the SACC values for otherwise identical single-speed models. DOE understands that cooling capacity is one of the primary metrics that manufacturers advertise to consumers. The approaches required under the existing waivers, by resulting in comparatively lower SACC values for the subject variable-speed models, may limit the comparability of the performance between single-speed models and the variable-speed models subject to the LG Waiver and Midea Interim Waiver.

Although DOE proposes to change how to measure SACC in appendix CC1, in appendix CC, DOE is proposing to maintain the Midea Interim Waiver approach of determining SACC using the low compressor speed to represent part-load operation at the 83 °F outdoor temperature test condition but adding another metric, $SACC_{Full}$, to facilitate consumer comparisons. DOE expects that portable ACs will typically encounter reduced cooling loads when the outdoor temperature is 83 °F, based on the building load calculation found in Section 11.2.1.2 of AHRI 210/240. Therefore, the cooling capacity more representative of the average period of use includes reduced compressor speed operation at the 83 °F outdoor temperature condition. However, DOE understands variable-speed portable AC manufacturers have an interest in the ability to make representations of cooling capacity based on full-compressor speed at the 83 °F outdoor temperature test condition, comparable to how single-speed units are tested in appendix CC. Therefore, DOE proposes to require in appendix CC that manufacturers of variable-speed portable ACs base representations of cooling capacity on an additional new metric, $SACC_{Full}$, using full compressor speed performance to calculate $SACC_{Full}$ at the low test condition. This additional metric would provide consumers with comparable capacity ratings for variable-speed and single-speed portable ACs while appendix CC is in use.

For the proposed new appendix CC1, DOE proposes to account for cyclic behavior in both single-speed and variable-speed units by modifying the SACC calculation to factor in reduced capacity from part-load operation at the low (83 °F) test condition. This change would align all models with the waiver approach to variable-speed SACC. For single-speed units, the test at the low test condition would still be performed at full load, but the resulting cooling capacity would be multiplied by a load factor defined as 0.6 for single-duct units and 0.5363 for dual-duct units.[14] These adjustments would account for cooling capacity lost due to compressor cycling under reduced cooling loads, which DOE expects portable ACs will typically encounter when the outdoor temperature is 83 °F, as discussed previously. This approach would result in reduced SACC values for single-speed portable ACs relative to those calculated by the current test procedure at appendix CC. This would also result in comparable SACC values between single-speed and variable-speed portable ACs, eliminating any need in appendix CC1 for the adjusted $SACC_{Full}$ proposed for appendix CC.

Appendix CC

DOE is proposing to maintain the current SACC calculation for single-speed units in the revised appendix CC. DOE also proposes that the SACC for variable-speed units be calculated using the low compressor speed at the 83 °F test condition in appendix CC consistent with the previously granted LG Waiver and Midea Interim Waiver. DOE also proposes to require manufacturers to represent cooling capacity with a new metric, $SACC_{Full}$, for variable-speed portable ACs, using the full compressor speed at the 83 °F test condition.

Appendix CC1

DOE is proposing to adopt an updated approach in calculating SACC, for variable-speed units, using the measured cooling capacity at the 83 °F test condition using the low compressor speed, aligning with the waiver approach, and for single-speed units, multiplying the measured cooling capacity at the 83 °F test condition by a load factor of 0.6 for single-duct units and 0.5363 for dual-duct units.

DOE requests comment on the proposal to maintain in the revised appendix CC the current SACC calculation for single-speed units and to adopt a SACC calculation consistent with the test procedure waivers for variable-speed units for the purposes of determining CEER. DOE also requests comment on the proposal to require manufacturers of variable-speed units to represent cooling capacity using a new metric, $SACC_{Full}$, based on full load performance at the low temperature condition. DOE further requests comment on the proposal to adopt an updated SACC calculation for single-speed units and variable-speed units that accounts for reduced cooling load

[13] A notation in the form ''Midea, Midea Petition for Waiver, No. 9 at pp. 1–2'' identifies a written comment: (1) Made by Midea; (2) recorded in document number 9 that is filed in the docket of the Midea Petition for Waiver from Portable Air Conditioners Test Procedure (Docket No. EERE–2020–BT–WAV–0023) and available for review at *www.regulations.gov;* and (3) which appears on pages 1 and 2 of document number 9.

[14] While dual-duct and single-duct portable ACs experience the same load at 83 °F, dual-duct units experience an increase in cooling capacity as outdoor process air temperatures decrease due to the cooler outdoor air being more effective at removing heat from the condenser. Single-duct units do not experience this increase because the air entering the condenser is always the same indoor air temperature of 80 °F. This cooling capacity increase allows dual-duct portable ACs to remove heat from rooms more quickly at the 83 °F outdoor temperature condition, thus leading to less time with the compressor on. DOE used thermodynamic modeling to measure the expected capacity change for dual-duct portable ACs between the 95 °F and 83 °F test conditions and used this to confirm the AHAM PAC–1–2022 Draft adjustment of the cooling load factor for dual-duct portable ACs from 60 percent of full load operation at a 95 °F outdoor temperature to 53.63 percent of full load operation at an 83 °F outdoor temperature.

at the 83 °F test condition in the proposed new appendix CC1.

d. Weighting Factors

The current portable AC test procedure calculates SACC and CEER as weighted averages of the results of various calculations, based on the measured capacity and power values at the two portable AC test conditions, representing outdoor temperatures of 95 °F and 83 °F. Both equations use weighting factors of 0.2 and 0.8 for the two test conditions, respectively. *See* Section 5.4 of appendix CC.

Rice and the Joint Commenters stated that these current weighting factors potentially underweight performance at 95 °F and overweight performance at 83 °F by not taking into account that the cooling provided during operation at 95 °F is significantly greater than during operation at 83 °F. They encouraged DOE to reevaluate the weighting factors used in the portable AC test procedure. (Rice, No. 11 at pp. 2–3; Joint Commenters, No. 9 at p. 3) Rice suggested deriving cycling loss factors using a building load calculation starting with full load at 95 °F and decreasing to zero load at 65 °F. This is similar to what is done in AHRI 210/240, except for the assumption of full load at 95 °F as opposed to altering the calculated full-load temperature based on test unit capacity. According to Rice, this would result in weighting factors of 0.27 and 0.73 for the 95 °F and 83 °F conditions, respectively. Rice suggested that the 0.8 and 0.2 fractional hours in Section 5.2 of appendix CC were originally derived by considering the hottest 750 hours in relevant regions around the country, combined with related RECS data. Rice stated that while the conditions and weighting appear to be based on the hottest 750 hours during the cooling season, the total seasonal cooling amount will be delivered over a wider range of ambient temperatures by matching the lower cooling loads, either by cycling or by variable-speed matching. As such, Rice argued that the assumption that portable ACs operate during the hottest 750 hours in each region seems inappropriate. Rice stated that if DOE decides to move away from assumption of the hottest 750 hours, DOE should consider for those fractional hours the 95, 87, and 82 °F test condition approach described above, with weighting factors of 0.28, 0.33, and 0.39, respectively, per AHRI 210/240 binned data sets. (Rice, No. 11 at pp. 2–3)

The CEER weighting factors are used to calculate the fractional contribution of CEER at each test condition relative to the average representative period of portable AC use, based on cooling provided and estimated cooling mode operating hours at each test condition. As discussed in section III.B.5.a of this document, DOE derived the weighting factors in the current appendix CC from a geographically weighted average of operating hours best represented by each test condition, based on the 2009 RECS data. The test conditions for which the weightings were determined represent peak performance (*i.e.,* the 95 °F test condition) and the weighted-average temperature and humidity observed during the hottest 750 hours, the hours during which DOE expects portable ACs are most likely to operate in cooling mode (*i.e.,* the 83 °F test condition). 81 FR 35242, 35252 (Jun. 1, 2016). Because DOE is proposing in the new appendix CC1 to change the portable AC operating hours estimate from a RECS-based estimate to an estimate based on the bin operating hours and building load calculation from AHRI 210/240, DOE is proposing similar changes to the weighting factors in the proposed new appendix CC1 to maintain internal consistency.

In determining the proposed new appendix CC1 weighting factors, DOE considered the portion of the proposed appendix CC1 total cooling mode and off-cycle mode hours spent at each temperature condition (see Table III.2 in section III.4.b of this document)—14.4 percent of the total cooling mode hours are allocated to the 95 °F test condition and 85.6 percent to the 83 °F test condition. DOE is proposing to adopt these weighting factors for SACC only in the new appendix CC1. To avoid changing the SACC relative to the current values, DOE is not proposing changes to the SACC or CEER calculations in appendix CC to match these updated weighting factors, which were the basis for determining the energy conservation standards that are effective in January 2025, as discussed above. Therefore, DOE is proposing that the modified weighting factors be adopted only in the new appendix CC1. Specifically, DOE is proposing to adjust the weighting factors for the two test conditions, in accordance with the changes to the operating hours, to 0.144 for the 95 °F test condition and 0.856 for the 83 °F test condition.

DOE requests comment on the proposed weighting factors in the proposed new appendix CC1 (0.144 for the 95 °F test condition and 0.856 for the 83 °F test condition).

e. Cycling Losses

Historically, portable ACs have been designed using a single-speed compressor, which operates at full cooling capacity while the compressor is on. When the required cooling load in a space is less than the full cooling capacity of the unit, a single-speed compressor cycles on and off. This cycling behavior introduces inefficiencies often referred to as ''cycling losses.'' In addition, single-speed portable ACs may experience inefficiencies by continuing to operate the blower fan during compressor off periods after the evaporator coils have warmed to the point that any further fan operation does not contribute to the unit's overall cooling capacity. These two types of inefficiencies occur only for single-speed portable ACs; as discussed in the April 2021 RFI, variable-speed ACs avoid such inefficiencies because their compressors run continuously, adjusting their speeds as required to match the cooling load. 86 FR 20044, 20050–20051.

Cycling losses associated with single-speed compressors are not currently accounted for in appendix CC. In the LG Waiver, DOE addressed the cycling of a single-speed compressor as part of a ''performance adjustment factor'' (''PAF''). As established in the LG Waiver, the PAF represents the average performance improvement of the variable-speed unit relative to a theoretical comparable single-duct single-speed unit, resulting from the variable-speed unit's avoiding cycling losses associated with the lower temperature test condition. 85 FR 33643, 33646. The Midea Interim Waiver similarly requires use of a PAF. 86 FR 17803, 17819–17820.

In the April 2021 RFI, DOE requested further information and data on efficiency losses associated with single-speed compressor cycling at part-load conditions. DOE also requested comment on the incorporation of the current waiver approach to determine variable-speed portable AC efficiency, based on a PAF representing the performance improvement relative to a single-speed portable AC resulting from elimination of cycling losses. 86 FR 20044, 20050–20051.

Rice, the Joint Commenters, and the California IOUs encouraged DOE to account for cycling losses in the portable AC test procedure to provide an accurate comparison of single-speed and variable-speed compressor performance. (Rice, No. 11 at p. 3; Joint Commenters, No. 9 at pp. 2–3; California IOUs, No. 10 at pp. 1–2)

The Joint Commenters and the California IOUs stated that, in calculating the performance of a ''theoretical comparable'' single-speed unit, the LG Waiver and Midea Interim Waiver for variable-speed portable ACs include an assumed cycling loss factor for single-speed units to capture the benefits of variable-speed units in reducing cycling losses. They further commented that, in the Midea Interim Waiver, DOE modified the cycling loss factor to reflect load-based testing of two single-speed room AC units at reduced cooling loads. (Joint Commenters, No. 9 at pp. 2–3; California IOUs, No. 10 at pp. 1–2) Rice and the Joint Commenters encouraged DOE to provide the basis for determining an appropriate cycling loss factor through the use of load-based testing, stating that there are likely differences related to cycling losses between room AC and portable AC designs. (Rice, No. 11 at p. 3; Joint Commenters, No. 9 at pp. 2–3) The California IOUs requested that DOE evaluate the cycling loss factor for a selection of single-duct and dual-duct portable ACs to determine the appropriate cycling loss factor to be used in the updated test procedure, but did not explicitly request that this be evaluated through the use of load-based testing. (California IOUs, No. 10 at pp. 1–2)

Rice also stated that, to date, the cooling degradation coefficients (''Cds'') proposed by DOE for portable ACs have been derived from load-based tests performed on single-speed room ACs, but asserted that there are likely various differences related to cycling losses between room AC and portable AC designs. Rice stated that no information was provided in those tests on how the fans were operated during the compressor off-cycles. Rice requested that this information should be reported and should be consistent with how these models will operate in the field at the rated control settings, asserting that fan operation can significantly affect Cd levels due to the fan power usage with minimal or no cooling output. (Rice, No. 11 at p. 3)

DOE conducted investigative testing of portable ACs to determine a representative cycling loss adjustment factor specifically for portable ACs. DOE aimed to calculate the difference in efficiency for single-speed portable ACs when tested under full-load constant load conditions and part-load cycling load conditions, while focusing on just the cycling losses and not fan operation in off-cycle mode. Load-based testing was infeasible for portable ACs with the equipment and facilities used in the investigative testing. Instead, DOE performed cyclic tests, which triggered single-speed portable AC cycling by remotely adjusting the setpoint of the test unit in a cyclic pattern while it was in the test chamber, simulating the behavior of the unit when the room temperature reaches the unit setpoint. DOE conducted tests on five units with two different test lengths, 10 minutes and 30 minutes, to account for real-world variations in unit capacity and room size. In the 30-minute test, the unit operated for roughly 16 minutes and cycled off for 14 minutes, approximating a 53 percent cooling load. In the 10-minute test, the unit operated for roughly 5.5 minutes and cycled off for 4.5 minutes, approximating a 55 percent cooling load. Table III.3 shows the relative difference in energy use during cyclic operation in comparison to energy use when operating continuously, expressed as a percentage.

As shown in Table III.3, on average, the portable ACs that were tested performed at 81.9 percent of the efficiency when operating cyclically compared to when operating continuously, not counting energy lost to fan operation in off-cycle mode.

TABLE III.3—RELATIVE EFFICIENCY DURING CYCLING OPERATION COMPARED TO CONTINUOUS OPERATION

Test length	30 min	10 min
Unit 1	86%	[1]
Unit 2	80%	84%
Unit 3	81%	84%
Unit 4	79%	82%
Unit 5	76%	82%
Combined Avg	81.9%	

[1] The 10-minute test was not performed on Unit 1 due to limited test laboratory availability.

Based on these test results, DOE proposes to use 0.82 as the cycling factor (CF), representing that a cycling unit is 82 percent as efficient as a unit which does not cycle, not accounting for any power consumed during off-cycle mode.

Appendix CC and Appendix CC1

DOE is proposing to account for cycling losses in the amended appendix CC by comparing variable-speed unit performance to that of a theoretical comparable single-speed unit, using the test procedure waiver approach, as previously discussed. Based on DOE's investigative testing, the proposed CF for the theoretical comparable single-speed unit in appendix CC would be 0.82.

In the proposed new appendix CC1, DOE would account for cycling losses directly in the single-speed portable AC CEER calculation, using the same CF proposed for appendix CC, 0.82.

DOE requests comment on the proposal to adopt a CF of 0.82 based on DOE's investigative testing, in appendix CC and in the proposed new appendix CC1.

f. Energy Efficiency Calculations

The current portable AC test procedure at appendix CC represents efficiency using CEER, an efficiency metric calculated as the weighted average of the condition-specific CEER values, including the annual energy consumption in cooling mode, off-cycle mode, and off or inactive mode. The alternate test procedures in the LG Waiver and Midea Interim Waiver adjusts the CEER metric in the test procedure to address the cycling of a single-speed compressor through a PAF. The PAF, which represents the average performance improvement of the variable-speed unit relative to a theoretical comparable single-duct single-speed unit at reduced operating conditions, is applied to the measured variable-speed unit efficiency. This approach increases the measured efficiency of a variable-speed portable AC relative to the measured efficiency of single-speed portable ACs. This approach reasonably represents the efficiency of a variable-speed portable AC relative to a single-speed portable AC as currently measured in accordance with appendix CC, and maintains compatibility with the existing portable AC standards. Therefore, DOE proposes to adopt in appendix CC the general approach from the LG Waiver and Midea Interim Waiver to determine variable-speed portable AC efficiency.

However, DOE recognizes that the waiver approach only indirectly addresses cycling losses and does not consider the effect on a single-speed unit's performance of cycling losses from operating at reduced conditions. A more representative approach would be to apply the cycling losses to a single-speed portable AC's performance directly, and to make no such modifications to the measured variable-speed portable AC efficiency. Such an approach would require no calculation of a comparable theoretical single-speed portable AC and would no longer require a PAF. DOE notes that this general approach has been adopted in AHAM PAC–1–2022 Draft and, in the interest of adopting a simpler and most representative test procedure, DOE proposes to adopt such an approach in the proposed new appendix CC1.

Section 5.4 of appendix CC currently specifies the equations for calculating CEER for both single-duct and dual-duct portable ACs. In each equation, the final CEER value is calculated as a weighted average of performance at each test condition (as applicable for the configuration):

$$CEER_{SD} = \left[\frac{ACC_{95} \times 0.2 + ACC_{83} \times 0.8}{\left(\frac{AEC_{SD} + AEC_T}{k \times t}\right)}\right]$$

$$CEER_{DD} = \left[\frac{ACC_{95}}{\left(\frac{AEC_{95} + AEC_T}{k \times t}\right)}\right] \times 0.2 + \left[\frac{ACC_{83}}{\left(\frac{AEC_{83} + AEC_T}{k \times t}\right)}\right] \times 0.8$$

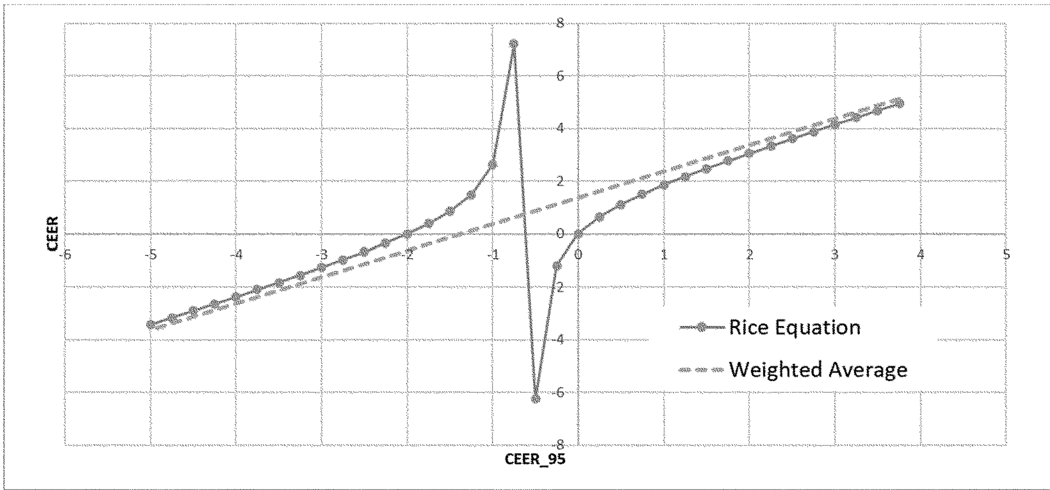
DOE received comments on the CEER equations in response to the April 2021 RFI. Rice suggested that the equation for CEER should be revised with the weighting factors as he recommended. Rice also urged DOE to use his recommended CEER equation for both variable-speed and single-speed portable ACs, which he asserted best represents the cooling season performance difference between variable-speed and single-speed portable AC units, as follows:

$$CEER = \frac{1}{\left(\frac{0.27}{CEER_{95}} + \frac{0.73}{(CEER_{83} \times CLF_{83})}\right)}$$

(Rice, No. 11 at pp. 2–3)

The equation suggested by Rice aims to produce an efficiency metric that that is simply total cooling provided divided by total power consumption, utilizing the CEER values for each test condition as determined in accordance with appendix CC. Although DOE agrees that the approach of representing efficiency as total cooling provided divided by total power consumption is appropriate for portable ACs, DOE has tentatively determined that Rice's specific approach is not. At low and negative $CEER_{95}$ values, the overall CEER is unrepresentatively driven to extreme high or low values due to the asymptotic behavior of the equation. In past testing, DOE has observed very small or negative $CEER_{95}$ values in single-speed portable ACs, particularly in single-duct configurations. DOE has observed values as low as −3.76 Btu/Wh and has tested at least 11 units with values that fall between −2 and +2 Btu/Wh, within the range of concern for Rice's approach. Although other residential AC products typically provide net cooling to the conditioned space, two factors can lead to such low $CEER_{95}$ values for portable ACs. Portable ACs lose cooling capacity to infiltration air and duct heat transfer, both of which appendix CC includes provisions to measure As shown in Figure 1, under the Rice suggested equation, the overall CEER can change drastically when $CEER_{95}$ becomes small or negative, producing unrealistic values, which is not the case for the weighted-average approach currently implemented in appendix CC. Figure 1 provides an example of the impact on overall CEER when $CEER_{95}$ ranges from −5 to 5 Btu/Wh for both Rice's suggested approach and the current weighted-average appendix CC approach.

Figure 1: CEER Values at Very Low and Negative CEER95 Using Two Approaches



For appendix CC1, based on comments from Rice and re-examination of the current CEER metric, DOE developed a new portable AC efficiency metric based on a ratio of annual cooling provided to annual energy consumed. This approach reflects EPCA requirements. First, DOE design the test procedure to produce test results which measure energy efficiency during a representative period of use. (42 U.S.C. 6293(b)(2)) Second, EPCA defines energy efficiency as ''the ratio of the useful output of services from a consumer product to the energy use of such product . . .'' (42 U.S.C. 6291(5)) The ratio of annual cooling provided to annual energy consumed would best reflect the efficiency of portable ACs during a full year of use by directly accounting for the efficiency of each mode in accordance with the number of operating hours spent in that mode. The two values would be calculated as follows.

The total cooling provided by a portable AC over the course of the year, in Btu, is equivalent to the average rate of cooling provided at each temperature condition, in Btu/h, multiplied by the number of hours operating at that test condition.

The total annual energy consumption of a portable AC, in kilowatt-hours (''kWh''), is equal to the sum of the average power consumed in each mode multiplied by the amount of time spent in that mode.

DOE tentatively concludes it is appropriate to deviate from AHAM PAC–1–2022 Draft because at an 83 °F outdoor temperature condition, part-load, rather than full-load operation, reflects an average period of use. AHAM PAC–1–2022 Draft includes a term in the CEER calculation representing the portable AC performance at full load with an 83 °F outdoor temperature condition. The proposed CEER calculations in appendix CC and appendix CC1 do not. Although this is a test condition in the proposed new appendix CC1, part-load operation is most representative of portable AC operation at the 83 °F outdoor temperature condition, based on the building load calculation found in AHRI 210/240. Therefore, DOE is proposing to include only low-speed variable-speed compressor efficiency or cycling-adjusted single-speed compressor efficiency at the 83 °F outdoor temperature condition when calculating overall CEER in the proposed new appendix CC1.

Appendix CC

In this NOPR, DOE is not proposing to amend the CEER equation for single-speed portable ACs in appendix CC. DOE is proposing to determine variable-speed portable AC efficiency by comparing the measured efficiency of the variable-speed unit to the efficiency of a theoretical single-speed unit of the same capacity, taking into account efficiency losses due to cycling, consistent with the general approach from the LG Waiver and Midea Interim Waiver, with changes to the CF as previously described.

Appendix CC1

DOE proposes to create a new efficiency metric for portable ACs in appendix CC1, AEER, which is equal to the total annual cooling delivered divided by the total annual energy consumption as previously described.

The proposed equation is as follows:

$$AEER = 0.001 \times \frac{(ACC_{95} \times 164) + (ACC_{83} \times t_{cm\_83})}{AEC_{95} + AEC_{83} + AEC_{oc} + AEC_{ia/om}}$$

Where:

AEER = annualized energy efficiency ratio of the sample unit in Btu/Wh.

ACC_{95} and ACC_{83} = adjusted cooling capacity at the 95 °F and 83 °F outdoor temperature conditions, respectively, as discussed in section III.5.c of this document.

AEC_{95}, AEC_{83}, AEC_{oc}, and $AEC_{ia/om}$ = total annual energy consumption attributed to all modes representative of the 95 °F operating condition, the 83 °F operating condition, off-cycle mode, and inactive or off mode, respectively, in kWh/year.

164 = number of annual hours spent in cooling mode at the 95 °F operating condition, as shown in Table III.2 of this document.

t_{cm_83} = number of annual hours spent in cooling mode at the 83 °F operating condition, t_{DD_83} for dual-duct single-speed units, $t_{DD\_83\_Low}$ for dual-duct variable-speed units, t_{SD_83} for single-duct single-speed units, or t_{SD_Low} for single-duct variable-speed units, as shown in Table III.2 of this document.

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

DOE requests comment on its proposal to adopt in appendix CC the PAF-based approach from the LG Waiver and Midea Interim Waiver to determine variable-speed portable AC efficiency, the weighted-average approach for the CEER equation, and not to change the CEER equation for single-speed portable ACs. DOE also requests comment on its proposal to adopt a new efficiency metric, AEER, to represent efficiency as the total annual cooling divided by the total annual energy consumption in the proposed new appendix CC1.

g. Load-Based Testing

The current test procedure prescribed by ANSI/AHAM PAC–1–2015 does not use a load-based test. It measures cooling capacity and energy efficiency ratio when the portable AC operates continuously at fixed indoor and outdoor temperature and humidity conditions (*i.e.,* a constant-temperature test), using an air enthalpy approach.[15] In contrast, a load-based test either fixes or varies the amount of heat added to the indoor test room by the reconditioning equipment, while the indoor test room temperature is permitted to change and is controlled by the test unit according to its thermostat setting. In the April 2021 RFI, DOE sought further comment and information on the feasibility and applicability of load-based testing for portable ACs. 86 FR 20044, 20051.

NEEA, the Joint Commenters, and Rice encouraged the use of load-based testing for the portable AC test procedure. (NEEA, No. 12 at pp. 2–3; Joint Commenters, No. 9 at p. 2; Rice, No. 11 at p. 3) NEEA stated a load-based test would measure equipment performance under conditions that better mimic what a unit is likely to experience in the field. According to NEEA, a load-based test is the best way to fully account for the effectiveness of controls, cycling effects, and variable-speed performance, which would better reflect field performance. (NEEA, No. 12 at pp. 2–3) The Joint Commenters stated a load-based test would further improve representativeness for both single-speed and variable-speed portable ACs. Specifically, they stated that a load-based test would capture cycling losses for single-speed units (as well as for variable-speed units to the extent that they exhibit cycling behavior) and, for variable-speed units, a load-based test would eliminate the need to use confidential, manufacturer-specified compressor speeds for the ''low speed'' test. (Joint Commenters, No. 9 at p. 2)

DOE continues to recognize the challenges associated with implementing load-based testing in the portable AC test procedure. As discussed in the recent final rule for room AC test procedures and in the April 2021 RFI, DOE expects that a load-based test would reduce repeatability and reproducibility due to current limitations in current test chamber capabilities—namely, the lack of specificity in industry standards regarding chamber dimensions and reconditioning equipment characteristics, which would negatively impact the representativeness of the results and potentially be unduly burdensome. 86 FR 16446, 16466 (March 29, 2021); 86 FR 20044, 20051. The psychrometer chambers used to test portable ACs using the air enthalpy approach present additional challenges for potential load-based testing, because they are not well equipped to conduct load-based testing. Air enthalpy testing equipment and controls systems are not designed to impose a cooling load; instead, they are designed to maintain specified temperature and humidity conditions.

Appendix CC and Appendix CC1

DOE has not identified approaches to mitigate the previously identified challenges that are associated with load-based testing, and commenters provided none. DOE does not propose load-based testing in either appendix CC or the proposed new appendix CC1.

DOE requests comment on its proposal not to prescribe load-based testing in appendix CC or the proposed new appendix CC1.

6. Heating Mode

DOE tentatively maintains its previous decision not to require measuring energy efficiency in heating mode. In the June 2016 Final Rule, DOE did not establish an efficiency metric for heating mode. 81 FR 35241, 35257. In the test procedure NOPR for portable ACs published by DOE on February 25, 2015 (February 2015 NOPR), DOE proposed to define heating mode as an active mode in which a portable AC has activated the main heating function in response 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. 80 FR 10211, 10217. In the June 2016 Final Rule, DOE did not establish a heating mode test or efficiency metric, noting that although some portable ACs offer an ''auto mode'' that allows for both cooling and heating mode operation depending upon the ambient temperature, available data suggested that portable ACs are not used for heating purposes for a substantial amount of time. 81 FR 35241, 35257. In the April 2021 RFI, DOE sought usage data on portable AC heating mode and what portion of portable AC annual energy use is in heating mode. 86 FR 20044, 20049.

In response to the April 2021 RFI, AHAM agreed with DOE's conclusion in the June 2016 Final Rule that portable ACs are not used for heating purposes for a substantial amount of time and urged DOE to not include heating mode in the test procedure. AHAM stated that there is no need to capture the energy usage of heating mode since the energy use in heating mode is not significant compared to the cooling function. AHAM further commented that DOE does not have data on the usage of these modes and asserted that without such data, DOE cannot add heating mode to the test procedure. AHAM noted that the AHAM PAC–1 test procedure does not address heating mode, in alignment with the current DOE test procedure. (AHAM, No. 8 at p. 3)

DOE has not identified nor have commenters provided any data that would allow DOE to draw a different conclusion to the use of portable ACs to provide heating. Thus, DOE requests comment on the tentative determination not to establish a heating mode efficiency metric in appendix CC and proposed new appendix CC1.

7. Air Circulation Mode

In air circulation mode, a portable AC has activated only the fan or blower and the compressor is off. Unlike off-cycle mode, air circulation mode is consumer-initiated. In the June 2016 Final Rule, due to a lack of usage information for this mode, DOE adopted the proposal not to measure or allocate annual operating hours to air circulation mode. 81 FR 35241, 35257.

In the April 2021 RFI, DOE discussed comments encouraging the incorporation of a ''fan-only mode,'' in which the fan is operating but the compressor is off, without distinguishing whether the fan operation is consumer initiated. DOE stated that it expects that the annual usage hours and energy consumption of fan operation referenced in comments could include operation in both off-cycle mode, which is currently addressed in appendix CC, and a user-initiated air circulation mode. DOE

[15] The air enthalpy approach entails measuring the air flow rate, dry-bulb temperature, and water vapor content of air at the inlet and outlet of the portable AC.

therefore sought further clarification and distinction from commenters regarding operating hours and energy consumption for a user-initiated air-circulation mode, which is not currently addressed in appendix CC. 86 FR 20044, 20050.

The portable AC field metering study conducted by Lawrence Berkeley National Laboratory (''LBNL'') in 2014 [16] reported the time only the fan was operating. NEEA and the California IOUs commented that it did not clearly specify whether those hours were spent in user-initiated air-circulation mode or were off-cycle mode hours in which the unit is waiting to respond to the thermostat. (NEEA, No. 12 at p. 1; California IOUs, No. 10 at p. 5) NEEA stated that the LBNL study did indicate that the number of hours spent in fan-only mode are significant and recommended that DOE further evaluate the market distribution of portable ACs with fan-only mode and the number of hours spent in this mode. (NEEA, No. 12 at p. 1)

The California IOUs stated that the LBNL study did not determine how much time is spent in either of these modes or whether there is any difference in power consumption between fan-only and air-circulation modes. They recommended that DOE further investigate the market distribution of portable ACs and their operating hours in user-initiated air circulation mode. (California IOUs, No. 10 at p. 5)

DOE continues to lack data on annual operating hours in air circulation mode. DOE is not aware of publicly available data, nor has DOE received data from commenters regarding consumer use of user-initiated air circulation mode. As commenters pointed out, the field metering study did not differentiate between time spent with fan operation in air circulation mode versus off-cycle mode. When the field study was conducted in 2014, DOE investigative testing found that all portable ACs in its test sample operate the fan in off-cycle mode once cooling mode operation reduces the ambient temperature below the set point, as shown in Table III.9 of the portable AC test procedure NOPR published on February 25, 2015. 80 FR 10211, 10232. The hours attributed to ''fan-only mode'' likely include substantial time in off-cycle mode, in addition to any time in the user-initiated air circulation mode because fan operation in off-cycle mode was likely common in portable ACs at the time of the field metering study, based on samples analyzed during the previous portable AC test procedure rulemaking. 80 FR 10212, 10231. Therefore, DOE cannot effectively utilize the field metering study to identify a reliably representative number of operating hours in air circulation mode and currently is unable to justify the additional test burden that would be associated with testing air circulation mode. Only with data for consumer use of air circulation mode could DOE determine typical operating hours in air circulation mode.

Appendix CC as proposed and proposed new appendix CC1 would require testing in off-cycle mode, and the energy use in that mode would be considered part of the efficiency metric. However, DOE is not proposing a test for user-initiated air circulation mode.

DOE requests comment on the tentative determination not to dedicate distinct operating hours or testing to user-initiated air circulation mode in appendix CC and proposed new appendix CC1.

8. Dehumidification Mode

In the April 2021 RFI, DOE discussed a comment stating that most portable ACs provide a dehumidification feature and recommending that DOE further investigate its usage and consider including dehumidification mode in an updated test procedure. DOE sought usage data on dehumidification features available on portable ACs, including prevalence in units on the market, annual operating hours, and energy consumption associated with this mode. 86 FR 20044, 20051.

In response to the April 2021 RFI, AHAM stated that there is no need for added testing for dehumidification mode because it is not a significant energy user compared to the cooling function and it would unnecessarily increase testing burden. Additionally, AHAM asserted that absent data on the usage of dehumidification mode, DOE cannot accurately add it to the test procedure. (AHAM, No. 8 at p. 3)

By contrast, NEEA commented that 212 out of the 218 products available on a major retailer's website as of January 2021 had a dehumidification feature. NEEA recommended, given the prevalence of this feature, that DOE further investigate the number of hours spent in dehumidification mode and include this energy usage in the test procedure as warranted. (NEEA, No. 12 at p. 2)

DOE is unaware of available consumer use data regarding dehumidification mode, and the presence of a function in and of itself is insufficient to indicate the frequency of its use. Given the lack of data, DOE is unable to address dehumidification mode in a representative manner. DOE therefore is not proposing test procedure provisions regarding dehumidification mode in either appendix CC or proposed new appendix CC1.

DOE requests comment on the tentative determination not to include dehumidification mode in appendix CC and proposed new appendix CC1.

9. Network Connectivity

Network connectivity implemented in portable ACs can enable functions such as providing real-time room temperature conditions or receiving commands via a remote user interface such as a smartphone. DOE has observed that network connectivity typically operates continuously in the background while the portable AC performs other functions. DOE recognizes that portable ACs with network functions are now readily available on the market in the United States and, in the April 2021 RFI, requested (1) further comment and data on the prevalence of network connectivity in portable ACs available on the market currently or in the near future, (2) available data quantifying the power consumption and usage time associated with network functionality in portable ACs, and (3) information regarding the capabilities and attributes enabled by network functions (*e.g.,* energy savings, demand response, convenience functions). 86 FR 20044, 20049–20050.

The Joint Commenters and California IOUs encouraged DOE to investigate network connectivity in the portable AC test procedure. (Joint Commenters, No. 9 at pp. 1–2; California IOUs, No. 10 at p. 5) To improve the representativeness of the test procedure, the Joint Commenters encouraged DOE to investigate the power consumed by portable ACs in network mode and consider incorporating a measurement of the standby power consumed when a portable AC with network functions is connected to a network. (Joint Commenters, No. 9 at pp. 1–2) The California IOUs stated that network connectivity is an important operational characteristic. They commented that appliance capability to participate in demand response events is growing in relevance and stated that California and other states are looking to demand response as an option in their flexible demand standards. They further commented that, by assessing the effects of network connectivity and further encouraging manufacturers to produce appliances capable of responding to

[16] ''Using Field-Metered Data to Quantify Annual Energy Use of Portable Air Conditioners,'' T. Burke *et al.,* Environmental Energy Technologies Division, LBNL, December 2014.

demand response signals, DOE may contribute to greater grid reliability. (California IOUs, No. 10 at p. 5)

By contrast, AHAM urged DOE to follow the approach it adopted for room ACs regarding network connectivity and require all network functions to be disabled during testing. AHAM revised its room AC test procedure to maintain consistency with DOE's position. It noted that Section 4.1 of AHAM RAC–1–2020, ''Energy Measurement Test Procedure for Room Air Conditioners'' now specifies that units shipped with communication devices shall be tested with the communication device off, and not connected to any communication network. AHAM asserted that there is not yet adequate consumer use data to justify including provisions within the room AC or portable AC test procedures to measure the energy performance of network-connected products. AHAM further stated it is aware that some consumers do not connect their network-enabled appliances to use the available features. AHAM stated that DOE should be mindful that it will take time before many new features, designs, and technologies lend themselves to a ''representative average'' consumer use, and urged DOE to ensure that the portable AC test procedure does not prematurely address new designs which may not yet have an average use or be in common use, as doing so could stifle innovation. (AHAM, No. 8 at p. 4)

Based on testing and information from industry, the total power use attributable to network connectivity is less than 1 watt and would occur only during active hours of operation. DOE estimates that including the power consumption of network connectivity would decrease CEER by 0.1 percent. While there are several network-connected portable ACs on the market with varying implementations of network functions, DOE is not aware of any data available, nor did interested parties provide any data, regarding the consumer use of network functions. Without these data, DOE is unable to establish a representative test configuration for assessing the energy consumption of network functionality for portable ACs. Therefore, DOE proposes to test portable ACs with network functions disabled, if possible, unless they cannot be disabled, in which case the portable AC would be tested with network functions in the factory default configuration.

In this NOPR, DOE proposes to specify in both appendix CC and proposed new appendix CC1 that, if a portable AC has network functions disable all network functions throughout testing if such settings can be disabled by the end-user and the product's user manual provides instructions on how to do so. If an end-user cannot disable the network functions, or the product's user manual does not provide instruction for disabling network settings, test the unit with the network settings in the factory default configuration for the duration of the test. DOE requests comment on this proposal.

10. Infiltration Air, Duct Heat Transfer, and Case Heat Transfer

The portable AC test procedure accounts for the effects of heat transfer from two sources: (1) infiltration of outdoor air into the conditioned space (*i.e.,* ''infiltration air'') and (2) heat leakage through the duct surface to the conditioned space (*i.e.,* ''duct heat transfer''). In the June 2016 Final Rule, DOE considered the effects of heat transfer through the outer chassis of the portable AC to the conditioned space (*i.e.,* ''case heat transfer'') but did not adopt provisions accounting for case heat transfer. The reasons for DOE's choice were that case heat transfer has a minimal impact on cooling capacity and that including measurement of it would substantively increase the test burden. 81 FR 35241, 35254–35255.

In the April 2021 RFI, DOE requested: (1) any available information or data on portable AC infiltration air, duct heat transfer, or case heat transfer that may improve the representativeness, repeatability, or reproducibility of the test procedure; (2) input on any industry test procedures that measure case heat transfer, estimates of test burden required to measure it, and data quantifying its impact on cooling capacity and efficiency; (3) input on any less burdensome approaches to address case heat transfer than previously considered in the June 2016 Final Rule; (4) feedback on the impacts of case material and case design on case heat transfer, and whether certain materials or designs soon to be implemented in units on the market would result in significantly different case heat transfer than current designs; and (5) data and feedback on any additional available data regarding a duct convection heat transfer coefficient, and whether the current convection heat transfer coefficient of 3 British thermal units per hour-square foot-degree Fahrenheit (''Btu/h-ft^2-°F'') remains representative for portable ACs in their typical installation and use environments. 86 FR 20044, 20049.

NEEA recommended that DOE maintain key features in the existing test procedure in any revision, specifically recommending that DOE continue to account for the energy impacts of infiltration air and duct heat transfer in the portable AC test procedure, which NEEA asserted can have significant effects on capacity and efficiency and therefore are appropriately accounted for in the test procedure. (NEEA, No. 12 at p. 3)

The Joint Commenters stated that, while DOE found the average impact of case heat transfer on SACC was about 2 percent, the impact for individual units tested by DOE ranged from 0 to 9.1 percent. They stated that for some units, the current test procedure may be significantly overestimating cooling capacity and failing to capture design differences that may improve efficiency by reducing case heat transfer. The Joint Commenters encouraged DOE to continue to investigate the impact of case heat transfer and methods to measure case heat transfer to improve the representativeness of the test procedure. (Joint Commenters, No. 9 at p. 1)

DOE has not received data from commenters or otherwise that indicates the impacts of case heat transfer have become more significant since the publication of the June 2016 Final Rule and when the supporting analysis was conducted. Thus, DOE has tentatively determined to continue to exclude case heat transfer from the portable AC test procedure both in appendix CC and appendix CC1 as concluded in the June 2016 Final Rule. DOE also proposes to maintain the incorporation of the energy impacts of infiltration air and duct heat transfer in the portable AC test procedure.

DOE requests comment on the tentative determinations to continue to include the energy impacts of infiltration air and duct heat transfer and exclude case heat transfer in appendix CC and proposed new appendix CC1.

C. Representations of Energy Efficiency

Manufacturers, including importers, must use product-specific test procedures in 10 CFR part 430 and sampling and rounding requirements in 10 CFR part 429 to determine the represented values of energy consumption or energy efficiency of a basic model. The proposed appendix CC1 would require use of AEER for representing the energy efficiency of a basic model of portable AC, which is different from the current metric for models tested using appendix CC. DOE proposes to add rounding instructions consistent with those in Table 1 of AHAM PAC–1–2022 Draft in 10 CFR 429.62 when representing the energy efficiency of a basic model tested using appendix CC1. DOE also proposes to incorporate the AHAM PAC–1–2022 Draft standard by reference in 10 CFR 429.4.

DOE requests comment on the proposals to add rounding requirements consistent with AHAM PAC–1–2022 Draft when certifying using appendix CC1 in 10 CFR 429.62. DOE also requests comment on its proposal to incorporate AHAM PAC–1–2022 Draft by reference in 10 CFR 429.4.

D. Test Procedure Costs and Harmonization

1. Test Procedure Costs and Impact

In this NOPR, DOE proposes to amend the existing test procedure for portable ACs by amending appendix CC and adopting a new appendix CC1. DOE has tentatively determined that these proposed amendments would not impact testing costs as discussed in the following paragraphs.

a. Appendix CC

DOE proposes to amend appendix CC to account for variable-speed portable ACs per the LG Waiver and Midea Interim Waivers with modifications. As discussed, the LG Waiver uses manufacturer instructions to achieve a fixed full compressor speed, but DOE's proposal uses consumer settings and a setpoint of 75 °F to do so. However, the modification would not require testing at additional conditions or increase the test time, as compared to the LG Waiver. As such, DOE has tentatively determined that the cost per test under appendix CC as proposed would be the same as the alternate test procedure specified in the LG Waiver. Due to the modification, the compressor speed required by the LG Waiver may differ from the compressor speed that would be required under the proposed amendments to appendix CC. LG would need to retest the variable-speed portable ACs subject to the LG Waiver if DOE amends the test procedure in a way that requires testing at a different compressor speed. At a minimum, LG would need to recertify any such units that are already certified, given the different full compressor speed and cycling factor proposed in appendix CC. Furthermore, if DOE adopts the amendments proposed in this NOPR, LG would be required to update representations of its variable-speed portable ACs subject to the LG Waiver to rely on $SACC_{Full}$ using the full compressor speed at the 83 °F test condition and to use the proposed new CF. These updates would not require retesting, only additional calculations using data already collected. The Midea variable-speed portable ACs subject to the existing interim waiver would not need to be retested, as there is no substantive difference in testing between the Midea Interim Waiver and the proposed amended appendix CC. However, like LG, Midea would be required to update representations of their variable-speed portable ACs to rely on $SACC_{Full}$ using the full compressor speed at the 83 °F test condition and to use the proposed new CF, if DOE adopts the proposed amendments. This update would not require retesting, only additional calculations using data already collected.

DOE requests comment on its characterization of test procedure costs and impacts of the proposed amendments to appendix CC.

b. Appendix CC1

DOE proposes to adopt a new appendix CC1 consistent with AHAM PAC–1–2022 Draft with modifications. For single-speed units, AHAM PAC–1–2022 Draft uses the same test conditions as the current appendix CC. For variable-speed portable ACs, AHAM PAC–1–2022 Draft uses the existing temperature conditions but has two additions. First, for a dual-duct variable-speed portable AC it adds a third test condition for full compressor speed at the low test condition. Second, it adds a specification to set the compressor speed to a low speed using manufacturer instructions at the lower temperature test condition. This proposal is consistent with the amendments to appendix CC above with three exceptions. First, appendix CC1 also updates the SACC and CEER calculations for all units to improve the representativeness of the test procedure with updated operating hours. Second, it adds a single-speed CF. Third, it includes adjustments to reflect the cooling provided at the 83 °F test condition. Under the proposed appendix CC1, cycling behavior would be factored into the measured values for all single-speed units, not just for variable-speed units as in appendix CC. DOE proposes that testing under proposed new appendix CC1 would not be required unless and until DOE adopts amended energy conservation standards that are based on the proposed new appendix CC1, and compliance with those standards is required. At that time, manufacturers would have to, in accordance with appendix CC1, re-test and re-certify all currently certified basic models.

DOE requests comment on its characterization of test procedure costs and impacts of the proposed new test procedure at appendix CC1.

2. Harmonization With Industry Standards

DOE's established practice is to adopt relevant industry standards as DOE test procedures unless such methodology would be unduly burdensome to conduct or would not produce test results that reflect the energy efficiency, energy use, water use (as specified in EPCA) or estimated operating costs of that product during a representative average use cycle or period of use. Section 8(c) of appendix A of 10 CFR part 430 subpart C. When the industry standard does not meet EPCA statutory criteria for test procedures, through the rulemaking process DOE will establish a test procedure reflecting modifications to these standards.

As discussed, appendices CC and CC1 incorporate by reference ANSI/AHAM PAC–1–2015, ANSI/ASHRAE Standard 37–2009, IEC Standard 62301, ANSI/ASHRAE Standard 41.1–1986, ANSI/ASRHAE Standard 41.6–1994 (RA 2006), and ANSI/ASHRAE Standard 51–1999 with modifications. The industry standards DOE proposes to incorporate by reference are discussed in further detail in section IV.N of this document. DOE requests comments on the benefits and burdens of the proposed updates and additions to industry standards referenced in the test procedure for portable ACs.

E. Compliance Date and Waivers

EPCA prescribes that, if DOE amends a test procedure, all representations of energy efficiency and energy use, including those made on marketing materials and product labels, must be made in accordance with that amended test procedure, beginning 180 days after publication of such a test procedure final rule in the **Federal Register**. (42 U.S.C. 6293(c)(2)) To the extent the modified test procedure proposed in this document is required only for the evaluation and issuance of updated efficiency standards, use of the modified test procedure, if finalized, would not be required until the compliance date of updated standards. Section 8(e) of appendix A 10 CFR part 430 subpart C.

If DOE publishes an amended test procedure, EPCA provides an allowance for individual manufacturers to petition DOE for an extension of the 180-day period if the manufacturer would experience undue hardship in meeting the deadline. (42 U.S.C. 6293(c)(3)) To receive such an extension, petitions must be filed with DOE no later than 60 days before the end of the 180-day period and must detail how the manufacturer will experience undue hardship. (*Id.*)

If DOE amends the test procedure, upon the compliance date of test procedure provisions of the amended test procedure, any waivers that had been previously issued and are in effect that pertain to issues addressed by such provisions are terminated. 10 CFR 430.27(h)(3). As of the compliance date of the amended test procedure, recipients of any such waivers would be required to test the products subject to the waiver according to the amended test procedure. This includes LG and Midea because the amendments proposed in this document pertain to issues addressed by waiver and interim waiver DOE granted to them.[17]

IV. Procedural Issues and Regulatory Review

A. Review Under Executive Order 12866 and 13563

Executive Order (''E.O.'') 12866, ''Regulatory Planning and Review,'' as supplemented and reaffirmed by E.O. 13563, ''Improving Regulation and Regulatory Review, 76 FR 3821 (Jan. 21, 2011), requires agencies, to the extent permitted by law, to (1) propose or adopt a regulation only upon a reasoned determination that its benefits justify its costs (recognizing that some benefits and costs are difficult to quantify); (2) tailor regulations to impose the least burden on society, consistent with obtaining regulatory objectives, taking into account, among other things, and to the extent practicable, the costs of cumulative regulations; (3) select, in choosing among alternative regulatory approaches, those approaches that maximize net benefits (including potential economic, environmental, public health and safety, and other advantages; distributive impacts; and equity); (4) to the extent feasible, specify performance objectives, rather than specifying the behavior or manner of compliance that regulated entities must adopt; and (5) identify and assess available alternatives to direct regulation, including providing economic incentives to encourage the desired behavior, such as user fees or marketable permits, or providing information upon which choices can be made by the public. DOE emphasizes as well that E.O. 13563 requires agencies to use the best available techniques to quantify anticipated present and future benefits and costs as accurately as possible. In its guidance, the Office of Information and Regulatory Affairs (''OIRA'') in the Office of Management and Budget (''OMB'') has emphasized that such techniques may include identifying changing future compliance costs that might result from technological innovation or anticipated behavioral changes. For the reasons stated in the preamble, this proposed regulatory action is consistent with these principles.

Section 6(a) of E.O. 12866 also requires agencies to submit ''significant regulatory actions'' to OIRA for review. OIRA has determined that this proposed regulatory action does not constitute a ''significant regulatory action'' under section 3(f) of E.O. 12866. Accordingly, this action was not submitted to OIRA for review under E.O. 12866.

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 (''IRFA'') 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 E.O. 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 website: *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. DOE certifies that the proposed rule, if adopted, would not have significant economic impact on a substantial number of small entities. The factual basis of this certification is set forth in the following paragraphs.

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 requires that any test procedures prescribed or amended under this section 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 not be unduly burdensome to conduct. (42 U.S.C. 6293(b)(3))

EPCA also requires that, at least once every 7 years, DOE evaluate test procedures for each type of covered product, including portable ACs, to determine whether amended test procedures would more accurately or fully comply with the requirements for the test procedures to not be unduly burdensome to conduct and be reasonably designed to produce test results that reflect energy efficiency, energy use, and estimated operating costs during a representative average use cycle or period of use. (42 U.S.C. 6293(b)(1)(A))

In addition, EPCA requires that DOE amend its test procedures for all covered products to integrate measures of standby mode and off mode energy consumption. (42 U.S.C. 6295(gg)(2)(A)) Standby mode and off mode energy consumption must be integrated into the overall energy efficiency, energy consumption, or other energy descriptor for each covered product unless the current test procedures already account for standby and off mode energy consumption or such integration is technically infeasible. If an integrated test procedure is technically infeasible, DOE must prescribe a separate standby mode and off mode energy use test procedure for the covered product, if technically feasible. (42 U.S.C. 6295(gg)(2)(A)(ii)) Any such amendment must consider the most current versions of the IEC Standard 62301 and IEC Standard 62087 as applicable. (42 U.S.C. 6295(gg)(2)(A))

DOE is proposing amendments to the test procedure for portable ACs in satisfaction of its statutory obligations under EPCA. Specifically, DOE proposes to amend 10 CFR 429.4 ''Materials incorporated by reference'' and 10 CFR 429.62, ''Portable air conditioners'' as follows:

(7) Incorporate by reference AHAM PAC–1–2022 Draft, ''Portable Air Conditioners'' (''AHAM PAC–1–2022 Draft'') which includes an industry-accepted method for testing variable-speed portable ACs, in 10 CFR 429.4;

(8) Add rounding instructions for the SACC, CEER, and AEER in 10 CFR 429.62;

In addition, DOE proposes to update 10 CFR 430.2, ''Definitions'' and 10 CFR 430.23, ''Test procedures for the measurement of energy and water consumption'' as follows:

(1) Add a definition for the term ''combined-duct'' to 10 CFR 430.2; and

(2) Add requirements to determine estimated annual operating cost for single-duct and dual-duct variable-speed portable ACs in 10 CFR 430.23.

DOE also proposes to amend appendix CC to subpart B of part 430—Uniform Test Method for Measuring the Energy Consumption of Portable Air Conditioners'' as follows:

[17] The LG Waiver was in Case No. 2018–004; the Midea Interim Waiver was in Case No. 2020–006.

(3) Add definitions in section 2 for ''combined-duct,'' ''single-speed,'' ''variable-speed,'' ''full compressor speed (full),'' ''low compressor speed (low),'' and ''theoretical comparable single-speed;''

(4) Divide section 4.1 into two sections, 4.1.1 and 4.1.2, for single-speed and variable-speed portable ACs, respectively, and detail configuration-specific cooling mode testing requirements for variable-speed portable ACs;

(5) Add a requirement in section 4.1.2 that, for variable-speed portable ACs, the full compressor speed at the 95 °F test condition be achieved with user controls, and the low compressor speed at the 83 °F test condition be achieved with manufacturer-provided settings or controls;

(6) Add a cycling factor, CF, in section 5.5.1;

(7) Add a requirement to calculate SACC with full compressor speed at the 95 °F test condition and low compressor speed at the 83 °F test condition in sections 5.1 and 5.2, consistent with the LG waiver and Midea interim waiver, with an additional requirement for variable-speed portable ACs to represent SACC with full compressor speed for both test conditions, and;

(8) Add a requirement in section 3.1.2 that, if a portable AC has network functions, all network functions must be disabled throughout testing if such settings can be disabled by the end-user and the product's user manual provides instructions on how to do so. If the network functions cannot be disabled by the end-user, or the product's user manual does not provide instruction for disabling network settings, test the unit with the network settings in the factory default configuration for the duration of the test.

DOE additionally proposes to adopt a new ''appendix CC1 to subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Portable Air Conditioners'' which would incorporate by reference AHAM PAC–1–2022 Draft and include the following changes:

(9) Incorporate by reference parts of AHAM PAC–1–2022 Draft, which includes an industry-accepted method for testing variable-speed portable ACs;

(10) Adopt a new efficiency metric, AEER, to more representatively calculate the efficiency of both variable-speed and single-speed portable ACs;

(11) Amend the annual operating hours;

(12) Update the SACC and CEER equations for both single-speed and variable-speed portable ACs;

(13) Apply a CF to single-speed portable AC efficiency; and

(14) Add a requirement that, if a portable AC has network functions, disable all network functions throughout testing. If the network functions cannot be disabled by the end-user, or the product's user manual does not provide instruction for disabling network settings, then test the unit with the network function settings in the factory default configuration for the duration of the test.

Testing according to the proposed new appendix CC1, if made final, would not be required until compliance is required with amended energy conservation standards that are based on the proposed new appendix CC1, should such standards be established.

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. DOE used SBA's small business size standards to determine whether any small entities would be subject to the requirements of the rule. These size standards and codes are established by the North American Industry Classification System (''NAICS'') and are available at *www.sba.gov/document/support--table-size-standards.* Portable ACs are classified under NAICS 333415, ''Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.'' The SBA sets a threshold of 1,250 employees or fewer for an entity to be considered as a small business for this category.

DOE used the California Energy Commission's Modernized Appliance Efficiency Database System (''MAEDbS'')[18] to create a list of companies that sell portable ACs covered by this rulemaking in the United States. DOE consulted publicly available data, such as manufacturer websites, manufacturer specifications and product literature, import and export logs, and basic model numbers, to identify original equipment manufacturers (''OEMs'') of the products covered by this proposed rulemaking. DOE relied on public data and subscription-based market research tools (*e.g.,* Dun & Bradstreet reports)[19] to determine company location, headcount, and annual revenue. DOE screened out companies that do not offer products covered by this proposed rulemaking, do not meet the SBA's definition of a ''small business,'' or are foreign-owned and operated.

DOE identified 17 companies that are OEMs of portable ACs. In reviewing the 17 OEMs, DOE did not identify any domestic OEMs that met the SBA criteria for a small entity. Given the lack of small entities with a direct compliance burden, DOE concludes that the impacts of the proposed test procedure amendments outlined in this NOPR would not have a ''significant economic impact on a substantial number of small entities.'' DOE will transmit the certification and supporting statement of factual basis to the Chief Counsel for Advocacy of the Small Business Administration for review under 5 U.S.C. 605(b).

DOE seeks comment on its findings that there are no small businesses that are OEMs of portable ACs based in the United States. DOE also seeks comment on its conclusion that the proposed test procedure amendments would not have a significant impact on a substantial number of small manufacturers.

C. Review Under the Paperwork Reduction Act of 1995

OMB Control Number 1910–1400, Compliance Statement Energy/Water Conservation Standards for Appliances, is currently valid and assigned to the certification reporting requirements applicable to covered equipment, including portable ACs.

DOE's certification and compliance activities ensure accurate and comprehensive information about the energy and water use characteristics of covered products and covered equipment sold in the United States. Manufacturers of all covered products and covered equipment must submit a certification report before a basic model is distributed in commerce, annually thereafter, and if the basic model is redesigned in such a manner to increase the consumption or decrease the efficiency of the basic model such that the certified rating is no longer supported by the test data. Additionally, manufacturers must report when production of a basic model has ceased and is no longer offered for sale as part of the next annual certification report following such cessation. DOE requires the manufacturer of any covered product or covered equipment to establish, maintain, and retain the records of certification reports, of the underlying test data for all certification testing, and of any other testing conducted to satisfy the requirements of 10 CFR part 429, 10 CFR part 430, and/or 10 CFR part 431. Certification reports

[18] *cacertappliances.energy.ca.gov/Pages/Search/AdvancedSearch.aspx.* Last accessed November 22, 2021.

[19] The Dun & Bradstreet Hoovers subscription login is available online at *app.dnbhoovers.com/.*

provide DOE and consumers with comprehensive, up-to date efficiency information and support effective enforcement.

The proposal in this NOPR would amend the representations of capacity for variable-speed portable ACs currently subject to test procedure waivers. If made final, the proposed amendments to appendix CC in this NOPR would require use of a new metric, *i.e.,* $SACC_{Full}$. DOE is not proposing certification or reporting requirements for portable ACs subject to appendix CC in this NOPR. Instead, DOE may consider proposals to address amendments to the certification requirements and reporting for portable ACs under a separate rulemaking regarding appliance and equipment certification. DOE will address changes to OMB Control Number 1910–1400 at that time, as necessary.

To the extent that the proposed new appendix CC1 would necessitate the reporting of different or additional information, DOE may consider proposals to amend the certification requirements and reporting for portable ACs under a separate rulemaking regarding appliance and equipment certification.

Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the PRA, unless that collection of information displays a currently valid OMB Control Number.

D. Review Under the National Environmental Policy Act of 1969

In this NOPR, 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 proposed 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, DOE has determined that adopting test procedures for measuring energy efficiency of consumer products and industrial equipment is consistent with activities identified in 10 CFR part 1021, appendix A to subpart D, A5 and A6. Accordingly, neither an environmental assessment nor an environmental impact statement is required.

E. Review Under Executive Order 13132

E.O. 13132, ''Federalism,'' 64 FR 43255 (Aug. 4, 1999) imposes certain requirements on agencies formulating and implementing policies or regulations that preempt State law or that have federalism implications. The E.O. 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 E.O. 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 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 E.O. 13132.

F. Review Under Executive Order 12988

Regarding the review of existing regulations and the promulgation of new regulations, section 3(a) of E.O. 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 E.O. 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 E.O. 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, the proposed rule meets the relevant standards of E.O. 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 *http://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 E.O. 12630, ''Governmental Actions and Interference with Constitutionally Protected Property Rights'' 53 FR 8859 (March 18, 1988), that this proposed regulation 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). Pursuant to OMB Memorandum M–19–15, Improving Implementation of the Information Quality Act (April 24, 2019), DOE published updated guidelines which are available at *www.energy.gov/sites/prod/files/2019/12/f70/DOE%20Final%20Updated%20IQA%20Guidelines%20Dec%202019.pdf.* 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

E.O. 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 E.O. 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.

The proposed regulatory action to amend the test procedure for measuring the energy efficiency of portable ACs is not a significant regulatory action under E.O. 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 NOPR 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.

The proposed modifications to the test procedure for portable ACs would incorporate testing methods contained in certain sections of the following commercial standards: ANSI/AHAM PAC–1–2015, AHAM PAC–1–2022 Draft, ANSI/ASHRAE Standard 37–2009, and IEC 62301. 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.,* whether it was developed in a manner that fully provides for public participation, comment, and review.) DOE will consult with both the Attorney General and the Chairman 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 in the proposed appendix CC1 the draft test standard provided by AHAM, titled, ''Portable Air Conditioners AHAM PAC–1–2022 Draft.'' AHAM PAC–1–2022 Draft is a draft industry test procedure that measures portable AC performance in cooling mode in a more representative manner than the previous iteration, ANSI/AHAM PAC–1–2015, and is applicable to products sold in North America. AHAM PAC–1–2022 Draft specifies testing conducted in accordance with other industry-accepted test procedures and determines energy efficiency metrics for various portable AC configurations and compressor types (*i.e.,* single-speed and variable-speed). The appendix CC1 test procedure proposed in this NOPR references various sections of AHAM PAC–1–2022 Draft that address test setup, instrumentation, test conduct, calculations, and rounding.

Copies of AHAM PAC–1–2022 Draft may be purchased from the Association of Home Appliance Manufacturers at 1111 19th Street NW, Suite 402, Washington, DC 20036, or by going to *www.aham.org/ht/d/Store/.*

In this NOPR, DOE also proposes to incorporate by reference the test standard ASHRAE Standard 37–2009, titled ''Methods of Testing for Rating Electrically Driven Unitary Air-Conditioning and Heat Pump Equipment,'' (ANSI Approved). ANSI/ASHRAE Standard 37–2009 is an industry-accepted test standard referenced by ANSI/AHAM PAC–1–2015 that defines various uniform methods for measuring performance of air conditioning and heat pump equipment. Although ANSI/AHAM PAC–1–2015 references a number of sections in ANSI/ASHRAE Standards 37–2009, the test procedure established in this proposed rule additionally references one section in ANSI/ASHRAE Standard 37–2009 that addresses test duration.

Copies of ANSI/ASHRAE Standard 37–2009 can be obtained from the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., at Publication Sales, 1791 Tullie Circle NE, Atlanta, GA 30329, or by going to *www.ashrae.org.*

In this NOPR, DOE also proposes to incorporate by reference the test standard ANSI/ASHRAE 51–1999 (also called ANSI/AMCA 210), titled ''Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.'' ANSI/ASHRAE 51–1999 is an industry-accepted test standard referenced by ANSI/ASHRAE Standard 37–2009 that defines methods for measuring the characteristics of air flow.

Copies of ANSI/ASHRAE 51–1999 can be obtained from the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., at Publication Sales, 1791 Tullie Circle NE, Atlanta, GA 30329, or by going to *www.ashrae.org.*

In this NOPR, DOE also proposes to incorporate by reference the test standard ANSI/ASHRAE 41.1–1986, titled ''Standard Method for Temperature Measurement,'' (ANSI

Approved). ANSI/ASHRAE 41.1–1986 is an industry-accepted test standard referenced by ANSI/ASHRAE Standard 37–2009 that defines a standard method for measuring temperature.

Copies of ANSI/ASHRAE 41.1–1986 can be obtained from the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., at Publication Sales, 1791 Tullie Circle NE, Atlanta, GA 30329, or by going to *www.ashrae.org.*

In this NOPR, DOE also proposes to incorporate by reference the test standard ANSI/ASHRAE 41.6–1994 (RA 2006), titled ''Standard Method for Measurement of Moist Air Properties,'' (ANSI Approved). ANSI/ASHRAE 41.6–1994 (RA 2006) is an industry-accepted test standard referenced by ANSI/ASHRAE Standard 37–2009 that defines a standard method for measuring moist air properties, including humidity and wet-bulb temperature.

Copies of ANSI/ASHRAE 41.6–1994 (RA 2006) can be obtained from the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., at Publication Sales, 1791 Tullie Circle NE, Atlanta, GA 30329, or by going to *www.ashrae.org.*

In this NOPR, DOE also proposes to incorporate by reference the test standard IEC 62301, titled ''Household electrical appliances—Measurement of standby power,'' (Edition 2.0, 2011–01). IEC 62301 is an industry-accepted test standard that sets a standardized method to measure the standby power of household and similar electrical appliances. IEC 62301 includes details regarding test set-up, test conditions, and stability requirements that are necessary to ensure consistent and repeatable standby and off-mode test results.

Copies of IEC 62301 can be obtained from the American National Standards Institute at 25 W 43rd Street, 4th Floor, New York, or by going to *webstore.ansi.org.*

V. Public Participation

A. Participation in the Webinar

The time and date of the webinar meeting are listed in the **DATES** section at the beginning of this document. Webinar registration information, participant instructions, and information about the functions available to webinar participants will be published on DOE's website: *www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=65.* 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 an interest in the topics addressed in this proposed rulemaking, or who is representative of a group or class of persons that has an interest in these issues, may request an opportunity to make an oral presentation at the webinar. Such persons may submit to *ApplianceStandardsQuestions@ee.doe.gov.* Persons who wish to speak should include with their request a computer file in WordPerfect, Microsoft Word, PDF, or text (ASCII) file format that briefly describes the nature of their interest in this proposed rulemaking and the topics they wish to discuss. Such persons should also provide a daytime telephone number where they can be reached.

C. Conduct of the Webinar

DOE will designate a DOE official to preside at the webinar 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 webinar. There shall not be discussion of proprietary information, costs or prices, market share, or other commercial matters regulated by U.S. anti-trust laws. After the webinar/public meeting and until the end of the comment period, interested parties may submit further comments on the proceedings and any aspect of the proposed rulemaking.

The webinar will be conducted in an informal, conference style. DOE will present a general overview of the topics addressed in this proposed rulemaking, allow time for prepared general statements by participants, and encourage all interested parties to share their views on issues affecting this proposed 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. 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 webinar 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 webinar/public meeting.

A transcript of the webinar/public meeting will be included in the docket, which can be viewed as described in the *Docket* section at the beginning of this proposed rule. 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 no later than the date provided in the **DATES** section at the beginning of this proposed rule.[20] Interested parties may submit comments using any of the methods described in the **ADDRESSES** section at the beginning of this document.

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

[20] DOE has historically provided a 75-day comment period for test procedure NOPRs pursuant to the North American Free Trade Agreement, U.S.-Canada-Mexico (''NAFTA''), Dec. 17, 1992, 32 I.L.M. 289 (1993); the North American Free Trade Agreement Implementation Act, Public Law 103–182, 107 Stat. 2057 (1993) (codified as amended at 10 U.S.C.A. 2576) (1993) (''NAFTA Implementation Act''); and E.O. 12889, ''Implementation of the North American Free Trade Agreement,'' 58 FR 69681 (Dec. 30, 1993). However, on July 1, 2020, the Agreement between the United States of America, the United Mexican States, and Canada (''USMCA''), Nov. 30, 2018, 134 Stat. 11 (*i.e.,* the successor to NAFTA), went into effect, and Congress's action in replacing NAFTA through the USMCA Implementation Act, 19 U.S.C. 4501 *et seq.* (2020), implies the repeal of E.O. 12889 and its 75-day comment period requirement for technical regulations. Thus, the controlling laws are EPCA and the USMCA Implementation Act. Consistent with EPCA's public comment period requirements for consumer products, the USMCA only requires a minimum comment period of 60 days. Consequently, DOE now provides a 60-day public comment period for test procedure NOPRs.

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 *www.regulations.gov* cannot be claimed as CBI. Comments received through the website will waive any CBI claims for the information submitted. For information on submitting CBI, see the Confidential Business Information section.

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

Submitting comments via email, hand delivery/courier, or postal mail. Comments and documents submitted via email, hand delivery/courier, or postal mail also will be posted to *www.regulations.gov.* If you do not want your personal contact information to be publicly viewable, do not include it in your comment or any accompanying documents. Instead, provide your contact information on a cover letter. Include your first and last names, email address, telephone number, and optional mailing address. The cover letter will not be publicly viewable as long as it does not include any comments.

Include contact information each time you submit comments, data, documents, and other information to DOE. If you submit via postal mail or hand delivery/courier, please provide all items on a CD, if feasible, in which case it is not necessary to submit printed copies. No faxes will be accepted.

Comments, data, and other information submitted to DOE electronically should be provided in PDF (preferred), Microsoft Word or Excel, 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. Pursuant to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email two well-marked copies: one copy of the document marked confidential including all the information believed to be confidential, and one copy of the document marked non-confidential with the information believed to be confidential deleted. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

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

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) DOE requests comment on the proposal to incorporate by reference AHAM PAC–1–2022 Draft in a new appendix CC1, with modifications to address comparability and representativeness.

(2) DOE requests comment on the proposal to amend the operating hours in the proposed new appendix CC1 as shown in Table III.2 above.

(3) DOE requests comment on the proposal to adopt in the new appendix CC1 the requirement that portable ACs able to operate as both a single-duct and dual-duct portable AC, as distributed in commerce by the manufacturer, must be tested and rated for both duct configurations.

(4) DOE requests comment on the proposal to add variable-speed test conditions in appendix CC consistent with the LG Waiver and Midea Interim Waiver while otherwise retaining the current test conditions, and to adopt the AHAM PAC–1–2022 Draft test conditions in the proposed new appendix CC1.

(5) DOE requests comment on the proposal to add compressor speed requirements in appendix CC consistent with the Midea Interim Waiver, and to adopt the AHAM PAC–1–2022 Draft compressor speed requirements in the proposed new appendix CC1.

(6) DOE requests comment on the proposal to maintain in the revised appendix CC the current SACC calculation for single-speed units and to adopt a SACC calculation consistent with the test procedure waivers for variable-speed units for the purposes of determining CEER. DOE also requests comment on the proposal to require manufacturers of variable-speed units to represent cooling capacity using a new metric, SACCFull, based on full load performance at the low temperature condition. DOE further requests comment on the proposal to adopt an updated SACC calculation for single-speed units and variable-speed units that accounts for reduced cooling load at the 83 °F test condition in the proposed new appendix CC1.

(7) DOE requests comment on the proposed weighting factors in the proposed new appendix CC1 (0.144 for the 95 °F test condition and 0.856 for the 83 °F test condition).

(8) DOE requests comment on the proposal to adopt a CF of 0.82 based on DOE's investigative testing, in appendix CC and in the proposed new appendix CC1.

(9) DOE requests comment on its proposal not to prescribe load-based testing in appendix CC or the proposed new appendix CC1.

(10) DOE requests comment on the tentative determination not to dedicate distinct operating hours or testing to user-initiated air circulation mode in appendix CC and proposed new appendix CC1.

(11) DOE requests comment on the tentative determination not to include dehumidification mode in appendix CC and proposed new appendix CC1.

(12) DOE requests comment on this proposal.

(13) DOE requests comment on the tentative determinations to continue to include the energy impacts of infiltration air and duct heat transfer and exclude case heat transfer in appendix CC and proposed new appendix CC1.

(14) DOE requests comment on its characterization of test procedure costs and impacts of the proposed amendments to appendix CC.

(15) DOE requests comment on its characterization of test procedure costs and impacts of the proposed new test procedure at appendix CC1.

(16) DOE seeks comment on its findings that there are no small businesses that are OEMs of portable ACs based in the United States. DOE also seeks comment on its conclusion that the proposed test procedure amendments would not have a significant impact on a substantial number of small manufacturers.

VI. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of this notice of proposed rulemaking and request for comment.

List of Subjects

10 CFR Part 429

Administrative practice and procedure, Confidential business information, Energy conservation, Household appliances, Incorporation by reference, Reporting and recordkeeping requirements.

10 CFR Part 430

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

Signing Authority

This document of the Department of Energy was signed on May 23, 2022, by Kelly J. Speakes-Backman, Principal Deputy Assistant Secretary for Energy Efficiency and Renewable Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the **Federal Register**.

Signed in Washington, DC, on May 24, 2022.

Treena V. Garrett,

Federal Register Liaison Officer, U.S. Department of Energy.

For the reasons stated in the preamble, DOE is proposing 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; 28 U.S.C. 2461 note.

■ 2. Section 429.4 is amended by adding paragraph (b)(3) to read as follows:

§ 429.4 Materials incorporated by reference.

* * * * *

(b) * * *

(3) ANSI/AHAM PAC–1–2022 Draft, (''AHAM PAC–1–2022 Draft''), Portable Air Conditioners, IBR approved for § 429.62.

* * * * *

■ 3. Section 429.62 is amended by revising paragraphs (a)(3) and (4) to read as follows:

§ 429.62 Portable air conditioners.

* * * * *

(a) * * *

(3) The value of seasonally adjusted cooling capacity of a basic model must be the mean of the seasonally adjusted cooling capacities for each tested unit of the basic model. When using appendix CC of subpart B of part 430, round the mean seasonally adjusted cooling capacity value to the nearest 50, 100, 200, or 500 Btu/h, depending on the magnitude of the calculated seasonally adjusted cooling capacity, in accordance with Table 1 of ANSI/AHAM PAC–1–2015, (incorporated by reference, see § 429.4), ''Multiples for reporting Dual Duct Cooling Capacity, Single Duct Cooling Capacity, Spot Cooling Capacity, Water Cooled Condenser Capacity and Power Input Ratings''. When using appendix CC1 of subpart B of part 430, round to the nearest 50, 100, 200, or 500 Btu/h, depending on the magnitude of the calculated seasonally adjusted cooling capacity, in accordance with Table 1 of AHAM PAC–1–2022 Draft, (incorporated by reference, see § 429.4), ''Multiples for reporting Dual Duct Cooling Capacity, Single Duct Cooling Capacity, Spot Cooling Capacity, Water Cooled Condenser Capacity and Power Input Ratings''.

(4) The represented value of combined energy efficiency ratio or annualized energy efficiency ratio of a basic model must be rounded to the nearest 0.1 Btu/Wh.

* * * * *

PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS

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

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

■ 5. Section 430.2 is amended by adding in alphabetical order the definition for ''Combined-duct'' to read as follows:

§ 430.2 Definitions.

* * * * *

Combined-duct means, for a portable air conditioner, the condenser inlet and outlet air streams flow through separate ducts housed in a single duct structure.

* * * * *

■ 6. Section 430.3 is amended by:

■ a. Adding paragraph (b)(5);

■ b. Revising paragraph (g)(3) and (5); c. Redesignating paragraphs (g)(11) through (18) as paragraphs (g)(12) through(19);

■ d. Adding new paragraphs (g)(11) and (i)(7);

■ e. Revising paragraph (o)(6).

The additions and revisions to read as follows:

§ 430.3 Materials incorporated by reference.

* * * * *

(b) * * *

(5) ANSI/ASHRAE 51–1999/ANSI/AMCA 210–99 (''ANSI/ASHRAE 51''), Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating, ANSI approved December 2, 1999; ASHRAE approved June 23, 1999; IBR approved for appendices CC and CC1 to subpart B.

* * * * *

(g) * * *

(3) ANSI/ASHRAE Standard 37–2009, (''ASHRAE 37–2009''), Methods of Testing for Rating Electrically Driven Unitary Air-Conditioning and Heat Pump Equipment, ANSI approved June 25, 2009, IBR approved for appendices AA, CC, and CC1 to subpart B.

* * * * *

(5) ANSI/ASHRAE 41.1–1986 (Reaffirmed 2006), Standard Method for Temperature Measurement, approved February 18, 1987, IBR approved for appendices E, AA, and CC1 to subpart B.

* * * * *

(11) ANSI/ASHRAE Standard 41.6–1994 (RA 2006), (''ASHRAE 41.6–1994''), Standard Method for Measurement of Moist Air Properties, ANSI reaffirmed on January 27, 2006, IBR approved for appendix CC1 to subpart B.

* * * * *

(i) * * *

(7) AHAM PAC–1–2022 Draft, (''AHAM PAC–1–2022 Draft''), Portable Air Conditioners, IBR approved for appendix CC1 to subpart B.

* * * * *

(o) * * *

(6) IEC 62301 (''IEC 62301''), Household electrical appliances—Measurement of standby power, (Edition 2.0, 2011–01), IBR approved for appendices C1, D1, D2, F, G, H, I, J2, N, O, P, Q, X, X1, Y, Z, BB, CC, and CC1 to subpart B.

* * * * *

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

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

* * * * *

(dd) *Portable air conditioners.*

(1) When using appendix CC of this subpart, measure the seasonally adjusted cooling capacity, in British thermal units per hour (Btu/h), and the combined energy efficiency ratio, in British thermal units per watt-hour (Btu/Wh) in accordance with sections 5.2 and 5.4 of appendix CC of this subpart, respectively. When using appendix CC1 of this subpart, measure the seasonally adjusted cooling capacity, in British thermal units per hour (Btu/h), and the combined energy efficiency ratio, in British thermal units per watt-hour (Btu/Wh) in accordance with sections 5.2 and 5.4, respectively, of appendix CC1 of this subpart.

(2) When using appendix CC of this subpart, determine the estimated annual operating cost for portable air conditioners, in dollars per year and rounded to the nearest whole number, by multiplying a representative average unit cost of electrical energy in dollars per kilowatt-hour as provided by the Secretary by the total annual energy consumption, determined as follows:

(i) For dual-duct single-speed portable air conditioners, the sum of AECDD_95 multiplied by 0.2, AECDD_83 multiplied by 0.8, and AECT as measured in accordance with section 5.3 of appendix CC of this subpart.

(ii) For single-duct single-speed portable air conditioners, the sum of AECSD and AECT as measured in accordance with section 5.3 of appendix CC of this subpart.

(iii) For dual-duct variable-speed portable air conditioners the overall sum of

(A) The sum of $AEC_{DD\_95\_Full}$ and $AEC_{ia/om}$, multiplied by 0.2, and

(B) The sum of $AEC_{DD\_83\_Low}$ and $AEC_{ia/om}$, multiplied by 0.8, as measured in accordance with section 5.3 of appendix CC of this subpart.

(iv) For single-duct variable-speed portable air conditioners, the overall sum of

(A) The sum of AECSD_Full and AECia/om, multiplied by 0.2, and

(B) The sum of AECSD_Low and AECia/om, multiplied by 0.8, as measured in accordance with section 5.3 of appendix CC of this subpart.

(3) When using appendix CC1 of this subpart, determine the estimated annual operating cost for portable air conditioners, in dollars per year and rounded to the nearest whole number, by multiplying a representative average unit cost of electrical energy in dollars per kilowatt-hour as provided by the Secretary by the total annual energy consumption. The total annual energy consumption is the sum of AEC_{95}, AEC_{83}, AEC_{oc}, and AEC_{ia}, as measured in accordance with section 5.3 of appendix CC1 of this subpart.

■ 8. Appendix CC to subpart B of part 430 is amended by:

■ a. Adding an introductory note;

■ b. Adding section 0;

■ c. Revising sections 2, 3.1.1, 3.1.1.1, 3.1.1.6, 3.1.2, 3.2, 3.2.1, 3.2.2.2, 3.2.3, 4.1, 4.1.1, and 4.1.2, ;

■ d. Adding sections 4.1.3 and 4.1.4;

■ e. Revising sections 4.3 and 5.1 ;

■ f. Adding sections 5.1.1 and 5.1.2;

■ g. Revising section 5.2;

■ h. Adding section 5.2.1;

■ i. Revising sections 5.3 and 5.4;

■ j. Adding sections 5.4.1, 5.4.2 and 5.4.2.1; and

■ k. Adding sections 5.5, 5.5.1, 5.5.2, 5.5.3, 5.5.4, 5.5.5, 5.5.6, 5.5.7, and 5.5.8.

The additions and revisions read as follows:

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

Note: Manufacturers must use the results of testing under this appendix to determine compliance with the standard at § 430.32(cc) with which compliance is required as of January 10, 2025. Before [Date 180 days following publication of the final rule] representations must be based upon results generated either under this appendix or under this appendix as it appeared in the 10 CFR parts 200–499 edition revised as of January 1, 2021.

Manufacturers must use the results of testing under appendix CC1 to determine compliance with any standards that amend the portable air conditioners standard at § 430.32(cc) with which compliance is required on January 10, 2025. Any representations related to energy also must be made in accordance with the appendix that applies (*i.e.,* this appendix CC or appendix CC1). Manufacturers may use appendix CC1 to certify compliance with any amended standards prior to the applicable compliance date for those standards.

0. Incorporation by Reference

DOE incorporated by reference in § 430.3 the entire standard for ANSI/AHAM PAC–1–2015, ANSI/ASHRAE Standard 37–2009, ANSI/ASHRAE 51, and IEC 62301; however, only enumerated provisions of those documents apply to this appendix as follows. Treat ''should'' in IEC 62301 as mandatory.0.1 ANSI/AHAM PAC–1–2015

(a) Section 4 ''Definitions,'' as specified in section 3.1.1 of this appendix, except for AHAM's definition for ''Portable Air Conditioner'';

(b) Section 7 ''Tests,'' as specified in section 3.1.1, 3.1.1.3, 3.1.1.4, 4.1.1, and 4.1.2 of this appendix.

0.2 ANSI/ASHRAE Standard 37–2009

(a) Section 5.4 ''Electrical Instruments,'' as specified in sections 4.1.1 and 4.1.2 of this appendix;

(b) Section 7.3 ''Indoor and Outdoor Air Enthalpy Methods,'' as specified in section 4.1.1 of this appendix;

(c) Section 7.6 ''Outdoor Liquid Coil Method,'' as specified in sections 4.1.1 and 4.1.2 of this appendix;

(d) Section 7.7 ''Airflow Rate Measurement,'' as specified in sections 4.1.1 and 4.1.2 of this appendix;

(e) Section 8.7 ''Test Procedure for Cooling Capacity Tests,'' as specified in sections 4.1.1 and 4.1.2 of this appendix;

(f) Section 9.2 ''Test Tolerances,'' as specified in sections 4.1.1 and 4.1.2 of this appendix;

(g) Section 11.1 ''Symbols Used In Equations,'' as specified in sections 4.1.1 and 4.1.2 of this appendix.

0.3 IEC 62301 (Edition 2.0, 2011–01)

(a) Paragraph 5.2 ''Preparation of product,'' as specified in section 3.2.1 of this appendix;

(b) Paragraph 4.3.2 ''Supply voltage waveform,'' as specified in section 3.2.2.2 of this appendix;

(c) Paragraph 4.4 ''Power measuring instruments,'' as specified in section 3.2.3 of this appendix;

(d) Annex D, ''Determination of Uncertainty of Measurement,'' as specified in sections 3.2.1, 3.2.2.2, and 3.2.3 of this appendix;

(e) Paragraph 4.2 ''Test room,'' as specified in section 3.2.4 of this appendix;

(f) Paragraph 5.1, ''General,'' Note 1, as specified in section 4.3 of this appendix;

(g) Paragraph 5.3.2 ''Sampling method,'' as specified in section 4.3 of this appendix.

0.4 ANSI/ASHRAE 51

(a) Figure 12 and Notes, ''Outlet Chamber Setup-Multiple Nozzles in Chamber'' as specified in section 4.1.1 of this appendix.

(b) [Reserved]

When there is a conflict, the language of this appendix takes precedence over those documents. Any subsequent amendment to a referenced document by the standard-setting organization will not affect the test procedure in this appendix, unless and until DOE amends the test procedure. Material is incorporated as it exists on the date of the approval, and any change to the reference to the material will be published in the **Federal Register**.

* * * * *

2. Definitions

Combined-duct means the condenser inlet and outlet air streams flow through separate ducts housed in a single duct structure.

Combined energy efficiency ratio means the energy efficiency of a portable air conditioner as measured in accordance with this test procedure in Btu per watt-hours (Btu/Wh) and determined in section 5.4 of this appendix.

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

Dual-duct means drawing some or all of the condenser inlet air from outside the conditioned space through a duct attached to an adjustable window bracket, potentially drawing additional condenser inlet air from the conditioned space, and discharging the condenser outlet air outside the conditioned space by means of a separate duct attached to an adjustable window bracket.

Full compressor speed (full) means the compressor speed at which the unit operates at full load test conditions, when using user controls with a unit thermostat setpoint of 75 °F to achieve maximum cooling capacity.

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

Low compressor speed (low) means the compressor speed specified by the manufacturer, at which the unit operates at low load test conditions (*i.e.,* Test Condition C and Test Condition E in Table 2 of this appendix, for a dual-duct and single-duct portable air conditioner, respectively), such that the measured cooling capacity at this speed is no less than 50 percent and no greater than 60 percent of the measured cooling capacity with the full compressor speed at full load test conditioners (*i.e.,* Test Condition A and Test Condition C in Table 2 of this appendix, for a dual-duct and single-duct portable air conditioner, respectively).

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

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

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

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

Off mode means a mode that may persist for an indefinite time in which a portable air conditioner is connected to a mains power source, and is not providing any active mode, off-cycle mode, or standby mode function. This includes an indicator that only shows the user that the portable air conditioner is in the off position.

Seasonally adjusted cooling capacity means the amount of cooling provided to the indoor conditioned space, measured under the specified ambient conditions, in Btu/h.

Single-duct means drawing all of the condenser inlet air from the conditioned space without the means of a duct, and discharging the condenser outlet air outside the conditioned space through a single duct attached to an adjustable window bracket.

Single-speed means incapable of automatically adjusting the compressor speed based on detected conditions.

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 cooling 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.

Theoretical comparable single-speed means a hypothetical single-speed unit that would have the same cooling capacity and electrical power input as the variable-speed unit under test, with no cycling losses considered, when operating with the full compressor speed and at the test conditions in table 1 of this appendix.

Variable-speed means capable of automatically adjusting the compressor speed based on detected conditions.

* * * * *

3.1 * * *

3.1.1 *Test conduct.* The test apparatus and instructions for testing portable air conditioners in cooling mode and off-cycle mode must conform to the requirements specified in Section 4, ''Definitions'' and Section 7, ''Tests,'' of ANSI/AHAM PAC–1–2015, except as otherwise specified in this appendix. Measure duct heat transfer and infiltration air heat transfer according to section 4.1.1 and section 4.1.2 of this appendix, respectively.

3.1.1.1 *Duct setup.* Use all ducting components provided by or required by the manufacturer and no others. Ducting components include ducts, connectors for attaching the duct(s) to the test unit, sealing, insulation, and window mounting fixtures. Do not apply additional sealing or insulation. For combined-duct units, the manufacturer must provide the testing facility an adapter that allows for the individual connection of the condenser inlet and outlet airflows to the test facility's airflow measuring apparatuses. Use that adapter to measure the condenser inlet and outlet airflows for any corresponding unit.

* * * * *

3.1.1.6 *Duct temperature measurements.* Install any insulation and sealing provided by the manufacturer. For a dual-duct or single-duct unit, adhere four thermocouples per duct, spaced along the entire length equally, to the outer surface of the duct. Measure the surface temperatures of each duct. For a combined-duct unit, adhere sixteen thermocouples to the outer surface of the duct, spaced evenly around the circumference (four thermocouples, each 90 degrees apart, radially) and down the entire length of the duct (four sets of four thermocouples, evenly spaced along the entire length of the duct), ensuring that the thermocouples are spaced along the entire length equally, on the surface of the combined duct. Place at least one thermocouple preferably adjacent to, but otherwise as close as possible to, the condenser inlet aperture and at least one thermocouple on the duct surface preferably adjacent to, but otherwise as close as possible to, the condenser outlet aperture. Measure the surface temperature of the combined duct at each thermocouple. Temperature measurements must have an error no greater than ±0.5 °F over the range being measured.

3.1.2 *Control settings.* For a single-speed unit, set the controls to the lowest available temperature setpoint for cooling mode, as described in section 4.1.1 of this appendix. For a variable-speed unit, set the thermostat setpoint to 75 °F to achieve the full compressor speed and use the manufacturer instructions to achieve the low compressor speed, as described in section 4.1.2 of this appendix. If the portable air conditioner has a user-adjustable fan speed, select the maximum fan speed setting. If the unit has an automatic louver oscillation feature and there is an option to disable that feature, disable that feature throughout testing. If the unit has adjustable louvers, position the louvers parallel with the air flow to maximize air flow and minimize static pressure loss. If the portable air conditioner has network functions, that an end-user can disable and the product's user manual provides instructions on how to do so, disable all network functions throughout testing. If an end-user cannot disable a network function or the product's user manual does not provide instruction for disabling a network function, test the unit with that network function in the factory default configuration for the duration of the test.

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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 Paragraph 5.2 of IEC 62301, referring to Annex D of that standard as necessary. Disregard the provisions regarding batteries and the determination, classification, and testing of relevant modes.

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3.2.2.2 Supply voltage waveform. For the standby mode and off mode testing, maintain the electrical supply voltage waveform indicated in, Paragraph 4.3.2 of IEC 62301, referring to Annex D of that standard as necessary.

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 Paragraph 4.4 of IEC 62301, using a two-tailed confidence interval and referring to Annex D of that standard as necessary.

4\. * * *

4.1 Cooling mode.

Note: For the purposes of this cooling mode test procedure, evaporator inlet air is considered the "indoor air" of the conditioned space and condenser inlet air is considered the "outdoor air" outside of the conditioned space.

4.1.1 *Single-Speed Cooling Mode Test.* For single-speed portable air conditioners, measure the indoor room cooling capacity and overall power input in cooling mode in accordance with Sections 7.1.b and 7.1.c of ANSI/AHAM PAC–1–2015, respectively, including the references to Sections 5.4, 7.3, 7.6, 7.7, and 11 of ANSI/ASHRAE Standard 37–2009. Determine the test duration in accordance with Section 8.7 of ASHRAE Standard 37–2009, including the reference to Section 9.2 of the same standard. Disregard the test conditions in Table 3 of ANSI/AHAM PAC–1–2015. Instead, apply the test conditions for single-duct and dual-duct portable air conditioners presented in table 1 of this appendix. For single-duct units, measure the indoor room cooling capacity, $Capacity_{SD,}$ and overall power input in cooling mode, $P_{SD,}$ in accordance with the ambient conditions for test condition 1.C, presented in table 1 of this appendix. For dual-duct units, measure the indoor room cooling capacity and overall power input twice, first in accordance with ambient conditions for test condition 1.A ($Capacity_{95}$, P_{95}), and then in accordance with test condition 1.B ($Capacity_{83}$, P_{83}), both presented in Table 1 of this appendix. For the remainder of this test procedure, test combined-duct single-speed portable air conditioners following any instruction for dual-duct single-speed portable air conditioners, unless otherwise specified.

TABLE 1—SINGLE-SPEED EVAPORATOR (INDOOR) AND CONDENSER (OUTDOOR) INLET TEST CONDITIONS

Test condition	Evaporator inlet air, °F (°C)		Condenser inlet air, °F (°C)	
	Dry bulb	Wet bulb	Dry bulb	Wet bulb
1.A	80 (26.7)	67 (19.4)	95 (35.0)	75 (23.9)
1.B	80 (26.7)	67 (19.4)	83 (28.3)	67.5 (19.7)
1.C	80 (26.7)	67 (19.4)	80 (26.7)	67 (19.4)

4.1.2 *Variable-Speed Cooling Mode Test.* For variable-speed portable air conditioners, measure the indoor room cooling capacity and overall power input in cooling mode in accordance with Section 7.1.b and 7.1.c of ANSI/AHAM PAC–1–2015, respectively, including the references to Sections 5.4, 7.3, 7.6, 7.7, and 11 of ANSI/ASHRAE Standard 37–2009, except as detailed below. Determine the test duration in accordance with Section 8.7 of ASHRAE Standard 37–2009, including the reference to Section 9.2 of the same standard. Disregard the test conditions in Table 3 of ANSI/AHAM PAC–1–2015. Instead, apply the test conditions for single-duct and dual-duct portable air conditioners presented in Table 2 of this appendix. For a single-duct unit, measure the indoor room cooling capacity and overall power input in cooling mode twice, first in accordance with the ambient conditions and compressor speed settings for test condition 2.D ($Capacity_{SD\_Full,}$ P_{SD_Full}), and then in accordance with the ambient conditions for test condition 2.E ($Capacity_{SD\_Low,}$ P_{SD_Low}), both presented in table 2 of this appendix. For dual-duct units, measure the indoor room cooling capacity and overall power input three times, first in accordance with ambient conditions for test condition 2.A ($Capacity_{95\_Full}$, P_{95_Full}), second in accordance with the ambient conditions for test condition 2.B ($Capacity_{83\_Full}$, P_{83_Full}), and third in accordance with the ambient conditions for test condition 2.C ($Capacity_{83\_Low}$, P_{83_Low}), each presented in table 2 of this appendix. For the remainder of this test procedure, test combined-duct variable-speed portable air conditioners following any instruction for dual-duct variable-speed portable air conditioners, unless otherwise specified. For test conditions 2.A, 2.B, and 2.D, achieve the full compressor speed with user controls, as defined in section 2.13 of this appendix. For test conditions 2.C and 2.E, set the required compressor speed in accordance with instructions the manufacturer provided to DOE.

TABLE 2—VARIABLE-SPEED EVAPORATOR (INDOOR) AND CONDENSER (OUTDOOR) INLET TEST CONDITIONS

Test condition	Evaporator inlet air °F (°C)		Condenser inlet air °F (°C)		Compressor speed
	Dry bulb	Wet bulb	Dry bulb	Wet bulb	
2.A	80 (26.7)	67 (19.4)	95 (35.0)	75 (23.9)	Full.
2.B	80 (26.7)	67 (19.4)	83 (28.3)	67.5 (19.7)	Full.
2.C	80 (26.7)	67 (19.4)	83 (28.3)	67.5 (19.7)	Low.
2.D	80 (26.7)	67 (19.4)	80 (26.7)	67 (19.4)	Full.
2.E	80 (26.7)	67 (19.4)	80 (26.7)	67 (19.4)	Low.

4.1.3. Duct Heat Transfer.

Throughout the cooling mode test, measure the surface temperature of the condenser exhaust duct and condenser inlet duct, where applicable. Calculate the average temperature at each thermocouple placement location. Then calculate the average surface temperature of each duct. For single-duct and dual-duct units, calculate the average of the four average temperature measurements taken on the duct. For combined-duct units, calculate the average of the sixteen average temperature measurements taken on the duct. Calculate the surface area (A_{duct_j}) of each duct according to:

$$A_{duct\_j} = Cj \times Lj$$

Where:

Cj = the circumference of duct ''j'', including any manufacturer-supplied insulation, measured by wrapping a flexible measuring tape, or equivalent, around the outside of a combined duct, making sure the tape is on the outermost ridges or, alternatively, if the duct has a circular cross-section, by multiplying the outer diameter by 3.14.

Lj = the extended length of duct ''j'' while under test.

j represents the condenser exhaust duct for single-duct units, the condenser exhaust duct and the condenser inlet duct for dual-duct units, and the combined duct for combined-duct units.

Calculate the total heat transferred from the surface of the duct(s) to the indoor conditioned space while operating in cooling mode at each test condition, as follows:

For single-duct single-speed portable air conditioners:

$$Q_{duct\_SD} = 3 \times A_{duct\_j} \times (T_{duct\_j} - T_{ei})$$

For dual-duct single-speed portable air conditioners:

$$Q_{duct\_DD\_95} = \Sigma_j\{3 \times A_{duct\_j} \times (T_{duct\_95\_j} - T_{ei})\}$$

$$Q_{duct\_DD\_83} = \Sigma_j\{3 \times A_{duct\_j} \times (T_{duct\_83\_j} - T_{ei})\}$$

For single-duct variable-speed portable air conditioners:

$$Q_{duct\_SD\_Full} = 3 \times A_{duct} \times (T_{duct\_Full\_j} - T_{ei})$$

$$Q_{duct\_SD\_Low} = 3 \times A_{duct} \times (T_{duct\_Low\_j} - T_{ei})$$

For dual-duct variable-speed portable air conditioners:

$$Q_{duct\_DD\_95\_Full} = \Sigma_j\{3 \times A_{duct\_j} \times (T_{duct\_Full\_95\_j} - T_{ei})\}$$

$$Q_{duct\_DD\_83\_Full} = \Sigma_j\{3 \times A_{duct\_j} \times (T_{duct\_Full\_83\_j} - T_{ei})\}$$

$$Q_{duct\_DD\_83\_Low} = \Sigma_j\{3 \times A_{duct\_j} \times (T_{duct\_Low\_83\_j} - T_{ei})\}$$

Where:

Q_{duct_SD} = the total heat transferred from the duct to the indoor conditioned space in cooling mode, in Btu/h, when tested at Test Condition 1.C.

$Q_{duct\_DD\_95}$ and $Q_{duct\_DD\_83}$ = the total heat transferred from the ducts to the indoor conditioned space in cooling mode, in Btu/h, when tested at Test Conditions 1.A and 1.B, respectively.

$Q_{duct\_SD\_Full}$ and $Q_{duct\_SD\_Low}$ = the total heat transferred from the duct to the indoor conditioned space in cooling mode, in Btu/h, when tested at Test Conditions 2.D and 2.E, respectively.

$Q_{duct\_DD\_95\_Full}$, $Q_{duct\_DD\_83\_Full}$, and $Q_{duct\_DD\_83\_Low}$ = the total heat transferred from the ducts to the indoor conditioned space in cooling mode, in Btu/h, when tested at Test Condition 2.A, Test Condition 2.B, and Test Condition 2.C, respectively.

3 = empirically-derived convection coefficient in Btu/h per square foot per °F.

A_{duct_j} = surface area of the duct ''j'', as calculated in this section, in square feet.

T_{duct_j} = average surface temperature for duct ''j'' of single-duct single-speed portable air conditioners, in °F, as measured at Test Condition 1.C.

$T_{duct\_95\_j}$ and $T_{duct\_83\_j}$ = average surface temperature for duct ''j'' of dual-duct single-speed portable air conditioners, in °F, as measured at Test Conditions 1.A and 1.B, respectively.

$T_{duct\_Full\_j}$ and $T_{duct\_Low\_j}$ = average surface temperature for duct ''j'' of single-duct variable-speed portable air conditioners, in °F, as measured at Test Conditions 2.D and 2.E, respectively.

$T_{duct\_Full\_95\_j}$, $T_{duct\_Full\_83\_j}$, and $T_{duct\_Low\_83\_j}$ = average surface temperature for duct ''j'' of dual-duct variable-speed portable air conditioners, in °F, as measured at Test Conditions 2.A, 2.B, and 2.C, respectively.

j represents the condenser exhaust duct for single-duct units, the condenser exhaust duct and the condenser inlet duct for dual-duct units, and the combined duct for combined-duct units.

T_{ei} = average evaporator inlet air dry-bulb temperature, as measured in section 4.1 of this appendix, in °F.

4.1.4. Infiltration Air Heat Transfer.

Calculate the sample unit's heat contribution from infiltration air into the conditioned space for each cooling mode test as follows:

Calculate the dry air mass flow rate of infiltration air, which affects the sensible and latent components of heat contribution from infiltration air, according to the following equations.

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For a single-duct single-speed unit:

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

For a dual-duct single-speed unit:

$$\dot{m}_{95} = \frac{V_{co\_95} \times \rho_{co\_95}}{(1 + \omega_{co\_95})} - \frac{V_{ci\_95} \times \rho_{ci\_95}}{(1 + \omega_{ci\_95})}$$

$$\dot{m}_{83} = \frac{V_{co\_83} \times \rho_{co\_83}}{(1 + \omega_{co\_83})} - \frac{V_{ci\_83} \times \rho_{ci\_83}}{(1 + \omega_{ci\_83})}$$

For a single-duct variable-speed unit:

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

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

For a dual-duct variable-speed unit:

$$\dot{m}_{95\_Full} = \frac{V_{co\_95\_Full} \times \rho_{co\_95\_Full}}{(1 + \omega_{co\_95\_Full})} - \frac{V_{ci\_95\_Full} \times \rho_{ci\_95\_Full}}{(1 + \omega_{ci\_95\_Full})}$$

$$\dot{m}_{83\_Full} = \frac{V_{co\_83\_Full} \times \rho_{co\_83\_Full}}{(1 + \omega_{co\_83\_Full})} - \frac{V_{ci\_83\_Full} \times \rho_{ci\_83\_Full}}{(1 + \omega_{ci\_83\_Full})}$$

$$\dot{m}_{83\_Low} = \frac{V_{co\_83\_Low} \times \rho_{co\_83\_Low}}{(1 + \omega_{co\_83\_Low})} - \frac{V_{ci\_83\_Low} \times \rho_{ci\_83\_Low}}{(1 + \omega_{ci\_83\_Low})}$$

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Where:

$\dot{m}_{SD}$, $\dot{m}_{SD\_Full}$, and $\dot{m}_{SD\_Low}$ = dry air mass flow rate of infiltration air for single-duct portable air conditioners, in pounds per minute (lb/m) when tested at Test Conditions 1.C, 2.D, and 2.E, respectively.

$\dot{m}_{95}$, $\dot{m}_{83}$, $\dot{m}_{95\_Full}$, $\dot{m}_{83\_Full}$, and $\dot{m}_{83\_Low}$ = dry air mass flow rate of infiltration air for dual-duct portable air conditioners, in lb/m, when tested at Test Conditions 1.A, 1.B, 2.A, 2.B, and 2.C, respectively.

V_{co_SD}, $V_{co\_SD\_Full}$, $V_{co\_SD\_Low}$, V_{co_95}, V_{co_83}, $V_{co\_95\_Full}$, $V_{co\_83\_Full}$, and $V_{co\_83\_Low}$ = average volumetric flow rate of the condenser outlet air, in cubic feet per minute (cfm), as measured at Test Conditions 1.C, 2.D, 2.E, 1.A, 1.B, 2.A, 2.B, and 2.C, respectively, as required in sections 4.1.1 and 4.1.2 of this appendix.

V_{ci_95}, V_{ci_83}, $V_{ci\_95\_Full}$, $V_{ci\_83\_Full}$, and $V_{ci\_83\_Low}$ = average volumetric flow rate of the condenser inlet air, in cfm, as measured at Test Conditions 1.A, 1.B, 2.A, 2.B, and 2.C, respectively, as required in sections 4.1.1 and 4.1.2 of this appendix.

ρ_{co_SD}, $\rho_{co\_SD\_Full}$, $\rho_{co\_SD\_Low}$, ρ_{co_95}, ρ_{co_83}, $\rho_{co\_95\_Full}$, $\rho_{co\_83\_Full}$, and $\rho_{co\_83\_Low}$ = average density of the condenser outlet air, in pounds mass per cubic foot (lb_m/ft^3), as measured at Test Conditions 1.C, 2.D, 2.E, 1.A, 1.B, 2.A, 2.B, and 2.C, respectively, as required in sections 4.1.1 and 4.1.2 of this appendix.

ρ_{ci_95}, ρ_{ci_83}, $\rho_{ci\_95\_Full}$, $\rho_{ci\_83\_Full}$, and $\rho_{ci\_83\_Low}$ = average density of the condenser inlet air, in lb_m/ft^3, as measured at Test Conditions 1.A, 1.B, 2.A, 2.B, and 2.C, respectively, as required in section 4.1.1 and 4.1.2 of this appendix.

ω_{co_SD}, $\omega_{co\_SD\_Full}$, $\omega_{co\_SD\_Low}$, ω_{co_95}, ω_{co_83}, $\omega_{co\_95\_Full}$, $\omega_{co\_83\_Full}$, and $\omega_{co\_83\_Low}$ = average humidity ratio of condenser outlet air, in pounds mass of water vapor per pounds mass of dry air (lb_w/lb_{da}), as measured at Test Conditions 1.C, 2.D, 2.E, 1.A, 1.B, 2.A, 2.B, and 2.C, respectively, as required in sections 4.1.1 and 4.1.2 of this appendix.

ω_{ci_95}, ω_{ci_83}, $\omega_{ci\_95\_Full}$, $\omega_{ci\_83\_Full}$, and $\omega_{ci\_83\_Low}$ = average humidity ratio of condenser inlet air, in lb_w/lb_{da}, as measured at Test Conditions 1.A, 1.B, 2.A, 2.B, and 2.C, respectively, as required in sections 4.1.1 and 4.1.2 of this appendix.

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

For single-duct single-speed units:

$Q_{s\_SD\_95} = \dot{m}_{SD} \times 60 \times [c_{p\_da} \times (95 - 80) + (c_{p\_wv} \times (0.0141 \times 95 - 0.0112 \times 80))]$

$Q_{s\_SD\_83} = \dot{m}_{SD} \times 60 \times [(c_{p\_da} \times (83 - 80) + (c_{p\_wv} \times (0.01086 \times 83 - 0.0112 \times 80))]$

For dual-duct single-speed units:

$Q_{s\_DD\_95} = \dot{m}_{95} \times 60 \times [c_{p\_da} \times (95 - 80) + (c_{p\_wv} \times (0.0141 \times 95 - 0.0112 \times 80))]$

$Q_{s\_DD\_83} = \dot{m}_{83} \times 60 \times [(c_{p\_da} \times (83 - 80) + (c_{p\_wv} \times (0.01086 \times 83 - 0.0112 \times 80))]$

For single-duct variable-speed units:

$Q_{s\_SD\_95\_Full} = \dot{m}_{SD\_Full} \times 60 \times [c_{p\_da} \times (95 - 80) + (c_{p\_wv} \times (0.0141 \times 95 - 0.0112 \times 80))]$

$Q_{s\_SD\_83\_Full} = \dot{m}_{SD\_Full} \times 60 \times [(c_{p\_da} \times (83 - 80) + (c_{p\_wv} \times (0.01086 \times 83 - 0.0112 \times 80))]$

$Q_{s\_SD\_83\_Low} = \dot{m}_{SD\_Low} \times 60 \times [(c_{p\_da} \times (83 - 80) + (c_{p\_wv} \times (0.01086 \times 83 - 0.0112 \times 80))]$

For dual-duct variable-speed units:

$Q_{s\_DD\_95\_Full} = \dot{m}_{95\_Full} \times 60 \times [c_{p\_da} \times (95 - 80) + (c_{p\_wv} \times (0.0141 \times 95 - 0.0112 \times 80))]$

$Q_{s\_DD\_83\_Full} = \dot{m}_{83\_Full} \times 60 \times [(c_{p\_da} \times (83 - 80) + (c_{p\_wv} \times (0.01086 \times 83 - 0.0112 \times 80))]$

$Q_{s\_DD\_83\_Low} = \dot{m}_{83\_Low} \times 60 \times [(c_{p\_da} \times (83 - 80) + (c_{p\_wv} \times (0.01086 \times 83 - 0.0112 \times 80))]$

Where:

$Q_{s\_SD\_95}$, $Q_{s\_SD\_83}$, $Q_{s\_DD\_95}$, and $Q_{s\_DD\_83}$ = sensible heat added to the room by infiltration air, in Btu/h, for each duct configuration and temperature condition.

$Q_{s\_SD\_95\_Full}$, $Q_{s\_SD\_83\_Full}$, $Q_{s\_SD\_83\_Low}$, $Q_{s\_DD\_95\_Full}$, $Q_{s\_DD\_83\_Full}$, and $Q_{s\_DD\_83\_Low}$ = sensible heat added to the room by infiltration air, in Btu/h, for each duct configuration, temperature condition, and compressor speed.

$\dot{m}_{SD}$, $\dot{m}_{95}$, and $\dot{m}_{83}$ = dry air mass flow rate of infiltration air for single-speed portable air conditioners, in lb/m, as calculated in section 4.1.4 of this appendix.

$\dot{m}_{SD\_95\_Full}$, $\dot{m}_{SD\_83\_Low}$, $\dot{m}_{95\_Full}$ and $\dot{m}_{83\_Low}$ = dry air mass flow rate of infiltration air for variable-speed portable air conditioners, in lb/m, as calculated in section 4.1.4 of this appendix.

c_{p_da} = specific heat of dry air, 0.24 Btu/(lbm °F).

c_{p_wv} = specific heat of water vapor, 0.444 Btu/(lbm °F).

80 = indoor chamber dry-bulb temperature, in °F.

95 = infiltration air dry-bulb temperature for Test Conditions 1.A and 2.A, in °F.

83 = infiltration air dry-bulb temperature for Test Conditions 1.B, 2.B, and 2.C, in °F.

0.0141 = humidity ratio of the dry-bulb infiltration air for Test Conditions 1.A and 2.A, in lb_w/lb_{da}.

0.01086 = humidity ratio of the dry-bulb infiltration air for Test Conditions 1.B, 2.B, and 2.C, in lb_w/lb_{da}.

0.0112 = humidity ratio of the indoor chamber air, in lb_w/lb_{da} (ω_{indoor}).

60 = conversion factor from minutes to hours.

Calculate the latent heat contribution of the infiltration air according to the following equations. For a single-duct single-speed unit:

$Q_{l\_SD\_95} = \dot{m}_{SD} \times 60 \times 1061 \times (0.0141 - 0.0112)$

$Q_{l\_SD\_83} = \dot{m}_{SD} \times 60 \times 1061 \times (0.01086 - 0.0112)$

For a dual-duct single-speed unit:

$Q_{l\_DD\_95} = \dot{m}_{95} \times 60 \times 1061 \times (0.0141 - 0.0112)$

$Q_{l\_DD\_83} = \dot{m}_{83} \times 60 \times 1061 \times (0.01086 - 0.0112)$

For a single-duct variable-speed unita:

$Q_{l\_SD\_95\_Full} = \dot{m}_{SD\_Full} \times 60 \times 1061 \times (0.0141 - 0.0112)$

$Q_{l\_SD\_83\_Full} = \dot{m}_{SD\_Full} \times 60 \times 1061 \times (0.01086 - 0.0112)$

$Q_{l\_SD\_83\_Low} = \dot{m}_{SD\_Low} \times 60 \times 1061 \times (0.01086 - 0.0112)$

For a dual-duct variable-speed unit:

$Q_{l\_DD\_95\_Full} = \dot{m}_{95\_Full} \times 60 \times 1061 \times (0.0141 - 0.0112)$

$Q_{l\_DD\_83\_Full} = \dot{m}_{83\_Full} \times 60 \times 1061 \times (0.01086 - 0.0112)$

$Q_{l\_DD\_83\_Low} = \dot{m}_{83\_Low} \times 60 \times 1061 \times (0.01086 - 0.0112)$

Where:

$Q_{l\_SD\_95}$, $Q_{l\_SD\_83}$, $Q_{l\_DD\_95}$, and $Q_{l\_DD\_83}$= latent heat added to the room by infiltration air, in Btu/h, for each duct configuration and temperature condition.

$Q_{l\_SD\_95\_Full}$, $Q_{l\_SD\_83\_Full}$, $Q_{l\_SD\_Low}$, $Q_{l\_DD\_95\_Full}$, $Q_{l\_DD\_83\_Full}$, and $Q_{l\_DD\_83\_Low}$ = latent heat added to the room by infiltration air, in Btu/h, for each duct configuration, temperature condition, and compressor speed.

$\dot{m}_{SD}$, $\dot{m}_{95}$, and $\dot{m}_{83}$ = dry air mass flow rate of infiltration air for portable air conditioners, in lb/m, when tested at Test Conditions 1.C, 1.A, and 1.B, respectively, as calculated in section 4.1.4 of this appendix.

$\dot{m}_{SD\_Full}$, $\dot{m}_{SD\_Low}$, $\dot{m}_{95\_Full}$, $\dot{m}_{83\_Full}$ and $\dot{m}_{83\_Low}$ = dry air mass flow rate of infiltration air for portable air conditioners, in lb/m, when tested at Test Conditions 2.D, 2.E, 2.A, 2.B, and 2.C, respectively, as calculated in section 4.1.4 of this appendix.

1061 = latent heat of vaporization for water vapor, in Btu/lb_m (H_{fg}).

0.0141 = humidity ratio of the dry-bulb infiltration air for Test Conditions 1.A and 2.A, in lb_w/lb_{da}.

0.01086 = humidity ratio of the dry-bulb infiltration air for Test Conditions 1.B, 2.B, and 2.C, in lb_w/lb_{da}.

0.0112 = humidity ratio of the indoor chamber air, in lb_w/lb_{da}.

60 = conversion factor from minutes to hours.

Calculate the total heat contribution of the infiltration air at each test condition by adding the sensible and latent heat according to the following equations.

For a single-duct single-speed unit:

$Q_{infiltration\_SD\_95} = Q_{s\_SD\_95} + Q_{l\_SD\_95}$

$Q_{infiltration\_SD\_83} = Q_{s\_SD\_83} + Q_{l\_SD\_83}$

For a dual-duct single-speed unit:

$Q_{infiltration\_DD\_95} = Q_{s\_DD\_95} + Q_{l\_DD\_95}$

$Q_{infiltration\_DD\_83} = Q_{s\_DD\_83} + Q_{l\_DD\_83}$

For a single-duct variable-speed unit:

$Q_{infiltration\_SD\_95\_Full} = Q_{s\_SD\_95\_Full} + Q_{l\_SD\_95\_Full}$

$Q_{infiltration\_SD\_83\_Full} = Q_{s\_SD\_83\_Full} + Q_{l\_SD\_83\_Full}$

$Q_{infiltration\_SD\_83\_Low} = Q_{s\_SD\_83\_Low} + Q_{l\_SD\_83\_Low}$

For a dual-duct variable-speed unit:

$Q_{infiltration\_DD\_95\_Full} = Q_{s\_DD\_95\_Full} + Q_{l\_DD\_95\_Full}$

$Q_{infiltration\_DD\_83\_Full} = Q_{s\_DD\_83\_Full} + Q_{l\_DD\_83\_Full}$

$Q_{infiltration\_DD\_83\_Low} = Q_{s\_DD\_83\_Low} + Q_{l\_DD\_83\_Low}$

Where:

$Q_{infiltration\_SD\_95}$, $Q_{infiltration\_SD\_83}$, $Q_{infiltration\_DD\_95}$, $Q_{infiltration\_DD\_83}$ = total infiltration air heat in cooling mode, in Btu/h, for each duct configuration and temperature condition.

$Q_{infiltration\_SD\_95\_Full}$, $Q_{infiltration\_SD\_83\_Full}$, $Q_{infiltration\_SD\_83\_Low}$, $Q_{infiltration\_DD\_95\_Full}$, $Q_{infiltration\_DD\_83\_Full}$, and $Q_{infiltration\_DD\_83\_Low}$ = total infiltration air heat in cooling mode, in Btu/h, for each duct configuration, temperature condition, and compressor speed.

$Q_{s\_SD\_95}$, $Q_{s\_SD\_83}$, $Q_{s\_DD\_95}$, and $Q_{s\_DD\_83}$ = sensible heat added to the room by infiltration air, in Btu/h, for each duct configuration, temperature condition, and compressor speed.

$Q_{s\_SD\_95\_Full}$, $Q_{s\_SD\_83\_Full}$, $Q_{s\_SD\_83\_Low}$, $Q_{s\_DD\_95\_Full}$, $Q_{s\_DD\_83\_Full}$, and $Q_{s\_DD\_83\_Low}$ = sensible heat added to the room by infiltration air, in Btu/h, for each duct configuration, temperature condition, and compressor speed.

$Q_{l\_SD\_95}$, $Q_{l\_SD\_83}$, $Q_{l\_DD\_95}$, and $Q_{l\_DD\_83}$= latent heat added to the room by infiltration air, in Btu/h, for each duct configuration, and temperature condition.

$Q_{l\_SD\_95\_Full}$, $Q_{l\_SD\_83\_Full}$, $Q_{l\_SD\_83\_Low}$, $Q_{l\_DD\_95\_Full}$, $Q_{l\_DD\_83\_Full}$, and $Q_{l\_DD\_83\_Low}$ = latent heat added to the room by infiltration air, in Btu/h, for each duct configuration, temperature condition, and compressor speed.

* * * * *

4.3 *Standby mode and off mode.* Establish the testing conditions set forth in section 3.2 of this appendix, ensuring that the unit does not enter any active modes during the test. As discussed in Paragraph 5.1, Note 1 of IEC 62301, allow sufficient time for the unit to reach the lowest power state before proceeding with the test measurement. Follow the test procedure specified in Paragraph 5.3.2 of IEC 62301 for testing in each possible mode as described in sections 4.3.1 and 4.3.2 of this appendix. If the standby mode is cyclic and irregular or unstable, collect 10 cycles worth of data.

* * * * *

5.1 * * *

5.1.1 *Single-Speed Adjusted Cooling Capacity.* For a single-speed portable air conditioner, calculate the adjusted cooling capacity at each outdoor temperature operating condition, in Btu/h, according to the following equations.

For a single-duct single-speed portable air conditioner unit:

$$ACC_{SD\_95\_SS} = Capacity_{SD} - Q_{duct\_SD} - Q_{infiltration\_SD\_95}$$

$$ACC_{SD\_83\_SS} = Capacity_{SD} - Q_{duct\_SD} - Q_{infiltration\_SD\_83}$$

For a dual-duct single-speed portable air conditioner unit:

$$ACC_{DD\_95\_SS} = Capacity_{95} - Q_{duct\_95} - Q_{inflitration\_DD\_95}$$

$$ACC_{SD\_83\_SS} = Capacity_{83} - Q_{duct\_83} - Q_{inflitration\_SD\_83}$$

Where:

$Capacity_{SD}$, $Capacity_{95}$, and $Capacity_{83}$ = cooling capacity for each duct configuration or temperature condition measured in section 4.1.1 of this appendix.

Q_{duct_SD}, $Q_{duct\_DD\_95}$, and $Q_{duct\_DD\_83}$ = duct heat transfer for each duct configuration or temperature condition while operating in cooling mode, calculated in section 4.1.3 of this appendix.

$Q_{infiltration\_SD\_95}$, $Q_{infiltration\_SD\_83}$, $Q_{infiltration\_DD\_95}$, $Q_{infiltration\_DD\_83}$= total infiltration air heat transfer in cooling mode for each duct configuration and temperature condition, calculated in section 4.1.4 of this appendix.

5.1.2 *Variable-Speed Adjusted Cooling Capacity.* For variable-speed portable air conditioners, calculate the adjusted cooling capacity at each outdoor temperature operating condition, in Btu/h, according to the following equations:

For a single-duct variable-speed portable air conditioner unit:

$$ACC_{SD\_95} = Capacity_{SD\_Full} - Q_{duct\_SD\_Full} - Q_{inflitration\_SD\_95\_Full}$$

$$ACC_{SD\_83\_Full} = Capacity_{SD\_Full} - Q_{duct\_SD\_Full} - Q_{inflitration\_SD\_83\_Full}$$

$$ACC_{SD\_83\_Low} = Capacity_{SD\_Low} - Q_{duct\_SD\_Low} - Q_{inflitration\_SD\_83\_Low}$$

For a dual-duct variable-speed portable air conditioner unit:

$$ACC_{DD\_95} = Capacity_{DD\_95\_Full} - Q_{duct\_DD\_95\_Full} - Q_{inflitration\_DD\_95\_Full}$$

$$ACC_{DD\_83\_Full} = Capacity_{DD\_83\_Full} - Q_{duct\_DD\_83\_Full} - Q_{inflitration\_DD\_83\_Full}$$

$$ACC_{DD\_83\_Low} = Capacity_{DD\_83\_Low} - Q_{duct\_DD\_83\_Low} - Q_{inflitration\_DD\_83\_Low}$$

Where:

$Capacity_{SD\_Full}$, $Capacity_{SD\_Low}$, $Capacity_{DD\_95\_Full}$, $Capacity_{DD\_83\_Full}$, and $Capacity_{DD\_83\_Low}$ = cooling capacity in Btu/h for each duct configuration, temperature condition (where applicable), and compressor speed, as measured in section 4.1.2 of this appendix.

$Q_{duct\_SD\_Full}$, $Q_{duct\_SD\_Low}$, $Q_{duct\_DD\_95\_Full}$, $Q_{duct\_DD\_83\_Full}$, and $Q_{duct\_DD\_83\_Low}$ = combined duct heat transfer for each duct configuration, temperature condition (where applicable), and compressor speed, as calculated in section 4.1.3 of this appendix.

$Q_{infiltration\_SD\_95\_Full}$, $Q_{infiltration\_SD\_83\_Full}$, $Q_{infiltration\_SD\_83\_Low}$, $Q_{infiltration\_DD\_95\_Full}$, $Q_{infiltration\_DD\_83\_Full}$, and $Q_{infiltration\_DD\_83\_Low}$ = total infiltration air heat transfer in cooling mode for each duct configuration, temperature condition, and compressor speed, as calculated in section 4.1.4 of this appendix.

5.2 *Seasonally Adjusted Cooling Capacity.* Calculate the unit's seasonally adjusted cooling capacity, SACC, in Btu/h, according to the following equations:

For a single-speed portable air conditioner unit:

$$SACC_{SD} = ACC_{SD\_95\_SS} \times 0.2 + ACC_{SD\_83\_SS} \times 0.8$$

$$SACC_{DD} = ACC_{DD\_95\_SS} \times 0.2 + ACC_{DD\_83\_SS} \times 0.8$$

For a variable-speed portable air conditioner unit:

$$SACC_{SD} = ACC_{SD\_95} \times 0.2 + ACC_{SD\_83\_Low} \times 0.8$$

$$SACC_{DD} = ACC_{DD\_95} \times 0.2 + ACC_{DD\_83\_Low} \times 0.8$$

Where:

$ACC_{SD\_95\_SS}$, $ACC_{SD\_83\_SS}$, $ACC_{DD\_95\_SS}$, and $ACC_{DD\_83\_SS}$ = adjusted cooling capacity for single-speed portable air conditioners for each duct configuration and temperature condition, in Btu/h, calculated in section 5.1.1 of this appendix.

ACC_{SD_95}, $ACC_{SD\_83\_Low}$, ACC_{DD_95}, and $ACC_{DD\_83\_Low}$ = adjusted cooling capacity for variable-speed portable air conditioners for each duct configuration, temperature condition, and compressor speed, in Btu/h, calculated in section 5.1.2 of this appendix.

0.2 = weighting factor for the 95 °F test condition.

0.8 = weighting factor for the 83 °F test condition.

5.2.1 *Full-Load Seasonally Adjusted Cooling Capacity Calculation.* For variable-speed portable ACs determine a Full-Load Seasonally Adjusted Cooling Capacity ($SACC_{Full}$) using the following formulas:

$$SACC_{Full\_SD} = ACC_{SD\_95} \times 0.2 + ACC_{SD\_83\_Full} \times 0.8$$

$$SACC_{Full\_DD} = ACC_{DD\_95} \times 0.2 + ACC_{DD\_83\_Full} \times 0.8$$

ACC_{SD_95}, $ACC_{SD\_83\_Full}$, ACC_{DD_95}, and $ACC_{DD\_83\_Full}$ = adjusted cooling capacity for variable-speed portable air conditioners for each duct configuration, temperature condition, and compressor speed (where applicable), in Btu/h, calculated in section 5.1.2 of this appendix.

0.2 = weighting factor for the 95 °F test condition.

0.8 = weighting factor for the 83 °F test condition.

5.3 *Annual Energy Consumption.* Calculate the sample unit's annual energy consumption in each operating mode according to the following equation. For each operating mode, use the following annual hours of operation and equation:

Type of portable air conditioner	Operating mode	Subscript	Annual operating hours
Variable speed (single- or dual-duct).	Cooling Mode: Test Conditions 2.A, 2.B, 2.C, 2.D, and 2.E [1].	DD_95_Full, DD_83_Full, DD_83_Low, SD_Full, and SD_Low..	750
Single speed (single- or dual-duct).	Cooling Mode: Test Conditions 1.A, 1.B, and 1C [1].	DD_95, DD_83, and SD	750
all	Off-Cycle	oc	880
all	Inactive or Off	ia or om	1,355

[1] These operating mode hours are for the purposes of calculating annual energy consumption under different ambient conditions and are not a division of the total cooling mode operating hours. The total cooling mode operating hours are 750 hours.

$$AEC_m = P_m \times t_m \times 0.001$$

Where:

AEC_m = annual energy consumption in the operating mode, in kWh/year.

m represents the operating mode as shown in the table above with each operating mode's respective subscript.

P_m = average power in the operating mode, in watts, as determined in sections 4.1.1 and 4.1.2 of this appendix.

t_m = number of annual operating time in each operating mode, in hours.0.001 kWh/Wh = conversion factor from watt-hours to kilowatt-hours.

Calculate the sample unit's total annual energy consumption in off-cycle mode and inactive or off mode as follows:

$$AEC_T = \sum_{ncm} AEC_{ncm}$$

Where:

AEC_T = total annual energy consumption attributed to off-cycle mode and inactive or off mode, in kWh/year;

AEC_m = total annual energy consumption in the operating mode, in kWh/year.

ncm represents the following two non-cooling operating modes: off-cycle mode and inactive or off mode.

5.4 *Combined Energy Efficiency Ratio.*

5.4.1 *Combined Energy Efficiency Ratio for Single-Speed Portable Air Conditioners.* Using the annual operating hours established in section 5.3 of this appendix, calculate the combined energy efficiency ratio, CEER, in Btu/Wh, for single-speed portable air conditioners according to the following equation, as applicable:

$$CEER_{SD} = \left[\frac{\left(ACC_{SD\_95\_SS} \times 0.2 + ACC_{SD\_83\_SS} \times 0.8\right)}{\left(\frac{AEC_{SD} + AEC_T}{0.750}\right)}\right]$$

$$CEER_{DD} = \left[\frac{ACC_{DD\_95\_SS}}{\left(\frac{AEC_{DD\_95} + AEC_T}{0.750}\right)}\right] \times 0.2 + \left[\frac{ACC_{DD\_83\_SS}}{\left(\frac{AEC_{DD\_83} + AEC_T}{0.750}\right)}\right] \times 0.8$$

Where:

$CEER_{SD}$ and $CEER_{DD}$ = combined energy efficiency ratio for a single-duct unit and dual-duct unit, respectively, in Btu/Wh.

$ACC_{SD\_95\_SS}$, $ACC_{SD\_83\_SS}$, $ACC_{DD\_95\_SS}$, $ACC_{DD\_83\_SS}$ = adjusted cooling capacity for each duct configuration and temperature condition, in Btu/h, calculated in section 5.1 of this appendix.

AEC_{SD}, AEC_{DD_95} and AEC_{DD_83} = annual energy consumption in cooling mode for each duct configuration and temperature condition, in kWh/year, calculated in section 5.3 of this appendix.

AEC_T = total annual energy consumption attributed to all modes except cooling, in kWh/year, calculated in section 5.3 of this appendix.

0.750 = number of cooling mode hours per year, 750, multiplied by the conversion factor for watt-hours to kilowatt-hours, 0.001 kWh/Wh.

0.2 = weighting factor for the 95 °F dry-bulb outdoor condition test.

0.8 = weighting factor for the 83 °F dry-bulb outdoor condition test.

5.4.2 *Combined Energy Efficiency Ratio for Variable-Speed Portable Air Conditioners.*

5.4.2.1 *Unadjusted Combined Energy Efficiency Ratio.*

For a variable-speed portable air conditioner, calculate the unit's unadjusted combined energy efficiency ratio, $CEER_{UA}$, in Btu/Wh, as follows:

For single-duct variable-speed portable air conditioners:

$$CEER_{SD\_UA} = \left[\frac{ACC_{SD\_95}}{\left(\frac{AEC_{SD\_Full} + AEC_{ia/om}}{0.750}\right)}\right] \times 0.2 + \left[\frac{ACC_{SD\_83\_Low}}{\left(\frac{AEC_{SD\_Low} + AEC_{ia/om}}{0.750}\right)}\right] \times 0.8$$

For dual-duct variable-speed portable air conditioners:

$$CEER_{DD\_UA} = \left[\frac{ACC_{DD\_95}}{\left(\frac{AEC_{DD\_95\_Full} + AEC_{ia/om}}{0.750}\right)}\right] \times 0.2 + \left[\frac{ACC_{DD\_83\_Low}}{\left(\frac{AEC_{DD\_83\_Low} + AEC_{ia/om}}{0.750}\right)}\right] \times 0.8$$

Where:

$CEER_{SD\_UA}$, and $CEER_{DD\_UA}$ = unadjusted combined energy efficiency ratio for a single-duct and dual-duct sample unit, in Btu/Wh, respectively.

ACC_{SD_95}, $ACC_{SD\_83\_Low}$, ACC_{DD_95}, and ACC_{DD_83} = adjusted cooling capacity for each duct configuration, temperature condition, and compressor speed, as calculated in section 5.1.2 of this appendix, in Btu/h.

AEC_{SD_Full}, AEC_{SD_Low}, $AEC_{DD\_95\_Full}$, and $AEC_{DD\_83\_Low}$ = annual energy consumption for each duct configuration, temperature condition, and compressor speed in cooling mode operation, as calculated in section 5.3 of this appendix, in kWh/year.

$AEC_{ia/om}$ = annual energy consumption attributed to inactive or off mode, in kWh/year, calculated in section 5.3 of this appendix.

0.750 = number of cooling mode hours per year, 750, multiplied by the conversion factor for watt-hours to kilowatt-hours, 0.001 kWh/Wh.

0.2 = weighting factor for the 95 °F dry-bulb outdoor temperature operating condition.

0.8 = weighting factor for the 83 °F dry-bulb outdoor temperature operating condition.

5.5 *Adjustment of the Combined Energy Efficiency Ratio.* Adjust the sample unit's unadjusted combined energy efficiency ratio as follows.

5.5.1 *Theoretical Comparable Single-Speed Portable Air Conditioner Cooling Capacity and Power at the Lower Outdoor Temperature Operating Condition.* Calculate the cooling capacity without and with cycling losses, in British thermal units per hour (Btu/h), and electrical power input, in watts, for a single-duct or dual-duct theoretical comparable single-speed portable air conditioner at an 83 °F outdoor dry-bulb outdoor temperature operating condition according to the following equations:

For a single-duct theoretical comparable single speed portable air conditioner:

$$Capacity_{SD\_83\_SS} = Capacity_{SD\_Full}$$

$$Capacity_{SD\_83\_SS\_CF} = Capacity_{SD\_Full} \times 0.82$$

$$P_{SD\_83\_SS} = P_{SD\_Full}$$

For a dual-duct theoretical comparable single speed portable air conditioner:

$$Capacity_{DD\_83\_SS} = Capacity_{83\_Full}$$

$$Capacity_{DD\_83\_SS\_CF} = Capacity_{83\_Full} \times 0.82$$

$$P_{DD\_83\_SS} = P_{83\_Low}$$

Where:

$Capacity_{SD\_83\_SS}$ and $Capacity_{DD\_83\_SS}$ = cooling capacity of a single-duct and dual-duct theoretical comparable single-speed portable air conditioner, calculated for the 83 °F dry-bulb outdoor temperature operating condition (Test Conditions 2.E and 2.B, respectively), in Btu/h.

$Capacity_{SD\_83\_SS\_CF}$ and $Capacity_{DD\_83\_SS\_CF}$ = cooling capacity of a single-duct and dual-duct theoretical comparable single-speed portable air conditioner with cycling losses, in Btu/h, calculated for the 83 °F dry-bulb outdoor temperature operating condition (Test Conditions 2.E and 2.B, respectively).

$Capacity_{SD\_Full}$ and $Capacity_{83\_Full}$ = cooling capacity of the sample unit, measured in section 4.1.2 of this appendix at Test Conditions 2.D and 2.B, in Btu/h.

$P_{SD\_83\_SS}$ and $P_{DD\_83\_SS}$ = power input of a single-duct and dual-duct theoretical comparable single-speed portable air conditioner calculated for the 83 °F dry-bulb outdoor temperature operating condition (Test Conditions 2.E and 2.B, respectively), in watts.

P_{SD_Full} and P_{83_Low} = electrical power input of the sample unit, measured in section 4.1.2 of this appendix at Test Conditions 2.D and 2.B, in watts.

0.82 = empirically-derived cycling factor for the 83 °F dry-bulb outdoor temperature operating condition.

5.5.2 *Duct Heat Transfer for a Theoretical Comparable Single-Speed Portable Air Conditioner at the Lower Outdoor Temperature Operating Condition.* Calculate the duct heat transfer to the conditioned space for a single-duct or dual-duct theoretical comparable single-speed portable air conditioner at the 83 °F dry-bulb outdoor temperature operating condition as follows:

For a single-duct theoretical comparable single-speed portable air conditioner:

$$Q_{duct\_SD\_83\_SS} = Q_{duct\_SD\_Full}$$

For a dual-duct theoretical comparable single-speed portable air conditioner:

$$Q_{duct\_DD\_83\_SS} = Q_{duct\_DD\_83\_Full}$$

Where:

$Q_{duct\_SD\_83\_SS}$ and $Q_{duct\_DD\_83\_SS}$ = total heat transferred from the condenser exhaust duct to the indoor conditioned space in cooling mode, for single-duct and dual-duct theoretical comparable single-speed portable air conditioners, respectively, at the 83 °F dry-bulb outdoor temperature operating condition (Test Conditions 2.E and 2.B, respectively), in Btu/h.

$Q_{duct\_SD\_Full}$ and $Q_{duct\_DD\_83\_Full}$ = the total heat transferred from the duct to the indoor conditioned space in cooling mode, when tested at Test Conditions 2.D and 2.B, respectively, as calculated in section 4.1.3 of this appendix, in Btu/h.

5.5.3 *Infiltration Air Heat Transfer for a Theoretical Comparable Single-Speed Portable Air Conditioner at the Lower Outdoor Temperature Operating Condition.* Calculate the total heat contribution from infiltration air for a single-duct or dual-duct theoretical comparable single-speed portable air conditioner at the 83 °F dry-bulb outdoor temperature operating condition, as follows:

For a single-duct theoretical comparable single-speed portable air conditioner:

$$Q_{infiltration\_SD\_83\_SS} = Q_{infiltration\_SD\_83\_Full}$$

For a dual-duct theoretical comparable single-speed portable air conditioner:

$$Q_{infiltration\_DD\_83\_SS} = Q_{infiltration\_DD\_83\_Full}$$

Where:

$Q_{infiltration\_SD\_83\_SS}$ and $Q_{infiltration\_DD\_83\_SS}$ = total infiltration air heat in cooling mode for a single-duct and dual-duct theoretical comparable single-speed portable air conditioner, respectively at the 83 °F dry-bulb outdoor temperature operating condition (Test Conditions 2.E and 2.B, respectively), in Btu/h.

$Q_{infiltration\_SD\_83\_Full}$ and $Q_{infiltration\_DD\_83\_Full}$ = total infiltration air heat transfer of the sample unit in cooling mode for each duct configuration, temperature condition, and compressor speed, as calculated in section 4.1.4 of this appendix, in Btu/h.

5.5.4 *Adjusted Cooling Capacity for a Theoretical Comparable Single-Speed Portable Air Conditioner at the Lower Outdoor Temperature Operating Condition.* Calculate the adjusted cooling capacity without and with cycling losses for a single-duct or dual-duct theoretical comparable single-speed portable air conditioner at the 83 °F dry-bulb outdoor temperature operating condition, in Btu/h, according to the following equations:

For a single-duct theoretical comparable single-speed portable air conditioner:

$$ACC_{SD\_83\_SS} = Capacity_{SD\_83\_SS} - Q_{duct\_SD\_83\_SS} - Q_{infiltration\_SD\_83\_SS}$$

$$ACC_{SD\_83\_SS\_CF} = Capacity_{SD\_83\_SS\_CF} - Q_{duct\_SD\_83\_SS} - Q_{infiltration\_SD\_83\_SS}$$

For a dual-duct theoretical comparable single-speed portable air conditioner:

$$ACC_{DD\_83\_SS} = Capacity_{83\_SS} - Q_{duct\_DD\_83\_SS} - Q_{infiltration\_DD\_83\_SS}$$

$$ACC_{DD\_83\_SS\_CF} = Capacity_{DD\_83\_SS\_CF} - Q_{duct\_DD\_83\_SS} - Q_{infiltration\_DD\_83\_SS}$$

Where:

$ACC_{SD\_83\_SS}$, $ACC_{SD\_83\_SS\_CF}$, $ACC_{DD\_83\_SS}$, and $ACC_{DD\_83\_SS\_CF}$ = adjusted cooling capacity for a single-duct and dual-duct theoretical comparable single-speed portable air conditioner at the 83 °F dry-bulb outdoor temperature operating condition (Test Conditions 2.E and 2.B, respectively) without and with cycling losses, respectively, in Btu/h.

$Capacity_{SD\_83\_SS}$ and $Capacity_{SD\_83\_SS\_CF}$ = cooling capacity of a single-duct theoretical comparable single-speed portable air conditioner without and with cycling losses, respectively, at Test Conditions 2.E and 2.B (the 83 °F dry-bulb outdoor temperature operating condition), respectively, calculated in section 5.5.1 of this appendix, in Btu/h.

$Capacity_{DD\_83\_SS}$ and $Capacity_{DD\_83\_SS\_CF}$ = cooling capacity of a dual-duct theoretical comparable single-speed portable air conditioner without and with cycling losses, respectively, at Test Conditions 2.E and 2.B (the 83 °F dry-bulb outdoor temperature operating condition), respectively, calculated in section 5.5.1 of this appendix, in Btu/h.

$Q_{duct\_SD\_83\_SS}$ and $Q_{duct\_DD\_83\_SS}$ = total heat transferred from the ducts to the indoor conditioned space in cooling mode for a single-duct and dual-duct theoretical comparable single-speed portable air conditioner, at Test Conditions 2.E and 2.B (the 83 °F dry-bulb outdoor temperature operating condition), respectively, calculated in section 5.5.2 of this appendix, in Btu/h.

$Q_{infiltration\_SD\_83\_SS}$ and $Q_{infiltration\_DD\_83\_SS}$ = total infiltration air heat in cooling mode for a single-duct and dual-duct theoretical comparable single-speed portable air conditioner, respectively, at Test Conditions 2.E and 2.B (the 83 °F dry-bulb outdoor temperature operating condition), respectively, calculated in section 5.5.3 of this appendix, in Btu/h.

5.5.5 *Annual Energy Consumption in Cooling Mode for a Theoretical Comparable Single-Speed Portable Air Conditioner at the Lower Outdoor Temperature Operating Condition.* Calculate the annual energy consumption in cooling mode for a single-duct or dual-duct theoretical comparable single-speed portable air conditioner at the 83 °F dry-bulb outdoor temperature operating condition, in kWh/year, according to the following equations:

For a single-duct theoretical comparable single-speed portable air conditioner:

$$AEC_{SD\_83\_SS} = P_{SD\_83\_SS} \times 0.750$$

For a dual-duct theoretical comparable single-speed portable air conditioner:

$$AEC_{DD\_83\_SS} = P_{DD\_83\_SS} \times 0.750$$

Where:

$AEC_{SD\_83\_SS}$ and $AEC_{DD\_83\_SS}$ = annual energy consumption for a single-duct and dual-duct theoretical comparable single-speed portable air conditioner, respectively, in cooling mode at the 83 °F dry-bulb outdoor temperature operating condition (Test Conditions 2.E and 2.B, respectively), in kWh/year.

$P_{SD\_83\_SS}$ and $P_{DD\_83\_SS}$ = electrical power input for a single-duct and dual-duct theoretical comparable single-speed portable air conditioner, respectively, at the 83 °F dry-bulb outdoor temperature operating condition (Test Conditions 2.E and 2.B, respectively) as calculated in section 5.5.1 of this appendix, in watts.

0.750 = number of cooling mode hours per year, 750, multiplied by the conversion factor for watt-hours to kilowatt-hours, 0.001 kWh/Wh.

5.5.6 *Combined Energy Efficiency Ratio for a Theoretical Comparable Single-Speed Portable Air Conditioner.* Calculate the combined energy efficiency ratios for a theoretical comparable single-speed portable air conditioner without cycling losses, $CEER_{SD\_SS}$ and $CEER_{DD\_SS}$, and with cycling losses, $CEER_{SD\_SS\_CF}$ and $CEER_{DD\_SS\_CF}$, in Btu/Wh, according to the following equations:

For a single-duct portable air conditioner:

$$CEER_{SD\_SS} = \left[\frac{ACC_{SD\_95}}{\left(\frac{AEC_{SD\_Full} + AEC_T}{0.750}\right)}\right] \times 0.2 + \left[\frac{ACC_{SD\_83\_SS}}{\left(\frac{AEC_{SD\_83\_SS} + AEC_T}{0.750}\right)}\right] \times 0.8$$

$$CEER_{SD\_SS\_CF} = \left[\frac{ACC_{SD\_95}}{\left(\frac{AEC_{SD\_Full} + AEC_T}{0.750}\right)}\right] \times 0.2 + \left[\frac{ACC_{SD\_83\_SS\_CF}}{\left(\frac{AEC_{SD\_83\_SS} + AEC_T}{0.750}\right)}\right] \times 0.8$$

For a dual-duct portable air conditioner:

$$CEER_{DD\_SS} = \left[\frac{ACC_{DD\_95}}{\left(\frac{AEC_{DD\_95\_Full} + AEC_T}{0.750}\right)}\right] \times 0.2 + \left[\frac{ACC_{DD\_83\_SS}}{\left(\frac{AEC_{DD\_83\_SS} + AEC_T}{0.750}\right)}\right] \times 0.8$$

$$CEER_{DD\_SS\_CF} = \left[\frac{ACC_{DD\_95}}{\left(\frac{AEC_{DD\_95\_Full} + AEC_T}{0.750}\right)}\right] \times 0.2 + \left[\frac{ACC_{DD\_83\_SS\_CF}}{\left(\frac{AEC_{DD\_83\_SS} + AEC_T}{0.750}\right)}\right] \times 0.8$$

Where:

$CEER_{SD\_SS}$ and $CEER_{SD\_CF\_SS}$ = combined energy efficiency ratio for a single-duct theoretical comparable single-speed portable air conditioner without and with cycling losses, respectively, in Btu/Wh.

$CEER_{DD\_SS}$ and $CEER_{DD\_CF\_SS}$ = combined energy efficiency ratio for a dual-duct theoretical comparable single-speed portable air conditioner without and with cycling losses, respectively, in Btu/Wh.

ACC_{SD_95} and ACC_{DD_95} = adjusted cooling capacity of the sample unit, as calculated in section 5.1.2 of this appendix, when tested at Test Conditions 2.D and 2.A, respectively, in Btu/h.

$ACC_{SD\_83\_SS}$ and $ACC_{SD\_83\_SS\_CF}$ = adjusted cooling capacity for a single-duct theoretical comparable single-speed portable air conditioner at the 83 °F dry-bulb outdoor temperature operating condition (Test Conditions 2.E) without and with cycling losses, respectively, as calculated in section 5.5.4 of this appendix, in Btu/h.

$ACC_{DD\_83\_SS}$ and $ACC_{DD\_83\_SS\_CF}$ = adjusted cooling capacity for a dual-duct theoretical comparable single-speed portable air conditioner at the 83 °F dry-bulb outdoor temperature operating condition (Test Condition 2.B) without and with cycling losses, respectively, as calculated in section 5.5.4 of this appendix, in Btu/h.

AEC_{SD_Full} = annual energy consumption of the single-duct sample unit, as calculated in section 5.4.2.1 of this appendix, in kWh/year.

$AEC_{DD\_95\_Full}$ = annual energy consumption for the dual-duct sample unit, as calculated in section 5.4.2.1 of this appendix, in kWh/year.

$AEC_{SD\_83\_SS}$ and $AEC_{DD\_83\_SS}$ = annual energy consumption for a single-duct and dual-duct theoretical comparable single-speed portable air conditioner, respectively, in cooling mode at the 83 °F dry-bulb outdoor temperature operating condition (Test Conditions 2.E and 2.B, respectively), calculated in section 5.5.5 of this appendix, in kWh/year.

AEC_T = total annual energy consumption attributed to all operating modes except cooling for the sample unit, calculated in section 5.3 of this appendix, in kWh/year.

0.750 as defined previously in this section.

0.2 = weighting factor for the 95 °F dry-bulb outdoor temperature operating condition.

0.8 = weighting factor for the 83 °F dry-bulb outdoor temperature operating condition.

5.5.7 *Combined-Duct Variable-Speed Portable Air Conditioner Performance Adjustment Factor.* Calculate the sample unit's performance adjustment factor, F_p, as follows:

For a single-duct unit:

$$F_{p\_SD} = \frac{(CEER_{SD\_SS} - CEER_{SD\_SS\_CF})}{CEER_{SD\_SS\_CF}}$$

For a dual-duct unit:

$$F_{p\_DD} = \frac{(CEER_{DD\_SS} - CEER_{DD\_SS\_CF})}{CEER_{DD\_SS\_CF}}$$

Where:

$CEER_{SD\_SS}$ and $CEER_{SD\_SS\_CF}$ = combined energy efficiency ratio for a single-duct theoretical comparable single-speed portable air conditioner without and with cycling losses considered, respectively, calculated in section 5.5.6 of this appendix, in Btu/Wh.

$CEER_{DD\_SS}$ and $CEER_{DD\_SS\_CF}$ = combined energy efficiency ratio for a dual-duct theoretical comparable single-speed portable air conditioner without and with cycling losses considered, respectively, calculated in section 5.5.6 of this appendix, in Btu/Wh.

5.5.8 *Single-Duct and Dual-Duct Variable-Speed Portable Air Conditioner Combined Energy Efficiency Ratio.* Calculate the sample unit's final combined energy efficiency ratio, CEER, in Btu/Wh, as follows:

For a single-duct portable air conditioner:

$$CEER_{SD} = CEER_{SD\_UA} \times (1 + F_{p\_SD})$$

For a dual-duct portable air conditioner:

$$CEER_{DD} = CEER_{DD\_UA} \times (1 + F_{p\_DD})$$

Where:

$CEER_{SD}$ and $CEER_{DD}$ = combined energy efficiency ratio for a single-duct and dual-duct sample unit, in Btu/Wh, respectively.

$CEER_{SD\_UA}$ and $CEER_{DD\_UA}$= unadjusted combined energy efficiency ratio for a single-duct and dual-duct sample unit, respectively, calculated in section 5.4.2.1 of this appendix, in Btu/Wh.

F_{p_SD} and F_{p_DD} = single-duct and dual-duct sample unit's performance adjustment factor, respectively, calculated in section 5.5.7 of this appendix.

9. Add appendix CC1 to subpart B of part 430 to read as follows:

Appendix CC1 to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Portable Air Conditioners

Note: Manufacturers must use the results of testing under this appendix to determine compliance with any standards that amend the portable air conditioners standard at § 430.32(cc) with which compliance is required on January 10, 2025. Any representation related to energy also must be made in accordance with the appendix that applies (*i.e.,* appendix CC or this appendix). Manufacturers may use this appendix to certify compliance with any amended standards before the compliance date for those standards.

0. Incorporation by Reference

DOE incorporated by reference in § 430.3, the entire standard for AHAM PAC–1–2022 Draft, ANSI/ASHRAE Standard 37–2009, ANSI/ASHRAE 51, and IEC 62301; however, only enumerated provisions of those documents are applicable to this appendix as follows. Treat ''should'' in IEC 62301 as mandatory.

0.1 AHAM PAC–1–2022 Draft

(a) Section 2 ''Scope,'' as specified in section 1 of this appendix;

(b) Section 4 ''Definitions,'' as specified in sections 2 and 3 of this appendix;

(c) Section 7 ''Tests,'' as specified in sections 3 and 4 of this appendix;

(d) Section 8.1 ''Cooling Mode,'' as specified in section 5 of this appendix;

(e) Section 9.1 ''Duct Heat Transfer,'' as specified in section 5.1 of this appendix;

(f) Section 9.2 ''Infiltration Air Heat Transfer,'' as specified in section 5.1 of this appendix.

0.2 ANSI/ASHRAE Standard 37–2009

(a) Section 5.1 ''Temperature Measuring Instruments,'' as specified in section 3 of this appendix;

(b) Section 5.3 ''Air Differential Pressure and Airflow Measurements,'' as specified in section 3 of this appendix;

(c) Section 5.4 ''Electrical Instruments,'' as specified in section 4 of this appendix;

(d) Section 6.2 ''Nozzle Airflow Measuring Apparatus,'' as specified in section 4 of this appendix;

(e) Section 6.3 ''Nozzles,'' as specified in section 4 of this appendix;

(f) Section 7.3 ''Indoor and Outdoor Air Enthalpy Methods,'' as specified in section 4 of this appendix;

(g) Section 7.7 ''Airflow Rate Measurement,'' as specified in section 4 of this appendix;

(h) Section 8.7 ''Test Procedure for Cooling Capacity Tests,'' as specified in section 4 of this appendix.

(i) Section 9 ''Data to be Recorded,'' as specified in section 4 of this appendix;

(j) Section 10 ''Test Results,'' as specified in section 4 of this appendix;

(k) Section 11.1 ''Symbols Used In Equations,'' as specified in section 4 of this appendix.

0.3 IEC 62301 (Edition 2.0, 2011–01)

(a) Paragraph 5.2 ''Preparation of product,'' as specified in section 3 of this appendix;

(b) Paragraph 4.3.2 ''Supply voltage waveform,'' as specified in section 3 of this appendix;

(c) Paragraph 4.4 ''Power measuring instruments,'' as specified in section 3 of this appendix;

(d) Annex D, ''Determination of Uncertainty of Measurement,'' as specified in section 3 of this appendix;

(e) Paragraph 4.2 ''Test room,'' as specified in section 3 of this appendix;
(f) Paragraph 5.1, ''General,'' Note 1, as specified in section 4 of this appendix;
(g) Paragraph 5.3.2 ''Sampling method,'' as specified in section 4 of this appendix.

0.4 ANSI/ASHRAE 51

(a) Figure 12 and Notes, ''Outlet chamber Setup—Multiple Nozzles in Chamber,'' as specified in section 4 of this appendix.
(0.5) ANSI/ASHRAE 41.1 as specified in section 4 of this appendix.
(0.6) ANSI/ASHRAE 41.7 as specified in section 4 of this appendix.

When there is a conflict, the language of this appendix takes precedence over those documents. Any subsequent amendment to a referenced document by the standard-setting organization will not affect the test procedure in this appendix, unless and until DOE amends the test procedure. Material is incorporated as it exists on the date of the approval, and any change to the reference to the material will be published in the **Federal Register**.

1. Scope

Establishes test requirements to measure the energy performance of single-duct and dual-duct, and single-speed and variable-speed portable air conditioners in accordance with AHAM PAC–1–2022 Draft, unless otherwise specified.

2. Definitions

Definitions for industry standards, terms, modes, calculations, etc. are in accordance with AHAM PAC–1–2022 Draft.

3. Test Apparatus and General Instructions

Follow requirements and instructions for test conduct and test setup in accordance with AHAM PAC–1–2022 Draft, including references to ASHRAE 37 Sections 5.1 and 5.3, and IEC 62301 Sections 4.3.2, 4.4, and 5.2, and Annex D. If the portable air conditioner has network functions, disable all network functions throughout testing if possible. If an end-user cannot disable a network function or the product's user manual does not provide instruction for disabling a network function, test the unit with that network function in the factory default configuration for the duration of the test.

4. Test Measurement

Follow requirements for test measurement in active and inactive modes of operation in accordance with AHAM PAC–1–2022 Draft, including references to Sections 5.4, 6.2, 6.3, 7.3, 7.7, 8.7, 9, 10, and 11 of ANSI/ASHRAE Standard 37–2009, referring to Figure 12 of ANSI/ASHRAE 51 to determine placement of static pressure taps, and including references to ANSI/ASHRAE 41.1–1986 and ANSI/ASHRAE 41.6–1994. When conducting standby power testing using the sampling method described in Section 5.3.2 of IEC 62301, if the standby mode is cyclic and irregular or unstable, collect 10 cycles worth of data.

5. Calculation of Derived Results From Test Measurements

Perform calculations from test measurements to determine Seasonally Adjusted Cooling Capacity (SACC) and Combined Energy Efficiency Ratio (CEER) in accordance with AHAM PAC–1–2022 Draft, unless otherwise specified in this section.

5.1 *Adjusted Cooling Capacity.* Calculate the adjusted cooling capacities at the 95 °F and 83 °F operating conditions specified below of the sample unit, in Btu/h, according to the following equations.

For a single-duct single-speed unit:

$$ACC_{95} = Capacity_{SD} - Q_{duct\_SD} - Q_{infiltration\_95}$$

$$ACC_{83} = 0.6000 \times (Capacity_{SD} - Q_{duct\_SD} - Q_{infiltration\_95})$$

For a single-duct variable-speed unit:

$$ACC_{95} = Capacity_{SD\_Full} - Q_{duct\_SD\_\_Full} - Q_{infiltration\_95}$$

$$ACC_{83} = Capacity_{SD\_Low} - Q_{duct\_SD\_Low} - Q_{infiltration\_83\_Low}$$

$$ACC_{83} = Capacity_{SD\_Low} - Q_{duct\_SD\_Low} - Q_{infiltration\_83\_Low}$$

For a dual-duct single-speed unit:

$$ACC_{95} = Capacity_{DD\_95} - Q_{duct\_DD\_95} - Q_{infiltration\_95}$$

$$ACC_{83} = 0.5363 \times (Capacity_{DD\_83} - Q_{duct\_DD\_83} - Q_{infiltration\_83})$$

For a dual-duct variable-speed unit:

$$ACC_{95} = Capacity_{DD\_95\_Full} - Q_{duct\_DD\_95\_Full} - Q_{infiltration\_95}$$

$$ACC_{83} = Capacity_{DD\_83\_Low} - Q_{duct\_DD\_83\_\_Low} - Q_{infiltration\_83\_Low}$$

Where:

ACC_{95} and ACC_{83} = adjusted cooling capacity of the sample unit, in Btu/h, calculated from testing at:

For a single-duct single-speed unit, test configuration 2A in Table 2 of AHAM PAC–1–2022 Draft.

For a single-duct variable-speed unit, test configurations 2B and 2C in Table 2 of AHAM PAC–1–2022 Draft.

For a dual-duct single-speed unit, test configurations 1A and 1B in Table 2 of AHAM PAC–1–2022 Draft.

For a dual-duct variable-speed unit: test configurations 1C and 1E in Table 2 of AHAM PAC–1–2022 Draft.

$Capacity_{SD}$, $Capacity_{SD\_Full}$, $Capacity_{SD\_Low}$, $Capacity_{DD\_95}$, $Capacity_{DD\_83}$, $Capacity_{DD\_95\_Full}$, and $Capacity_{DD\_83\_Low}$ = cooling capacity, in Btu/h, measured in testing at test configuration 2A, 2B, 2C, 1A, 1B, 1C, and 1E of Table 2 in Section 8.1 of AHAM PAC–1–2022 Draft, respectively.

Q_{duct_SD}, $Q_{duct\_SD\_Full}$, $Q_{duct\_SD\_Low}$, $Q_{duct\_DD\_95}$, $Q_{duct\_DD\_83}$, $Q_{duct\_DD\_95\_Full}$, and $Q_{duct\_DD\_83\_Low}$ = duct heat transfer while operating in cooling mode for each duct configuration, compressor speed (where applicable) and temperature condition (where applicable), calculated in Section 9.1 of AHAM PAC–1–2022 Draft, in Btu/h.

$Q_{infiltration\_95}$, $Q_{infiltration\_83}$, and $Q_{infiltration\_83\_Low}$ = total infiltration air heat transfer in cooling mode, in Btu/h, for each of the following compressor speed and duct configuration combinations:

For a single-duct single-speed unit, use $Q_{infiltration\_95}$ as calculated for a single-duct single-speed unit in Section 9.2 of AHAM PAC–1–2022 Draft.

For a single-duct variable-speed unit, use $Q_{infiltration\_95}$ and $Q_{infiltration\_83\_Low}$ as calculated for a single-duct variable-speed unit in Section 9.2 of AHAM PAC–1–2022 Draft.

For a dual-duct single-speed unit, use $Q_{infiltration\_95}$ and $Q_{infiltration\_83}$ as calculated for a dual-duct single-speed unit in Section 9.2 of AHAM PAC–1–2022 Draft.

For a dual-duct variable-speed unit, use $Q_{infiltration\_95}$ and $Q_{infiltration\_83\_Low}$ as calculated for a dual-duct variable-speed unit in Section 9.2 of AHAM PAC–1–2022 Draft.0.6000 and 0.5363 = empirically-derived load-based capacity adjustment factor for a single-duct and dual-duct single-speed unit, respectively, when operating at test conditions 1B and 2C.

5.2 *Seasonally Adjusted Cooling Capacity.* Calculate the seasonally adjusted cooling capacity for the sample unit, SACC, in Btu/h, according to:

$$SACC = ACC_{95} \times 0.144 + ACC_{83} \times 0.856$$

Where:

ACC_{95} and ACC_{83} = adjusted cooling capacities at the 95 °F and 83 °F outdoor temperature conditions, respectively, in Btu/h, calculated in section 5.1 of this appendix.

0.144 = empirically-derived weighting factor for ACC_{95}.

0.856 = empirically-derived weighting factor for ACC_{83}.

5.3 *Annual Energy Consumption.* Calculate the annual energy consumption in each operating mode, AECm, in kilowatt-hours per year (kWh/year). Use the following annual hours of operation for each mode:

TABLE 1—ANNUAL OPERATING HOURS

Operating mode	Annual operating hours
Cooling Mode Test Configurations 1A, 1C, 2A (95), 2B	164
Cooling Mode Test Configurations 1B, 2A (83)	586
Cooling Mode Test Configuration 1E, 2C	977
Off-Cycle, Single-Speed	391
Off-Cycle, Variable-Speed	0
Total Cooling and Off-cycle Mode	1,141
Inactive or Off Mode	1,844

Calculate total annual energy consumption in all modes according to the following equations:

$$AEC_{ia/om} = P_{ia/om} \times t_{ia/om} \times k$$

For a single-duct single-speed unit:

$$AEC_{95} = P_{SD\_95} \times t_{SD\_95} \times k$$

$$AEC_{83} = \frac{P_{SD\_83} \times t_{SD\_83} \times k}{0.82}$$

For a single-duct variable-speed unit:

$$AEC_{95} = P_{SD\_Full} \times t_{SD\_Full} \times k$$

$$AEC_{83} = P_{SD\_Low} \times t_{SD\_Low} \times k$$

For a dual-duct single-speed unit:

$$AEC_{95} = P_{DD\_95} \times t_{DD\_95} \times k$$

$$AEC_{83} = \frac{P_{DD\_83} \times t_{DD\_83} \times k}{0.82}$$

For a dual-duct variable-speed unit:

$$AEC_{95} = P_{DD\_95\_Full} \times t_{DD\_95\_Full} \times k$$

$$AEC_{83} = P_{DD\_83\_Low} \times t_{DD\_83\_Low} \times k$$

Where:

AEC_{95} and AEC_{83} = total annual energy consumption attributed to all modes representative of either the 95 °F and 83 °F operating condition, respectively, in kWh/year.

P_m = average power in each mode, in watts, as determined in sections 4.1.1 and 4.1.2 of this appendix.

t_m = number of annual operating time in each mode, in hours.

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

0.82 = empirically-derived factor representing efficiency losses due to compressor cycling outside of fan operation

m represents the operating mode:

—''DD_95'' and ''DD_83'' correspond to cooling mode in Test Configurations 1A and 1B in Table 2 of AHAM PAC–1–2022 Draft, respectively, for dual-duct single-speed units,

—''DD_95_Full'', ''DD_83_Low'' correspond to cooling mode in Test Configurations 1C and 1E in Table 2 of AHAM PAC–1–2022 Draft, respectively, for dual-duct variable-speed units,

—''SD_95'' corresponds to cooling mode in Test Configuration 2A in Table 2 of AHAM PAC–1–2022 Draft for single-duct single-speed units, for use when calculating AEC at the 95 °F outdoor temperature condition,

—''SD_83'' corresponds to cooling mode in Test Configuration 2A in Table 2 of AHAM PAC–1–2022 Draft for single-duct single-speed units, for use when calculating AEC at the 83 °F outdoor temperature condition

—''SD_Full'' and ''SD_Low'' correspond to cooling mode in Test Configurations 2B and 2C in Table 2 of AHAM PAC–1–2022 Draft, respectively, for single-duct variable-speed units

—''oc'' corresponds to off-cycle,

—''ia/om'' corresponds to inactive or off mode,

5.4 *Annual Cooling and Energy Ratio.* Calculate the annualized energy efficiency ratio, AEER, in Btu/Wh, according to the following equation:

$$AEER = 0.001 \times \frac{(ACC_{95} \times t_{cm\_95}) + (ACC_{83} \times t_{cm\_83})}{AEC_{95} + AEC_{83} + AEC_{oc} + AEC_{ia/om}}$$

Where:

AEER = the annualized energy efficiency ratio of the sample unit in Btu/Wh.

ACC_{95} and ACC_{83} = adjusted cooling capacity at the 95 °F and 83 °F outdoor temperature conditions, respectively, calculated in section 5.1 of this appendix.

AEC_{95}, AEC_{83}, AEC_{oc}, and $AEC_{ia/om}$ = total annual energy consumption attributed to all modes representative the 95 °F operating condition, the 83 °F operating condition, off-cycle mode, and inactive or off mode respectively, in kWh/year, calculated in section 5.3 of this appendix.

t_{cm_95} = number of annual hours spent in cooling mode at the 95 °F operating condition, t_{DD_95} for dual-duct single-speed units, $t_{DD\_95\_Full}$ for dual-duct variable-speed units, t_{SD_95} for single-duct single-speed units, or t_{SD_Full} for single-duct variable-speed units, defined in section 5.3 of this appendix.

164 = number of annual hours spent in cooling mode at the 95 °F operating condition, as shown in Table 1 of section 5.3 of this appendix.

t_{cm_83} = number of annual hours spent in cooling mode at the 83 °F operating condition, t_{DD_83} for dual-duct single-speed units, $t_{DD\_83\_Low}$ for dual-duct variable-speed units, t_{SD_83} for single-duct single-speed units, or t_{SD_Low} for single-duct variable-speed units, defined in section 5.3 of this appendix.

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

[FR Doc. 2022–11469 Filed 6–7–22; 8:45 am]

BILLING CODE 6450–01–P