DEPARTMENT OF ENERGY

10 CFR Parts 429 and 430

[EERE–2022–BT–TP–0028]

RIN 1904–AF49

Energy Conservation Program: Test Procedure for Central Air Conditioners and Heat Pumps

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

ACTION: Notice of proposed rulemaking and announcement of public meeting.

SUMMARY: The U.S. Department of Energy (''DOE'') proposes to amend the Federal test procedure for central air conditioners and heat pumps (''CAC/HPs'') to incorporate by reference the latest versions of the applicable industry standards. Specifically, DOE proposes: to amend the current test procedure for CAC/HPs (''appendix M1'') for measuring the current cooling and heating metrics—seasonal energy efficiency ratio 2 (''SEER2'') and heating seasonal performance factor 2 (''HSPF2''), respectively; and to establish a new test procedure (''appendix M2'') for CAC/HPs that would adopt two new metrics—seasonal cooling and off-mode rating efficiency (''SCORE'') and seasonal heating and off-mode rating efficiency (''SHORE''). Testing to the SCORE and SHORE metrics would not be required until such time as compliance is required with any amended energy conservation standard based on the new metrics. Additionally, DOE proposes to amend certain provisions of DOE's regulations related to representations and enforcement for CAC/HPs. DOE welcomes written comments from the public on any subject within the scope of this document (including relevant topics not raised in this proposal), as well as the submission of data and other relevant information.

DATES:

Comments: DOE will accept comments, data, and information regarding this proposal no later than June 4, 2024. *See* section V, ''Public Participation,'' for details.

Meeting: DOE will hold a public meeting via webinar on Thursday, April 25, 2024, 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* under docket number EERE–2022–BT–TP–0028. Follow the instructions for submitting comments. Alternatively, interested persons may submit comments, identified by docket number EERE–2022–BT–TP–0028, by any of the following methods:

(1) *Email: CACandHeatPump2022TP0028@ee.doe.gov.* Include the docket number EERE–2022–BT–TP–0028 in the subject line of the message.

(2) *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.

(3) *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 for this activity, 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, not all documents listed in the index may be publicly available, such as information that is exempt from public disclosure.

The docket web page can be found at *www.regulations.gov/docket/EERE-2022-BT-TP-0028.* 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–2J, 1000 Independence Avenue SW, Washington, DC 20585–0121. Telephone: (202) 287–5904. Email: *ApplianceStandardsQuestions@ee.doe.gov.*

Mr. Pete Cochran, U.S. Department of Energy, Office of the General Counsel, GC–33, 1000 Independence Avenue SW, Washington, DC 20585–0121. Telephone: (202) 586–9496. Email: *peter.cochran@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 (if one is held), contact the Appliance and Equipment Standards Program staff at (202) 287–1445 or by email: *ApplianceStandardsQuestions@ee.doe.gov.*

SUPPLEMENTARY INFORMATION: DOE proposes to maintain previously approved incorporations by reference and incorporate by reference the following industry standards into 10 CFR parts 429 and 430:

AHRI 210/240–202X, *202X Standard for Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment* (''AHRI 210/240–202X Draft''). AHRI 210/240–202X Draft is in draft form and this draft was announced for public review on November 16, 2023.[1] DOE references this version for the purposes of drafting this Notice of Proposed Rulemaking (''NOPR''). If this industry test standard is formally adopted, DOE intends to incorporate by reference the final published version of AHRI 210/240, not the current draft version, in DOE's subsequent test procedure final rule, unless there are substantive changes between the draft and final versions, in which case DOE may adopt the substance of the AHRI 210/240–202X Draft or provide additional opportunity for comment on the changes to the industry consensus standard.

AHRI 1600–202X, *202X Standard for Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment* (''AHRI 1600–202X Draft''). AHRI 1600–202X Draft is in draft form and this draft was announced for public review on November 16, 2023.[2] DOE references this version for the purposes of drafting this NOPR. If this industry test standard is formally adopted, DOE intends to incorporate by reference the final published version of AHRI 1600, not the current draft version, in DOE's subsequent test procedure final rule, unless there are substantive changes between the draft and published versions, in which case DOE may adopt the substance of the AHRI 1600–202X

[1] Public review of AHRI 210/240–202X Draft was announced in the November 16, 2023 AHRI Update here: *http://newsmanager.commpartners.com/ahri/issues/2023-11-16-email.html.*

[2] Public review of AHRI 1600–202X Draft was also announced in the November 16, 2023 AHRI Update here: *http://newsmanager.commpartners.com/ahri/issues/2023-11-16-email.html.*

Draft or provide additional opportunity for comment on the changes to the industry consensus standard.

Copies of the AHRI 210/240–202X Draft and AHRI 1600–202X Draft are available in the docket for this proposed rulemaking for review.

ANSI/ASHRAE Standard 16–2016, *Method of Testing for Rating Room Air Conditioners, Packaged Terminal Air Conditioners, and Packaged Terminal Heat Pumps for Cooling and Heating Capacity,* ANSI approved November 1, 2016, (''ANSI/ASHRAE 16–2016'').

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

ANSI/ASHRAE 116–2010, *Methods of Testing for Rating Seasonal Efficiency of Unitary Air Conditioners and Heat Pumps,* ANSI approved February 24, 2010, (''ASHRAE 116–2010'').

Copies of ANSI/ASHRAE 16–2016, ANSI/ASHRAE 37–2009, and ASHRAE 116–2010 can be purchased from the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (''ASHRAE'') website at *www.ashrae.org/resources--publications.*

See section IV.M of this document for further discussion of these standards.

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I. Authority and Background

Central air conditioners (''CACs'') and central air conditioning heat pumps (''HPs'') (collectively, ''CAC/HPs'') are included in the list of ''covered products'' for which DOE is authorized to establish and amend energy conservation standards and test procedures. (42 U.S.C. 6292(a)(3)) DOE's test procedures for CAC/HPs are currently prescribed at 10 CFR part 430, subpart B, appendix M1 (''appendix M1''). The following sections discuss DOE's authority to establish and amend test procedures for CAC/HPs and relevant background information regarding DOE's consideration of test procedures for this product.

A. Authority

The Energy Policy and Conservation Act, Pub. L. 94–163, as amended (''EPCA''),[3] 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 of EPCA[4] established the Energy Conservation Program for Consumer Products Other Than Automobiles, which sets forth a variety of provisions designed to improve energy efficiency. These products include CAC/HPs, the subject of this document. (42 U.S.C. 6292(a)(3))

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

[3] 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.

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

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 other 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))

EPCA also requires that, at least once every 7 years, DOE evaluate test procedures for each type of covered product, including CAC/HPs, 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 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. (42 U.S.C. 6293(b)(1)(A)(ii))

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 [5] and IEC Standard 62087 [6] as applicable. (42 U.S.C. 6295(gg)(2)(A))

DOE is publishing this NOPR in satisfaction of the 7-year review requirement specified in EPCA. (42 U.S.C. 6293(b)(1)(A))

B. Background

On January 5, 2017, DOE published a final rule regarding the Federal test procedures for CAC/HPs. 82 FR 1426 (''January 2017 Final Rule''). The January 2017 Final Rule amended the current test procedure at that time, 10 CFR part 430, subpart B, appendix M (''appendix M'') and established appendix M1, use of which was required beginning January 1, 2023, for any representations, including compliance certifications, made with respect to the energy use or efficiency of CAC/HPs. Appendix M provides for the measurement of the cooling and heating performance of CAC/HPs using the seasonal energy efficiency ratio (''SEER'') metric and heating seasonal performance factor (''HSPF'') metric, respectively. Appendix M1 specifies a revised SEER metric (*i.e.,* ''SEER2'') and a revised HSPF metric (*i.e.,* ''HSPF2'').

On October 25, 2022, DOE published a final rule to address limited-scope amendments to the existing test procedures for CAC/HPs in appendix M1. 87 FR 64550 (''October 2022 Final Rule''). The October 2022 Final Rule provided changes to improve the functionality of appendix M1 to address the issues identified in test procedure waivers, improve representativeness, and correct typographical issues raised by commenters. *Id.* at 87 FR 64551. In the October 2022 Final Rule, DOE noted that several commenters indicated the need for test procedure amendments beyond the scope of the rulemaking. *Id.* at 87 FR 64554–64555. DOE received comments recommending consideration of load-based testing methods, controls validation (particularly for variable speed systems), amended metrics, amended definitions, and expansion of test methods to capture low-temperature heating performance for heat pumps. *Id.* In its response to these comments, DOE noted that it had initiated that rulemaking not as a comprehensive revision that would satisfy the 7-year lookback requirements (*see* 42 U.S.C. 6293(b)(1)(A)), but to address a limited set of known issues, including those that have been raised through the test procedure waiver process. 87 FR 64554. DOE, however, also acknowledged that a future rulemaking may more comprehensively address the issues raised by the commenters. *Id.*

On January 24, 2023, DOE published in the **Federal Register** a request for information (''RFI'') regarding the need for amendments to the test procedures for CAC/HPs, including the need for amendments to address the issues raised by commenters in the previous rulemaking, in satisfaction of the 7-year review requirements specified in EPCA. 88 FR 4091 (''January 2023 RFI''). In the January 2023 RFI, DOE requested comments, information, and data about a number of issues, and considered these issues in two separate categories: (1) the consideration of load-based testing methodologies under development by various organizations and whether certain aspects of these methodologies might be adopted into

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

[6] IEC 62087, *Audio, video and related equipment—Methods of measurement for power consumption* (Edition 1.0, Parts 1–6: 2015, Part 7: 2018).

the DOE test procedure; and (2) issues with the current appendix M1 test procedure that may or may not still be relevant if or when load-based concepts are adopted in the DOE test procedure. *Id.* at 88 FR 4092–4093.

DOE received comments in response to the January 2023 RFI from the interested parties listed in Table I.1.

TABLE I.1—LIST OF COMMENTERS WITH WRITTEN SUBMISSIONS IN RESPONSE TO THE JANUARY 2023 RFI

Commenter(s)	Reference in this NOPR	Comment No. in the docket	Commenter type
Air-Conditioning, Heating, and Refrigeration Institute	AHRI	14	Trade Association.
Appliance Standards Awareness Project, American Council for an Energy-Efficient Economy, Consumer Federation of America, and National Consumer Law Center.	Joint Advocates	8	Efficiency Organizations and Consumer Advocacy Organizations.
British Columbian Hydro and Power Authority	BC Hydro	15	Utility.
Pacific Gas and Electric Company, San Diego Gas and Electric, and Southern California Edison; collectively, the California Investor-Owned Utilities.	CA IOUs	10	Utilities.
Carrier Global Corporation	Carrier	5	Manufacturer.
CoilPod LLC	CoilPod	4	Service Provider.
Daikin Comfort Technologies North America Inc	Daikin	16	Manufacturer.
Lennox International Inc	Lennox	6	Manufacturer.
National Comfort Products	NCP	7	Manufacturer.
Northwest Energy Efficiency Alliance	NEEA	13	Efficiency Organization.
New York State Energy Research and Development Authority	NYSERDA	9	State Agency.
Rheem Manufacturing Company	Rheem	12	Manufacturer.
Samsung HVAC	Samsung	11	Manufacturer.

A parenthetical reference at the end of a comment quotation or paraphrase provides the location of the item in the public record.[7]

In response to the January 2023 RFI, DOE received multiple comments regarding the energy conservation standards for CAC/HPs. Comments regarding energy conservation standards are outside the scope of consideration for this test procedure rulemaking and are not addressed in this NOPR. Topics related to energy conservation standards for CAC/HPs would be addressed in a separate rulemaking process.

II. Synopsis of the Notice of Proposed Rulemaking

In this NOPR, DOE proposes to update its test procedures for CAC/HPs by: (1) updating the reference in the Federal test procedure at appendix M1 to the most recent draft version of the AHRI Standard 210/240 industry test procedure, AHRI 210/240–202X Draft, for measuring SEER2 and HSPF2; and (2) establishing a new test procedure at 10 CFR part 430, subpart B, appendix M2 (''appendix M2'') that references the draft new industry test procedure, AHRI 1600–202X Draft, for measuring new efficiency metrics, seasonal cooling and off-mode rating efficiency (''SCORE''), and seasonal heating and off-mode rating efficiency (''SHORE'').

If AHRI 210/240–202X Draft and AHRI 1600–202X Draft are finalized and formally adopted, DOE intends to incorporate by reference the final published version of AHRI 210/240 and AHRI 1600 in DOE's subsequent test procedure final rule.

To implement the proposed changes, DOE proposes: (1) to amend appendix M1 to incorporate by reference AHRI 210/240–202X Draft for CAC/HPs, while maintaining the current efficiency metrics; and (2) to add a new appendix M2 to subpart F of 10 CFR part 430 to incorporate by reference AHRI 1600–202X Draft, which introduces new efficiency metrics, SCORE and SHORE. DOE would list appendix M2 as the applicable test method for CAC/HPs for any standards denominated in terms of SCORE and SHORE. Use of appendix M2 would not be required until such time as compliance is required with any amended energy conservation standard based on the new metrics, should DOE adopt such standards. After the date on which compliance with appendix M2 would be required, appendix M1 would no longer be required as part of the Federal test procedure. DOE is also proposing to amend certain provisions within DOE's regulations for representation and enforcement consistent with the proposed test procedure amendments.

Table II.1 summarizes the current DOE test procedure for CAC/HPs, DOE's proposed changes to that test procedure, and the reason for each proposed change.

TABLE II.1—SUMMARY OF CHANGES IN PROPOSED APPENDIX M1 AND PROPOSED APPENDIX M2 TEST PROCEDURES RELATIVE TO CURRENT TEST PROCEDURE

Current DOE test procedure	Proposed appendix M1 test procedure	Proposed appendix M2 test procedure	Attribution
Incorporates by reference AHRI 210/240–2008.	Incorporates by reference AHRI 210/240–202X Draft.	Incorporates by reference AHRI 1600–202X Draft.	Updates to the applicable industry test procedures.
Includes provisions for determining SEER2, HSPF2, EER2, and $P_{W,OFF}$.	Maintains provisions for determining SEER2, HPSF2, EER2, and $P_{W,OFF}$.	Includes provisions for determining SCORE and SHORE and maintains provisions for determining EER2.	Updates to the applicable industry test procedures.

[7] The parenthetical reference provides a reference for information located in the docket of DOE's rulemaking to develop test procedures for CAC/HPs. (Docket No. EERE–2022–BT–TP–0028, which is maintained at *www.regulations.gov*). The references are arranged as follows: (commenter name, comment docket ID number, page of that document).

TABLE II.1—SUMMARY OF CHANGES IN PROPOSED APPENDIX M1 AND PROPOSED APPENDIX M2 TEST PROCEDURES RELATIVE TO CURRENT TEST PROCEDURE—Continued

Current DOE test procedure	Proposed appendix M1 test procedure	Proposed appendix M2 test procedure	Attribution
Includes certain CAC/HP provisions regarding determination of represented values in 10 CFR 429.16.	Includes provisions to remove the alternative efficiency determination method ("AEDM") exception for split-systems in 10 CFR 429.16.	Includes provisions to remove the AEDM exception for split-systems, to extend the AEDM tolerance requirement to SCORE and SHORE, and to no longer require representations of the $P_{W,OFF}$ metric in 10 CFR 429.16.	Improve representativeness of test procedure.
Does not include certain CAC/HP-specific enforcement provisions in 10 CFR 429.134(k).	Includes CAC/HP-specific enforcement provisions regarding verification of cut-out and cut-in temperatures and a controls verification procedure.	Includes CAC/HP-specific enforcement provisions regarding verification of cut-out and cut-in temperatures and a controls verification procedure.	Clarify how DOE will conduct enforcement testing.

DOE has tentatively determined that the proposed amendments to the CAC/HP test procedures in appendix M1 and the proposed appendix M2 would not be unduly burdensome. Furthermore, DOE has tentatively determined that the proposed amendments to appendix M1, if made final, would not alter the measured efficiency of CAC/HPs or require retesting or recertification solely as a result of DOE's adoption of the proposed amendments to the test procedure. Additionally, DOE has tentatively determined that the proposed amendments to appendix M1, if made final, would not increase the cost of testing. If finalized, representations of energy use or energy efficiency would be required to be based on testing in accordance with the amended test procedure in appendix M1 beginning 180 days after the date of publication of the test procedure final rule in the **Federal Register**.

DOE has tentatively determined, however, that the newly proposed test procedure at appendix M2 would, if adopted, alter the measured efficiency of CAC/HPs, in part because the amended test procedure would adopt different energy efficiency metrics than in the current test procedure. Additionally, DOE has tentatively determined that the proposed amendments to appendix M2, if made final, would not increase the cost of testing. Tentative cost estimates are discussed in section III.L of this document. As discussed, use of appendix M2 would not be required until the compliance date of amended energy conservation standards denominated in terms of SCORE and SHORE, should DOE adopt such standards.

The proposed amendments to representation requirements in 10 CFR 429.43 would not be required until 180 days after publication in the **Federal Register** of a test procedure final rule.

Discussion of DOE's proposed actions are addressed in further detail in section III of this NOPR.

III. Discussion

In the following sections, DOE proposes certain amendments to its test procedures for CAC/HPs. For each proposed amendment, DOE provides relevant background information, explains why the proposed amendment merits consideration, discusses relevant public comments, and proposes a potential approach.

A. Scope of Applicability

This rulemaking applies to CAC/HPs. DOE defines the term *Central air conditioner or central air conditioner heat pump* to mean a product, other than a packaged terminal air conditioner or packaged terminal heat pump, single-phase single-package vertical air conditioner with cooling capacity less than 65,000 British thermal units (''Btu'') per hour (''Btu/h''), single-phase single-package vertical heat pump with cooling capacity less than 65,000 Btu/h, computer room air conditioner, or unitary dedicated outdoor air system as these equipment categories are defined at 10 CFR 431.92, which is powered by single phase electric current, air cooled, rated below 65,000 Btu/h, not contained within the same cabinet as a furnace, the rated capacity of which is above 225,000 Btu/h, and is a heat pump or a cooling unit only. A central air conditioner or central air conditioning heat pump may consist of: A single-package unit; an outdoor unit and one or more indoor units; an indoor unit only; or an outdoor unit with no match. In the case of an indoor unit only or an outdoor unit with no match, the unit *must* be tested and rated as a system (combination of both an indoor and an outdoor unit). 10 CFR 430.2.

Appendix M1 applies to the following CACs/HPs:

(a) Split-system air conditioners, including single-split, multi-head mini-split, multi-split (including VRF), and multi-circuit systems;

(b) Split-system heat pumps, including single-split, multi-head mini-split, multi-split (including VRF), and multi-circuit systems;

(c) Single-package air conditioners;

(d) Single-package heat pumps;

(e) Small-duct, high-velocity systems (including VRF);

(f) Space-constrained products—air conditioners; and

(g) Space-constrained products—heat pumps.

See section 1.1 of appendix M1.

DOE is not proposing to change the scope of CACs/HPs covered by the test procedure in appendix M1 or the proposed appendix M2.

B. Definitions

CAC/HPs are defined in 10 CFR 430.2, as described in the previous section. This definition was last amended in the October 2022 Final Rule. DOE revised the central air conditioner or central air conditioning heat pump definition so that it explicitly excluded certain equipment categories that met the CAC/HP definition based on their characteristics but are exclusively distributed in commerce for commercial and industrial applications. 87 FR 64550, 64573. DOE noted in the October 2022 Final Rule that there are certain types of equipment that meet the CAC/HP definition but are exclusively distributed in commerce for commercial and industrial applications, and that EPCA did not intend to regulate as consumer products. *Id.*

As laid out in section 1.1 of appendix M1, the test procedure applies to CAC/

HPs, including the following categories, which are defined either in 10 CFR 430.2 or in section 1.2 of appendix M1:

(a) Split-system air conditioners, including single-split, multi-head mini-split, multi-split (including variable refrigerant flow (''VRF'')), and multi-circuit systems;

(b) Split-system heat pumps, including single-split, multi-head mini-split, multi- split (including VRF), and multi-circuit systems;

(c) Single-package air conditioners;

(d) Single-package heat pumps;

(e) Small-duct, high-velocity systems (including VRF);

(f) Space-constrained products—air conditioners; and

(g) Space-constrained products—heat pumps.

In the January 2023 RFI, DOE sought comment on whether the definition of CAC/HP needs revision, and whether the scope of the appendices M and M1 needs to be limited, expanded, clarified, or revised in any way.[8] 88 FR 4091, 4093.

In its response, Rheem requested a revision to the definition and scope of CAC/HPs covered by appendix M1 to add a new product class of ''space-constrained vertical package'' product. (Rheem, No. 12 at pp. 1–2) Rheem proposed that this new product class would meet all definitions of the current ''space-constrained'' product class but also consist of the following three additions: (1) is factory-assembled as a single package that has major components that are arranged vertically; (2) is intended for interior mounting on adjacent, interior to, or through an outside wall; (3) and is non-weatherized. (*Id.*) Rheem suggested the product class delineation should be used to establish a reasonable minimum test external static pressure (''ESP'') of 0.15 inches of water column (''in. wc.''), which Rheem claimed will result in more congruity between tested and actual unit operation for the consumer for these types of units. *Id.*

Rheem asserted that DOE's current space-constrained product class is too general, and as a result puts unreasonable testing burden on ''space-constrained vertical package'' units. (*Id.*) Specifically, Rheem commented that the minimum ESP of 0.3 in. wc. required by appendix M1 for space-constrained products[9] is not representative of installations of these units. Rheem explained that ''space-constrained vertical package'' products are typically entirely installed inside a closet with a short supply duct of 5–15 feet, without a return duct, and usually are found within small multifamily or lodging applications (such as assisted living and low-income housing). (*Id.*) Additionally, Rheem noted that one of its brands, Friedrich, has multiple products in which operation at an ESP greater than 0.3 in. wc. is prohibited per the installation and operation instructions. (*Id.*) Rheem commented that designing and testing the equipment to meet the minimum 0.3 in. wc. requirement of the current space-constrained category will lead to size and cost changes that will serve no benefit to the consumer and would make replacement units cost or size prohibitive. (*Id.*)

DOE notes that Rheem's comment lacked sufficient information, such as product literature and test data, that would indicate that the current test procedure ESP requirement for ''space-constrained'' products is unsuitable for the products Rheem described in its comment, puts undue burden on manufacturers for testing, and is not representative of current installations of these units in the field. DOE is not aware of any space-constrained products that are not able to be tested according to the existing test procedure requirements. Given the limited information describing the products that are the subject of Rheem's comment, DOE is not proposing to amend the definition of space-constrained vertical package units within the scope of CAC/HPs.

Regarding the scope and definition of CAC/HPs, AHRI, Carrier, and Lennox all submitted comments relating to a definition for heat pumps optimized for performance in cold climates. (AHRI, No. 14 at p. 7; Carrier, No. 5 at p. 2; Lennox, No. 6 at p. 3) Comments regarding heat pumps optimized for low-temperature heating performance are discussed in section III.F.2 of this NOPR. AHRI also submitted a comment regarding systems that use a heat pump and a furnace in combination as a source for heating (*i.e.,* ''dual-fuel'' heat pumps). (AHRI, No. 14 at p. 7) Comments regarding such systems are discussed in section III.F.6 of this NOPR.

Notably, both Carrier and Lennox commented that they find the current scope of CAC/HPs covered by appendix M1 to be appropriate. (Carrier, No. 5 at p. 2; Lennox, No. 6 at p. 3) Lennox also stated that it finds the general definition of central air conditioner or central air conditioning heat pump to be adequate. (Lennox, No. 6 at p. 3)

Except as noted, DOE is not proposing any further amendments to the definition of central air conditioner or to the scope of CAC/HPs covered by appendix M1 or the newly proposed appendix M2.

C. Updates to Industry Standards

DOE's current test procedures for CAC/HPs are codified at appendix M1 and incorporate by reference various industry standards. The regulatory text at appendix M1 has generally been closely aligned with the relevant industry standard for CAC/HPs, AHRI Standard 210/240—however, several rulemakings have changed the regulatory portions of appendix M1 over time with amendments and additions, not all of which have been mirrored in the AHRI 210/240 standards.

Appendix M1 currently references ANSI/AHRI 210/240–2008 with Addenda 1 and 2 (''AHRI 210/240–2008'' [10]): 2008 Standard for Performance Rating of Unitary Air Conditioning & Air-Source Heat Pump Equipment. However, the latest AHRI Standard 210/240 is AHRI 210/240–2023, Standard for Performance Rating of Unitary Air Conditioning & Air Source Heat Pump Equipment, copyright 2020 (''AHRI 210/240–2023 (2020)'' [11]).

Following publication of the January 2023 RFI, AHRI and other relevant stakeholders, including DOE, participated in the development of two updated industry standards relevant to CAC/HPs, the AHRI 210/240–202X Draft and the AHRI 1600–202X Draft.[12] DOE understands that these drafts were commissioned primarily to address the issues raised by DOE in the January 2023 RFI, and secondarily to harmonize the AHRI industry standards with the DOE test procedures, which were last amended in the October 2022 Final Rule.

DOE has reviewed both drafts and determined that they allow for a more representative measurement of the efficiencies of CAC/HPs than the current Federal test procedure, without being unduly burdensome. Rather than make

[8] On January 1, 2023, use of appendix M1 became required for any representations—including compliance certifications—made with respect to the energy use, power, or efficiency of CAC/HPs. Prior to January 1, 2023, such representations were required to be based on the test procedure at appendix M to subpart B of 10 CFR part 430.

[9] *See* Table 4 of appendix M1 for the minimum ESP requirements for ducted blower-coil systems, including the 0.3 in. wc. requirement for space-constrained systems.

[10] A copy of AHRI 210/240–2008 can be obtained from AHRI, 2111 Wilson Boulevard, Suite 500, Arlington, VA 22201, USA, 703–524–8800, or by going to *www.ahrinet.org.*

[11] A copy of AHRI 210/240–2023 (2020) can be obtained from AHRI, 2111 Wilson Boulevard, Suite 500, Arlington, VA 22201, USA, 703–524–8800, or by going to *www.ahrinet.org.*

[12] Both draft standards are available in Docket No. EERE–2022–BT–TP–0028.

more amendments to the regulatory text of the current appendix M1 test procedure, DOE is proposing to adopt each industry standard respectively as the basis for an updated appendix M1 and a new appendix M2, similar to how AHRI 210/240–2008 was adopted as the basis of the current appendix M1 test procedure. Specifically, DOE is proposing to incorporate by reference AHRI 210/240–202X Draft, and the relevant standards it references: ANSI/ASHRAE 16–2016, ANSI/ASHRAE 37–2009, and ASHRAE 116–2010 as the basis for the updated appendix M1 test procedure. Similarly, DOE is proposing to incorporate by reference AHRI 1600–202X Draft, and the relevant standards it references ANSI/ASHRAE 16–2016, ANSI/ASHRAE 37–2009, and ASHRAE 116–2010 as the basis for the new appendix M2 test procedure. Incorporating each industry standard would enable DOE to better harmonize with the industry standards and eliminate manufacturer burden in certifying with separate test procedures.

1. AHRI 210/240–202X Draft

As previously discussed, AHRI and other relevant stakeholders, including DOE, worked to develop a revised AHRI 210/240 standard that would incorporate revisions to align with the October 2022 Final Rule, and additionally, seek to address the issues raised in the January 2023 RFI with broad stakeholder consensus. DOE understands that this new update is currently in draft form (*i.e.,* AHRI 210/240–202X Draft) and will supersede the current version of the standard, AHRI 210/240–2023 (2020). While AHRI 210/240–202X Draft does not introduce changes that would alter the measured efficiency of CAC/HPs, it does introduce new test provisions as compared to AHRI 210/240–2023 (2020), and addresses several issues that DOE raised in the January 2023 RFI. Section III.F of this NOPR includes further discussion of the changes that are reflected in AHRI 210/240–202X Draft.

In light of these updates to AHRI 210/240–202X Draft, DOE is proposing to amend its test procedure for CAC/HPs at appendix M1 by incorporating by reference AHRI 210/240–202X Draft. DOE intends to update its incorporation by reference to the final published version of AHRI 210/240–202X Draft in the final rule, unless the draft version is not finalized before the final rule or there are substantive changes between the draft and published versions, in which case DOE may adopt the substance of the AHRI 210/240–202X Draft or provide additional opportunity for comment on the substantive changes to the updated industry consensus standard. Specifically, DOE is proposing to utilize sections 3 (excluding 3.2.15, 3.2.19, 3.2.47, 3.2.52, 3.2.64, 3.2.79 and 3.2.80), 5, 6 (excluding 6.1.8, 6.2, 6.3, 6.4 and 6.5), 11, and 12 and appendices D, E, G, K, and L of the AHRI 210/240–202X Draft in the Federal test procedure for CAC/HPs at appendix M1.

Additionally, DOE is proposing additions and deletions to the incorporations by reference for the CAC/HP Federal test procedure to align with the references made within the AHRI 210/240–202X Draft. Currently, appendix M1 incorporates by reference: AMCA 210–2007,[13] AHRI 210/240–2008, AHRI 1230–2010,[14] ASHRAE 23.1–2010,[15] ANSI/ASHRAE 37–2009, and ASHRAE 116–2010. 10 CFR 430.3.

In the proposed test procedures at appendix M1, DOE is proposing to add an incorporation by reference to ANSI/ASHRAE 16–2016 and remove incorporations by reference to AMCA 210–2007, AHRI 210/240–2008, AHRI 1230–2010 and ASHRAE 23.1–2010. Therefore, DOE is proposing to incorporate by reference the AHRI 210/240–202X Draft, ANSI/ASHRAE 16–2016, ANSI/ASHRAE 37–2009, and ASHRAE 116–2010, at appendix M1.

2. AHRI 1600–202X Draft

In parallel to the AHRI 210/240–202X Draft, AHRI and other relevant stakeholders, including DOE, worked to develop a forward-looking AHRI test procedure that would act as the successor to the AHRI 210/240–202X Draft and be effective in the long-term (*i.e.,* AHRI 1600–202X Draft). DOE is proposing to establish a new test procedure for CAC/HPs at appendix M2 by incorporating by reference AHRI 1600–202X Draft. DOE intends to update its incorporation by reference to the final published version of AHRI 1600–202X Draft in the final rule, unless the draft version is not finalized before the final rule or there are substantive changes between the draft and published versions, in which case DOE may adopt the substance of the AHRI 1600–202X Draft or provide additional opportunity for comment on the substantive changes to the updated industry consensus standard. Specifically, DOE is proposing to utilize sections 3 (excluding 3.1.15, 3.1.19, 3.1.47, 3.1.52, 3.1.65, 3.1.80, and 3.1.81), 5, 6 (excluding 6.1.8, 6.2, 6.3, 6.4 and 6.5), 11, and 12 and appendices D, E, G, K, and L of the AHRI 1600–202X Draft in the Federal test procedure for CAC/HPs at appendix M2.

DOE is also proposing to incorporate by reference ANSI/ASHRAE 16–2016, ANSI/ASHRAE 37–2009, and ASHRAE 116–2010, which are referenced within AHRI 1600–202X Draft. Therefore, in total, DOE is proposing to incorporate by reference the AHRI 1600–202X Draft, ANSI/ASHRAE 16–2016, ANSI/ASHRAE 37–2009, and ASHRAE 116–2010, at appendix M2.

3. ANSI/ASHRAE 37–2009

ANSI/ASHRAE 37–2009, which provides a method of test for many categories of air conditioning and heating products and equipment, is referenced for testing CAC/HPs by both AHRI 210/240–202X Draft and the AHRI 1600–202X Draft. More specifically, section 5 and appendices C, D, E, I, and J of AHRI 210/240–202X and AHRI 1600–202X Draft refer to methods of test in ANSI/ASHRAE 37–2009. DOE currently incorporates by reference ANSI/ASHRAE 37–2009 in 10 CFR part 430, subpart B, and the current incorporation by reference applies to the current Federal test procedure for CAC/HPs specified at appendix M1. Given that AHRI 210/240–202X Draft references ANSI/ASHRAE 37–2009 for several test instructions, DOE has tentatively concluded that it is appropriate to maintain the existing incorporation by reference of ANSI/ASHRAE 37–2009 in appendix M1. Additionally, given that the AHRI 1600–202X Draft references ANSI/ASHRAE 37–2009 for several test instructions, DOE is proposing to additionally incorporate by reference ANSI/ASHRAE 37–2009 for use with appendix M2.

4. ANSI/ASHRAE 16–2016

ANSI/ASHRAE 16–2016, which provides a method of test for rating Room Air Conditioners, Packaged Terminal Air Conditioners, and Packaged Terminal Heat Pumps, is referenced for testing CAC/HPs by both

[13] ANSI/AMCA 210–2007, ANSI/ASHRAE 51–2007, (''AMCA 210–2007'') Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating, ANSI approved Aug. 17, 2007. A copy of AMCA 210–2007 can be purchased from the Air Movement and Control Association International Inc. (''AMCA'') website at *www.amca.org/store/index.php.*

[14] ANSI/AHRI 1230–2010 with Addendum 2, (''AHRI 1230–2010''): 2010 Standard for Performance Rating of Variable Refrigerant Flow (''VRF'') Multi-Split Air-Conditioning and Heat Pump Equipment, ANSI approved Aug. 2, 2010. A copy of AHRI 1230–2010 can be obtained from AHRI, 2111 Wilson Boulevard, Suite 500, Arlington, VA 22201, USA, 703–524–8800, or by going to *www.ahrinet.org.*

[15] ANSI/ASHRAE 23.1–2010, (''ASHRAE 23.1–2010''): Methods of Testing for Rating the Performance of Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Temperatures of the Refrigerant, ANSI approved Jan. 28, 2010. A copy of ASHRAE 23.1–2010 can be obtained from the ASHRAE website at *www.ashrae.org/resources--publications.*

the AHRI 210/240–202X Draft and the AHRI 1600–202X Draft. More specifically, section 5.1.1 of AHRI 210/240–202X Draft and AHRI 1600–202X Draft refer to testing of non-ducted CAC/HPs from provisions in ANSI/ASHRAE 16–2016, or by using a combination of provisions in ANSI/ASHRAE 37–2009 and ANSI/ASHRAE 116–2016. Currently, ANSI/ASHRAE 16–2016 is not incorporated by reference in appendix M1. DOE has tentatively concluded that testing conducted per ANSI/ASHRAE 16–2016 for non-ducted CAC/HPs, will not impact ratings in comparison to testing conducted per provisions in ANSI/ASHRAE 37–2009 and ANSI/ASHRAE 116–2010. Thus, given that the AHRI 210/240–202X Draft and AHRI 1600 202X Draft refer to ANSI/ASHRAE 16–2016 as an option for testing of non-ducted CAC/HPs, and that it does not impact ratings, DOE has tentatively concluded that it is appropriate to incorporate by reference ANSI/ASHRAE 16–2016 for appendices M1 and M2.

5. ANSI/ASHRAE 116–2010

ANSI/ASHRAE 116–2010, which provides a method of test for unitary air conditioners and heat pumps with a cooling capacity of 65,000 Btu/h and less, is referenced for testing CAC/HPs by both AHRI 210/240–202X Draft and AHRI 1600–202X Draft. More specifically, sections 5, 6, 8, and 11 and appendices D and E of AHRI 210/240–202X Draft and AHRI 1600–202X Draft refer to methods of test in ANSI/ASHRAE 116–2010. Given that AHRI 210/240–202X Draft references ANSI/ASHRAE 116–2010 for several test instructions, DOE has tentatively concluded that it is appropriate to maintain the existing incorporation by reference of ANSI/ASHRAE 116–2010 in appendix M1. Additionally, given that the AHRI 1600–202X Draft references ANSI/ASHRAE 116–2010 for several test instructions, DOE is proposing to additionally incorporate by reference ANSI/ASHRAE 116–2010 for use with appendix M2.

D. Proposed CAC/HP Test Procedure

As discussed, EPCA requires that test procedures for each type of covered product, including CAC/HPs, 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 this NOPR, DOE is proposing to maintain the current efficiency metrics of SEER2 and HSPF2 in appendix M1 and is proposing to reference AHRI 210/240–202X Draft in appendix M1 for measuring the existing metrics. DOE has tentatively determined that the proposed amendments to appendix M1 would not affect the measured efficiency of CAC/HPs or require retesting solely because of DOE's adoption of the proposed amendments to the appendix M1 test procedure, if made final. Additionally, DOE is proposing to establish a new test procedure at appendix M2 that would adopt the AHRI 1600–202X Draft, including the newly proposed SCORE and SHORE metrics. Use of appendix M2 would not be required until the compliance date of any amended standards denominated in terms of the proposed new metrics for appendix M2, should such standards be adopted.

If finalized versions of AHRI 210/240 and AHRI 1600 are not published before the test procedure final rule, or if there are substantive changes between the drafts and published versions of the standards that are not supported by stakeholder comments in response to this NOPR, DOE may adopt the substance of the AHRI 210/240–202X Draft and AHRI 1600–202X Draft or provide additional opportunity for comment on the final version of that industry consensus standard.

Specifically, at appendix M1, DOE is proposing to require the following sections of the AHRI 210/240–202X Draft: sections 3 [16], 5, 6 [17], 11, and 12, and appendices D, E, G, K, and L. At appendix M2, DOE is proposing to require the following sections of the AHRI 1600–202X Draft: sections 3 [18], 5, 6 [19], 11, and 12 and appendices D, E, G, K and L.

Further, at both appendix M1 and appendix M2, DOE is proposing to incorporate by reference the following: ANSI/ASHRAE 37–2009; ANSI/ASHRAE 16–2016; and ANSI/ASHRAE 116–2010.

Issue 1: DOE requests feedback on its proposal to revise appendix M1 to incorporate by reference AHRI 210/240–202X Draft for measuring the existing metrics, SEER2 and HSPF2.

Issue 2: DOE requests feedback on its proposal to establish a new appendix M2, which would incorporate by reference AHRI 1600–202X Draft to determine the SCORE and SHORE metrics.

E. Efficiency Metrics

As discussed, DOE proposes to update the current Federal test procedure for CAC/HPs at appendix M1 consistent with the most recent draft version of the relevant industry consensus test procedure, AHRI 210/240–202X Draft. DOE is also proposing a new Federal test procedure at 10 CFR part 430, subpart B, appendix M2, consistent with the draft version of the industry consensus test procedure, AHRI 1600–202X Draft. Sections III.E.1 and III.E.2 indicate which metrics are applicable for appendices M1 and M2, respectively.

1. Metrics Applicable to Appendix M1

In the updated appendix M1, DOE proposes to maintain the current energy efficiency metrics (*i.e.,* energy efficiency ratio 2 (''EER2''), SEER2, and HSPF2), and to define a new optional metric: the peak load coefficient of performance (''COP_{peak}''), applicable to CHPs (*see* details in section III.F.2.d of this document). The proposed revisions to appendix M1 to align with the most recent draft of AHRI 210/240–202X Draft maintain the existing energy efficiency metrics, and DOE has tentatively determined that testing under the proposed appendix M1 would be consistent with the existing test procedure and there would be no impact on measured efficiencies.

2. Metrics Applicable to Appendix M2

As previously discussed in this NOPR, the proposed appendix M2 will introduce new integrated cooling and integrated heating efficiency metrics, namely SCORE and SHORE, respectively. Unlike SEER2 and HSPF2, which are seasonal energy efficiency descriptors, SCORE and SHORE are

[16] DOE is not proposing to include the following provisions from section 3 of AHRI 210/240–202X Draft because the terms are either defined in appendix M1, or are not needed for the proposed DOE test procedure: 3.2.15 (Double-duct system), 3.2.19 (Gross Capacity), 3.2.47 (Oil Recovery Mode), 3.2.52 (Published Rating), 3.2.64 (Standard Filter), 3.2.80 (Unitary Air-conditioner), and 3.2.81 (Unitary Heat Pump).

[17] DOE is not proposing to include the following provisions from section 6 of AHRI 210/240–202X Draft because the provisions are either defined in 10 CFR 429.16, or are not needed for the proposed DOE test procedure: 6.1.8 (Tested Combinations or Tested Units), 6.2 (Application Ratings), 6.3 (Publication of Ratings), 6.4 (Ratings), and 6.5 (Uncertainty and Variability).

[18] DOE is not proposing to include the following provisions from section 3 of AHRI 1600–202X Draft because the terms are either defined in appendix M1, or are not needed for the proposed DOE test procedure: 3.1.15 (Double-duct System), 3.1.19 (Gross Capacity), 3.1.47 (Oil Recovery Mode), 3.1.52 (Published Rating), 3.1.65 (Standard Filter), 3.1.80 (Unitary Air-conditioner), and 3.1.81 (Unitary Heat Pump).

[19] DOE is not proposing to include the following provisions from section 6 of AHRI 1600–202X Draft because the provisions are either defined in 10 CFR 429.16, or are not needed for the proposed DOE test procedure: 6.1.8 (Tested Combinations or Tested Units), 6.2 (Application Ratings), 6.3 (Publication of Ratings), 6.4 (Ratings), and 6.5 (Uncertainty and Variability).

integrated metrics that include off-mode power, $P_{W,OFF}$. Hence, appendix M2 will not require separate representations for off-mode power.

DOE is proposing to retain EER2 in appendix M2, with EER2 evaluated in the same way as it was in appendix M1. DOE is also proposing the determination of an optional metric, COP_{peak}, as discussed in section III.E.1 of this document, in appendix M2.

F. Near-Term Changes in the CAC/HP Test Procedure

The following sections discuss issues that affect the CAC/HP test procedure in the near-term—*i.e.,* they will be effective 180 days after publication of the final rule. As previously explained, these near-term revisions are implemented at appendix M1 via incorporation by reference of the relevant industry consensus test procedure, AHRI 210/240–202X Draft. DOE has reviewed AHRI 210/240–202X Draft and has concluded that it satisfies the EPCA requirement that test procedures should not be unduly burdensome to conduct and should be representative of an average use cycle. (42 U.S.C. 6293(b)(1)(A)) These near-term amendments in appendix M1 would not alter the measured efficiency of CAC/HPs in terms of the current cooling and heating test metrics, SEER2 and HSPF2, respectively.

DOE clarifies that while all issues discussed subsequently are considered near-term, they are also part of the long-term CAC/HP test procedure—*i.e.,* these revisions are also included in AHRI 1600–202X Draft, which DOE is proposing to incorporate by reference at appendix M2. As such, when discussing these near-term changes, DOE makes references to both AHRI 210/240–202X Draft and AHRI 1600–202X Draft.

1. Representativeness of Fixed Speed Testing for Variable Speed (VS) Systems

(a) Background

Appendix M1 uses a steady-state test concept where test room conditions are kept within narrow operating tolerances for each test point, and the CAC/HP system is manually controlled to operate at the specified compressor speed and airflow rate for each test point. In the October 2022 Final Rule, several stakeholders encouraged DOE to review ways to improve the representativeness of the test procedures for CAC/HPs (especially variable speed), particularly to examine test procedures where the unit operates under its own native controls in responding to conditioning loads (*i.e.,* load-based testing).[20] DOE stated in the October 2022 Final Rule that the rulemaking had been initiated only to address a limited number of known issues in the current appendix M1 method, including those raised through the test procedure waiver process. 87 FR 64554, 64554. However, DOE also responded that in order to satisfy the 7-year lookback requirement (see 42 U.S.C. 6293(b)(1)(A)), a future rulemaking may address more comprehensively the issues raised by the commenters. (*Id.*)

As discussed in section I.B of this document, on January 24, 2023, DOE published the January 2023 RFI in order to collect data and information regarding the need to amend the test procedures for CAC/HPs, to address issues raised by commenters in the October 2022 Final Rule, and in satisfaction of the 7-year review requirement specified in EPCA. (42 U.S.C. 6293(b)(1)(A)). 87 FR 64554, 64554. In the January 2023 RFI, DOE requested comments, information, and data pertaining to the consideration of load-based testing methodologies under development by various organizations and whether certain aspects of these methodologies might be adopted into the DOE test procedure. 88 FR 4091, 4098–4101. Among the load-based testing methodologies summarized by DOE in the January 2023 RFI was the first edition of Canadian Standard Association (''CSA'') EXP07:19, ''Load-based and climate-specific testing and rating procedures for heat pumps and air conditioners'' (''EXP07''). 88 FR 4091, 4095. DOE notes that EXP07 was superseded by CSA SPE–07:23 [21] (''SPE07'') in January 2023, an updated version of EXP07 with changes made based on comments received during a technical review period.

(b) Comments Received

In response to the January 2023 RFI, DOE received a variety of comments related to various aspects of load-based testing. The comments are summarized in the following sub-sections, segregated by topic as appropriate.

(1) Repeatability and Reproducibility

In the January 2023 RFI, DOE presented several initiatives and programs that were investigating, researching, and/or developing load-based test methods. 88 FR 4091, 4095–4098. DOE requested data and information to quantify which of these load-based methods—and any other that DOE is not aware of—had higher repeatability and reproducibility compared to the others, and also compared to fixed-speed tests. 88 FR 4091, 4099.

In response, Samsung, Carrier, Daikin, Rheem, AHRI, and Lennox all commented that available test data have shown that the repeatability and reproducibility of load-based methods is not on par with current fixed-speed testing used for regulatory purposes. (Samsung, No. 11 at p. 1; Carrier, No. 5 at pp. 2–3; Daikin, No. 16 at pp. 2–3; Rheem, No. 12 at pp. 2–3; AHRI, No. 14 at pp. 8–9; Lennox, No. 6 at p. 3) Samsung asserted that adopting something unproven, like the load-based test methods, may create a chaotic situation in the marketplace, and will create additional test burden for manufacturers since load-based testing methods do not address alternative efficiency determination methods (''AEDMs''). (Samsung, No. 11 at p. 1)

Carrier referred to the Technology Collaboration Program of Energy Efficient End-use Equipment, International Energy Efficiency (''4E IEA'') [22] and AHRI 8026 [23] initiatives, which showed that load-based testing of the same units across different facilities showed high variability, and commented that more work and research needs to be done in order to reduce this variability before adopting load-based testing for determining energy efficiency of CAC/HP systems. (Carrier, No. 5 at pp. 2–3) Daikin also commented that until all issues pertaining to load-based testing are fully vetted, there would be significant problems with repeatability and reproducibility. (Daikin, No. 16 at pp. 2–3) Daikin mentioned several items that contribute to variability in load-

[20] A load-based test method differs from the steady-state test method currently used in DOE test procedures for air conditioning and heat pump equipment. In a steady-state test method, the indoor room is maintained at a constant temperature throughout the test. In this type of test, any variable speed or variable-position components of air conditioners and heat pumps are set in a fixed position, which is typically specified by the manufacturer. In contrast, a load-based test has the conditioning load applied to the indoor room using a load profile that approximates how the load varies for units installed in the field. In this type of test, an air conditioning system or heat pump is allowed to automatically determine and vary its control settings in response to the imposed conditioning loads rather than relying on manufacturer-specified settings.

[21] SPE07 is available for download at: *wwwcsagroup.org/store/product/CSA%20SPE-07:23/.*

[22] ''AC/HP Test Methods Investigative Testing: Phase 2 Preliminary Findings'' 4E IEA presentation (May 7, 2021). *See www.iea-4e.org/wp-content/uploads/2021/08/AC-HP-Test-Methods-Phase-2-key-Findings-2021-08-06-CLEAN.pdf.*

[23] Dhillon, P., Horton, W.T., & Braun, J.E. (2022). AHRI 8026—Repeatability and Reproducibility Assessment of CSA EXP07:19 and AHRI 210–240:2023. Air Conditioning, Heating, and Refrigeration Institute.

based testing, such as the controller (room thermostat), controller setup, control modifications in the test chamber, and the application of the load. (*Id.* at pp. 2–3) Daikin also requested that stakeholders thoroughly evaluate the secondary capacity check process during load-based testing, and compare that with the accuracy, repeatability, and reproducibility of conventional fixed-speed testing. (Daikin, No. 16 at p. 12)

Rheem and AHRI both referred to the results of AHRI 8026. (Rheem, No. 12 at pp. 2–3; AHRI, No. 14 at pp. 8–9) Rheem commented that per AHRI 8026, the transient conditions during load-based testing cause poorer repeatability and reproducibility in comparison to fixed-speed testing currently in appendix M1. (Rheem, No. 12 at pp. 2–3) Rheem further stated that even with appendix M1 testing, reproducibility of transient components like cyclic degradation and defrost can be challenging. (*Id.*) AHRI commented that AHRI 8026 results revealed concerns when it comes to repeatability and reproducibility of performance metrics of load-based testing. (AHRI, No. 14 at pp. 8–9) Further, AHRI noted that there are no analyses of control system parameter variability available for load-based testing, and that such analyses would require significant investments in lab facilities and technical training and none of the load-based testing methods address the use of AEDMs. (*Id.*) Similarly, Lennox mentioned several items that affect the repeatability and reproducibility of load-based testing, including the varying degrees of test burden in the different methods, changes required to lab facilities to accommodate load-based testing, interaction between the unit under test and the lab facility, and how the lab facility affects the load-based tests. (Lennox, No. 6 at p. 3) Lennox expressed concern over the fact that labs may need to significantly invest in their facilities and resources if their present setups were found to positively or negatively influence load-based test results. (*Id.*)

NEEA commented that a pre-defined load test [24] may have greater repeatability and reproducibility in comparison to an adaptive load test, because multiple variables need to be controlled for an adaptive load, and there are several interactive effects between unit performance and test lab conditions. (NEEA, No. 13 at p. 6) NEEA referred to the 4E IEA program,[25] stating that preliminary results from phase 4 of 4 are expected to be available by mid-summer 2023, with full study results to be released at the end of 2023 or early in 2024. (*Id.*)

(2) Field Performance

In the January 2023 RFI, DOE requested data showing that load-based testing was more representative of field performance, in comparison to conventional fixed-speed and fixed-setting test procedures. 88 FR 4091, 4099. DOE also requested data that would indicate whether CAC/HP units that performed poorly in the lab, when tested using load-based methods, also performed poorly in the field. *Id.*

Carrier commented that it was not aware of publicly available data showing that load-based test methods are more or less representative than fixed-speed and fixed-setting test procedures. (Carrier, No. 5 at p. 3) Carrier further commented that even though there is value in verifying the operation of variable speed systems, it was unclear if a load-based test method would provide more representative tests in comparison to fixed-speed testing with a controls verification procedure (''CVP'') to confirm unit operation at the speeds specified in the fixed-speed tests. (*Id.*) Similarly, Daikin stated that even though several studies are being conducted, there is a general lack of information and data to substantiate whether load-based testing or fixed-speed testing is more representative of real-world scenarios. (Daikin, No. 16 at p. 3) Daikin expressed concern over the fact that load-based test methods, such as SPE07, do not account for real-world scenarios when a CAC/HP is installed with a controller (or room thermostat) of a different brand than the manufacturer of the CAC/HP. (*Id.*) Daikin commented that if controller operation is central to load-based testing, then smart thermostat manufacturers would also need to provide ratings when their product is matched with another manufacturer's CAC/HP, similar to the process followed by independent coil manufacturers (''ICMs'') for representing the ratings of their indoor coils with different combinations of other manufacturers' outdoor coils. (*Id.*) Daikin also commented that load-based test methods currently do not address AEDM calculation methods for non-tested combinations (''NTCs''), nor do they have a method for ICMs to rate their indoor coil products with an outdoor unit that has been tested using load-based methods. (*Id.*)

Rheem commented that while it believed more studies are needed for evaluating the representativeness of load-based methods, field performance is very dependent on installation practices. (Rheem, No. 12 at p. 3) The CA IOUs commented that the current appendix M1 test procedure uses fixed compressor speeds and air volume rates with fixed indoor and outdoor temperature conditions, and is thus not representative of field use, indicating that the energy efficiencies may be misinterpreted. (CA IOUs, No. 10 at pp. 1–2)

(3) Test Burden

A critical component of load-based testing is the relevant burden(s) associated with the testing—*i.e.,* total testing time, time needed for control system learning, number of official test points, time required to transition between test points, upgrades to laboratory equipment, and cost and time associated with training technicians to be able to conduct load-based testing. In the January 2023 RFI, DOE requested comment from stakeholders on information pertaining to the aforementioned test burdens. 88 FR 4091, 4099.

In response, Carrier, Daikin, and Rheem commented that the test burden of load-based testing is generally more than that of fixed-speed testing. (Carrier, No. 5 at pp. 3–4; Daikin, No. 16 at pp. 3–4; Rheem, No. 12 at pp. 3–4) Regarding costs, Carrier commented that lab investments will be needed to emulate Virtual Building Load (''VBL''),[26] and Rheem commented that even though predicting the cost impact of emerging load-based methods is difficult, there will definitely be costs associated with changes to test chambers and equipment that manufacturers will have to bear. (Carrier, No. 5 at pp. 3–4; Rheem, No.

[24] In its comment, NEEA defined a pre-defined load test as those where the unit under test (UUT) is subjected to pre-defined sensible or latent loads, and stated that the 4E program and the DOE CCHP Tech Challenge were examples of such a load based test method. They defined adaptive load test methods as those where a constant or variable sensible and latent is applied to the UUT, but the magnitude of the load can be altered, based on unit behavior, and stated that the SPE07 was an example of such a method.

[25] ''AC/HP Test Methods Investigative Testing: Phase 2 Preliminary Findings'' 4E IEA presentation (May 7, 2021). *See: www.iea-4e.org/wpcontent/uploads/2021/08/AC-HP-Test-Methods-Phase-2-key-Findings-2021-08-06-CLEAN.pdf.*

[26] Virtual Building Load is a load-based or native controls test procedure during which the software that controls the indoor test room conditions (*i.e.,* operates the indoor room reconditioning system) is programmed to mimic the response of building heating or cooling in real time by monitoring the capacity of the unit under test and adjusting the indoor room conditions according to the virtual building model. The virtual building model defines the time-dependent rate of change of the indoor room temperature and humidity conditions as a function of the target building load and the measured capacity of the tested system.

12 at pp. 3–4) Carrier and Daikin both commented that load-based testing methods would require more time to conduct due to the higher number of tests involved. (Carrier, No.5 at pp. 3–4; Daikin, No.16 at pp. 3–4)

Daikin also stated that during new product development, manufacturers only have to do a subset of appendix M1 tests, often iteratively, because results of those subsets are enough to inform the manufacturer of the design changes needed. (Daikin, No. 16 at pp. 3–4) Daikin commented that due to lack of experience with load-based methods such as SPE07, it would not be possible to do quick assessments like these. (*Id.* at pp. 3–4) Finally, Daikin stated that changes to refrigerant regulations that will occur in 2023 will require a full redesign of the products, and manufacturers may not be able to accomplish that in a timely manner using load-based methods. (*Id.*)

Rheem referred to the 4E IEA project report, in which it was estimated that the additional test burden due to the Target Compensation Load method will have a 60-percent to 250-percent increase in test burden. (Rheem, No. 12 at pp. 3–4) Rheem commented that load-based test methods would require changes to control schemes, additional test setups, and additional equipment, due to rapidly changing loads inside the chamber. (*Id.*) Rheem referred to several research studies [27] [28] that showed load-based test methods are influenced by the thermal inertia of the psychrometric chambers in which the tests are conducted; thus, adaptation of the control system to this thermal inertia may be a time-consuming process. (*Id.*) AHRI stated that even though the value of load-based testing remains unknown, the burden has been quantified. (AHRI, No. 14 at p. 5)

In summary, all comments received indicated that the test burden for load-based testing will be higher than that of conventional fixed-speed testing laid out in appendix M1.

(4) Thermostat Selection and Built-In Control Firmware

Thermostats (*i.e.,* ''control systems'') can vary significantly in their control algorithms and communication with the unit under test. Thus, thermostat selection can play a key role in the results of load-based tests. In the January 2023 RFI, DOE requested comment on several impacts of thermostats with respect to load-based testing, including the observed range of performance of the same unit tested with different thermostats, and consideration of whether a thermostat needs to be certified as part of the tested combination. 88 FR 4091, 4099. DOE also requested comment on what percentage of thermostats may be updated remotely versus in the field, and how unit behavior in the field depends on thermostats shipped with the unit versus those purchased from third-party suppliers. (*Id.*)

In response to this issue, DOE received comments from several stakeholders. Carrier and Rheem commented that thermostats have a big impact on load-based test results. (Carrier, No. 5 at p. 4; Rheem, No. 12 at p. 4) Carrier commented that since the majority of HVAC systems in the market are not installed with a manufacturer's thermostat, it would not be feasible for manufacturers to test with the different thermostats available. (Carrier, No. 5 at p. 4) Carrier further stated that only variable speed systems shipped with the manufacturer's thermostat should have certification requirements. (*Id.*) The Joint Advocates and NYSERDA encouraged DOE to require certification of thermostats as part of the tested combination. (Joint Advocates, No. 8 at p. 2; NYSERDA, No. 9 at pp. 6–7) Specifically, the Joint Advocates encouraged DOE to investigate how the performance of single-stage, two-stage, and variable speed equipment is impacted by integrations of different thermostats, and to develop testing requirements for ensuring that the tested thermostat is representative of the one selected in the field. (Joint Advocates, No. 8 at pp. 2–3)

NYSERDA commented that thermostat selection will be integral to a CVP, which verifies that the manufacturer's supplemental testing instructions for setting critical parameters during fixed-speed testing are within the range of critical parameters that the system would utilize when operating under its native controls. (NYSERDA, No. 9 at pp. 6–7) NYSERDA further commented that communicating systems may only be compatible with certain thermostats; hence, DOE should have a regulatory requirement that discourages pairing such systems with third-party thermostats. (*Id.*) However, NYSERDA recognized that in some situations, such as for blower coil indoor units, the system has communication technology built in that allows the use of any thermostat, which may not require certification with external thermostats. (*Id.* at p. 7) NYSERDA concluded that the actual firmware governing unit behavior is built into the unit, and not into the thermostat, meaning that updated testing would be required only in instances when the updated firmware results in an updated model number. (*Id.*) AHRI stated that certification requirements will be complicated with thermostats, especially when utilizing those that are not specified by the manufacturer. (AHRI, No. 14 at pp. 9–10) AHRI also stated that different thermostats will give different load-based test results, and referred to an article stating that smart thermostats were only being used by 16 percent of households. (*Id.*)

Daikin commented that due to the limited time allowed for submitting comments in response to the January 2023 RFI, it did not have thermostat-associated data to share with DOE other than that from its own ''Daikin One'' thermostat. (Daikin, No. 16 at pp. 4–5) Daikin stated that several issues pertain to thermostat selections, making load-based testing unrepresentative of real-world situations; for instance, Daikin questioned whether, in the case of systems installed with smart thermostats like Nest or EcoBee, the unit manufacturer will be responsible for rating the system if the thermostat receives a remote firmware upgrade. (*Id.*)

Several commenters referred to Annex I of SPE07, which outlines a Thermostat Environment Emulator (''TEE'') developed by Purdue University that is a thermostat enclosure aimed at providing controlled airflow and temperature distribution to the air sensed by the thermostat. (Daikin, No. 16 at pp. 4–5; Joint Advocates, No. 8 at p. 3; NYSERDA, No. 9 at p. 7) Specifically, Daikin commented that the TEE demonstrated that thermostat location is an integral part of unit performance, but such an enclosure is not representative of real-world installations. (Daikin, No. 16 at pp. 4–5) In contrast, the Joint Advocates encouraged DOE to adopt something similar to the TEE in its test procedure so that reproducibility issues occurring between the various indoor rooms of psychrometric chambers (that conduct

[27] Cremaschi, L., & Perez Paez, P. (2017). Experimental feasibility study of a new load-based method of testing for light commercial unitary heating, ventilation, and air conditioning (ASHRAE RP–1608). Science and Technology for the Built Environment, 23(7), 1178–1188. Available at *www.tandfonline.com/doi/full/10.1080/23744731.2016.1274628*.

[28] Göbel, S.A., Zottl, A., Noack, R., Mock, D., Wachau, A., Vering, C., & Müller, D. (2022, August). How to calibrate heat pump test stands for load-based testing—Towards technology-neutral prescriptions [Paper presentation]. 14th International Conference on Applied Energy, ICAE22, August 8–11, 2022, Bochum, Germany. Available at *www.ebc.eonerc.rwth-aachen.de/go/id/dncb/file/855717?lidx=1*.

load-based testing) may be mitigated. (Joint Advocates, No. 8 at p. 3)

Rheem pointed out that temperature sensors inside thermostats may not be as responsive or accurate as laboratory-grade temperature sensors, and because of this, temperature offsets are often necessary for tests done under native controls. (Rheem, No. 12 at p. 4) Rheem further commented that since these offsets may be influenced by the air flow rate over the thermostat, thermostat location, and orientation, there may be a requirement to dynamically modify this offset as the load-based test proceeds. (*Id.*) Rheem stated that remote update of unit/controller firmware is a relatively new feature, and therefore not as widely available as firmware updates done in the field by service technicians. (*Id.*)

(5) Utilizing Distinct Test Methods for Different Purposes

In the January 2023 RFI, DOE requested comment on whether there are any load-based methods that are being used for regulatory or voluntary incentive-based programs. 88 FR 4091, 4100. Rheem, AHRI, and NYSERDA all commented that they are unaware of any load-based methods being used for the aforementioned purposes. (Rheem, No. 12 at p. 4; AHRI, No. 14 at p. 10; NYSERDA, No. 9 at p. 9) Daikin commented that in 2024, U.S. Environmental Protection Agency (''EPA'') ENERGY STAR® Version 6.1 specifications (''ENERGY STAR Spec V6.1'') [29] will be required for the Canada Greener Homes Program, even though currently it is an optional load-based method applicable only to cold climate heat pumps (''CCHPs''). (Daikin, No. 16 at p. 5) Daikin pointed out that due to the resources and efforts required to develop new products with low global warming potential (''GWP'') refrigerants like R32, Daikin doubts it will engage in any non-mandatory load-based testing. (*Id.*) NYSERDA referred to three initiatives associated with load-based testing, namely (1) the Canadian market transformation roadmap presented at the 2018 Energy and Mines Ministers' Conference,[30] (2) British Columbia's 2022 Heat Pump Technology Attraction Strategy,[31] and (3) a plan for differentiating advanced heat pumps using load-based testing criteria in the Northeast Energy Efficiency Partnerships (''NEEP'') qualified product list.[32] (NYSERDA, No. 9 at pp. 8–9) NYSERDA encouraged incentive-based approaches for advanced heat pumps that include: (1) a CVP to identify unit operation under native controls, (2) using regional HSPF2 to differentiate advanced heat pumps, and (3) prescribing capacity maintenance and coefficient of performance (''COP'') levels at 5 °F, similar to those in the ENERGY STAR Spec V6.1 requirements. (*Id.* at p. 9)

(6) Comparison of Test Conditions of Appendix M1 and SPE07

In the January 2023 RFI, DOE provided a detailed explanation of the first edition of EXP07. 88 FR 4091, 4095. As previously mentioned, EXP07 was superseded by SPE07, an updated version of EXP07 with changes made based on comments received during a technical review period in January 2023. SPE07 is a load-based methodology where the unit under test is allowed to respond to a thermostat installed in the return air stream, while the indoor room conditioning equipment control is used to adjust that temperature (to represent heating or cooling conditioning load), mimicking the response of a typical building. The test sequences through a set of representative outdoor room conditions. In the January 2023 RFI, DOE pointed out that these test conditions differ from those laid out in appendix M1. 88 FR 4091, 4100. Due to these differences, DOE requested comment on how unit performance would compare when tested using the SPE07 test conditions (indoor as well as outdoor) and the appendix M1 test conditions. *Id.* DOE further requested feedback on the pros and cons of potentially revising the test conditions in appendix M1. *Id.*

AHRI pointed out that the concept of SPE07 is interesting from a research perspective but not suitable for regulatory purposes. (AHRI, No. 14 at p. 5) AHRI noted that the seasonal COP metrics in SPE07 are climate zone dependent, and there is no metric that calculates unit performance at a national average level. (AHRI, No. 14 at pp. 5–6) AHRI pointed to 42 U.S.C. 6291(22), to state that the seasonal COP metrics cannot be adopted by DOE in appendix M1 as the efficiency descriptors. (*Id.* at p. 6) Further, AHRI commented that SPE07 is currently not applicable to coil-only systems, which means that if adopted, the process of certification and enforcement for split systems would need to be overhauled. (*Id.*) AHRI also pointed that SPE07 currently does not address AEDMs, which implies that a regulatory regime under SPE07 would create significant test burden due to the large number of rated combinations of split-system units. (*Id.*) AHRI referred to the testing reporting requirements in appendix M1 for variable speed mini and multi-splits, stating that SPE07 does not properly define requirements for established ratings for these products. (*Id.* at p.7) Finally, AHRI cited a section of 42 U.S.C 6293(b)(3) to point out that test procedures should not be unduly burdensome to conduct.[33] (*Id.*) AHRI commented that its commentary is limited to SPE07, stating that it is the most developed and established load-based methodology, but AHRI still does not see a viable pathway for SPE07 moving forward. (*Id.*)

Daikin and Rheem both commented that since appendix M1 and SPE07 have different performance metrics, their ratings cannot be compared. (Daikin, No. 16 at p. 5; Rheem, No. 12 at pp. 4–5) Daikin commented that it lacks data that can be shared comparing appendix M1 and SPE07 testing. (Daikin, No. 16 at p. 5) Daikin pointed out that the different indoor dry bulb and wet bulb temperature setpoints in appendix M1 and SPE07 would lead to different efficiencies, and the higher number of test points in SPE07 adds to test burden. (Daikin, No. 16 at p. 5) Daikin referred to how the tolerance of 10 percent was chosen when commercial HVAC products moved to a seasonal metric (integrated energy efficiency ratio (''IEER'')), from a peak load metric (*i.e.,* EER), rather than 5 percent, indicating that the tolerance for certified ratings would have to be increased if DOE adopted a load-based testing method for regulatory purposes. (*Id.* at p. 6)

Rheem referred to a research paper [34] to back its claim that relative rankings

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[29] Version 6.1 of the ENERGY STAR specification for CAC/HPs, revised in January 2022, can be found at *www.energystar.gov/products/spec/central_air_conditioner_and_air_source_heat_pump_specification_version_6_0_pd.*

[30] NYSERDA referred to p. 32 of the 2018 report titled ''Paving the Road to 2030 and Beyond: Market transformation road map for energy efficient equipment in the building sector.'' Available at *www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/electricity-alternative-energy/energy-efficiency/18-00072-nrcan-road-map-eng.pdf.*

[31] NYSERDA referred to pages 20, 25, and 26 of the Vancouver Energy Commission's *BC Heat Pump Technology Attraction Strategy,* available at *vancouvereconomic.com/wp-content/uploads/2022/11/11-2022-BC-Heat-Pump-Strategy-Report-Web-1.1.pdf.*

[32] NYSERDA referred to page 14 of the ''Advanced Heat Pump White paper,'' available at *www.mwalliance.org/sites/default/files/media-document/Advanced%20HP%20Whitepaper%20v1.13.pdf.*

[33] From this comment, DOE considers that AHRI wanted to make the point that SPE07, as it currently stands, is unduly burdensome.

[34] Dhillon, P., Horton, W. T., & Braun, J. E. (2022). Comparison of residential heat pump heating seasonal performance based on load-based and steady-state testing methodologies. ASHRAE Transactions, 128(1), 181–189. Available at

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of SPE07 and appendix M1 are impossible. (Rheem, No. 12 at pp. 4–5) Rheem further pointed out that since the indoor dry bulb and wet bulb temperature in appendix M1 are the same for all tests, the time for testing is optimized. (*Id.*) Similarly, Carrier commented that research currently in progress would enable a comparison of the ranking of units when tested with appendix M1 and SPE07, but any conclusions cannot be reached currently. (Carrier, No. 5 at pp. 4–5) Samsung supported AHRI's comment on SPE07 and stated that load-based testing is not currently at a stage where it may be adopted as the mandatory test procedure by DOE. (Samsung, No. 11 at p. 1)

BC Hydro strongly encouraged DOE to adopt SPE07 as the next test procedure for CAC/HPs and referred to four NEEA papers [35] that highlighted lessons learned from EXP07 testing that prompted the update to SPE07. (BC Hydro, No. 15 at pp. 1–2) Similarly, both the CA IOUs and the Joint Advocates referred to a NEEP representativeness project [36] and encouraged DOE to update the CAC/HP test procedure on the basis of those results. (CA IOUs, No. 10 at p. 2; Joint Advocates, No. 8 at p. 2) NYSERDA commented that more work needs to be done in order to consider the VBL approach (used as the basis of testing in SPE07), and specifically referred to additional efforts needed to ensure the repeatability and reproducibility of this method—namely, field data to validate lab data, lab-to-lab round robin testing, and an uncertainty analysis method that accounts for the unit under test's embedded controls and thermostat. (NYSERDA, No. 9 at p. 6)

Regarding test conditions, NYSERDA commented that it did not have specific analysis about the overall outdoor conditions but did point out: (1) SPE07 focuses on more extreme outdoor conditions; (2) different rankings of appendix M1 metrics and load-based testing results are mainly due to the influence of the unit's native controls on operation and any minor changes to the appendix M1 test conditions will not have a big impact on rankings; and (3) the addition of a hot-dry SEER2 rating would better capture performance at extreme climates.[37] (NYSERDA, No. 9 at p. 10) AHRI recommended that a fair comparison of appendix M1 and SPE07 would involve a study where the test conditions of each are swapped and the test results compared. (AHRI, No. 14 at p. 10) AHRI added that measurement uncertainties associated with both procedures should be accounted for in the comparison as well. (*Id.*)

(7) Communicating and Non-Communicating Variable Speed Systems

Controls used with CAC/HPs may transfer information between system components (*i.e.,* communicating systems), or they may use more conventional low-voltage on-off signals to indicate ''calls'' for space conditioning and/or consumer selection of fan settings (*i.e.,* non-communicating). Communicating systems are defined as those that communicate the difference between space temperature and space setpoint temperature to the control that sets compressor speed and provides a signal to the indoor fan to set fan speed appropriate for compressor staging and air volume rate. 87 FR 16830, 16837. In the January 2023 RFI, DOE requested test data that could potentially show how the performance of communicating and non-communicating variable speed CAC/HPs compares when tested using load-based methods, and how do load-based methods address modulation of compressor speed for systems equipped with non-communicating controls. 88 FR 4091, 4100.

In response, Daikin, Rheem, AHRI, and NYSERDA commented that they are not aware of any test or field data comparing the performance of communicating and non-communicating systems when tested using load-based methods. (Daikin, No. 16 at p. 6; Rheem, No. 12 at p. 5; AHRI, No. 14 at pp. 10–11; NYSERDA, No. 9 at p. 10)

Daikin commented that load-based test methods would incentivize manufacturers to develop control schemes that optimize performance in the test lab rather than in the field. (Daikin, No. 16 at p. 6) Daikin further stated that the definition adopted by DOE in the October 2022 Final Rule [38] for Variable Speed Coil-Only systems was too restrictive and will limit technology and progress. (*Id.*)

Rheem commented that even for non-communicating systems, operating parameters of the refrigeration cycle are affected by the heat sink temperatures and heat source. Rheem listed suction pressure, liquid line pressure, return gas temperature, and liquid line temperature as the parameters, and cited a research paper [39] that outlined a variable system controlled by refrigerant superheat. (Rheem, No. 12 at p. 5)

NYSERDA commented that a non-communicating thermostat would not typically allow the variable speed system to modulate, and the system will simply cycle on and off like a single-speed system. (NYSERDA, No. 9 at p. 10) NYSERDA cited a research paper indicating that for low-load conditions, variable speed units suffer more from cycling losses in comparison to single-stage and two-stage systems. (*Id.*)

(8) Load-Based Testing for Single-Stage and Two-Stage Systems

In the January 2023 RFI, DOE requested comment on whether there

www.techstreet.com/standards/lv-22-c025-comparison-of-residential-heat-pump-heating-seasonal-performance-based-on-load-based-and-steady-state-testing-methodologies?product_id=2505150.

[35] Heat Pump and Air Conditioner Efficiency Ratings: Why Metrics Matter. Available at *neea.org/resources/heat-pump-and-air-conditioner-efficiency-ratings-why-metrics-matter*.

EXP07:19 Load-Based and Climate-Specific Testing and Rating Procedures for Heat Pumps and Air Conditioners. Available at *neea.org/resources/exp0719-load-based-and-climate-specific-testing-and-rating-procedures-for-heat-pumps-and-air-conditioners*.

CSA EXP07: Ongoing Progress, Lessons Learned, and Future Work in Load-based Testing of Residential Heat Pumps. Available at *neea.org/resources/csa-exp07-ongoing-progress-lessons-learned-and-future-work-in-load-based-testing-of-residential-heat-pumps*.

EXP07 Value Engineering Memo and PowerPoint. Available at *neea.org/resources/exp07-value-engineering-memo-and-powerpoint*.

[36] The NEEP Heat Pump Rating Representativeness Project. Available at *neep.org/sites/default/files/media-files/hp_representativeness_research_project-rfp_7.7.21.pdf*.

[37] In one of its comments, NYSERDA referred to the contents in Table II–1, which outlines the applicability of the load-based methods to equipment types (ducted or non-ducted), and the capacity measurement procedure (calorimetric room or air enthalpy method). (NYSERDA, No. 9 at p. 9) NYSERDA commented that DOE did not point out that SPE07 applies to ducted equipment, and the ENERGY STAR CCHP CVP applies to non-ducted equipment. DOE would like to point out that it did, in fact, indicate in the table that SPE07 and the ENERGY STAR CCHP CVP are applicable to ducted and non-ducted equipment, respectively.

[38] Section 1.2 of appendix M1 defines ''Communicating Variable Speed Coil-Only Central Air Conditioner or Heat Pump'' as follows: Variable speed Communicating Coil-Only Central Air Conditioner or Heat Pump means a variable speed compressor system having a coil-only indoor unit that is installed with a control system that (a) communicates the difference in space temperature and space setpoint temperature (not a setpoint value inferred from on/off thermostat signals) to the control that sets compressor speed; (b) provides a signal to the indoor fan to set fan speed appropriate for compressor staging and air volume rate; and (c) has installation instructions indicating that the required control system meeting both (a) and (b) must be installed.

[39] Yang, D. S., Lee, G., Kim, M. S., Cho, Y. M., Hwang, Y. J., & Chung, B. Y. (2004). *A study on the capacity control of a variable speed vapor compression system using superheat information at compressor discharge*. In *10th International Refrigeration and Air Conditioning Conference at Purdue, July 12–15, 2004*. Purdue University Libraries, West Lafayette, IN. Available at *docs.lib.purdue.edu/iracc/689/*.

are aspects of single- and two-stage system operation that are not adequately captured by appendix M1, and if load-based testing should be applicable to them. 88 FR 4091, 4101. DOE also requested comment on whether the current cyclic tests in appendix M1 adequately capture cyclic losses associated with cycling of compressors when unit capacity exceeds building load. (*Id.*)

In response, the Joint Advocates commented that even though load-based testing is best suited to accurately capture part-load operation of variable speed systems, it may be beneficial to apply it to single-stage and two-stage systems. (Joint Advocates, No. 8 at p. 2) In contrast, Carrier commented that appendix M1 captures the performance of single- and two-stage systems adequately, and the application of load-based testing to these systems will not provide any value. (Carrier, No. 5 at p. 5) Daikin commented that if fixed-speed testing (currently in appendix M1) is used for single-stage and two-stage products and load-based testing is used for variable speed products, then it will not be possible to compare these products on an equivalant basis. (Daikin, No. 16 at p. 6) Similarly, Rheem pointed out that load-based testing is mainly appropriate for variable speed products, and its suitability for single-stage and two-stage systems is questionable. (Rheem, No. 12 at p. 5) AHRI commented that any test procedure needs to compare different equipment classes on an equal basis. (AHRI, No. 14 at p. 11)

Regarding cyclic losses, the Joint Advocates commented that appendix M1 fails to properly account for the cycling performance of units. (Joint Advocates, No. 8 at p. 2) The Joint Advocates referred to the current method of calculating the cyclic degradation coefficient in appendix M1 [40] and cited a research paper [41] to highlight the issues in this calculation methodology. (*Id.*) Daikin pointed out the unsuitability of load-based tests for capturing cyclic losses, by stating that the cyclic tests in appendix M1 are executed with dry indoor coils since it is not easy to measure briskly changing moisture content during these tests. (Daikin, No. 16 at p. 6) Daikin added that for load-based cyclic tests, the coils will get wet, which will lead to concerns with the repeatability and reproducibility of capturing cyclic losses using load-based methods. (*Id.*)

(9) Other Factors Affecting System Energy Use

In the January 2023 RFI, DOE requested comment on how load-based testing could be used to capture other parameters that affect energy use of CAC/HPs, particularly, but not limited to, defrost systems, operation of electric resistance heat, operation of fans during the shoulder season, and operation of crankcase heaters during off-mode hours. 88 FR 4091, 4101.

In response, Rheem commented that most power consumption is accounted for in the off-mode test procedure,[42] except fan-only operation, which may be difficult to capture in a load-based test since outside air is not introduced during operation. (Rheem, No. 12 at p. 5) AHRI commented that incorporation of the parameters and aspects mentioned by DOE would result in the need for new energy efficiency descriptors. (AHRI, No. 14 at p. 11) NYSERDA recommended that DOE adopt an average space heating capacity adjustment using a defrost degradation coefficient consistent with the provisions of a test procedure term sheet issued by the Appliance Standards and Rulemaking Federal Advisory Committee Commercial Unitary Air Conditioner and Heat Pump Working Group on December 15, 2022 (''2022 ASRAC CUAC and CUHP WG TP term sheet'').[43] (NYSERDA, No. 9 at pp. 10–11) NYSERDA commented that the cyclic defrost tests in appendix M1 (at outdoor temperature of 35 °F) could still be applicable for evaluating the maximum defrost degradation. (*Id.*)

(c) Commenter Conclusions Regarding Load-Based Testing

In general, almost all commenters pointed toward several issues with load-based testing that make it infeasible for adoption as a regulatory test method at this time. Carrier commented that it is strongly opposed to DOE adopting any of the load-based testing procedures described in the January 2023 RFI since current research on these methods needs to be finalized before DOE incorporates them into the test procedure. (Carrier, No. 5 at p. 2) Daikin pointed out that while load-based testing may be appropriate when used as a CVP (similar to how it is used for VRF products in AHRI 1230–2021: 2021 Standard for Performance Rating of Variable Refrigerant Flow Multi-Split Air-Conditioning and Heat Pump Equipment (''AHRI 1230–2021'')),[44] it is not suitable for evaluating unit efficiency and capacity. (Daikin, No. 16 at p. 1) Daikin encouraged DOE to make modifications to the existing appendix M1 and adopt a CVP in appendix M1 that is similar to the VRF CVP, but not to adopt load-based testing as the primary regulatory test method. (*Id.* at pp. 1–2) Similary, AHRI commented that although it will support the improvement of load-based testing as an academic pursuit, load-based testing has not yet developed sufficiently such that it may be used for regulatory purposes. (AHRI, No. 14 at p. 7) AHRI further commented it expects DOE to carefully evaluate all the information manufacturers have to report for certification of their products and also evaluate the burden for this reporting and testing if planning to adopt load-based testing. (*Id.*) NEEA stated that although it has published several articles that question the rank order performance ratings evaluated from fixed-speed testing, there is currently no clear evidence that exhibits the advantages of load-based testing. (NEEA, No. 13 at p. 1) NYSERDA commented that regarding the adoption of load-based methods for regulatory purposes, DOE should account for products such as coil-only systems, split system ACs or HPs with coil blowers, and multi-split products.[45] (NYSERDA, No. 9 at p. 6) NYSERDA further commented that there is still more work that needs to be done in order to make load-based testing suitable for DOE regulatory purposes. (*Id.*) Finally,

[40] Sections 3.5 and 3.8 of appendix M1 contain provisions for conducting optional cooling and heating cyclic tests. These cyclic tests are used to determine the Coefficient of Degradation (''CD''), which is incorporated into the calculation of SEER2 and HSPF2, to account for any compressor cycling losses. If the optional cyclic tests are not conducted, appendix M1 requires use of the default CD value of 0.25. However, for the majority of single- and two-stage systems, a lower CD can be achieved when completing the optional cyclic tests, which results in higher SEER2 and HSPF2.

[41] Dhumane, Rohit; Qiu, Tianyue; Ling, Jiazhen; Aute, Vikrant Chandramohan; Hwang, Yunho; Radermacher, Reinhard; Kirkwood, Allen Chad; and Esformes, Jack, ''Evaluating the Impact of the Measurement Setup on Cyclic Degradation Coefficient of Air Conditioning Systems'' (2018). International Refrigeration and Air Conditioning Conference. Paper 2012. Available at *docs.lib.purdue.edu/iracc/2012*.

[42] Section 3.13 of appendix M1 outlines the procedure to determine off-mode average power ratings.

[43] On July 21, 2022, ASRAC chartered the CUAC and CUHP Working Group to negotiate term sheets on the test procedure and energy conservation standards for CUACs and CUHPs. On December 15, 2022, the Working Group completed a term sheet for the test procedure, which is available at *www.regulations.gov/document/EERE-2022-BT-STD-0015-0065*.

[44] *See www.ahrinet.org/system/files/2023-06/AHRI_Standard_1230-2021.pdf*.

[45] DOE believes that NYSERDA made this comment owing to the fact that SPE07 does not explicitly state that it is applicable to these product types.

NYSERDA stated that although it supports a feasible and representative load-based approach, developing a procedure could be challenging. (*Id.* at p. 4) The CA IOUs encouraged DOE to collaborate with stakeholders to move to a test procedure that requires units to operate under native controls, but recognized that an industry-wide transition to load-based testing will be time consuming and cost intensive. (CA IOUs, No. 10 at pp. 1–2) The Joint Advocates commented that load-based testing methodologies would provide better information on the field operation of a CAC/HP, in comparison to the fixed-speed tests currently in appendix M1. (Joint Advocates, No. 8 at pp. 1–2) The Joint Advocates referred to how the native controls testing in DOE's Cold Climate Heat Pump Technology Challenge (''DOE CCHP Tech Challenge'') [46] was informed by the results of the steady-state regulatory tests,[47] and suggested that DOE could adopt a similar provision for both cooling and heating tests, in its amended load-based test procedure. (*Id.*)

Instead of wholesale adoption of a load-based method, comments received on the January 2023 RFI pointed toward consensus preference for a limited form of load-based testing to verify steady-state regulatory test performance under native controls (*i.e.,* a CVP). Samsung, Lennox, AHRI, NYSERDA, NEEA, and Rheem all encouraged DOE to adopt a CVP that would ensure settings used during steady state tests are representative of those during native controls operation. (Samsung, No. 11 at pp. 1–2; Lennox, No. 6 at p. 3; AHRI, No. 14 at p. 7; NYSERDA, No. 9 at p. 5; NEEA, No. 13 at p. 3; Rheem, No. 12 at p. 3) Specifically, Lennox stated that while steady state testing currently used in appendix M1 should continue to be used, a CVP can be used to validate the settings used to test variable capacity systems. (Lennox, No. 6 at p. 3) AHRI commented that use of a CVP would be more repeatable and less burdensome than using load-based testing for direct measurement of performance, adding that CVPs have been used for other product categories and may need some adapatation for application to CAC/HPs. (AHRI, No. 14 at p. 9) Additionally, AHRI referred to a study it co-sponsored with NEEA to collect representative field data, which was expected to conclude at the end of winter 2022/2023. (*Id.* at p. 9) NYSERDA described the CVP used in AHRI 1230–2021 for VRFs and recommended that DOE adopt something similar to it. (NYSERDA, No. 9 at p. 5) NYSERDA further recommended that DOE adopt the CVP outlined in ENERGY STAR Spec V6.1 for the low ambient heating steady-state tests in appendix M1, namely $H3_2$ and $H4_2$. (*Id.* at pp. 5–6) NYSERDA referred to how the wet bulb test conditon in the H4 heating test had increased from 3 °F to 4 °F, which would decrease test burden for labs if they conduct a load-based CVP outlined in ENERGY STAR Spec V6.1. (*Id.*) NYSERDA further encouraged DOE to adopt a ''budget'' method to account for variability in critical parameters during a CVP, and recommended incorporation of a CVP for validating the $H1_1$ (heating minimum) test, and also a minimum-speed CVP at outdoor dry bulb temperature of 17 °F.[48] (*Id.*) NYSERDA commented that performance of units at part-load at milder temperatures has a pronounced impact on the overall seasonal energy efficiency, especially when considering the intersection of low-speed loads beween 17 °F and 47 °F, highlighting that this impact was not fully considered in implementation of the ''Min/Mild'' CVP in the specifications of the DOE CCHP Tech Challenge. (*Id.* at p. 6) NEEA referred to the two types of CVPs as descibed in section III.F.1.b. and commented the results of a study it performed called into question whether a CVP can truly capture the impact of native controls on unit performance.[49] (*Id.* at pp. 3–6) Hence, NEEA commented that DOE needs additional test data to make any claims that CVP testing fully addresses the impact of native control logic on unit performance. *Id.* NEEA pointed to the representativeness study[50] being conducted by NEEP on three ducted and three non-ducted heat pumps, tested using AHRI 210/240 and SPE07, and stated that this study could potentially indicate what elements of a CVP are critical to include in a revised appendix M1, and also inform other issues raised by DOE in the RFI, namely the repeatability, reproducibility, and test burden of load-based methods when compared to fixed-speed testing. (*Id.* at pp. 2–3)

To summarize, comments from the January 2023 RFI indicated that stakeholders preferred a CVP for validating the performance of variable capacity systems, rather than adopting a load-based testing method for regulatory purposes.

(d) DOE's Conclusion and Approach

As mentioned previously, AHRI and other relevant stakeholders, including DOE, participated in the development of revised AHRI test standards to address the issues raised in the January 2023 RFI. In particular, the issues outlined in the aforementioned comments in regard to the representativeness of fixed-speed testing for variable speed systems were discussed in detail and consensus was developed on a CVP approach. Based on review of the stakeholder comments received in response to the January 2023 RFI, specifically that it has not yet been conclusively demonstrated that such methods have sufficient repeatability and reproducibility to be the basis of direct measurement of system performance, DOE has tentatively concluded that use for direct measurement of performance for regulatory purposes would not be suitable at this time. However, DOE also tentatively concludes that a CVP would be necessary to ensure that fixed-speed settings of variable speed systems would be achieved using native (unfixed) control. Thus, DOE proposes to adopt the CVP outlined in AHRI 210/240–202X Draft and AHRI 1600–202X Draft through incorporation by reference. The next section discusses the aforementioned CVP approach.

(e) CVP Proposal

Appendix I of the AHRI 210/240–202X Draft and AHRI 1600–202X Draft includes a CVP to verify variable capacity system operation. The CVP is intended to validate whether override of modulating components in regulatory tests is consistent with native control operation. The CVP verifies: (1) compliance with the variable capacity compressor system definition; and (2) consistency of fixed-position settings for the compressor and indoor fan used in steady-state regulatory tests with native control operation.

The CVP in appendix I includes a set of three cooling tests conducted in

[46] On May 19, 2021, DOE, in conjunction with EPA and NRCan, announced the DOE CCHP Tech Challenge as part of the Energy, Emissions and Equity (''E3'') Initiative. The specification of the DOE CCHP Tech Challenge is available at *www.energy.gov/sites/default/files/2021-10/bto-cchp-tech-challenge-spec-102521.pdf.*

[47] As an example, if a heating capacity of 18,000 Btu/h was measured during the $H1_1$ regulatory test, the native controls ''Min/Mild'' test would apply an equivalent 18,000 Btu/h cooling load to the indoor room's conditioning equipment.

[48] Currently, appendix M1 only has a full-speed heating test at an ambient outdoor temperature of 17 °F, *i.e.,* the $H3_2$ test.

[49] Bruce Harley, Mark Alatorre, Christopher Dymond, Gary Hamer, ''CSA EXP07: Ongoing Progress, Lessons Learned, and Future Work in Load-based Testing of Residential Heat Pumps'' (2022). Purdue University. Available at *docs.lib.purdue.edu/cgi/viewcontent.cgi?article=3455&context=iracc.*

[50] In its comment, NEEA pointed out that preliminary analysis and data from this study will be available probably by July 2023, but at the time of writing this NOPR, neither the analysis, nor the data, has become available.

series with intervening transition periods, including the full, intermediate, and minimum capacities. The CVP uses a modified VBL [51] approach to simulate space condition (temperature and humidity) response to system operation, as explained in section III.F.1.b.3 of this document. Similarly, the CVP also includes three or four heating tests conducted in series for CHPs—the fourth test is specified for those CHPs for which performance at 5 °F outdoor temperature is measured. Similar to the cooling tests, the heating tests have intervening transition periods between the full, intermediate, and minimum capacity test intervals.

For the three cooling tests, the indoor return air conditions are controlled by equations I1–I6 and paragraph I4.1.8 in AHRI 210/240–202X Draft and AHRI 1600–202X Draft—*i.e.,* the indoor return air wet bulb temperature is set at 67 °F, and the indoor return air dry bulb target varies near 80 °F based on the varying system capacity and calculated building load. The temperature setpoint of the control of the system being tested is set throughout the series of tests near 80 °F with some adjustment to account for control bias and offset. The outdoor dry bulb temperature is held constant at three different levels during the three cooling-mode tests, but is controlled to ramp down from higher to lower temperature as the cooling mode CVP transitions between the full load, intermediate load, and low load test intervals.

For the heating tests, the indoor return air conditions are controlled by equations I7–I13 in AHRI 210/240–202X Draft and AHRI 1600–202X Draft. The indoor return air dry bulb temperature varies near 70 °F based on the varying system capacity and calculated building load. The temperature setpoint of the control of the system being tested is set throughout the series of tests near 70 °F with some adjustment to account for control bias and offset. The outdoor dry bulb temperature is held constant at three or four different levels, but is controlled to ramp up from lower to higher temperature as the heating mode CVP transitions between the full load (at 5 °F if applicable and 17 °F outdoor dry bulb temperature), intermediate load, and low load test intervals.

As noted, part of the CVP (the intermediate-load test) determines compliance with the variable-capacity compressor system definition. AHRI 210/240–202X Draft and AHRI 1600–202X Draft define variable capacity compressor systems as:

Variable capacity compressor system means an air conditioner or heat pump that has either (a) a compressor that uses a variable speed drive or inverter to vary the compressor speed by four or more speeds in each mode of operation (*i.e.,* cooling/heating), or (b) a digital compressor that mechanically modulates output using a duty cycle; and which controls the system by monitoring system operation and automatically modulating the compressor output, indoor air flow and other system parameters as required in order to maintain the indoor room temperature.

To determine compliance with the definition, the CVP results obtained from the intermediate load interval is evaluated based on section I4.3.1 of appendix I in in AHRI 210/240–202X Draft, which requires that the standard deviation of the system power does not exceed 20 percent of the mean system power. For a system that does not comply with this compressor power (or outdoor unit power) requirement, and cycles between off and a single stage or capacity level (+/−15 percent), the system is classified as a variable capacity certified, single capacity system. If this occurs for just one of the operating modes (heating or cooling) for a heat pump, the system is classified as variable capacity certified, single capacity for both modes. Additionally, a system that does not comply with the compressor power (or outdoor unit power) requirement is not classified as Variable Capacity Certified, Single-Capacity, and cycles between more than one stage or capacity level (+/−15 percent) is classified as a Variable Capacity Certified, Two-Capacity System. Again, this designation applies for both modes for a heat pump, even if the operation meets this description for one of the modes. These terms are defined in AHRI 210/240–202X Draft and AHRI 1600–202X Draft as:

Variable Capacity Certified, Single Capacity System means a system that is certified as a variable capacity system but demonstrates Single-Capacity System behavior during the Variable Capacity Determination CVP in appendix I.

Variable Capacity Certified, Two Capacity System means a system that is certified as a variable capacity system, but demonstrates Two-Capacity System behavior during the Variable Capacity Determination CVP in appendix I.

Use of the Intermediate Load CVP test and its determination of compliance with the variable speed system definition in DOE enforcement testing is discussed in section III.K.2 of this document.

The full-load and low-load intervals of the CVP determine if the fixed-speed settings for the compressor and indoor fan used during the regulatory test are consistent with those that occur when the unit is allowed to modulate under native controls, as it maintains the indoor room dry bulb temperature. During the cooling mode CVP,[52] the indoor return air wet bulb temperature is maintained at 67.0 °F, but the updated target indoor dry-bulb temperature setpoint for the indoor room reconditioning system, $RAT(t + \Delta t)$, is updated based on equations I4–I6 of AHRI 210/240–202X Draft and AHRI 1600–202X Draft, as shown below:

$$RAT(t + \Delta t) = RAT(t) + \frac{\Delta t[VLs(T_J) - \dot{Q}_S]}{C},$$

Where,

RAT(t) = the current indoor dry-bulb temperature setpoint for the indoor room reconditioning system

$\dot{Q}_s$ = the net sensible cooling capacity provided by the unit under test in the current time step, as determined by air-side measurements (*see* note below)

Δt = the time interval for updating the indoor room reconditioning system controller setpoint, in h

C = the simulated thermal capacitance of the building interior, in units of Btu/°F, given by

$$C = \frac{SHR_{A,full} * \dot{Q}_c(95)}{24}$$

$VLs(T_j)$ = the sensible cooling portion of the modified VBL for target outdoor ambient dry-bulb temperature for each interval.

The magnitude of $VLs(T_j)$ is directly proportional to the certified cooling

[51] The modified VBL in the CVP differs from the VBL in SPE07. For the modified VBL, the building load used in the equations does not depend on the indoor temperature and is a fixed function of target indoor and outdoor temperatures.

[52] For brevity, only cooling mode is explained in the NOPR, to illustrate the 2nd part of the CVP.

capacity at 67 °F outdoor ambient-dry bulb temperature—*i.e.,* the F_{low} test, and the target SHR from the F_{low} regulatory tests, as illustrated in equations I1 and I3 of AHRI 210/240–202X Draft and AHRI 1600–202X Draft. Thus, this illustrates that the modulation of the compressor speed setting and indoor air flow rate is verified against those used in the regulatory tests, as the unit tries to maintain the indoor dry-bulb temperature.

DOE proposes that load-based testing will be not part of the test procedure required for each test for any CAC/HP products. DOE acknowledges that the CVP approach outlined in appendix I of the relevant AHRI drafts represents industry consensus regarding the verification of compliance of systems with the variable capacity system definition, and to verify the consistency of fixed-speed settings of compressor and indoor fan with native control operation as part of enforcement. DOE considers that this CVP approach will provide a more representative test procedure for variable speed systems operating in the field, because it provides a tool to verify that the compressor speed settings and indoor air fan settings used in regulatory tests are representative of native-control operation as the unit operates to maintain the thermostat setpoint, *i.e.,* indoor dry-bulb temperature. Therefore, DOE is proposing to incorporate by reference appendix I of the AHRI 210/240–202X Draft to support enforcement associated with testing conducted in accordance with appendix M1, and to incorporate by reference appendix I of the AHRI 1600–202X Draft to support enforcement associated with testing conducted in accordance with appendix M2. This is discussed in more detail in section III.K.2 of this document.

2. Low-Temperature Heating Performance

In the January 2023 RFI, DOE requested comment on several issues regarding the foundational work needed to improve the appendix M1 test procedure to better account for CAC/HP performance in cold climates, as recommended by NYSERDA during the previous rulemaking cycle that culminated in the October 2022 Final Rule. 88 FR 4091, 4103. In response to the low-temperature heating performance issues raised in the January 2023 RFI (*i.e.,* whether to make the H4 heating tests mandatory, whether the heating load line should be based on heating or cooling capacity, and methods of heat pump sizing), DOE received several comments regarding the establishment of a clear definition for a CCHP as well as potential ways of reporting performance for CCHPs. These aforementioned topics are detailed in separate sections below.

(a) CCHP Definition

In response to the January 2023 RFI, several stakeholders commented in support of establishing a definition for products specifically engineered to provide comfort heating at low ambient conditions (*i.e.,* CCHPs). Daikin recommended that DOE work with stakeholders to establish a clear definition for CCHPs, whether as a separate product class or an optional set of recognition criteria. (Daikin, No. 16 at p. 9) Similarly, AHRI commented in support of a uniform definition for products specifically engineered to provide comfort heating at low ambient conditions. (AHRI, No. 14 at pp. 2–3) AHRI commented that engagement from all stakeholders would be necessary to overcome the shortcomings of previous efforts to develop a definition for CCHPs. (*Id.*)

Additionally, in forming a DOE definition for CCHPs, AHRI requested it be acknowledged that (1) not all U.S. consumers would benefit from higher-tech CCHPs, and (2) the topography of the United States makes it difficult to assign regions that would correlate heating degree days in the same way as is done for split-system air conditioners, as shown by Figure 1 [53] of AHRI's response to the January 2023 RFI. (AHRI, No. 14 at p. 3) Referring to Figure 1, AHRI commented that it is easy to see the cooling degree day division between the North and South, as in effect today, and that heating degree days, on the other hand, meander and are very closely tied to elevation and longitude (to some extent). (*Id.*)

As previously mentioned, AHRI and other stakeholders, including DOE, discussed several issues raised in the January 2023 RFI when considering updated versions of industry standards, including the topic of a clear definition for CCHPs. DOE notes that AHRI 210/240–202X Draft and AHRI 1600–202X Draft both include a new definition for CCHP as shown below:

Cold climate heat pump means a heat pump for which both low-temperature compressor cut-out and cut-in temperatures are specified to be less than 5 °F and for which capacity for the $H4_{full}$ test (at 5 ºF) is certified to be at least 70 percent of the capacity for the nominal full capacity test conducted at 47 ºF ($H1_{Full}$ or $H1_{Nom}$).

DOE surmises that the CCHP definition provided in the relevant AHRI drafts represents industry consensus regarding a uniform definition for products specifically engineered to provide comfort heating at low ambient conditions. DOE has also tentatively determined that the definition includes the relevant criteria to characterize CCHP performance, specifically low-temperature cut-out and cut-in temperature settings to allow operation down to at least 5 °F ambient temperature, and maintenance of heating capacity at low temperatures. Therefore, DOE is proposing to incorporate by reference the definition of a cold climate heat pump provided in the AHRI 210/240–202X and AHRI 1600–202X Drafts, at appendix M1 and appendix M2, respectively.

(b) Mandatory H4 Heating Tests for CCHPs

While the H4 heating tests provide meaningful information and more representative ratings for products designed specifically for low temperature operation, in the January 2023 RFI, DOE noted that the current appendix M1 test procedure includes H4 heating tests as optional tests, as they may not be appropriate for all HPs. 88 FR 4091, 4103. Currently, appendix M1 allows the performance at 5 °F to be extrapolated based on tests conducted at 17 °F and 47 °F (*i.e.,* using the $H3_2$ and $H1_2$ tests, respectively) for HPs that are not tested at the H4 heating condition.

As such, in the January 2023 RFI, DOE requested comment on whether it would be appropriate to make the H4, $H4_2$, or $H4_3$ heating tests in appendix M1 mandatory for either all or a subset of HPs (*e.g.,* CCHPs) in order to produce more representative ratings that account for system performance at 5 °F. 88 FR 4091, 4103. In the case of mandating the H4 heating tests for only a subset of HPs, DOE requested information on what characteristics would represent a clear delineation to distinguish such models from others. (*Id.*) DOE also requested information on the prevalence of test chambers capable of testing CHPs at an outdoor ambient temperature of 5 °F. (*Id.*)

In response, AHRI and Daikin recommended that the H4 tests be mandated only for variable speed HPs for which the compressor speed at the H4 condition was different from that at the H1 and H3 condition. (AHRI, No. 14 at p. 13; Daikin, No. 16 at p. 9) Daikin

[53] Figure 1 of AHRI's response to the January 2023 RFI shows average annual cooling and heating degree days in the contiguous United States from 1901–2000, using National Centers for Environmental Information (''NCEI'') data compiled by the National Oceanic and Atmospheric Administration (''NOAA''). (AHRI, No. 14 at p. 3) A degree day is equivalent to one day with an average temperature that is one degree above or below 65 °F.

asserted that it does not make sense to require the H4 tests for any HP that does not change speed, because, for single- and two-stage HPs, performance at 5 °F can be extrapolated based on existing test data since compressor performance is linear for those products. (Daikin, No. 16 at p. 9) Daikin clarified that the mandatory H4 tests would be applicable even for a variable speed HP where the manufacturer is targeting the southern United States as a market. (*Id.*)

Like AHRI and Daikin, Rheem commented against mandating the H4 tests for single- and two-stage equipment; however, Rheem neither supported nor opposed mandating the H4 tests for variable speed systems. (Rheem, No. 12 at p. 7) Rheem noted that the current test procedure in appendix M1 allows linear extrapolation of heat pump performance at outdoor temperatures colder than 17 °F using equations 4.2.1–4 and 4.2.1–5 for HPs having a single-speed compressor, and using equations 4.2.2–3 and 4.2.2–4 for HPs having a two-capacity compressor. (*Id.*) As such, Rheem commented that the test procedure in appendix M1 reliably indicates heat pump performance in cold climates for single- and two-stage equipment. (*Id.*) However, for variable speed systems, Rheem acknowledged that, in addition to compressor speed, indoor and outdoor airflow rates may change, which may bring the accuracy of linear extrapolation into question for these systems. (*Id.*)

Lennox commented against the idea of making the H4 tests mandatory for any HPs, contending that consumer needs in many areas of the United States with milder climates do not need the capability of a CCHP and, thus, should not require the additional test burden associated with mandatory H4 tests. (Lennox, No. 6 at p. 4)

NEEA recommended making the H4 heating tests mandatory for all HPs, but not required within the test metric, contending that this would result in a more representative assessment of cold climate efficiency and capacity across all HPs. (NEEA, No. 13 at pp. 7–8) Further, NEEA commented that in conversations with industry representatives, NEEA has received indications that many manufacturers already have test chambers that can test down to 5 °F, suggesting that the testing infrastructure is already in place to implement a mandatory requirement for the H4 heating tests. (*Id.*)

NEEA also recommended that for units required to test at part-load conditions (*e.g.,* CCHPs), DOE require reporting unit COP at part load conditions. (NEEA, No. 13 at p. 7) Specifically, NEEA recommended that DOE require the reporting of COP at F_{Low} (at 67 °F) and $H1_{Low}$ (at 47 °F) for units that are required to test at those conditions. (*Id.*) NEEA commented that, by requiring manufacturers to report this data in a consistent format, contractors will be able to make better-informed choices about equipment that works in their climate, and utility companies will know which heat pumps to recommend (*i.e.,* incentivize) to their customers. (*Id.*) NEEA pointed to DOE's CCHP Tech Challenge specifications as an example of the kind of information that consumers and utilities need in order to make informed decisions for their desired region and application. (*Id.*)

NYSERDA encouraged DOE to make $H4_2$ tests mandatory, but only for United States North climate regions, at air-entering outdoor unit temperatures of 5 °F dry bulb and 4 °F (max) wet bulb. (NYSERDA, No. 9 at p. 4) NYSERDA explained that a precedence for mandatory $H4_2$ tests was recently codified in Canada's *Regulations Amending the Energy Efficiency Regulations, 2016 (Amendment 17),* published in the Canada Gazette, Part II, on December 7, 2022.[54] (*Id.*) NYSERDA noted that mandatory reporting requirements to National Resources Canada (''NRCan'') as of January 1, 2023, are as follows: (a) a Region V HSPF2; (b) information that indicates whether the results of the appendix M1 H4 test, if conducted, were included in the calculation of the Region V HSPF2; (c) heating capacity at 5 °F if the H4 test was conducted; and (d) COP at 5 °F if the H4 test was conducted. (*Id.*) Further, NYSERDA noted that, in Canada, HPs manufactured on or after January 1, 2025, must be tested at the H4 test conditions prescribed in appendix M1, and that mandatory reporting requirements to NRCan for the H4 test conditions include heating capacity at 5 °F and COP at 5 °F. (*Id.*) More broadly, NYSERDA recommended that DOE should study more carefully whether the incentives to conduct the optional $H4_2$ tests on good-performing cold climate equipment (because it would increase the HSPF2 rating, particularly in region V) are enough to ensure that most manufacturers would conduct the test to demonstrate that benefit. (*Id.*)

As previously mentioned, AHRI and other stakeholders, including DOE, discussed issues raised in the January 2023 RFI, including the topic of mandatory H4 heating tests for either all or a subset of HPs, when developing updated industry standards in AHRI 210/240–202X Draft and AHRI 1600–202X Draft. DOE notes that these draft industry standards include a footnote to Table 7 (*i.e.,* the required tests table), applicable to all product types, requiring the $H4_{full}$ heating test for all products that meet the definition of a CCHP. DOE surmises that this new mandate for all products certified as a CCHP in the relevant AHRI drafts represents industry consensus regarding whether it would be appropriate to make the H4 heating tests mandatory for either all or a subset of HPs. DOE has tentatively determined that the H4 heating tests are representative of CCHP operation. Therefore, in addition to its proposal to incorporate the CCHP definition as discussed in section III.E.2.a of this document, DOE is proposing to incorporate by reference the mandate for products certified as CCHP to conduct the H4 heating tests (either the H4, $H4_2$, or $H4_3$ heating test, as applicable) provided in the AHRI 210/240–202X Draft and AHRI 1600–202X Draft, at appendix M1 and appendix M2, respectively.

(c) Heating Load Line and Sizing for CCHPs

In a supplemental notice of proposed rulemaking (''SNOPR'') regarding CAC/HP test procedures published on August 24, 2016 (''August 2016 SNOPR''), DOE noted that most heat pump units in the field are sized based on cooling capacity as opposed to heat pump capacity, consistent with the Air Conditioning Contractors of America (''ACCA'') Manual S provisions. 81 FR 58163, 58188. Subsequently, in the January 2017 Final Rule, DOE revised appendix M1 such that the determination of the heating load line was based on cooling capacity rather than heating capacity. 82 FR 1426, 1453–1454. In the January 2023 RFI, DOE explained that part of the motivation for this change was that the previous approach of heating load line determination based on the nominal heating capacity (''$H1_N$ capacity'') provided little incentive to design for good heat pump performance, since low $H1_N$ capacity resulted in a low load line and generally better HSPF2. 88 FR 4091, 4103. DOE explained that sizing based on cooling capacity is consistent with trends for sales distributions of heat pumps, which have had greater adoption in milder climates than cold climates.[55] (*Id.*) However, DOE also

[54] *See canadagazette.gc.ca/rp-pr/p2/2022/2022-12-21/html/sor-dors265-eng.html.*

[55] Residential Energy Consumption Survey (''RECS'') 2020 data shows that electric heat pumps represent 29 percent of primary space heating equipment in homes in the South region, which is a higher number as compared to the 14 percent for

Continued

expressed awareness that NRCan has proposed alternatives for sizing CAC/HPs, in its ''Air Source Heat Pump Sizing and Selection Guide,'' [56] which provides four different approaches with varying emphasis on heating vs. cooling, ranging from sizing based on cooling to sizing such that the heat pump can meet the design heating load without need for resistance auxiliary heat. (*Id.)* In the January 2023 RFI, DOE acknowledged that in cold climates, sizing a heat pump for heating may be more appropriate than sizing for cooling. (*Id.*) Further, DOE acknowledged that accurate information regarding heat pump cold-weather performance is relevant for selection of the best heat pumps for cold climates. (*Id.*) Nevertheless, DOE found it unclear how a test procedure using a heating load line based on heating performance would incentivize good heating performance, particularly if it is based on heating performance at 47 °F, which is not a heating design temperature, and noted that this is the same issue that led DOE to move to the cooling-capacity-based heating load line in appendix M1 in the January 2017 Final Rule.[57] (*Id.*) As a result, in the January 2023 RFI, DOE requested comment on whether the test procedure for CCHPs should use a heating load line based on heating performance, and how such an approach could be implemented such that it does not weaken the incentive for good cold-temperature heating performance.

In response, NYSERDA commented that sizing for cooling mode in climates where HPs will increasingly be relied upon to provide full home heat is not an appropriate approach to ensure that the right equipment is sized and selected, and suggested that a regional approach to HSPF2 ratings should be considered for CCHPs to allow for the prioritization of design heating performance. (NYSERDA, No. 9 at p. 2) NYSERDA commented in support of prioritizing sizing based on design heating loads at design temperatures as low as −4 °F, specifically pointing to the NRCan ''Air Source Heat Pump Sizing and Selection Guide'' mentioned previously. (*Id.*) Citing the NEEP ''Guide to Sizing & Selecting Air-Source Heat Pumps in Cold Climates,'' [58] NYSERDA explained that installers are recommended to match system heating capacity (minus any reliance on auxiliary heat) at design temperatures within 100–115 percent of the estimated heating load. (*Id.*) Further, NYSERDA commented that in partnership with electric utilities in New York, NYSERDA has designed a tool for residential buildings capable of demonstrating that a CCHP sized for heating load may be considered to meet an alternate compliance method for the mechanical design requirements under the 2020 Energy Conservation Construction Code of New York State, which would typically apply to the International Energy Conservation Code (''IECC'') as well.[59] (*Id.*) NYSERDA noted that the tools and guidance around sizing for heating load were developed to ensure successful installations of CCHPs and grew out of market needs for this information. NYSERDA pointed to a DOE-sponsored market survey conducted of 156 ductless HP (single-split systems as defined in appendix M1) owners in Juneau, Alaska, that confirmed owners place emphasis on design heating loads while prioritizing climate, reducing fossil fuel usage, and lowering heating costs.[60] (*Id.*) The survey results showed that the ability to have air conditioning was ranked the lowest in terms of owners' priorities, that about 93 percent of homeowners expressed satisfaction with their decision to install ductless HPs, and that most respondents viewed ductless HPs as products that would entirely replace or significantly reduce the use of other heating sources.

Aside from its suggested design for heating in cold climates, NYSERDA commented that it would not support changing the heating load line equations in appendix M1. (NYSERDA, No. 9 at pp. 2–3) NYSERDA reasoned that revising the rating procedure to account for heating sizing in the building heating load line equation would essentially suppress the heating load seen by HPs and reduce or minimize the assumed use of auxiliary electric heat in the HSPF bin model. (*Id.*) NYSERDA commented that this would have the impact of overstating the performance of systems that have poor capacity in cold weather conditions, and would reduce (not emphasize) the differences in HSPF between those systems and others that have high capacity at low outdoor temperatures. (*Id.*)

The CA IOUs commented in support of NYSERDA's recommendation for assuming heat pump sizing based on the design heating load solely in heating-dominated regions. (CA IOUs, No. 10 at p. 4) Similarly, AHRI and Rheem both commented that they would support modifications to the test procedure to address the differences between the cooling and heating load profiles for colder climates. (AHRI, No. 14 at p. 13; Rheem, No. 12 at p. 7)

As previously mentioned, AHRI and other stakeholders, including DOE, discussed several issues raised in the January 2023 RFI, including the topic of the heating load line and sizing for CCHPs, when considering updated versions of industry standards. The information provided in the aforementioned comments was discussed in detail in the development of the AHRI 210/240–202X Draft and AHRI 1600–202X Draft, which include no exception for CCHPs to base the heating load line on heating performance rather than cooling performance. DOE surmises that the absence of such an exception in the relevant AHRI drafts represents industry consensus regarding whether the test procedure for CCHPs should use a heating load line based on heating performance, rather than cooling performance. Further, DOE has tentatively concluded that the aforementioned approach is appropriate for sizing of CCHPs and is consistent with DOE's position expressed in a prior rulemaking that the heating load line determination based on the nominal heating capacity (H1N capacity) provides little incentive to design for good heat pump performance, since low H1N capacity results in a low load line and generally better HSPF. (*See* 81 FR 58164, 58186). This would hold true also if the heating load line was based on a different heating operating condition, *e.g.* capacity for 5 °F outdoor temperature, since poor performance at the test point would lower the heating load line. Therefore, DOE is proposing to incorporate no exception for CCHPs to base the heating load line on heating performance rather than cooling performance (*i.e.,* DOE proposes to retain the current size-for-cooling approach) at both appendix M1 and appendix M2.

US overall. *See www.eia.gov/consumption/residential/data/2020/hc/pdf/HC%206.8.pdf.*

[56] The ''Air Source Heat Pump Sizing and Selection Guide'' was written by NRCan in response to stakeholder requests for consistent guidance for sizing ASHPs according to the design heating or cooling load and intended use as well as identifying the appropriate system according to the installation and application. The four methods of sizing in the Guide are Options 4A (Emphasis on Cooling), 4B (Balanced Heating and Cooling), 4C (Emphasis on Heating) and 4D (Sized on Design Heating Load). The ''Air Source Heat Pump Sizing and Selection Guide'' is available at *publications.gc.ca/collections/collection_2021/rncan-nrcan/M154-138-2020-eng.pdf.*

[57] *See* 82 FR 1426, 1453–1459 of the January 2017 Final Rule.

[58] *See neep.org/sites/default/files/resources/ASHP%20Sizing%20%26%20Selecting%20-%208x11_edits.pdf.*

[59] *See cleanheat.ny.gov/contractor-resources/.*

[60] *See cchrc.org/media/2020-Juneau-DHP-Survey-Final1.pdf.*

(d) Cold Climate Heating Metric of Interest, COP_{peak}

Currently, the Federal energy conservation standards and certification, compliance, and enforcement provisions for CAC/HPs only require manufacturers to report the HSPF2 of HPs based on Region IV. However, DOE acknowledges that Region IV HSPF2 may not adequately represent the cold climate performance of such systems.

To better represent the heating performance of HPs in cold climates, in response to the January 2023 RFI, NYSERDA commented in support of the use and publication of Region V HSPF2 in addition to Region IV HSPF2, and of designating Region V HSPF2 as a relevant ''cold climate'' heating metric of interest. (NYSERDA, No. 9 at p. 3) Table 1 of NYSERDA's response summarizes the heating fractional bin hours for several U.S. cities in cold and very cold climate regions [61] and compares them to the current Region IV heating fractional bin hours presented in Table 20 of appendix M1. (*Id.*) NYSERDA stated that, since the heating fractional bin hours in Region V are present across all bins compared to Region IV, for cities located in climate zones designated as subarctic/arctic by the IECC, weather data suggest a Region V HSPF2 is more appropriate for all cold climate regions and shows focusing only on Region IV HSPF2 does not benefit consumers in colder climates. (*Id.*)

Similarly, AHRI commented in support of a test method for products specifically engineered to provide comfort heating at low ambient conditions. (AHRI, No. 14 at pp. 2–3) AHRI commented that engagement from all stakeholders would be necessary to overcome the shortcomings of previous efforts to develop testing methodologies for CCHPs. (*Id.*) Carrier also commented that all stakeholders could benefit from an update to appendix M1 that includes optional tests to improve the representativeness of products marketed as a CCHP. (Carrier, No. 5 at p. 1)

As previously mentioned, AHRI and other stakeholders, including DOE, discussed several issues raised in the January 2023 RFI when considering updated versions of industry standards, including the topic of test methods that accurately measure the cold climate heating performance of HPs. The information provided in the aforementioned comments was discussed in detail in the development of the AHRI 210/240–202X Draft and AHRI 1600–202X Draft, which add a new test method in appendix L to measure the heating performance of HPs at low ambient temperatures. Rather than designate Region V HSPF2 as the relevant ''cold climate'' heating metric of interest or requiring a separate test procedure for CCHPs, appendix L of the AHRI 210/240–202X and AHRI 1600–202X Drafts include the calculation steps for a new heating performance metric, the peak load coefficient of performance (''COP_{peak}''), intended to provide an indication of total heating efficiency as applied under peak heating load conditions. Specifically, COP_{peak} conveys the total energy consumed by both the HP and supplemental heat when meeting the building load at 5 °F, calculated using the equation below:

$$COP_{Peak} = \frac{BL(5)}{3.412 \cdot P_{Full}(5) + [BL(5) - \dot{q}_{Full}(5)]}$$

and BL(5) is the building load at 5 °F, is the electrical power consumption of the heat pump during the $H4_{Full}$ test, and $_{Full}$ is the space heating capacity of the heat pump during the $H4_{Full}$ test.

COP_{peak} provides the opportunity for manufacturers to make optional representations of their HPs, regardless of whether they are CCHPs, and is distinct from COP at the H4 testing conditions as it accounts for the additional resistance heat required to meet the building load under peak conditions. As such, COP_{peak} would be less than the tested COP at 5 °F but greater than 1, for any HP with COP greater than 1 at 5 °F.

DOE surmises that the inclusion of COP_{peak} in the relevant AHRI drafts represents industry consensus regarding improvements to representations of HP performance at low ambient temperatures. DOE has tentatively determined that inclusion of COP_{peak} would allow for representative characterizations of HP performance at low ambient temperatures. Therefore, DOE is proposing to incorporate by reference COP_{peak} as an optional representation for manufacturers hoping to advertise their HPs' peak load performance, as outlined in appendix L of the AHRI 210/240–202X and AHRI 1600–202X Drafts, at appendix M1 and appendix M2, respectively.

3. Cut-Out and Cut-In Temperature Certification

The calculation of HSPF2 in appendix M1 requires values for cut-out [62] and cut-in [63] temperatures (*see, e.g.,* equation 4.2.1–3 in section 4.2 of appendix M1). For CAC/HPs that do not include the cut-out and cut-in temperatures in their installation manuals, the manufacturer (or DOE, in the case of compliance testing) must provide the test lab with this information. In the January 2023 RFI, DOE explained that, based on lab testing, it has found manufacturers often use cut-out and cut-in temperatures in their HSPF2 calculations that are much lower than can be reasonably expected in the field—in some instances as low as −40 °F. 88 FR 4091, 4105. DOE expressed concern in this finding because of a review of product literature for scroll compressors with model numbers Copeland ZP*3KE and ZP*5KE R–410A (typically used in CAC/HPs) that shows the lowest refrigerant evaporating temperature of these systems is no lower than −10 °F.[64] (*Id.*)

In the January 2023 RFI, DOE also shared findings, in testing, that the ambient temperatures at which a unit's control cuts out and cuts in may significantly differ from the control's specified temperatures. 88 FR 4091, 4105. DOE acknowledged that this can be due to control component manufacturing variation. (*Id.*) However, DOE also explained that it can be due to sensors being located where

[61] The heating fractional bin hours in Table 1 of NYSERDA's response are based on archived weather data accessed from National Renewable Energy Laboratory's (''NREL'') National Solar Radiation Database (''NSRDB'') and NREL's PSM v3 TMY weather data accessed from NSRDB.

[62] Cut-out temperature refers to the outdoor temperature at which the unit compressor stops (cuts out) operation.

[63] Cut-in temperature refers to the outdoor temperature at which the unit compressor restarts (cuts in) operation.

[64] Figure 7 in the operating bulletin of the Copeland ZP*3KE and ZP*5KE R–410A scroll compressors shows their evaporating envelope, clearly indicating that they should not be used below saturated suction temperatures of −10 °F, implying that this should be set as the cut-out temperature. The bulletin is available at *climate.emerson.com/documents/ae-1331-zp16-to-zp44k3e-zp14-to-zp61k5e-r-410a-1-5-to-5-ton-copeland-scroll-compressors-en-us-1571048.pdf.*

temperature deviates from that of the ambient air (*e.g.,* downstream of the outdoor coil, which absorbs heat from the ambient air during heat pump operation). (*Id.*) As such, in the January 2023 RFI, DOE requested information on the range of cut-out temperatures for compressor operation of CAC/HPs. (*Id.)*

In response, Rheem commented that a sufficient hysteresis, or difference between cut-in and cut-out temperatures, is necessary for reliable compressor operation and in some cases is prescribed by the compressor drive manufacturer. (Rheem, No. 12 at p. 8) The CA IOUs concurred with DOE's observation that the controls and sensors can significantly impact actual cut-in and cut-out temperatures and commented in support of DOE's investigation of cut-out and cut-in temperature certification, stating that the CA IOUs had observed similar discrepancies between cut-out temperatures listed in manufacturer installation/operations materials relative to those seen under native controls in laboratory testing of packaged terminal heat pumps. (CA IOUs, No. 10 at p. 4) The Joint Advocates encouraged DOE to consider adopting a cut-in and cut-out temperature validation test (instead of relying on manufacturer-provided values), if DOE determines that the discrepancies regarding cut-out and cut-in temperatures described earlier contributes to unrepresentative ratings of seasonal heating performance. (Joint Advocates, No. 8 at p. 3)

NYSERDA also supported an approach to certify cut-out and cut-in temperatures and proposed that DOE consider recommendation 10 of the 2022 ASRAC CUAC and CUHP WG TP term sheet. (NYSERDA, No. 9 at pp. 12–13) Recommendation 10 suggests requiring manufacturers to certify cut-out and cut-in temperatures to DOE or the absence thereof, and prescribes that DOE adopt a product-specific enforcement provision that includes a verification test based on the following method:

- Outdoor air temperature (''OAT'') is measured using an outdoor coil air sampler.
- Start at an OAT above but close to cut-out temperature.
- Ramp down OAT temperature at 1 °F per 5 minutes.
- Wait for 5 minutes once unit shuts off. Cut-out temperature is the measured temperature with the unit turned off.
- Reverse temperature ramp and increase the temperature by 1 °F per 5 minutes.
- Wait for 5 minutes once the unit turns on. Cut-in temperature is the measured temperature with the unit turned on.

NYSERDA further commented that recommendation 10 could be adapted for HPs in a manner that allows adjustment to the low temperature cut-out factor specified in equation 4.2.1–3 of appendix M1, if DOE deems during its enforcement test that the measured cut-out and cut-in temperatures significantly deviate from manufacturer-certified values, thereby impacting the calculated HSPF2 value during the enforcement testing process. (NYSERDA, No. 9 at pp. 12–13)

As previously mentioned, AHRI and other stakeholders, including DOE, discussed several issues raised in the January 2023 RFI, including the topic of cut-out and cut-in temperature certification, when considering updated versions of industry standards. The information provided in the aforementioned comments was discussed in detail in the development of the AHRI 210/240–202X and AHRI 1600–202X Drafts, which, in the appendix K of their respective drafts, include a test applicable to all HPs to determine cut-out and cut-in temperatures (*i.e.,* T_{off} and T_{on} respectively). Appendix K follows recommendation 10 of the 2022 ASRAC CUAC and CUHP WG TP term sheet and includes an accommodation for those test facilities incapable of reaching OATs below −22 °F. For units with cut-out temperatures below −22 °F tested in facilities that are incapable of reaching OATs below −22 °F, appendix K instructs to (alternatively) end the test 5 minutes after the average outdoor coil air inlet temperature reaches and maintains the coldest achievable temperature below −22 °F, and to record T_{off} as this coldest achievable temperature below −22 °F. DOE surmises that this approach provided in appendix K of the relevant AHRI drafts represents industry consensus regarding a test to verify cut-out and cut-in temperatures for HPs. DOE has tentatively determined that this approach is appropriate while accounting for the capability limitations of certain test facilities. Therefore, DOE is proposing to require appendix K of the AHRI 210/240–202X Draft to support enforcement associated with testing conducted in accordance with appendix M1, and to require appendix K of the AHRI 1600–202X Draft to support enforcement associated with testing conducted in accordance with appendix M2. As further discussed in section III.J.1 of this document, DOE may verify certified cut-out and cut-in temperatures using the test methods in appendix K of the relevant AHRI drafts for the purposes of assessment and enforcement testing.

4. Low-Static Single-Split Blower-Coil System Definition and Testing Provisions

Section 3.1.4.1.1 of appendix M1 defines the minimum ESP for ducted blower-coil systems in Table 4. For conventional blower-coil systems (*i.e.,* all CAC/HPs that are not classified as ceiling-mount, wall-mount, mobile home, low-static, mid-static, small-duct high-velocity (''SDHV''), or space-constrained), the minimum ESP is specified as 0.5 in. wc. The definition for low-static blower-coil systems includes only multi-split and multi-head mini-split systems—it does not include single-split systems.

In the January 2023 RFI, DOE explained that, during the previous rulemaking cycle that culminated in the October 2022 Final Rule, stakeholders requested that the low-static blower-coil system definition be expanded to include products, such as single-split systems, that cannot accommodate the 0.5 in. wc. necessary for testing. 88 FR 4091, 4105–4106. However, in the October 2022 Final Rule, DOE did not revise the definition for low-static blower-coil systems, nor did it include any new test provisions to accommodate these system types. 87 FR 64550, 64575–64576. DOE believed that revising the definition of low-static blower-coil systems would conflict with the intent of comments made by stakeholders when establishing appendix M1, and could potentially create an unfair competitive advantage for these system types by allowing more lenient testing conditions (and thus comparatively higher ratings) as compared to conventional centrally ducted systems tested at minimum ESPs exceeding 0.5 in. wc. (*Id.*)

In the January 2023 RFI, DOE considered it appropriate to revisit the issue of extending the definition of low-static blower-coil systems to single-split systems, rather than grant test procedure waivers to allow such models to test using lower ESPs.[65] 88 FR 4091, 4106. As such, DOE requested comment from stakeholders on whether the low-static blower-coil system definition should be extended to single-split systems, and if extended, how these low-static blower-

[65] In the time since the January 2023 RFI, DOE has granted an interim waiver pending final determinations that allow testing for certain basic models of single-split low-static ducted blower-coil systems (which are incapable of meeting the conventional minimum ESP requirement of 0.5 in. wc. found in Table 4 of appendix M1). This interim waiver was granted to Samsung on June 5, 2023 (*see* 88 FR 36558).

coil systems should be differentiated from conventional systems. (*Id.*)

In response, Daikin commented in support of developing a definition with stakeholders. (Daikin, No. 16 at p. 11) Similar to the existing ''wall-mount'' and ''ceiling-mount'' blower-coil systems defined in appendix M1, Daikin commented that low-static blower-coil systems have physical and operational characteristics that could be defined such that it would not be possible for a common residential ducted blower-coil to 'cheat' the system and test at a lower ESP. (*Id.*) Daikin suggested this could be accomplished by defining physical dimensions (in a similar fashion to ''ceiling-mount'') as well as applying an appropriate maximum airflow rate per capacity (cfm per ton) at a relatively low ESP. (*Id.*)

AHRI also commented in support of the addition of a definition for single-split low-static blower-coil systems, as low static single-zone [66] units cannot accommodate the minimum 0.5 in. wc. ESP necessary to be tested using appendix M1. (AHRI No. 14 at pp. 14–15) AHRI proposed the following amended definition of a low-static blower-coil system (addition is in *italic*):

Low static blower-coil system means (a) a ducted multi split or multi head mini split system for which all indoor units produce [67] greater than 0.01 in. wc. and a maximum of 0.35 in. wc. external static pressure when operated at the cooling full load air volume rate not exceeding 400 cfm per rated ton of cooling, *or (b) a ducted single zone mini split for which the indoor unit produces a maximum of 0.25 in. wc. external static pressure not exceeding 350 cfm/ton when operated at the highest possible air flow rate and has a rated heating or cooling capacity less than 24,500 Btu/h.*

Samsung agreed with AHRI's proposed definition and requested its adoption. (Samsung, No. 11 at p. 2)

As previously mentioned, AHRI and other stakeholders, including DOE, considered several issues raised in the January 2023 RFI, including the topic of extending the definition of low-static blower-coil systems, when considering updated versions of industry test standards. The information provided in the aforementioned comments was discussed in detail in the development of the AHRI 210/240–202X Draft and AHRI 1600–202X Draft, which, rather than amend the current low-static blower-coil system definition, include a new definition specific for low-static single-split blower-coil systems as shown below.

Low-static single-split blower-coil system means a ducted single-split system air conditioner or heat pump for which all of the following apply:

(1) The Outdoor Unit has a certified cooling capacity less than or equal to 24,000 Btu/h;

(2) If the Outdoor Unit is a heat pump or a variable capacity air conditioner, it is separately certified with a blower-coil indoor unit tested with a minimum 0.5 in. wc. ESP, otherwise it is separately certified with a coil-only indoor unit; and

(3) The Indoor Unit is marketed for and produces a maximum ESP less than 0.5 in. wc. when operated at the certified cooling full-load air volume rate not exceeding 400 scfm per rated ton of cooling.

Both AHRI 210/240–202X Draft and AHRI 1600–202X Draft also include provisions instructing low-static single-split blower-coil systems to be tested at their certified airflow (not to exceed 400 scfm per rated ton of cooling capacity) at their maximum airflow setting. If the ESP achieved at the rated airflow is less than 0.1 in. wc., the provisions instruct adjustment of the airflow measurement apparatus fan to reduce airflow and increase ESP until a minimum of 0.1 in. wc. is achieved.

DOE surmises that the new definition of low-static single-split blower-coil system and associated testing provisions provided in the relevant AHRI drafts represent industry consensus regarding the issue of expanding the low-static blower-coil system definition to include products, such as single-split systems, that cannot accommodate the 0.5 in. wc. necessary for testing in appendix M1. DOE considers the new definition of low-static single-split blower-coil systems and the corresponding test requirements to be appropriate as they allow for testing of system combinations including indoor units that cannot meet the minimum ESP of 0.5 in. w.c. This approach would also require the outdoor unit to be rated when operating with a 0.5 in w.c. (or blower-coil) indoor unit, thus ensuring that the outdoor units of low-static combinations do not gain an unfair advantage due to being allowed to test with an indoor unit at a lower ESP. Therefore, DOE is proposing to incorporate by reference the new definition of low-static single-split blower-coil system and the aforementioned testing provisions outlined in the AHRI 210/240–202X and AHRI 1600–202X Drafts, at appendix M1 and appendix M2, respectively.

Should the new definition of low-static single-split blower-coil system and the associated testing provisions be adopted, DOE would terminate an interim waiver pending final determination, which allows testing for certain basic models of low-static single-split ducted blower-coil systems that are incapable of meeting the conventional minimum ESP requirement of 0.5 in. wc. found in Table 4 of appendix M1. The interim waiver was granted to Samsung on June 5, 2023 (*see* 88 FR 36558). The interim waiver granted an alternate test procedure, which instructs the manufacturer to test their specific basic models at 0.1 in. wc. ESP but to adjust the fan power [68] to reflect operation at 0.5 in. wc. ESP, consistent with the requirements of appendix M1. The alternate test procedure also instructed to adjust heating and cooling capacities [69] to account for increased fan heat. The interim waiver was granted with the understanding that it was impossible to test the manufacturers' specific basic models according to the prescribed test procedures in appendix M1, DOE surmises that this alternate test procedure would no longer be necessary should appendix M1 be amended to enable testing of the manufacturers' specific basic models. Therefore, DOE is proposing to terminate the aforementioned waiver for Samsung, should the new definition of low-static single-split blower-coil system and associated testing provisions provided in the AHRI 210/240–202X and AHRI 1600–202X Drafts be adopted.

5. Mandatory Constant Circulation Systems

In the January 2023 RFI, DOE noted that there is a potential for increased use of indoor fan constant circulation in systems that employ new refrigerants to mitigate flammability risks. 88 FR 4091, 4102. Currently, nearly all CAC/HP products are designed with R–410A as the refrigerant. The EPA Significant New Alternatives Policy (''SNAP'') Program evaluates and regulates substitutes for ozone-depleting chemicals (such as CAC/HP refrigerants)

[66] The comments used the term ''single-zone'', which is addressed by the term ''single-split'' in appendix M1.

[67] The proposed alternate definition for ''Low-Static Blower-Coil System'' in AHRI's response uses the language ''the indoor unit produce.'' (AHRI No. 14 at p. 14) DOE surmises that this is a typographical error and that AHRI meant to write ''all indoor units produce'' as is in appendix M1.

[68] In all sections of appendix M1 where total cooling capacity, total heating capacity, sensible cooling capacity, and electrical power consumption are calculated, the alternate test procedure requires the measured indoor fan power to be increased by 87 watts per 1000 scfm. (*see* 88 FR 36558).

[69] The alternate test procedure requires that, for all tests, cooling capacity be decreased by the Btu/h equivalent of the fan power adjustment (*i.e.,* 297 Btu/h per 1000 scfm); likewise, for all tests, the heating capacity be increased by the same Btu/h equivalent. (*see* 88 FR 36558).

that are being phased out under the stratospheric ozone protection provisions of the Clean Air Act. (42 U.S.C. 7401 *et seq.*) [70] Of interest to CAC/HPs, the EPA SNAP Program's list of viable substitutes [71] includes a group of refrigerants classified as A2L refrigerants. A2L refrigerants receive high attention for their low GWP in addition to their minimal to zero ozone depletion potential. However, A2L refrigerants also face stricter safety requirements than most due to the flammability concerns associated with their ''2L'' ASHRAE safety classification.[72]

Considering A2L flammability concerns and the large push toward their increased use in design, UL published updated safety standards [73] for electrical heat pumps, air-conditioners, and dehumidifiers that include the CAC/HP products at issue in this document. One safety risk these standards address is refrigerant leakage, which can be especially hazardous with A2Ls involved. In satisfaction of new UL safety requirements, manufacturers may need to adjust CAC/HP product design to include refrigerant leak detection systems that use sensors and control logic to detect a loss of pressure, activate the evaporator fan, and use circulated air to quickly disperse and dilute refrigerant in the event of a leakage. In the January 2023 RFI, DOE acknowledged that a subsequent need may exist for the constant circulation of refrigerant or circulation based on leak detection to accommodate these refrigerant leak detection and mitigation strategies in CAC/HP product design. 88 FR 4091, 4102. As such, DOE requested comment on whether UL safety requirements for A2L refrigerants will require some level of circulation on a continuous basis from a unit's indoor fan, or whether circulation to disperse refrigerant will only be required when sensors detect a leak. *Id.* DOE also expressed interest to know of any other techniques that manufacturers will use for dispersing the A2L refrigerant in the event of a refrigerant leak. *Id.*

In response, AHRI, Rheem, and Samsung all commented that constant circulation is a permitted option for A2L mitigation, but is not required. (AHRI, No. 14 at p. 12; Rheem, No. 12 at p. 6; Samsung, No. 11 at p. 2) Daikin specifically noted that UL/CSA 60335–2–40 will only require circulation in the event of detection of a refrigerant leak, which is abnormal operation, and thus not a ''typical use cycle.'' (Daikin, No. 16 at p. 8) For alternative methods of A2L mitigation, Rheem pointed to ASHRAE Standard 15–2016, Safety Standard for Refrigeration Systems (''ASHRAE 15–2016''),[74] which prescribes several methods to disperse/diffuse leaked refrigerant and allows selection of one or more methods to comply with safety standards. (Rheem, No. 12 at p. 6) Related to this topic, the CA IOUs commented that leak detection systems (which only activate the fan when required to disperse fugitive refrigerant) likely reduce a unit's energy consumption. (CA IOUs, No. 10 at p. 4)

While constant circulation may not be a required option, DOE notes that CAC/HPs may increasingly incorporate constant circulation systems in future design. As previously mentioned, AHRI and other stakeholders, including DOE, discussed several issues raised in the January 2023 RFI, including the topic of mandatory constant circulation systems, when considering updated versions of industry standards. The information provided in the aforementioned comments was discussed in detail in the development of AHRI 210/240–202X Draft and AHRI 1600–202X Draft, for which stakeholders agreed to include a new definition for ''mandatory constant circulation system,'' shown below.

Mandatory constant circulation system means an air conditioner or heat pump that operates the indoor fan continuously when power is applied to the unit regardless of control settings.

The updated industry standard drafts also include testing provisions for such systems, outlined in sections 5.1.1, 6.1.3.1.1, and 6.1.3.2.1 as well as Table 7 of both AHRI 210/240–202X Draft and AHRI 1600–202X Draft.[75] These provisions require CAC/HPs meeting the mandatory constant circulation system definition not to use the default cooling and heating degradation coefficients, but rather to evaluate these degradation coefficients using the respective cyclic tests specified by Table 7, conducted in accordance with section E12 of appendix E of AHRI 210/240–202X Draft and AHRI 1600–202X Draft. DOE surmises that the new definition of mandatory constant circulation system and the aforementioned testing provisions provided in the relevant AHRI drafts represent industry consensus regarding representative testing of those CAC/HPs that may use constant circulation to meet the safety requirements for A2L refrigerants. DOE has tentatively determined that the definition and approach included in the draft industry standards provides a more representative measure of CAC/HP efficiency for units with mandatory constant circulation systems. Therefore, DOE is proposing to incorporate by reference the new definition of mandatory constant circulation system and the aforementioned testing provisions outlined in AHRI 210/240–202X Draft and AHRI 1600–202X Draft, at appendix M1 and appendix M2, respectively.

6. Dual-Fuel Systems

Heat pumps generally perform less efficiently at low ambient outdoor temperatures than they do at moderate ambient outdoor temperatures. In the January 2023 RFI, DOE expressed awareness of HPs that combine the operation of a conventional electric HP with a back-up heating source, such as a fuel-fired furnace or boiler. 88 FR 4091, 4106. These are referred to as ''dual-fuel'' systems or hybrid heat pumps (''HHPs'') and provide an alternative to heat pumps specifically designed to perform in cold climates (*i.e.,* cold climate heat pumps). Dual-fuel systems rely on heat pump operation at milder ambient temperatures, but switch to the back-up heating source at low ambient temperatures.

Currently, the HSPF2 calculation at appendix M1 does not differ for a dual-fuel system and a HP that relies solely on vapor-compression or electric resistance auxiliary heating. However, in the January 2023 RFI, DOE explained that this may not be representative of HHP field operation since the back-up heating source takes over for much of the coldest conditions when HP efficiency would be lower. 88 FR 4091, 4106. DOE also noted that, while the focus of test procedures for cold climate heat pumps has been on evaluation of performance at colder temperatures

[70] Additional information regarding EPA's SNAP Program is available online at: *www.epa.gov/ozone/snap/.*

[71] List of EPA SNAP program-approved refrigerant substitutes is available at *www.epa.gov/snap/substitutes-residential-and-light-commercial-air-conditioning-and-heat-pumps.*

[72] ASHRAE assigns safety classification to refrigerants based on toxicity and flammability data. The capital letter designates a toxicity class based on allowable exposure and the numeral denotes flammability. For toxicity, Class A denotes refrigerants of lower toxicity, and Class B denotes refrigerants of higher toxicity. For flammability, class 1 denotes refrigerants that do not propagate a flame when tested as per the standard; classes 2 and 2L denote refrigerants of lower flammability; and class 3 denotes highly flammable refrigerants (such as hydrocarbons).

[73] On November 1, 2019, UL published an updated 3rd edition of UL 60335–2–40 that includes safety requirements regarding the use A2L refrigerants in CAC/HP product design.

[74] ASHRAE 15–2016 is available for purchase at *www.techstreet.com/ashrae/standards/ashrae-15-2016-packaged-w-34-2016?product_id=1938420.*

[75] DOE notes that additional testing provisions for mandatory constant circulation systems are included in the AHRI 1600–202X Draft, which are separately discussed and proposed to be adopted in section III.F.1.e) of this NOPR.

(*e.g.,* the optional 5 °F test condition) to incentivize improved cold-temperature performance, incentivizing efficiency improvement for HHPs might more appropriately focus on warmer conditions, potentially temperatures warmer than 17 °F. (*Id.*)

In the January 2023 RFI, DOE requested information on the prevalence of HHP systems (including shipment numbers and shipment breakdown among single-stage, two-stage and variable-capacity) and the climates they are most used in. 88 FR 4091, 4106. Additionally, DOE requested information on how the controls for HHPs are generally set up to provide dual functionality—specifically, whether the furnace is just set at a higher stage, or whether there is a crossover temperature below which the HP isn't used; if so, the range of crossover temperatures and whether these systems have electric resistance auxiliary heaters. (*Id.*) DOE also requested feedback on whether it is more appropriate to adjust the HSPF2 to address actual operation of the heat pump or just to emphasize performance only in heat pump mode (*i.e.,* when the back-up source is not operating). (*Id.*)

In response, AHRI and Daikin both suggested that a proper definition and scope for HHP products should be developed if modifications to appendix M1 are made to address HHPs. (AHRI, No. 14 at pp. 3–4; Daikin, No. 16 at p. 11) Daikin commented that, while the most common HHPs, dual-fuel systems, have a temperature-based changeover where the heat pump stops operating and the gas furnace takes over, other HHPs may not always follow that model and may operate the gas furnace simultaneously with the heat pump under certain conditions. (Daikin, No. 16 at p. 11) Similarly, AHRI commented that, in most cases, accessory control tries to satisfy the set point temperature with the heat pump by itself, and, when unable to satisfy the set point, it will turn off the heat pump and turn on the furnace. (AHRI, No. 14 at p. 15) AHRI also noted that the heat pump lock-out temperature is typically set by the homeowner in the accessory control. (*Id.*)

AHRI and Rheem both commented in support of a credit for dual-fuel systems in the HSPF2 calculation and noted that dual-fuel systems do not typically have electric resistance heaters. (AHRI, No. 14 at p. 15; Rheem, No. 12 at pp. 8–9) AHRI commented that dual-fuel heat pumps and HHPs offer a lower carbon heating solution that may pose other benefits as well. (AHRI, No. 14 at pp. 3–4) AHRI commented that electrification with fuel backup provides resiliency to the energy grid, particularly in locations where the grid is designed to accommodate summer peaking loads. (*Id.*) AHRI also commented that moving the thermal load from gas to electric results in a significant increase in peak electric demand in winter. (*Id.*)

NYSERDA commented against including a credit for HHPs in the HSPF2 calculation, noting that an HSPF2 credit adjustment would serve to encourage the use of switch-over controls that operate at a higher outdoor ambient temperature, which is at odds with maximizing heat pump performance and limits the decarbonization potential of heat pumps. (NYSERDA, No. 9 at p. 13) NYSERDA suggested a certification approach, which would incentivize an integrated control that optimally locks out auxiliary heating options (electric or gas) until it is no longer feasible for the HP to heat the space via only the vapor-compression cycle. (*Id.*) NYSERDA also recommended that DOE work to encourage lower temperature settings for the switchover device of a HHP whenever possible in the structure of the test procedure. (*Id.*) NYSERDA suggested that certification of cut-in and cut-out temperatures may help address some aspects of the issues presented in the January 2023 RFI regarding HHPs. (*Id.*) However, NYSERDA also stated that it has found manufacturer's lowest catalogued temperature (''LCT'') in the engineering tables may be more important in practice than the cut-out and cut-in temperatures, which are often quite low. (*Id.*) While it acknowledged that cut-out and cut-in temperatures are useful for planning equipment applications and should be accounted for in bin model calculations of HSPF2, NYSERDA recommended using the LCT, the lowest temperature at which a manufacturer will stand behind its capacity and that DOE require the HSPF2 bin model always attribute a COP of 1 for any bin temperature below the LCT of a tested product. (*Id.*)

NEEA recommended that DOE continue to explore HHP ratings that focus on maximizing time spent in electric heat pump mode before switching over to supplemental heating and suggested that on-board controls, which learn and adjust the crossover temperature based on performance, could earn a higher efficiency rating. (NEEA, No. 13 at p. 8)

As previously mentioned, AHRI and other stakeholders, including DOE, discussed several issues raised in the January 2023 RFI, including the topic of dual-fuel systems, when considering updated versions of industry standards. The information provided in the aforementioned comments was discussed in detail in the development of AHRI 210/240–202X Draft and AHRI 1600–202X Draft, which include a new definition for ''dual-fuel heat pump,'' shown below.

Dual-fuel heat pump means A central air conditioning heat pump consisting of (a) a rated combination of outdoor heat pump unit, of any type covered within this standard, (b) an indoor coil and (c) a furnace certified to DOE as an air mover and backup heat source.

Additionally, AHRI 210/240–202X Draft and AHRI 1600–202X Draft introduce a new seasonal efficiency metric, Dual Fuel Utilization Efficiency (''DFUE''), meant to capture the heating efficiency of such dual-fuel heat pump systems. Calculation of DFUE is optional, requires no additional testing, and is outlined in appendix L of both AHRI 210/240–202X Draft and AHRI 1600–202X Draft.

DOE has tentatively determined that the definition and optional test approach included in the draft industry standards may provide a representative test approach for dual-fuel heat pump systems, but DOE is continuing to evaluate whether to include such provisions in its CAC/HP test procedures. Therefore, DOE is not proposing to incorporate by reference the new definition of dual-fuel heat pump and the optional seasonal efficiency metric, DFUE, outlined in the AHRI 210/240–202X and AHRI 1600–202X Drafts at this time.

DOE notes that since dual-fuel heat pump systems are comprised of two covered products currently subject to energy conservations standards (*i.e.,* a heat pump and a furnace), DOE would continue to require reporting of the relevant CAC/HP and consumer furnace heating metrics—HSPF2 and SHORE for CAC/HP, and AFUE for consumer furnaces—but recognizes that representations of dual-fuel heat pump performance may be useful to consumers. DOE is not proposing provisions for dual-fuel heat pumps, but would allow manufacturers to make optional representations of dual-fuel heat pump performance consistent with available industry test standards.

7. Provisions for Outdoor Units With No Match

For split-system CAC/HPs, section 2.2.e of appendix M1 requires that an outdoor unit with no match (''OUWNM'') (*i.e.,* outdoor units that are not distributed in commerce with any indoor units) be tested using a coil-only indoor unit with a single cooling air volume rate whose coil has round tubes of outer diameter no less than 0.375

inches, and normalized gross indoor fin surface (''NGIFS'', gross indoor fin surface divided by the measured cooling capacity) no greater than 1.0 square inch per British thermal unit per hour (sq. in./Btu/hr). (10 CFR 429.16 (b)(2)(i) and appendix M1, section 2.2.e) These provisions were introduced in a final rule regarding CAC/HP test procedures published on June 8, 2016 (''June 2016 Final Rule''), to address outdoor-unit-only replacements of old R–22 outdoor units. 81 FR 36992, 37008–37012. Effective January 1, 2010, EPA banned sales and distribution of CAC/HPs designed to use R–22, a hydrochlorofluorocarbon (''HCFC'') refrigerant, that causes ozone depletion. 74 FR 66450 (Dec. 15, 2009). However, EPA continued to allow sale and distribution of ''components'' of CAC/HP systems for repair purposes, such as outdoor units. *Id.* at 74 FR 66452. In the June 2016 Final Rule, DOE introduced the testing provisions for OUWNM to ensure that performance ratings for such installations would be representative of the replacement of outdoor units originally designed for R–22 and using the original indoor units. *See* 81 FR 36992, 37008–37011.

While these OUWNM provisions were precipitated by EPA's ruling on R–22 units, DOE's intention was to apply them more broadly to any case where an outdoor unit is sold without an indoor unit. In the June 2016 Final Rule, DOE noted that its test provisions were introduced to ensure that an unmatched outdoor unit would be compliant when tested with an indoor unit that is representative of indoor units in the field with which the outdoor unit could be paired. 81 FR 36992, 37009. DOE designed these requirements to meet the statutory requirement that the test procedure measure a representative average use cycle. *Id.* DOE noted that the indoor unit specifications represent lower-efficiency indoor units that would be paired with a given outdoor unit with no match. *Id.* DOE believed this approach was consistent with the requirement that the represented value for a basic model reflect the performance of the poorest-performing model that is part of the basic model. *Id.*

In a final rule published on October 24, 2023 (''October 2023 EPA Final Rule''), EPA, pursuant to provisions of the American Innovation and Manufacturing Act, enacted on December 17, 2020 (42 U.S.C. 7675), restricted the installation of residential and light commercial systems that are designed for hydrofluorocarbon (''HFC'') refrigerants having a GWP greater than 700, starting January 1, 2025. 88 FR 73098. On December 26, 2023, EPA published an amendment to the October 2023 EPA Final Rule that extended the installation deadline to January 1, 2026 as long as the components being installed were manufactured or imported prior to January 1, 2025. 88 FR 88825. Split-system CAC/HPs are included in the scope of residential and light commercial systems. As such, split-system CAC/HPs designed for use with R–410A and sold as a combination of an outdoor and indoor unit, would be banned for installation per the October 2023 EPA Final Rule. However, EPA allows consumers and businesses to replace, retrofit, and service components of existing systems that are over the GWP limits defined in the October 2023 EPA Final Rule to ensure that new equipment with lower-GWP refrigerants is phased in only when all components of the older equipment reach the end of their functional life. 88 FR 73089, 73202. Hence, this provides an exemption for individual components of R–410A based split-system CAC/HP to be sold as replacements, similar to the component exemption adopted when R–22 was phased out. 74 FR 66450, 66459–66460.

As noted, DOE's OUWNM provisions apply for any outdoor units that are distributed in commerce without an indoor matching pair, regardless of the refrigerant the outdoor unit employs. Therefore, DOE clarifies that because of the October 2023 EPA Final Rule, any outdoor unit designed for R–410A or any banned refrigerant as per EPA regulations, when distributed in commerce without an indoor unit on or after January 1, 2026, would be deemed an outdoor unit with no match, precisely because the October 2023 EPA Final Rule allows installation of such outdoor units only as no-match replacements. As EPA provided for after the R–22 ban, such outdoor units may be installed as a replacement component for an existing system but may not be sold with indoor units for installation as a complete split CAC/HP system.

Although the current provisions for an outdoor unit with no match in appendix M1, 10 CFR 429.16, and 10 CFR 429.70 were finalized in the June 2016 Final Rule, DOE notes that appendix M1 currently does not explicitly define outdoor units with no match. While AHRI 210/240–202X Draft and AHRI 1600–202X Draft define outdoor units with no match, the definition applies explicitly only to R–22 replacement outdoor units and outdoor units using refrigerants with properties similar to R–22. This was because the initial establishment of the outdoor unit with no match provisions occurred in the wake of the R–22 ban. In light of the October 2023 EPA Final Rule, DOE is clarifying that similar treatment is applicable to replacement outdoor units designed for use with R–410A, and any other refrigerants banned by EPA for full system installations. Because the definition of outdoor unit with no match in AHRI 210/240–202X Draft and AHRI 1600–202X Draft is specifically focused on R–22 outdoor units, DOE is not incorporating the definition by reference, and is instead proposing a clarifying definition that is consistent with DOE's intention in the June 2016 Final Rule. The proposed definition for appendix M1 is as follows:

Outdoor Unit with No Match (OUWNM). An Outdoor Unit that is not distributed in commerce with any indoor units, and that meets any of the following criteria:

(a) is designed for use with a refrigerant that makes the unit banned for installation when paired with an Indoor Unit as a system, according to EPA regulations in 40 CFR chapter I, subchapter C,

(b) is designed for use with a refrigerant that has a 95 °F midpoint saturation absolute pressure that is ±18 percent of the 95 °F saturation absolute pressure for R–22, or

(c) is shipped without a specified refrigerant from the point of manufacture or is shipped such that more than two pounds of refrigerant are required to meet the charge per section 5.1.8 of AHRI 210/240–202X Draft. This shall not apply if either (a) the factory charge is equal to or greater than 70% of the outdoor unit internal volume times the liquid density of refrigerant at 95 °F or (b) an A2L refrigerant is approved for use and listed in the certification report.

The proposed definition of OUWNM for appendix M2 is the same as that for appendix M1, except that the reference in part (c) of the definition is to section 5.1.8 of AHRI 1600–202X Draft.

DOE is proposing separate definitions in appendix M1 and appendix M2 because part of the definitions refer to sections of the relevant AHRI standards that are incorporated by reference (*i.e.,* AHRI 210/240–202X Draft for appendix M1, and AHRI 1600–202X Draft for appendix M2). Additionally, since the terms ''outdoor unit'' and ''indoor unit'' appear in the definition of outdoor unit with no match, DOE proposes to incorporate by reference the definitions for them from AHRI 210/240–202X Draft and AHRI 1600–202X Draft.

DOE tentatively concludes that the above definitions would further help clarify that the existing test procedure and rating requirements for outdoor units with no match are applicable to R–410A based systems, and any other refrigerants banned by EPA regulations from January 1, 2026, as they have been previously, for R–22 and any other ozone depleting refrigerants. The proposed definitions would apply to all types of outdoor units (*i.e.,* heat pump, air conditioner, single-speed, two-speed, variable-speed, etc.). Outdoor units with no match would continue to be tested with an indoor coil having nominal tube diameter of 0.375 in and an NGIFS of 1.0 or less (as determined in section 5.1.6.3 of AHRI 210/240–202X Draft and AHRI 1600–202X Draft). The determination of represented values, AEDM requirements, combinations selected for testing, and certification report requirements applicable to outdoor units with no match would remain the same as those specified in Table 1 to paragraph (a)(1), paragraph (c)(2), Table 2 to paragraph (b)(2)(i), and paragraph (e)(3), respectively in 10 CFR 429.16. Existing outdoor models currently distributed in commerce as part of a split system basic model that transition to a replacement outdoor unit only would need to be tested, rated, and recertified under the provisions in 10 CFR 429.16 for an outdoor unit with no match. The basic model number would need to change to reflect that the outdoor unit is no longer part of a combination as previously certified, but rather as an outdoor unit with no match, but the outdoor unit model could still be assigned the same individual model number.

8. Inlet and Outlet Duct Configurations

In the June 2016 Final Rule, DOE made the following amendments regarding inlet and outlet duct configurations: clarified indoor unit air inlet geometry; ensured that the inlet plenum is not installed upstream of the airflow prevention device; and specified that the minimum lengths of inlet plenum, locations of static-pressure taps, and minimum cross-sectional dimensions are consistent with ANSI/ASHRAE 37–2009. 81 FR 36992, 37037. DOE also clarified that when an inlet plenum is not used, then the length of straight duct upstream of the unit's inlet within the airflow prevention device must still adhere to the inlet plenum length requirements as illustrated in ANSI/ASHRAE 37–2009, Figures 7b, 7c, and 8. (*Id.*)

In response, as discussed in the January 2017 Final Rule, stakeholders commented that DOE's clarification of inlet plenum may result in the overall height of unit setup exceeding the current height limit of many existing psychrometric rooms. 82 FR 1426, 1463. These stakeholders proposed that DOE consider allowing the approach included in ASHRAE's Research Project (''RP'') 1581, requesting DOE to approve the use of the 6″ skirt coupled with the 90° square vane elbow, along with the appropriate outlet duct. *Id.*

In the January 2023 RFI, DOE sought test data that shows testing done using reduced overall height of the unit setup (similar to that proposed in ASHRAE RP 1581) and compared against the baseline duct designs in ANSI/ASHRAE 37–2009 Figures 7b and 7c for blower-coil indoor units, and Figure 8 for coil-only indoor units. 88 FR 4091, 4105. DOE also requested information that could help inform the existing CAC/HP test procedures to allow testing in smaller environmental chambers, or to incorporate adjustments to the test setup that might reduce test burden. (*Id.*) DOE did not receive any such test data in responses to the January 2023 RFI. However, AHRI, Daikin, and Rheem all commented in support of including updates from the newest draft version of ASHRAE Standard 37 into the test procedure, which includes revisions investigated in RP 1581. (AHRI, No. 14 at p. 14; Daikin, No. 16 at p. 10; Rheem, No. 12 at p. 8) Stakeholders also commented in support of including revisions investigated in RP 1743, which explored reduced-length, alternative inlet duct configurations. (*Id.*)

In May 2023, ASHRAE released for public review its first draft of a new version of ANSI/ASHRAE Standard 37 (''May 2023 ASHRAE 37 Draft''), which includes both RP 1581 and RP 1743 updates in section 6.4 of the standard. Subsequently, AHRI and other stakeholders, including DOE, worked to include these updates in AHRI 210/240–202X Draft and AHRI 1600–202X Draft. Both appendix D of the AHRI 210/240–202X Draft and appendix D of the AHRI 1600–202X Draft contain May 2023 ASHRAE 37 Draft updates regarding inlet and outlet duct configurations, including the duct revisions investigated in RP 1581 and RP 1743 to accommodate smaller environmental chambers. DOE surmises that the inclusion of these May 2023 ASHRAE 37 Draft updates in appendix D of the relevant AHRI drafts represents industry consensus regarding inlet and outlet duct configurations. Additionally, DOE has tentatively determined that the updates included in the May 2023 ASHRAE 37 Draft are appropriate for CAC/HP testing while limiting testing burden. Consequently, DOE is proposing to incorporate by reference appendix D of AHRI 210/240–202X Draft at appendix M1 and to incorporate by reference appendix D of AHRI 1600–202X Draft at appendix M2.

DOE notes that AHRI 210/240–202X Draft and AHRI 1600–202X Draft reference the current version of ASHRAE Test Standard 37, ANSI/ASHRAE 37–2009, because the May 2023 ASHRAE 37 Draft has not yet been finalized and published. DOE notes that it may choose to update its incorporation by reference to the final published version of the May 2023 ASHRAE 37 Draft in a future rulemaking.

9. Heat Comfort Controllers

A heat comfort controller enables a heat pump to regulate the operation of the electric resistance elements such that the air temperature leaving the indoor section does not fall below a specified temperature (*see* section 1.2 of appendix M1).

Section 3.6.5 of appendix M1 includes test instructions for testing heat pumps having a heat comfort controller. Section 4.2.5 of appendix M1 includes additional steps for calculating the HSPF2 of heat pumps having a heat comfort controller, and covers the following system types:

(1) heat pumps having a single-speed compressor and either a fixed-speed indoor blower or a constant-air-volume-rate indoor blower installed;

(2) single-speed coil-only system heat pumps;

(3) heat pumps having a single-speed compressor and a variable-speed, variable-air-volume-rate indoor blower;

(4) heat pumps having a two-capacity compressor;

Unlike the other aforementioned system types having a heat comfort controller, appendix M1 does not currently specify additional steps for calculating the HSPF2 of heat pumps having a heat comfort controller and having a variable-speed compressor. However, section 4.2.5.4 of appendix M1 is reserved for potential additional steps for calculating HSPF2 for this system type. This section was initially reserved in appendix M in the CAC/HP test procedure final rule published on October 11, 2005. 70 FR 59122 (''October 2005 Final Rule'').

In the January 2023 RFI, DOE requested information on the prevalence of HP systems that include heat comfort controllers. 88 FR 4091, 4105. DOE also requested feedback on whether the heat comfort controller test approach in appendix M1 is utilized by manufacturers, and if yes, whether it needs to be updated. (*Id.*)

In response, Rheem commented that heat comfort controllers are typically found on premium CAC/HPs, many of which are variable-speed. (Rheem, No. 12 at p. 8) However, Rheem also noted that since no additional steps for calculating the HSPF2 of heat pumps having a variable-speed compressor and a heat comfort controller are specified in the appendix M1 test procedure, there is limited utilization of the heat comfort controller test approach in appendix M1. (*Id.*) AHRI commented that it was unable to provide information regarding the current prevalence of heat comfort controllers due to time constraints but suggested that DOE require manufacturers notify consumers of the additional impacts to power consumption that come with the purchase of a heat comfort controller. (AHRI, No. 14 at p. 14)

As previously mentioned, AHRI and other stakeholders, including DOE, considered several issues raised in the January 2023 RFI, including the topic of heat comfort controller provisions, when considering updated versions of industry test standards. The information provided in the aforementioned comments was discussed in detail in the development of AHRI 210/240–202X Draft and AHRI 1600–202X Draft. Neither the AHRI 210/240–202X Draft nor the AHRI 1600–202X Draft include any changes to the heat comfort controller testing provisions for the following system types:

(1) heat pumps having a single-speed compressor and either a fixed-speed indoor blower or a constant-air-volume-rate indoor blower installed;

(2) single-speed coil-only system heat pumps;

(3) heat pumps having a single-speed compressor and a variable-speed, variable-air-volume-rate indoor blower;

(4) and heat pumps having a two-capacity compressor.

However, AHRI 210/240–202X Draft and AHRI 1600–202X Draft now specify additional steps for calculating the HSPF2 and SHORE of heat pumps having a variable-capacity compressor and a heat comfort controller. These additional steps are similar to the additional steps for calculating the HSPF2 and SHORE of other system types having a heat comfort controller. DOE has tentatively determined that the inclusion of these additional steps for calculating HSPF2 and SHORE is appropriate for heat pumps having a variable-capacity compressor and a heat comfort controller because these provisions provide a representative measures of unit operation when installed with heat comfort controllers. Therefore, DOE is proposing to incorporate by reference the additional steps for calculating the HSPF2 of heat pumps having a variable-capacity compressor and a heat comfort controller outlined in section 11.2.2.5 of AHRI 210/240–202X Draft, at appendix M1. Likewise, DOE is proposing to incorporate by reference the additional steps for calculating the SHORE of heat pumps having a variable-capacity compressor and a heat comfort controller outlined in section 11.2.2.5 of AHRI 1600–202X Draft, at appendix M2.

G. Long-Term Changes in the CAC Test Procedure

The following sections discuss issues that affect the CAC/HP test procedure in the long-term—*i.e.,* they will be effective when new CAC/HP standards are established denominated in terms of the metrics in appendix M2, SCORE, and SHORE. As previously explained, these long-term revisions would be implemented at appendix M2 via incorporation by reference of the relevant industry consensus test procedure, AHRI 1600–202X Draft. DOE has reviewed the AHRI 1600–202X Draft in relevance to its proposed to incorporate the standard by reference at appendix M2, and has tentatively concluded that it satisfies the EPCA requirement that test procedures should not be unduly burdensome to conduct and should be representative of an average use cycle. (42 U.S.C. 6293(b)(1)(A)) These long-term amendments in appendix M2 would alter the measured efficiency of CAC/HPs and would require representations in terms of new cooling and heating test metrics, SCORE and SHORE, respectively.

Additionally, DOE clarifies that all proposals related to near-term issues discussed in section III.F of this document also apply to appendix M2.

1. Power Consumption of Auxiliary Components

In the January 2023 RFI, discussed consideration of reflecting the power consumption of auxiliary components in the SEER2 and HSPF2 efficiency metrics for CAC/HPs, at the recommendation of a comment made by the CA IOUs during the limited scope rulemaking that culminated in the October 2022 Final Rule. 88 FR 4091, 4102–4103. To help DOE further assess whether its test procedure adequately addresses crankcase heater (and other auxiliary component) energy use, DOE requested information and data from stakeholders regarding the power consumption of crankcase heaters and other auxiliary components in the January 2023 RFI. 88 FR 4091, 4102–4103. The sections below address a range of topics associated with power consumption of auxiliary components.

In addition, in the January 2023 RFI, DOE also requested information and available field data on any auxiliary components other than crankcase heaters that come equipped with CAC/HPs that use energy or affect systems energy use. 88 FR 4091, 4103. In response, Rheem commented that the off-mode power measurement per appendix M1 would account for leak sensor power consumption if leak sensors are required to be installed in the system during testing. (Rheem, No. 12 at p. 7) Additionally, Rheem commented that base pan heaters can only be installed by the factory, while other accessories, such as UV lights and electrostatic filters, are typically field installed. (*Id.*)

As previously mentioned, AHRI and other stakeholders, including DOE, discussed several topics included in the January 2023 RFI, including the topic of accounting for auxiliary components' power consumption, when considering updated versions of industry standards. The information provided by stakeholders in comments, summarized in the following subsections, was discussed in detail in the development of the AHRI 1600–202X Draft, which accounts for crankcase heater, base pan heater, and constant circulation fan energy consumption (as applicable) in the calculations of the new cooling and heating performance metrics, SCORE and SHORE. As part of the proceedings to develop the AHRI 1600–202X Draft, manufacturers provided survey data regarding auxiliary components, their prevalence and their wattages, and the group conducted analysis to determine which auxiliary components not yet addressed in the current DOE test procedure should be considered.

(a) General Comments About Standby and Off Mode Power Consumption

In response to the January 2023 RFI, the CA IOUs and NYSERDA both requested that DOE revisit the issue of accounting for the standby mode energy consumption of auxiliary components in appendix M1. (CA IOUs, No. 10 at p. 2; NYSERDA No. 9 at p. 7) NYSERDA requested elaboration on the justification for DOE's conclusion in the January 2023 RFI that standby mode energy consumption is addressed in the off-mode power consumption calculations in section 4.3 of appendix M1. (NYSERDA, No. 9 at p. 7) NYSERDA commented that it seeks this clarification because DOE had previously summarized that standby mode is addressed in the part load SEER and HSPF metrics in both the August

2016 SNOPR[76] and the June 2016 Final Rule.[77] (*Id.*) Further, NYSERDA noted that, in the June 2016 Final Rule, DOE previously reviewed IEC Standard 62301 and determined that the procedures contained therein are not sufficient to properly measure off mode power for the unique characteristics of the components that contribute to off-mode power for CAC/HP products (*i.e.,* the crankcase heaters).

Daikin commented that, in line with the general principle floated in the recent commercial unitary air conditioner (''CUAC'') and commercial unitary heat pump (''CUHP'') (collectively, ''CUAC/HP'') rulemaking,[78] a seasonal metric should measure all capacity delivered divided by all power consumed; and there should be a single seasonal metric for cooling and a single seasonal metric for heating to encompass all energy consumption, eliminating secondary metrics such as energy efficiency ratio (''EER'') and off-mode power (''$P_{W,OFF}$''). (Daikin, No. 16 at p. 7)

NYSERDA commented that, while further consideration to off-mode energy consumption may not be strictly necessary for CAC/HPs (because appendix M1 already includes off-mode provisions), it urges DOE to consider a more comprehensive approach to standby mode. (NYSERDA, No. 9 at pp. 7–8) NYSERDA recommended the inclusion of crankcase heater power in seasonal efficiency ratings that include shoulder periods. (*Id.*)

DOE notes that, while IEC Standard 62301 and EPCA (*see* 42 U.S.C. (gg)(1)) define both standby mode and off mode for energy-using products such as air-conditioners and heat pumps, DOE defined only ''off mode'' in its test procedures for CAC/HPs. ''Off mode power consumption'' is defined as the power consumption when the unit is connected to its main power source but is neither providing cooling nor heating to the building it serves. Thus, off-mode power consumption can be considered to include power consumption associated with any system components (*e.g.,* crankcase heaters, fans, controls, base pan heaters, etc.) during any times that neither cooling nor heating are being provided, including shoulder season, heating season for a cooling-only air-conditioner, and times when the compressor is not operating (*e.g.,* during an off-cycle during a cooling or heating season). While some of the system modes during these times could be seen as complying with the EPCA definition for standby mode, the appendix M1 test procedure uses the single term ''off mode'' to refer to all of these modes. Discussion about these modes for central air conditioner and heat pumps has often used both the terms ''standby'' and ''off,'' even though they are both, per appendix M1, defined as ''off mode.''

Thus, in response to NYSERDA, DOE clarifies that standby power consumption (per appendix M1, ''off-mode'' power consumption) is indeed incorporated to an extent in the SEER2 and HSPF2 metrics, and that some of the off-mode power consumption is separately regulated by the off-mode power metric, $P_{W,OFF}$. As noted in a footnote of the January 2023 RFI, some energy use associated with crankcase heaters may be measured in the cyclic cooling test (for non-temperature dependent crankcase heaters) and cyclic heating test in appendix M1. 88 FR 4091, 4102. The energy use of auxiliary components such as control boards, reversing valves, and electronic expansion valves would also be captured during the off cycle during cyclic testing. Hence, some off mode energy consumption is captured in the SEER2 and HSPF2 metrics. However, DOE acknowledges that not all off mode energy consumption is captured by the SEER2 and HSPF2 metrics because the calculations for these metrics do not account for all the hours in a year. Specifically, shoulder-season energy use of auxiliary components is not captured consistent with the number of hours that such components may be energized (*e.g.,* for hours representing outdoor temperatures between 54.5 °F and 64.5 °F). In response, as detailed in section III.F.1.e of this NOPR, DOE is proposing to incorporate by reference the AHRI 1600–202X Draft at appendix M2, which addresses additional standby and off-mode power consumption in the SCORE and SHORE metrics, including base pan heaters and indoor fans that are required to operate in constant circulation mode to address A2L refrigerant requirements. The test standard also provides a more comprehensive way to include all significant standby and off-mode energy use, including that of crankcase heaters, in the efficiency metrics, in a way that is similar to the approach described in recommendation 13 of the 2022 ASRAC CUAC and CUHP WG TP term sheet.[79] Specifically, the SCORE and SHORE efficiency metrics both represent conditioning provided during the cooling or heating season, respectively, divided by relevant energy use associated with all components that contribute significantly to energy use.

(b) Adjustment of Off Mode Power Consumption for Number of Compressors, System Capacity, and Variable Speed and Weighting of Off-Mode Test Power Measurements

In response to the January 2023 RFI, the CA IOUs requested that DOE consider removing the adjustment factors for off-mode power consumption, and, instead, change the requirement for off-mode power consumption to a maximum allowed power consumption table based on system capacity, number of compressors, and stages. (CA IOUs, No. 10 at pp. 2–3)

The CA IOUs also recommended that the P_1 and P_2 components of $P_{W,OFF}$ be weighted based on the population-weighted number of hours where the outdoor temperature is less than 70 ºF, instead of simply averaged. (CA IOUs, No. 10 at p. 3) Aligning with the data presented in Table 2 of their response,[80] the CA IOUs stated that this approach would change the weighting from 50-percent P_1 and 50-percent P_2 (a simple average) to 30-percent P_1 and 70-percent P_2. (*Id.*)

DOE notes that the modified approach for off-mode energy consumption in AHRI 1600–202X Draft, which DOE proposes to incorporate by reference, addresses both of these points, as discussed in section III.G.1.e of this NOPR.

(c) Crankcase Heaters

Regarding crankcase heaters, in the January 2023 RFI, DOE requested information as to what percentage of units on the market (split separately

[76] *See* 81 FR 58163, 58165. DOE noted, ''for CAC/HP, standby mode is incorporated into the SEER and HSPF metrics, while off mode power consumption is separately regulated. This SNOPR includes proposals relevant to the determination of both SEER and HSPF (including standby mode) and off mode power consumption.''

[77] *See* 81 FR 36992, 36994. DOE noted, ''for central air conditioners and heat pumps, standby mode is incorporated into the SEER metric, while off mode power consumption is separately regulated. This final rule includes modifications relevant to the determination of both SEER (including standby mode) and off mode power consumption.''

[78] *See* 88 FR 56392 for the most recent NOPR regarding CUAC/HPs published on August 17, 2023.

[79] Recommendation 13 of the 2022 ASRAC CUAC and CUHP WG TP term sheet requires manufacturers to certify crank case heat watts for each heater in the certified CUAC/CUHP, where each of the certified wattages must be within 10% of the maximum heater wattage determined according to the CUAC/CUHP TP at the tested nameplate voltage

[80] Table 2 of the CA IOUs response to the January 2023 RFI includes data taken from ASHRAE Standard 169–2021, *Climatic Data for Building Design Standard,* and the United States Census Bureau, with additional analysis performed by CA IOUs. (CA IOUs, No. 10 at p. 3)

between air conditioners and heat pumps) are shipped from the factory with crankcase heaters; what percentage have crankcase heaters installed in the field (*e.g.,* by contractors); and the percentage breakdown of controls used with units (both factory- and field-installed)—by those that are energized at full power during the compressor off cycle, those that also have an ambient thermostat to prevent use when temperature is high, and those that are self-regulating. 88 FR 4091, 4102–4103.

In response, Daikin commented that the majority (shipment volume) of air conditioners do not have crankcase heaters, while nearly all heat pumps do have crankcase heaters. (Daikin, No. 16 at p. 8) Daikin stated that the use of crankcase heaters typically correlates with higher refrigerant charge quantities, and that, as a result, higher efficiency AC units, with higher refrigerant charge quantities, are more likely to have crankcase heaters than lower efficiency ones. (*Id.*) Further, Daikin commented that long-line set applications, such as multi-story apartment buildings, would be the most common applications of field-installed crankcase heaters—again due primarily to the additional refrigerant charge required in those applications. (*Id.*) Rheem estimated that less than 10 percent of factory units have crankcase heaters and commented that it believes field installations for crankcase heaters to be infrequent, but depends on the length of refrigerant line set for a given installation. (Rheem, No. 12 at pp. 6–7)

The CA IOUs, NEEA, and NYSERDA all recommended that DOE account for crankcase heater energy use by aligning with recommendation 13 of the 2022 ASRAC CUAC and CUHP WG TP term sheet. (CA IOUs, No. 10 at p. 2; NEEA, No. 13 at p. 8; NYSERDA, No. 9 at pp. 10–12) Recommendation 13 of the 2022 ASRAC CUAC and CUHP WG TP term sheet suggests that DOE require manufacturers to certify crankcase heater wattage for each heater, and that each wattage certified be within 10 percent of the maximum wattage for that heater as determined in accordance with the test procedure at the tested nameplate voltage. Further, equipment that does not employ crankcase heating shall certify a value of zero.

In response, DOE notes that accounting for crankcase heater energy use for CUAC/CUHPs differs from such accounting for CAC/HPs in two fundamental ways that make recommendation 13 of the CUAC/CUHP WG TP term sheet inappropriate for this test procedure. First, CUACs and CUHPs generally have more than one compressor, often three or four compressors, whereas nearly every CAC/HP has just one. Second, control of crankcase heaters in CUACs and CUHPs, as discussed in the WG discussions is much more straightforward than for CAC/HPs. Specifically, the crankcase heaters for CUACs and CUHPs are nearly exclusively controlled to be on when the compressor is off and off when the compressor is on, with no consideration of shutoff for warm temperatures, and no significant use of self-regulating heater designs. Thus, it is both possible and necessary to conduct testing to understand CAC/HP crankcase energy use—possible because of the single compressor (and crankcase heater), and necessary to understand the control. The certification of crankcase heater wattages, as was adopted CUACs and CUHPs to avoid the additional test burden to testing multiple heaters, would not reduce the need for testing in the case of CAC/HPs. Although this rulemaking does not specifically address certification, DOE may consider certification requirements for crankcase heater wattages in a separate rulemaking.

Similar to ratings in SPE07, NYSERDA suggested that crankcase heaters and drain pan heaters (if present) could be included in the test procedure as separate tests and appropriately attributed to efficiency metrics depending on their specific control strategy. (NYSERDA, No. 9 at p. 8) NYSERDA suggested this approach, commenting it could be employed in the DOE procedure without causing a wholesale change in operating test procedures. (*Id.*)

DOE responds that the test procedure as included in AHRI 1600–202X Draft, which DOE proposes to incorporate by reference in the CAC/HP test procedure, addresses crankcase heaters (and base pan heaters if present) in a way that is consistent with the approach recommended by NYSERDA. The information provided in the aforementioned comments was discussed in detail in the development of the AHRI 1600–202X Draft, which accounts for crankcase heater power consumption in the new cooling and heating metrics, SCORE and SHORE. The AHRI 1600–202X Draft provisions that account for crankcase heater power consumption are detailed in section III.G.1.e of this NOPR.

In the August 2016 SNOPR, DOE revised the off-mode test procedure by imposing time delays to allow self-regulating crankcase heaters to approach equilibrium. 81 FR 58163, 58173–58174. Specifically, DOE proposed a 4-hour time delay for units without compressor sound blankets and an 8-hour time delay for units with compressor sound blankets. (*Id.*) DOE proposed these time delays based on testing of a 5-ton residential condensing unit. (*Id.*) In response to stakeholder comments regarding the aforementioned time delays, DOE decided in the January 2017 Final Rule to adopt the proposed time delays for measurements of off-mode power in appendix M1 for units with self-regulating crankcase heaters or heater systems in which the crankcase heater control is affected by the heater's heat. 82 FR 1426, 1438. Nevertheless, in the January 2023 RFI, DOE acknowledged that with more test procedure development time, an approach could potentially be developed that would allow for accurate projections of self-regulating crankcase heater energy use to be determined in reduced time and requested comment on this possibility. 88 FR 4091, 4103.

In the January 2023 RFI, DOE requested test data that would indicate if and how the 4-hour time delay (for compressors without sound blankets) and 8-hour time delay (for compressors with sound blankets) may be reduced for units with self-regulating crankcase heaters without compromising the accuracy of the off-mode power consumption measurement. 88 FR 4091, 4103. In response, Rheem commented that more study would be needed to understand the effects of delay reductions on both the accuracy of off-mode power consumption as well as on reliability of the compressor and crankcase heater. (Rheem, No. 12 at p. 7) No other stakeholders commented on this issue. Hence, DOE is proposing no changes to the 4- or 8-hour test duration for self-regulating crankcase heaters.

(d) Shoulder-Season Fan Power Consumption

In the January 2023 RFI, DOE requested comments on fan-only operation during the shoulder season, constant circulation controls, current use of constant circulation among CAC/HP products, the potential of increased future fan use (considering the transition to low-GWP refrigerants), and whether a need exists to account for constant circulation mode in the measurement of SEER2 and HSPF2. 88 FR 4091, 4101–4102. Additionally, DOE requested information on the typical fan power for constant circulation mode for blower-coil systems (or as a fraction of cooling or heating fan power), the percentage of people that use this mode and the associated hours per year on average the system would be in this mode, whether constant circulation mode is a default or user configurable setting for these systems, whether the measurement of SEER2 and/or HSPF2 should take into consideration that a certain fraction of systems will use constant circulation mode rather than turn off the fan during the compressor off mode, and whether manufacturers could use constant circulation as part of their mitigation strategy for refrigerant leakage. (*Id.*)

In response, AHRI, Daikin, and Samsung all commented that constant circulation mode is a user configurable setting; and Samsung elaborated that the default constant circulation mode setting for its products is ''OFF.'' (AHRI, No. 14 at p. 11; Daikin, No. 16 at p. 7; Samsung, No. 11 at p. 2) AHRI and Daikin commented that only a small portion of consumers use constant circulation mode, citing the January 2023 RFI's reference to DOE's furnace fan efficiency rulemaking that suggests it is only used by 9 percent of consumers.[81] (AHRI, No. 14 at p. 11; Daikin, No. 16 at p. 7)

AHRI and Rheem commented that it is impossible to predict how widespread the use of constant circulation will be as a potential mitigation for A2L refrigerants. (AHRI, No. 14 at p. 11; Rheem No. 12 at pp. 5–6) Rheem explained that, for systems containing group A2L refrigerants and utilizing continuous circulation airflow as a mitigation strategy, the required circulation airflow rate is defined in safety standards as a function of system charge and refrigerant lower flammability limit. (Rheem No. 12 at pp. 5–6) Rheem noted that airflow rates (and associated blower motor power consumption) in continuous airflow mode for systems designed today—which contain group A1 refrigerants—are unlikely to be the same as the minimum circulation airflow rate defined in safety standards, and that, therefore, using data from systems sold today is unlikely to be representative of systems sold in the future. (*Id.*) Rheem asserted that it is difficult to predict whether manufacturers will redesign blower-coil systems to match the minimum circulation airflow as calculated from equations prescribed by safety standards, or choose an existing airflow tap that gives an airflow rate greater than the required minimum when utilizing continuous circulation airflow as the mitigation action. (*Id.*)

AHRI, Daikin, Rheem, and Samsung all were opposed to accounting for constant circulation mode in the test procedure and efficiency metrics for CAC/HPs, reasoning that, as described earlier, constant circulation airflow is utilized by only a small portion of all consumers and only occurs due to consumer selection. (AHRI, No. 14 at p. 12; Daikin, No. 16 at pp. 7–8; Rheem, No. 12 at p. 6; Samsung, No. 11 at p. 2) Conversely, the CA IOUs and NYSERDA both recommended that DOE consider addressing the energy consumption of fans in constant circulation mode for all products in either the CAC/HP test procedure or furnace fan test procedure. (CA IOUs, No. 10 at p. 4; NYSERDA, No. 9 at p. 12) To back its position, NYSERDA pointed to its evaluation of heat pump programs that found fan energy is not adequately accounted for in reported data and can be widely variable. (NYSERDA, No. 9 at p. 12) Further, NYSERDA suggested that, when a manufacturer's standard equipment settings include a continuous or intermittent fan-on mode of operation (for example, to sample the air temperature) as the default, constant fan-on energy should be incorporated in the standby power measurement, along with the bin-hour attribution of standby to SEER2 and HSPF2. (*Id.*)

As previously mentioned, AHRI and stakeholders, including DOE, considered several topics raised in the January 2023 RFI, including shoulder-season fan power consumption, when considering updated versions of industry standards. The information provided in the aforementioned comments was discussed in detail in the development of AHRI 1600–202X Draft. The draft industry test standards do not include constant circulation fan energy consumption in the efficiency metrics due to the use of this mode by the minority of consumers which are understood to select it, for systems for which the mode is user-selectable. However, for systems that require constant circulation at all times as a refrigerant leakage mitigation strategy, the constant circulation is considered as part of the standby and off mode energy use in the SCORE and SHORE metrics of AHRI 1600–202X Draft, and also in the cyclic degradation coefficient for both test standards. The AHRI 1600–202X Draft provisions that account for shoulder-season fan power consumption are detailed in section III.F.1.e of this NOPR.

(e) Accounting for Auxiliary Components' Power Consumption

The information provided by stakeholders in comments, summarized in the previous subsections, was discussed in detail in the development of AHRI 1600–202X Draft, which accounts for crankcase heater, base pan heater, and constant circulation fan energy consumption (as applicable) in the calculations of the new cooling and heating performance metrics, SCORE and SHORE. AHRI 1600–202X Draft introduces SCORE and SHORE as replacements for the current cooling and heating performance metrics, SEER2 and HSPF2, used to determine the measured efficiency of CAC/HPs. Unlike SEER2 and HSPF2, which DOE previously noted are only seasonal descriptors, these new metrics account for the standby and off-mode power consumption of auxiliary components, including those components discussed previously (*i.e.,* crankcase heaters and indoor fans utilizing constant-circulation) for both SCORE and SHORE; and, additionally, base pan heaters for SHORE.

AHRI 1600–202X Draft includes a new quantity, $E_{s,c}$ (measured in watt-hours), added to the denominator of the calculation for SCORE, meant to represent all auxiliary component energy usage during cooling mode (*i.e.,* during both cooling conditioning hours and cooling-season shoulder-season hours, as applicable). Outlined in section 11.2.1.4 of AHRI 1600–202X Draft, $E_{s,c}$ is the summation of each component's average power multiplied by each component's number of hours of standby operation during cooling mode, as follows:

$$E_{s,c} = (P_1 * N_1 + P_2 * N_2) + (P_{CCF} * N_{CCF})$$

Table 14 of AHRI 1600–202X Draft outlines instructions for determining each component's number of standby power operating hours in cooling mode (N_1 and N_2 for the crankcase heater and N_{CCF} for the constant circulation fan). In the case of crankcase heaters, calculations for N_1 and N_2 depend on the type of crankcase heater controls used by the CAC/HP system.

AHRI 1600–202X Draft also includes a new quantity, $E_{s,h}$ (also measured in watt-hours), added to the denominator of the calculation for SHORE, that is meant to represent all auxiliary component energy usage during heating mode (*i.e.,* during both heating conditioning hours and heating-season shoulder-season hours, as applicable). Outlined in section 11.2.1.4 of AHRI 1600–202X Draft, $E_{s,c}$ is the summation of each component's average power multiplied by each component's number of hours of standby operation during heating mode, as follows:

$$E_{s,h} = (P_1 * N_1 + P_2 * N_2) + (P_{BPH} * N_{BPH})$$

Table 16 of AHRI 1600–202X Draft outlines instructions for determining each component's number of standby power operating hours in heating mode (N_1 and N_2 for the crankcase heater,

[81] *See* 77 FR 28674, 28682–28683 for the survey data used to estimate this value in a furnace fan NOPR published on May 15, 2012.

N_{CCF} for the constant circulation fan, and N_{BPH} for the base pan heater). In the case of crankcase heaters, calculations for N_1 and N_2 depend on the type of crankcase heater controls used by the CAC/HP system. Similarly, the calculation of N_{BPH} depends on the type of base pan heater controls used by the system.

Appendix H of AHRI 1600–202X Draft outlines instructions for determining the average power (P_1 and P_2 for the crankcase heater, P_{CCF} for the constant circulation fan, and P_{BPH} for the base pan heater) of all auxiliary components considered in the calculations of either $E_{s,c}$ or $E_{s,h}$.

DOE surmises that the respective inclusions of $E_{s,c}$ and $E_{s,h}$ into the calculations of the new cooling and heating performance metrics, SCORE and SHORE, represent industry consensus regarding whether to reflect the power consumption of auxiliary components in the efficiency metrics for CAC/HPs. DOE has tentatively determined that inclusion of the energy consumed by auxiliary components in the efficiency metrics for CAC/HPs would result in more representative measures of efficiency. Therefore, DOE is proposing to incorporate by reference the new cooling and heating performance metrics, SCORE and SHORE, as included in AHRI 1600–202X Draft, and the associated provisions regarding the standby and off-mode power consumption of auxiliary components, in appendix M2.

2. Impact of Defrost on Performance

When operating in moderate to low outdoor ambient temperatures, the outdoor coil surface temperature of a HP is sufficiently low to freeze over, and frost collects on the coil. To combat the collection of ice on the outdoor coil, a HP must undergo a defrost cycle, where the HP temporarily switches to cooling mode operation. Temporarily switching to cooling mode operation enables a HP to transfer heat from the indoor coil to the outdoor coil, thus providing the heat needed to warm the coil and melt the frost. During defrost, different control strategies are applied to maintain comfort level inside the house. For example, the indoor fan may or may not be operated during defrost, and (if the indoor fan is operated) the auxiliary resistance heater may or may not be energized to warm the indoor air while the system is temporarily in defrost mode. Defrost initiation can be based on time (clock time or time of compressor operation), or the need for defrost can be determined based on temperature and pressure or other measurements that provide an indication of the need for defrost.[82] Currently, appendix M1 defines a demand-defrost control system as a system that defrosts the HP outdoor coil only when measuring a predetermined degradation of performance. When frequent defrost occurrences are not needed (*e.g.,* when there is insufficient moisture in the outdoor air to build up a significant frost layer on the outdoor coil), demand defrost can save energy by delaying defrost initiation. Defrost cycles are terminated when there is indication that defrost has been long enough for frost to be eliminated from the coil (*e.g.,* when a coil temperature sensor indicates the coil is well above 32°F).

(a) Demand Defrost Credit

For CAC/HPs equipped with demand defrost, appendix M1 includes a term called the demand defrost credit (''F_{def}'') in the HSPF2 calculation to provide nominal credit for HPs with a demand-defrost control system,[83] reflecting the relative improvement in heating mode efficiency due to use of demand defrost rather than defrosts with fixed periodicity. The credit equation has remained unchanged in its current form in the test procedure since at least January 22, 2001, when DOE published a NOPR regarding CAC/HP test procedures. 66 FR 6767. In the January 2023 RFI, based on test results of several CAC/HPs in various programs, DOE noted that it is aware of a range of defrost operation sequences and a range of approaches to defrost initiation for demand defrost. 88 FR 4091, 4104. Based on these observations, DOE acknowledged that the demand defrost credit may no longer accurately reflect the benefits of demand defrost. *Id.*

In the January 2023 RFI, DOE sought information on the operation of demand-defrost control systems, specifically any information that would indicate whether the demand-defrost credit outlined in the calculation in section 3.9.2 of appendix M1 is representative of the improvement in seasonal heating efficiency in field operation. 88 FR 4091, 4104. DOE also requested comment on whether any specific change in the credit equation could improve its accuracy. *Id.*

In response, AHRI, Daikin, and Rheem all commented that they would support an effort by stakeholders to establish a new demand defrost credit that incentivizes advanced defrost strategies and more accurately reflects the current state of defrost technology. (AHRI, No. 14 at p. 13; Daikin, No. 16 at pp. 9–10; Rheem, No. 12 at pp. 7–8) Similarly, the Joint Advocates encouraged DOE to provide a more sophisticated calculation of the credit, if a revised test procedure maintains the treatment of defrost separately (as a separate test). (Joint Advocates, No. 8 at pp. 3–4)

Daikin and the Joint Advocates commented that the current defrost credit is overly dependent on timing between defrosts and suggested that the current defrost credit calculation methodology should be modified to recognize, differentiate, and incentivize other advanced defrost strategies and their controls. (Daikin, No. 16 at pp. 9–10; Joint Advocates, No. 8 at pp. 3–4) Daikin specifically pointed out that appendix M1 currently only recognizes a 3-percent maximum credit during defrost for a defrost cycle of 91 minutes (even though modern equipment in some cases can go significantly longer than 91 minutes before performance degradation necessitates a defrost) and suggested that the current procedure be modified so that it no longer incentivizes the 91-minute cycle regardless of whether equipment needs to defrost at that time. (Daikin, No. 16 at pp. 9–10) The Joint Advocates noted that, in the definition of demand defrost control system, DOE acknowledges the different types of controls including parameters that vary with the amount of frost accumulated on the outdoor coil (*e.g.,* coil to air differential temperature, coil differential air pressure, outdoor fan power or current, or optical sensors) and suggested that these parameters be included in the calculation methodology of a new demand defrost credit. (Joint Advocates, No. 8 at pp. 3–4)

As previously mentioned, AHRI and other stakeholders, including DOE, discussed several issues raised in the January 2023 RFI, including the topic of the demand defrost credit, when considering updated versions of industry standards. The information provided in the aforementioned comments was discussed in detail in the development of AHRI 1600–202X Draft, which includes a simplified demand

[82] Some examples of parameters monitored for demand-defrost control systems are coil to air differential temperature, coil differential air pressure, outdoor fan power or current, optical sensors. Note that systems that vary defrost intervals according to outdoor dry-bulb temperature are not demand-defrost systems.

[83] The demand-defrost credit, first introduced in a March 14, 1988 rulemaking (53 FR 8304, 8319), is calculated by the following equation in section 3.9.2 of appendix M1: $F_{def} = 1 + 0.03[1 - \Delta\tau_{def} - 1.5/\Delta\tau_{max} - 1.5]$, where $\Delta\tau_{def}$ = time between defrost terminations (in hours) or 1.5, whichever is greater. $\Delta\tau_{def}$ is assigned a value of 6 if this limit is reached during a frost accumulation test and the heat pump has not completed a defrost cycle, and $\Delta\tau_{max}$ = maximum time between defrosts as allowed by the controls (in hours) or 12, whichever is less, as provided in the certification report.

defrost credit that uniformly applies a 3% increase to the SHORE rating for all HPs. As such, F_{def} no longer depends on the amount of time between defrost initiations (*e.g.,* T_{def} and T_{max} in appendix M1), and can be either one of two values: 1.03 (for systems equipped with a demand defrost control system) or 1 (for all other systems). DOE surmises that the simplified demand defrost credit in AHRI 1600–202X Draft represents industry consensus regarding improvements to the accuracy of the credit, incentives for more efficient defrost control strategies, and more accurate representations of modern defrost control technologies in the test procedure. DOE has tentatively determined that a simplified demand defrost credit would disincentivize unnecessary early defrosts (90 minutes after the termination of the prior defrost cycle), accurately represent defrost energy use while limiting test burden, and consequently allow for more advanced and efficient defrost control strategies. Therefore, DOE is proposing to incorporate by reference the simplified demand defrost credit in AHRI 1600–202X Draft, at appendix M2.

(b) Supplementary Heat Usage

Appendix M1 requires that HPs undergo a test at 35 °F dry-bulb temperature and 33 °F wet-bulb temperature, a condition for which frost accumulation is rapid, generally affecting performance before a 30-minute steady-state test can be completed. For this condition, the test procedure prescribes use of a transient test, including a frost accumulation period followed by defrost. Capacity and power input for the test are averaged for a full cycle of heating followed by defrost. At this condition, appendix M1 estimates the average capacity is at least 10 percent lower than it would be if there were no frost accumulation, while average power may be just slightly lower, thus reducing efficiency. At temperatures between 17 °F and 45 °F, the performance calculations prescribed in the test procedure call for representing capacity as a linear function of temperature based on the tests conducted at 17 °F and 35 °F—likewise for power input. Hence, the frost/defrost impact is built into the HSPF2 calculation for temperatures in this range. The DOE test procedure requires use of the 35 °F test for single-stage and two-stage HPs for all capacity levels. However, for variable speed HPs, the test procedure requires the defrost test be conducted only at intermediate compressor speed, and performance is estimated using default degradation factors at full capacity (*see* section 3.6.4.1.c of appendix M1).

In the January 2023 RFI, DOE noted that it has observed variations in testing among HP models regarding defrost control (*e.g.,* time durations of the defrost can vary significantly for different models, and the indoor unit fan shuts off during defrost for some units but not all). 88 FR 4091, 4104. In addition, as part of testing systems with electric resistance heaters for the DOE CCHP Tech Challenge, DOE noted that it has observed that resistance heater operation during defrost can vary significantly for different models. (*Id.*) DOE acknowledged that this varying behavior clearly affects energy use, and, while some aspects of resistance heater operation may be captured by the current appendix M1 test procedure, others may not be.

As a result, in the January 2023 RFI, DOE requested information regarding defrost impact on heating capacity and power input over a range of temperatures to inform evaluation of whether the approach used in the DOE test procedure to account for this impact is accurate or whether it could be improved.

In response, Daikin commented that it believes the current appendix M1 test conditions represent the worst-case scenario and adequately capture performance during frosting and defrosting operation. (Daikin, No. 16 at pp. 9–10) As such, Daikin asserted that additional test points would provide little benefit. (*Id.*) Similarly, neither AHRI nor Rheem had any concerns with the current testing approach. (AHRI, No. 14 at p. 13; Rheem, No. 12 at p. 8)

However, Daikin, the Joint Advocates, and NEEA all suggested that DOE somehow include auxiliary resistance heat during defrost as part of the defrost test, claiming it would be more representative to include this power. (Daikin, No. 16 at p. 12; Joint Advocates, No. 8 at p. 3; NEEA, No. 13 at p. 8) Currently, the appendix M1 test procedure specifies that electric heat is not to be powered during the defrost test, regardless of whether a unit may do so in the field. To try and estimate the change in efficiency that comes with including auxiliary resistance heat, the Joint Advocates cited a recent Purdue study of a 3-ton, single-stage heat pump, which calculated a COP at 34 °F that was 10-percent lower when the auxiliary heat was allowed to operate in defrost.[84] (Joint Advocates, No. 8 at p. 3) Acknowledging that many test facilities are not designed to handle the power required for auxiliary heat operation, Daikin suggested that power be added to the defrost test energy consumption and capacity as a calculation only, based on the maximum allowable power for a given HP system. (Daikin, No. 16 at p. 12)

NYSERDA and the Joint Advocates both noted that as a load-based test, SPE07 would inherently address defrost impacts, including power input and capacity loss, and require no separate test. (Joint Advocates, No. 8 at pp. 3–4; NYSERDA, No. 9 at pp. 10–11)

As previously mentioned, AHRI and other stakeholders, including DOE, discussed several topics raised in the January 2023 RFI, including the topic of accounting for supplementary heat usage (*e.g.,* auxiliary resistance heat) in the CAC/HP efficiency metrics, when considering updated versions of industry standards. The information provided in the aforementioned comments was discussed in detail in the development of AHRI 1600–202X Draft, which accounts for use of supplementary heat during defrost. The AHRI 1600–202X Draft approach reduces the efficiency ratings of such systems, depending on: (1) whether the HP uses what is defined as defrost heat mode; (2) whether the HP meets what is defined as the lockout limitation criteria; and (3) the time period for which the HP operates in what is defined as defrost overrun mode. The definitions for defrost heat mode, lockout limitation, and defrost overrun mode in AHRI 1600–202X Draft are shown below.

Defrost Heat Mode means a mode of operation in which an indoor heating source controlled by any component of the rated combination (*e.g.,* by the heat pump, heat pump controls, blower controls, or thermostat) operates for any period of time while the system is defrosting. Heat pump systems that have the ability to operate the indoor blower during defrost, whether or not that ability is the manufacturer default, are considered to have a *Defrost Heat Mode.*

Defrost Overrun Mode means a mode of operation in which a rated individual combination that has been operating in a *Defrost Heat Mode,* continues to operate for a period of time following the termination of a defrost. In order to qualify as having a *Defrost Overrun Mode,* rated individual combinations must first have a *Defrost Heat Mode.*

Lockout Limitation means rated individual combinations that lock out the operation of all non-heat pump indoor heating sources under the control of the rated individual

[84] *See docs.lib.purdue.edu/cgi/viewcontent.cgi?article=3475&context=iracc* at p. 6. The 34 °F outdoor ambient test condition is taken from EXP07.

combination during defrost do not have a *Defrost Heat Mode.* Locking out means preventing those heating sources from operating in all cases, with no configuration option to change this behavior.

AHRI 1600–202X Draft introduces two new debits, multiplied to the new heating metric, SHORE, in the same manner as the demand defrost credit, to penalize the efficiency ratings of HPs that use defrost heat mode (unless they meet the lockout limitation criteria) or spend a period of time greater than or equal to 60 seconds in defrost overrun mode. One such debit is the defrost heat debit (''F_H''), which is meant to reflect the reduction in efficiency experienced by HPs that use defrost heat mode and can be either one of two values: 0.98 (for systems with a defrost heat mode) or 1 (for systems that meet the lockout limitation criteria). The second debit is the defrost overrun debit (''F_O''), which is meant to reflect the reduction in efficiency experienced by HPs that spend longer time periods in defrost overrun mode and can be either one of two values: 0.98 (for systems with a defrost overrun mode greater than or equal to 60 seconds) or 1.00 (for systems with a defrost overrun mode less than 60 seconds, or systems that meet the lockout limitation criteria).

DOE surmises that the AHRI 1600–202X Draft's introductions of the defrost heat debit, the defrost overrun debit, and the associated definitions for defrost heat mode, lockout limitation, and defrost overrun mode represent industry consensus regarding whether and how to include the additional power consumption required by supplementary heat (*e.g.,* auxiliary resistance heat) in the defrost test. DOE has tentatively determined that these provisions result in more representative CAC/HP efficiencies for models with supplementary heat during defrost. Therefore, DOE is proposing to incorporate by reference at appendix M2 the defrost heat debit, the defrost overrun debit, and the associated definitions for defrost heat mode, lockout limitation, and defrost overrun mode in AHRI 1600–202X Draft.

3. Updates to Building Load Lines and Temperature Bin Hours

In the current CAC/HP test procedure at appendix M1, the cooling efficiency metric, SEER2, is calculated by evaluating the ratio of the heating removed from the conditioned space to the energy use of the refrigeration cycle during the cooling season. For CHPs, the heating efficiency metric, HSPF2, is calculated by evaluating the ratio of the heating provided to the conditioned space to the space energy usage of both the CHP unit (reverse refrigeration cycle) and the resistive heat component, during the heating season. For the evaluation of SEER2 and HSPF2, the respective ratios are summed over a temperature range, which is split into 5-degree ''bins,'' and an average temperature and fractional hours are assigned to each bin, denoted by *n(j)/N.* The cooling season fractional hours, used in the evaluation of SEER2, are set forth at Table 19 of appendix M1. The heating season fractional hours, used in the evaluation of HSPF2, are set forth at Table 20 of appendix M1. The HSPF2 rating is calculated using the fractional hours particular to Region IV. The amount of cooling and/or heating delivered are driven by the building cooling and heating loads, $BL(T_j)$.[85] For the current test procedure, the building cooling and heating loads are both proportional to the nominal cooling capacity at 95 °F outdoor temperature, $\dot{Q}_c$(95 °F), except for heating-only heat pumps, for which the heating load is directly proportional to the nominal heating capacity at 47 °F outdoor temperature, $\dot{Q}_h$(47 °F).

In response to the January 2023 RFI, NYSERDA encouraged DOE to reevaluate the fractional cooling bin hours used for calculating SEER2. (NYSERDA, No. 9 at pp. 9–10) NYSERDA pointed out that these fractional cooling bin hours were originally developed in 1978 specifically for units with a two-speed compressor and units equipped with two compressors. (*Id.*) NYSERDA suggested that these hours should be recalculated using more recent Typical Meteorological Year (''TMY'') data, and also consider the improvements in CAC/HP technology since 1978. (*Id.* at p. 10)

As previously mentioned, AHRI 1600–202X Draft includes new cooling and heating metrics for namely SCORE and SHORE. These new metrics use total hours instead of fractional hours. This change is consistent with the recent approach of having metrics that represent total conditioning delivered divided by all power consumed. Total hours are split into conditioning hours and shoulder hours—conditioning hours are hours when conditioning (cooling/heating) is required and shoulder hours are hours when conditioning (cooling/heating) is not required (*i.e.,* there is no conditioning load). For the cooling season, the total hours are split into cooling conditioning hours and cooling season shoulder hours. For the heating season, the total hours are split into heating conditioning hours and heating season shoulder hours. The cooling conditioning hours and cooling season shoulder hours for each bin are listed in Table 13 of AHRI 1600–202X Draft, and the heating conditioning hours and heating season shoulder hours for each bin are listed in Table 15 of AHRI 1600–202X Draft.

The total hours for the cooling and heating seasons were calculated using TMYx:2007–2021 data (''TMYx''), which is a specific set of weather data from years 2007 to 2021. Because SCORE and SHORE are intended to be national efficiency standards, the total hours for each season were population-weighted. Multiple cities were selected, based on their population, from each climate zone specified in ASHRAE 169–2021,[86] for capturing the variations in climate along those zones. To determine the appropriate split between conditioning hours (*i.e.,* when cooling/heating is required) and shoulder hours (*i.e.,* when cooling/heating is not required), Pacific Northwest National Laboratory (''PNNL'') performed a series of building load analyses using EnergyPlus version 9.6 on a prototype single-family detached house based on the 2009 IECC code, located in representative cities in ASHRAE climate zones 1–8. The inputs for the EnergyPlus simulations were selected to largely mirror those that had been previously used in informing the January 2017 Final Rule, but with appropriate updates to the weather data and the IECC code.[87] The underlying weather data was updated to TMYx and the IECC building code was updated to the 2009 version. The data from each individual EnergyPlus simulation output was binned and yielded the cooling conditioning hours, cooling season shoulder hours, heating conditioning hours, and heating season shoulder hours for each climate zone, which were then population-weighted to arrive at the national numbers in Table 13 and Table 15 of AHRI 1600–202X Draft. Additionally, for CAC/HPs

[85] The building cooling load and building heating load are calculated by Equations 4.1–2, and 4.2–2, respectively, in appendix M1.

[86] ASHRAE 169–2021 ''Climatic Data for Building Design Standards'' provides a variety of climatic information used mainly the design, planning and sizing of buildings' energy systems and equipment. Available for purchase at *www.ashrae.org/technical-resources/bookstore/weather-data-center#:~:text=Standard%20169%2D2021%2C%20Climatic%20Data,the%202021%20ASHRAE%20Handbook%E2%80%94Fundamentals.*

[87] For the January 2017 Final Rule, the building load analysis done by ORNL using EnergyPlus is summarized in the following report: ORNL, Rice, C. Keith, Bo Shen, and Som S. Shrestha, 2015. An Analysis of Representative Heating Load Lines for Residential HSPF Ratings, ORNL/TM–2015/281, July. (Docket No. EERE–2009–BT–TP–0004–0046).

located in cold climates, Table 15 of AHRI 1600–202X Draft also includes the ''Cold Climate Average'' heating conditioning hours and heating shoulder hours. These were calculated by a population-weighted average of the data from EnergyPlus simulations for the colder climate ASHRAE zones 5–8.

Regarding updates to the building load lines, the PNNL EnergyPlus simulations also yielded the average cooling and average heating loads for each climate zone, binned by temperature intervals of 5 °F. The results obtained were largely consistent with the building load lines (BL(T_j)) in the current appendix M1, barring the minor flattening of the building load near the zero-load points. As such, the equations used for calculating the building loads were 'split' into two sections in AHRI 1600–202X Draft. The cooling building load line for outdoor temperatures at and above 72.5 °F was maintained consistent with current appendix M1, but with one change—requiring that the multiplier 'V' in the cooling building load line apply to all variable-capacity compressor systems instead of just variable-capacity heat pumps.

For outdoor temperatures above 72.5 °F, the cooling building load line was modified, given by:

$$BL(t_j) = \frac{\{tj - 61\}}{\{72.5 - 61\}} \cdot BL(72.5)$$

Where *BL*(47.5) is the cooling building load at 72.5 °F.

Similarly, the heating building load line for outdoor temperatures at and below 47.5 °F was maintained consistent with current appendix M1, but with one change—requiring that the slope (adjustment) factor, C_x, be set to 1.07 for variable-capacity compressor systems, and 1.15 otherwise, regardless of climate zone.

For outdoor temperatures above 47.5 °F, the heating building load line was modified, given by:

$$BL(t_j) = \frac{\{59 - t_j\}}{\{59 - 47.5\}} \cdot BL(47.5)$$

Where *BL*(47.5) is the heating building load at 72.5 °F.

DOE surmises that the switch from fractional hours to total hours, the associated values of the conditioning hours and shoulder hours, and changes in the building load line equations represent industry consensus for calculations of the new cooling and heating performance metrics, SCORE and SHORE. DOE has tentatively determined that this approach best represents CAC/HP operation over a representative period of use. Therefore, DOE is proposing to incorporate by reference the new cooling conditioning hours, cooling season shoulder hours, heating conditioning hours, heating season shoulder hours, and the updated building load line equations in the AHRI 1600–202X Draft, at appendix M2. DOE is also clarifying that representations of SHORE made using the 'Cold Climate Average' heating conditioning hours and shoulder season hours in Table 15 of AHRI 1600–202X Draft are optional.

4. Default Fan Power Coefficients for Coil-Only Systems

Coil-only air conditioners are matched split systems consisting of a condensing unit and indoor coil that are distributed in commerce without an indoor blower or separate designated air mover. Such systems installed in the field rely on a separately installed furnace or a modular blower for indoor air movement. Because coil-only CAC/HPs do not include their own indoor fan to circulate air, the DOE test procedures prescribe equations that are used to calculate the assumed (*i.e.,* ''default'') power input and heat output of an average furnace fan with which the test procedure assumes the indoor coil is paired in a field installation. In each equation, the measured airflow rate (in cubic feet per minute of standard air (''scfm'')) is multiplied by a defined coefficient (expressed in Watts (''W'') per 1000 scfm (''W/1000 scfm'') for fan power, and Btu/h per 1000 scfm (''Btu/h/1000 scfm'') for fan heat), hereafter referred to as the ''default fan power coefficient'' and ''default fan heat coefficient.'' The resulting fan power input value is added to the electrical power consumption measured during testing. The resulting fan heat output value is subtracted from the measured cooling capacity of the CAC/HP for cooling mode tests and added to the measured heating capacity for heating mode tests.

In appendix M1, separate fan power and fan heat equations are provided for different types of coil-only systems (*e.g.,* the equations for mobile home or space-constrained are different than for ''conventional'' non-mobile home and non-space-constrained, and the equations for single-stage are different than for two-stage and variable speed).[88] *See, e.g.,* appendix M1, section 3.3. For single-stage coil-only units installed in mobile homes and for single-stage space-constrained systems, appendix M1 defines a default fan power coefficient of 406 W/1000 scfm and a default fan heat coefficient of 1385 Btu/h/1000 scfm. *See, e.g.,* appendix M1, section 3.3.d. For single-stage coil-only units installed in ''conventional'' (*i.e.,* non-mobile-home and non-space-constrained) systems, appendix M1 defines a default fan power coefficient of 441 W/1000 scfm and a default fan heat coefficient of 1505 Btu/h/1000 scfm. *See, e.g.,* appendix M1, section 3.3.e.

For two-stage and variable speed coil-only systems, appendix M1 defines equations to interpolate different default fan power coefficients and default fan heat coefficients for the full-load and part-load tests, depending on the air volume rate used for each test expressed as a percentage of the cooling full-load air volume rate (''%FLAVR''). *See, e.g.,* appendix M1, section 3.3, equations for $DFPC_{MHSC}$ and $DFPC_C$. Appendix M1 interpolates the default fan power coefficient for two-stage and variable speed coil-only units installed in mobile homes and for two-stage and variable speed space-constrained coil-only systems (''$DFPC_{MHSC}$'') using assumptions for full-load default fan power at 406 W (*i.e.,* the same as for single-stage systems) and a lower-load default fan power at a reduced air volume rate of 75 percent, at 308 W. For ''conventional'' non-mobile-home and non-space-constrained two-stage and variable speed systems, appendix M1 interpolates the default fan power coefficient (''$DFPC_C$'') using assumptions for full-load default fan power at 441 W (*i.e.,* the same as for single-stage systems) and a lower-load default fan power at a reduced air volume rate of 75 percent, at 335 W. The default fan power values used in the determination of the default fan power coefficients were a result of empirical analysis presented by DOE in the October 2022 Final Rule. (*See* 87 FR 64550, 64555–64559).

As previously mentioned, AHRI and other stakeholders, including DOE, considered several topics, including the topic of default fan power coefficients for coil-only systems, when developing updated versions of industry standards. AHRI 1600–202X Draft updates the default fan power values used in each interpolation to better reflect the fan power values used by coil-only systems today (on average) and changes the equations for default fan power

[88] The different default fan power and default fan heat coefficients for mobile-home and space-constrained systems as compared to conventional systems reflect the lower duct pressure drop expected for such systems in field operation—the lower values are consistent with the lower ESP levels required in testing of blower-coil systems intended for mobile home and spaced-constrained applications (*see* Table 4 of appendix M1).

coefficients to use lower-load default fan powers at a reduced air volume rate of 65 percent, rather than 75 percent as in appendix M1. For space-constrained coil-only systems, the AHRI 1600–202X Draft uses a full-load default fan power of 293 W and a lower-load default fan power of 135 W in the default fan power coefficient interpolation. For non-space-constrained coil-only systems, AHRI 1600–202X Draft uses a full-load default fan power of 346 W and a lower-load default fan power of 159 W. All default fan powers are lower than those used in the calculation of $DFPC_{MHSC}$ and $DFPC_{C}$ in appendix M1. DOE surmises that the new equations for default fan power coefficients and default fan heat coefficients (and their reduced full-load default fan powers and their reduced lower-load default fan powers at a reduced air volume rate of 65 percent) in AHRI 1600–202X Draft represent industry consensus regarding the assumed power input and heat output of an average furnace fan or modular blower with which the test procedure assumes the indoor coil is pared in a field installation. DOE has tentatively determined that the reduced full-load and low-load default fan powers more accurately reflect the average design of the current installed base for blowers paired with coil-only CAC/HP installations, which increasingly use more efficient fan motors (with lower wattages). DOE has also tentatively determined that the reduced air volume rate more accurately reflects the average low-load air volume rate of the current installed base for blowers paired with coil-only CAC/HP installations. Therefore, DOE is proposing to incorporate by reference the default fan power coefficient equations and default fan heat coefficient equations, and associated default fan powers used to interpolate such coefficients, in AHRI 1600–202X Draft, at appendix M2.

5. Indoor Ambient Test Conditions for Cooling Mode Tests

Currently, appendix M1 prescribes test conditions for CAC/HPs in Tables 5, 6, 7, and 8 that require all cooling mode tests to be performed under air entering indoor unit temperatures of 80 °F (dry-bulb temperature)/67 °F (wet-bulb temperature), with some wet-bulb temperature exceptions.

In response to the January 2023 RFI, DOE received several comments regarding these indoor ambient test conditions. As mentioned previously in this NOPR, the Joint Advocates encouraged DOE to choose more representative indoor air temperatures for the cooling mode tests. (Joint Advocates, No. 8 at p. 3) Specifically, the Joint Advocates referred to an ACEEE paper [89] that suggests indoor temperatures of 75 °F/63 °F would be more representative than the 80 °F/67 °F conditions currently used in appendix M1. (*Id.*) The Joint Advocates also referred to recommendation 4 of the 2022 ASRAC CUAC and CUHP WG TP term sheet, which recommends return air temperature (''RAT'') test conditions for cooling at 77 °F/64 °F, not 80 °F/67 °F, to calculate seasonal performance metrics. (*Id.*) Similarly, NYSERDA also recommended that DOE consider revising the air entering indoor unit temperature conditions in the cooling mode tests, asserting that the conditions are not representative of actual setpoints in the field, per 2020 RECS data.[90] (NYSERDA, No. 9 at p. 9)

In its comments regarding the comparison of appendix M1 test conditions to those test conditions used by SPE07, Daikin pointed out that changing the indoor dry-bulb and wet-bulb temperature conditions would significantly alter the numerical value of resultant efficiency metrics. (Daikin, No. 16 at p. 5) Specifically, Daikin estimated that changing the indoor ambient test conditions from 80 °F/67 °F to 75 °F/63 °F alone would result in an approximate 9-percent reduction in capacity (and therefore efficiency), although Daikin could not share its data to back this estimate. (*Id.*) If the indoor ambient test conditions were to change, Daikin stated that the numerical shift should not affect the ranking order of CAC/HPs by measured efficiencies. (*Id.*) Daikin also noted that requiring additional testing at different test conditions would increase time burden, costs, and trouble for manufacturers. (*Id.*)

The information provided in the aforementioned comments was discussed in detail in the development of the AHRI 1600–202X Draft, which maintained the existing indoor ambient test conditions for cooling tests. DOE surmises that this absence of change tentatively represents industry consensus regarding whether the existing 80 °F/67 °F indoor ambient test conditions require amendments at this time. DOE has tentatively determined that the potential benefits of such a change would not outweigh the resulting consumer confusion and oversizing issues stemming from a change to the nominal ratings of systems. Therefore, DOE is proposing no change to the current indoor ambient test conditions for the cooling mode tests.

6. Air Flow Limits To Address Inadequate Dehumidification

During the development of AHRI 1600–202X Draft, AHRI and other stakeholders, including DOE, considered a variety of topics regarding CAC/HPs, including topics that were not explicitly raised by issues presented in the January 2023 RFI. Among those topics was how to address issues relating to the dehumidification inadequacy of some CAC/HPs. Some CAC/HPs have sensible heat ratios (''SHRs'') too high to meet consumer needs for dehumidification, especially in hot and warm, humid climates.

To ensure that CAC/HPs ratings account for adequate dehumidification in these climates, the AHRI 1600–202X Draft establishes new airflow limits for the cooling mode tests to avoid high SHRs. Specifically, section 6.1.5.2 of the AHRI 1600–202X Draft sets a maximum airflow limit at 37.5 scfm per 1000 Btu/h (*i.e.,* 450 cfm per ton of capacity) for cooling full airflow. Additionally, section 6.1.5.3 of the AHRI 1600–202X Draft sets a maximum airflow limit at 50 scfm per 1000 Btu/h (*i.e.,* 600 cfm per ton of capacity) for cooling low airflow. Should the cooling full airflow or cooling low airflow specified by the manufacturer exceed these limits, the AHRI 1600–202X Draft requires that airflows be reduced to meet these limits for testing.

DOE surmises that the addition and selection of specific cooling airflow limits in the AHRI 1600–202X Draft represent industry consensus regarding the issue of inadequate dehumidification. DOE has tentatively determined that such airflow limits are appropriate to ensure that CAC/HPs provide adequate dehumidification during cooling mode operation. Therefore, DOE is proposing to incorporate by reference the cooling full airflow and cooling low airflow limits specified in the AHRI 1600–202X Draft, at appendix M2.

H. General Comments Received in Response to the January 2023 RFI

In response to the January 2023 RFI, DOE received several general comments not specific to any one test procedure provision. This section discusses those general comments received.

Both AHRI and NCP commented that the requirement to test according to appendix M1 (effective January 1, 2023), specifically the change to SEER2 and HSPF2 metrics, caused considerable confusion in the marketplace. (AHRI, No. 14 at p. 4; NCP, No. 7 at p. 2) As

[89] *See www.aceee.org/files/proceedings/2006/data/papers/SS06_Panel1_Paper24.pdf.*

[90] *See www.eia.gov/consumption/residential/data/2020/hc/pdf/HC%207.1.pdf.*

a result of the metrics change (and lower values for efficiency for SEER2 and HSPF2), AHRI and NCP explained that they and other manufacturers worked together to develop educational resources for dealers, contractors, code officials, and end-users in an effort to quell confusion. (*Id.*) However, AHRI stated that distributing such resources was difficult considering the large number of contractors and installers in jurisdictions across the nation. (*Id.*) Both AHRI and NCP commented that the burden associated with the previous metrics change to SEER2 and HSPF2 was not well accounted for in the last test procedure rulemaking. (*Id.*) Subsequently, NCP stated that DOE should allow time to measure the overall impact of the new appendix M1 ratings and assess any actual benefit before undertaking additional steps to amend the procedure in this test procedure rulemaking. (NCP, No. 7 at p. 2)

As noted earlier, DOE is proposing to incorporate by reference industry standards at appendix M1 and appendix M2, which were developed with the broad consensus of several stakeholders, including AHRI and NCP. It is DOE's hope that incorporating each industry standard in full as the basis for each respective appendix would enable DOE to limit manufacturer burden that would have otherwise arisen solely due to certifying to a standalone Federal test procedure. DOE has tentatively determined that the revisions proposed at appendix M1 would not result in changes in the SEER2 and HSPF2 metrics, and notes that use of appendix M2 would not be required until the compliance date of any amended standards denominated in terms of the new metrics, SCORE and SHORE. Additionally, DOE has assessed the test procedure costs and impacts in section III.M of this NOPR and has provided an opportunity to comment.

Lennox stated that DOE should fully consider the impacts of transitioning to lower GWP refrigerants as part of the test procedure rulemaking process. (Lennox, No. 6 at p. 2) Lennox commented that HVACR manufactures will be investing millions of dollars in product development and capital investment to facilitate a transition across the entire HVACR product portfolio of residential and commercial equipment and that these impacts must be considered in this test procedure rulemaking. (*Id.*)

DOE notes that Lennox did not identify any specific impacts related to transitioning to low GWP refrigerants. As discussed in section III.F.5, DOE has considered that with the use of low GWP refrigerants, particularly A2L refrigerants, a subsequent need may exist for the constant circulation of air or circulation based on leak detection to accommodate the refrigerant leak detection and mitigation strategies in CAC/HP product design. Both the AHRI 210/240–202X Draft and AHRI 1600–202X Draft include provisions for such systems, which DOE is incorporating by reference at appendix M1 and appendix M2, respectively. Lennox was involved in the development of these industry standards and DOE surmises that Lennox's concerns pertaining to impacts of lower GWP refrigerants have been appropriately addressed.

Lennox also stated that DOE should exercise caution as it proceeds with test procedure amendments for CAC/HP products to ensure the impacts and timing of test procedure amendments are fully considered, particularly so that manufacturers may fully evaluate any test procedure impacts before DOE assesses potentially amending energy conservation standards. (Lennox, No. 6 at p. 2)

In response to Lennox, DOE notes that both test procedures and energy conservation standards actions are subject to the requirements of EPCA. As discussed, EPCA states that the Secretary shall review test procedures for all covered products, including CAC/HPs, at least once every 7 years. (*see* 42 U.S.C. 6293(b)(1)(a)) The most recent CAC/HP test procedure rulemaking completed in satisfaction of EPCA's 7-year review requirement concluded with the January 2017 Final Rule. (*See* 82 FR 1426). Similarly, EPCA also requires that, not later than 6 years after the issuance of any final rule establishing or amending a standard, DOE evaluate the energy conservation standards for each type of covered product, including CAC/HPs, and publish either a notification of determination that the standards do not need to be amended, or a NOPR that includes new proposed energy conservation standards (proceeding to a final rule, as appropriate). (*See* 42 U.S.C. 6295(m)(1)) The most recent CAC/HP energy conservation standards rulemaking completed in satisfaction of EPCA's 6-year review requirement concluded with a direct final rule published on January 6, 2017 (''January 2017 ECS DFR''). (*See* 82 FR 1786). As noted, revisions proposed at appendix M1 would not result in changes in the SEER2 and HSPF2 metrics, and use of appendix M2 would not be required until the compliance date of any amended standards denominated in terms of the new metrics, SCORE and SHORE. DOE has tentatively determined that this proposed test procedure structure would provide sufficient time to assess new metrics when considering any future amended energy conservation standards.

While Lennox stated it supports test procedure changes to improve the representativeness of the CAC/HP test procedures, it also emphasized that such changes must not be unduly burdensome. (Lennox, No. 6 at p. 4) Similarly, NCP stated that DOE should avoid amendments to the test procedure that increase burden and noted that EPCA requires test procedures to not be unduly burdensome. (NCP, No. 7 at p. 2) Specifically, NCP stated that DOE should avoid amendments to the test procedure that increase burden for space-constrained AC and HP products, as it has found no significant benefits to be attained by test procedure changes to this type of product at this time. (*Id.*)

As discussed previously, EPCA requires test procedures proposed by DOE not be unduly burdensome to conduct. (*See* 42 U.S.C. 6293(b)(3)) DOE discusses the estimated costs and impact of the proposed test procedures at appendix M1 and appendix M2 in section III.M of this NOPR. As noted earlier, DOE is proposing to incorporate by reference industry standards at appendix M1 and appendix M2 that were developed with the broad consensus of several stakeholders, including Lennox and NCP. DOE has tentatively determined that incorporating each industry standard in full as the basis for each respective appendix would limit manufacturer burden.

AHRI requested that DOE parse test procedure changes into separate groupings, so stakeholders can understand those changes that would substantively impact the ratings and, if possible, the extent of their impact. (AHRI, No. 14 at p. 4)

In response, DOE notes that it has categorized the proposed test procedures by topic and timing of changes (*i.e.,* near-term changes at appendix M1 versus long-term changes at appendix M2) to assist in manufacturers' understandings of the changes themselves and the impacts they may pose.

The Joint Advocates encouraged DOE to consider additional reporting requirements in a test procedure rulemaking. (Joint Advocates, No. 8 at p. 4) Specifically, the Joint Advocates asserted that the ability for various stakeholders to calculate performance in any climate will likely be very important for the adoption of heat pumps in coming years. (*Id.*) Subsequently, the Joint Advocates encouraged DOE to engage stakeholders to determine which additional performance reporting requirements would be beneficial (*e.g.,* capacity maintenance or COP at various temperatures) in a test procedure rulemaking. (*Id.*)

In response, DOE notes that it will consider certification requirements for CAC/HPs, including additional reporting requirements mentioned by the Joint Advocates, in a separate rulemaking for certification, compliance, and enforcement.

NYSERDA recommended that DOE consider approaches in the test procedure that address both demand response-enabled and thermal storage performance features of CAC/HPs. (NYSERDA, No. 9 at p. 14) To highlight the potential opportunities for load curtailment using demand response, NYSERDA stated that it evaluated outdoor temperatures greater than or equal to 95 °F for certain U.S.-based cities. (NYSERDA, No. 9 at p. 14) NYSERDA stated that it then developed charge and discharge pattern estimates using renewable portfolio standards (''RPS'') as a pathway to generation while relying on the energy storage perspectives offered in a California Independent System Operator Corporation (''CAISO'') report on California and Europe.[91] (*Id.*) NYSERDA stated that these estimates are summarized in Figure 1 of NYSERDA's response to the January 2023 RFI. (*Id.*) NYSERDA commented that several high outdoor temperatures within Figure 1 fall within the charge zone associated with lower-price periods and high generation and contended that the small percentage of outdoor temperatures within the discharge zone (*i.e.,* higher price periods with peak demand) could be managed using the general curtailment and critical curtailment approaches specified in AHRI Standard 1380–2019. (*Id.*)

Additionally, NYSERDA noted that specifications issued by EPA and the Consortium for Energy Efficiency (''CEE'') prescribe connected criteria for demand response-enabled products, and that energy efficiency program administrators may consider offering incentives on connected criteria to strategically manage peak load outside of solely focusing on performance metrics such as SEER2, HSPF2, and EER2. (NYSERDA, No. 9 at p. 14) NYSERDA recommended that DOE account for such demand response-enabled features in the revised test procedure, for example, by down-weighting or eliminating the bin hours from the SEER2 rating above a typical curtailment threshold. (*Id.*) NYSERDA stated that this could be provided as a secondary metric so that users who choose not to participate in demand-response programs would still have access to the ''normal'' SEER2 rating for comparison. (*Id.*)

Neither AHRI 210/240–202X Draft nor AHRI 1600–202X Draft include any provisions regarding demand response-enabled products. In the absence of discussion or changes to the AHRI test procedures, DOE surmises that no changes need to be made regarding demand response-enabled CAC/HP products in the test procedures at this time. Therefore, DOE is proposing no provisions to address demand response-enabled CAC/HP products in the test procedures at either appendix M1 or appendix M2. DOE will continue to evaluate demand response functions in CAC/HPs and consider whether such functions should be accounted for in a future DOE test procedure. While DOE is not proposing changes to the Federal test procedures, DOE does note that the ENERGY STAR Spec V6.1 includes requirements for demand response capability and provides a means for product differentiation.

NYSERDA also commented that it has been working with heat pump technologies that incorporate thermal storage,[92] and suggested that this technology would fit under DOE's CAC/HP test procedure rulemaking. (NYSERDA, No. 9 at pp. 14–15) NYSERDA recommended that DOE consider if this technology may make sense to be a standalone product category or otherwise consider the potential growth of this technology and how it would fit into the scope of CAC/HPs. (*Id.*)

As previously mentioned, AHRI and other stakeholders, including DOE, considered a variety of topics regarding CAC/HPs. However, the topic of heat pump technologies that incorporate thermal storage was not brought up as a topic for discussion, and neither AHRI 210/240–202X Draft nor AHRI 1600–202X Draft include any provisions regarding such technologies. Additionally, DOE has tentatively determined that heat pumps with thermal storage are a niche application, and DOE currently does not have enough information to include test provisions for such systems within CAC/HP test procedure. DOE also has not received any petitions for test procedure waivers to date that would address this technology. In the absence of discussion or changes to the AHRI test procedures, DOE has tentatively determined that no provisions are currently necessary regarding heat pump technologies that incorporate thermal storage in the test procedures at either appendix M1 or appendix M2. However, DOE may consider the topic of heat pump technologies that incorporate thermal storage in a future rulemaking.

I. Represented Values

In the following sections, DOE discusses requirements regarding represented values. To the extent that DOE is proposing changes to the requirements specified in 10 CFR 429 regarding representations of CAC/HPs, such amendments to 10 CFR part 429, if made final, would be required starting 180 days after publication in the **Federal Register** of the test procedure final rule. Prior to 180 days after publication in the **Federal Register** of the test procedure final rule, the current requirements would apply. However, manufacturers would be permitted to choose between using the current or new requirements for a period between 30 days and 180 days after publication in the **Federal Register** of the test procedure final rule.

1. Calculating Represented Values for the Federal Trade Commission

As described in a final rule regarding EnergyGuide labels published on October 12, 2022, the Federal Trade Commission (''FTC'') is responsible for periodical updates to energy labeling for major home appliances and other consumer products, including CAC/HPs, to help consumers compare competing models. 87 FR 61465, 61466. Among other disclosures, EnergyGuide labels for CAC/HPs include estimated annual energy costs for both cooling and heating, which are based on the represented values for each basic model's efficiencies (SEER2 and HSPF2, as applicable) and cooling capacities and estimates for cooling load hours (''CLH'') and heating load hours (''HLH'') in a year. Currently, the FTC uses 1,000 and 1,572 hours as estimates for CLH and HLH, respectively, for all ratings of CAC/HP basic models.[93] In this NOPR, DOE is proposing to retain the current CLH and HLH estimates in appendix M1, for use in conjunction

[91] *See www.caiso.com/Documents/EnergyStorage-PerspectivesFromCalifornia-Europe.pdf.*

[92] In its simplest form, thermal storage involves using excess energy to heat/cool, melt or vaporize a material so that this stored energy can be recovered later. Heat pumps with thermal energy storage can store energy during times when electricity prices are low and release it during peak demand hours.

[93] *See* Table 21 of appendix M1 for the current CLH and HLH estimates used for rating values.

with SEER2 and HSPF2 representations. However, DOE is also proposing new estimates for CLH and HLH for use in conjunction with the proposed appendix M2 efficiency metrics, SCORE and SHORE. Specifically, DOE is proposing to use 1,457 and 972 hours as estimates for CLH and HLH, respectively, for use in conjunction with SCORE and SHORE representations. Unlike SEER2 and HSPF2, SCORE and SHORE are integrated metrics (that include off-mode and standby power) and use updated weather data for the United States' average number of conditioning and shoulder-season hours per temperature bin. Given the different metrics, DOE has tentatively determined that the proposed appendix M2 requires new CLH and HLH values for use by the FTC. Step-by-step derivations of proposed appendix M2 CLH and HLH values are presented in a docketed white paper titled ''Derivation of Proposed Appendix M2 Cooling Load Hours and Heating Load Hours for the Federal Trade Commission.'' [94]

2. Off-Mode Power

Off-mode power, $P_{W,OFF,}$ is a required represented value for all CAC/HPs, as specified in 10 CFR 429.16(a)(1). Currently, section 3.13 of appendix M1 includes testing instructions to determine off mode power ratings for CAC/HPs. As discussed in section III.F.1, the revised appendix M1 incorporates by reference AHRI 210/240–202X Draft. Section 11.2.3 and appendix H of AHRI 210/240–202X Draft include the same test instructions to determine $P_{W,OFF}$ as are present in the current appendix M1 and therefore no changes are required when representation are made per appendix M1.

However, as discussed in section III.F.1 of this NOPR, the metrics applicable to appendix M2, SCORE and SHORE, incorporate off-mode power consumption, unlike the current cooling and heating metrics SEER2 and HSPF2, respectively. As such, requiring representation of $P_{W,OFF}$ would be redundant for appendix M2. Therefore, DOE is proposing to clarify at 10 CFR 429.16(a)(2) that represented values of $P_{W,OFF}$ are only required when testing in accordance with appendix M1.

Additionally, 10 CFR 429.16(b)(2)(ii) currently allows flexibility for manufacturers to not test each individual model/combination (or tested combination) for $P_{W,OFF,}$ but at a minimum, test at least one individual model/combination for $P_{W,OFF}$ among individual models/combinations with similar off-mode construction. DOE is retaining this flexibility for testing to appendix M1. DOE is also extending similar flexibility for determining off-mode power values P_1 (off-mode power in shoulder season) and P_2 (off-mode power in heating season), which are used in the calculation of the SCORE and SHORE metrics when testing to appendix M2, but for which DOE is not proposing to require represented values.

Specifically, DOE is proposing at 10 CFR 429.16(b)(2)(iii) that when testing in accordance with appendix M2 and determining SCORE and SHORE, each individual model/combination is not required to be tested for values of P_1 (off-mode power in shoulder season) and P_2 (off-mode power in heating season). Instead, at a minimum, among individual models/combinations with similar off-mode construction (even spanning different models of outdoor units), a manufacturer must test at least one individual model/combination, for which P_1 and P_2 are the most consumptive.

Issue 3: DOE requests comment on its proposal at 10 CFR 429.16(b)(2)(iii) to extend testing flexibility to P1 (off-mode power in shoulder season) and P2 (off-mode power in heating season) when determining SCORE and SHORE, such that each individual model/combination is not required to be tested for values of P1 and P2.

3. AEDM Tolerance for SCORE and SHORE

DOE's existing regulations allow the use of an AEDM, in lieu of testing, to simulate the efficiency of CAC/HPs. 10 CFR 429.16(d). For models certified with an AEDM, results from DOE verification tests are subject to certain tolerances when compared to certified ratings. 10 CFR 429.70(e)(5)(v). The current tolerance specified for efficiency metrics for CAC/HPs (*i.e.,* SEER2, HSPF2, and EER2) requires that the result from the DOE verification test must be greater than or equal to 0.95 multiplied by the certified represented value. To maintain consistency with the existing efficiency metrics, DOE is proposing to extend the same tolerance requirement to the new efficiency metrics measured per appendix M2—SCORE and SHORE.

4. Removal of the AEDM Exception for Split-System CAC/HPs

Currently, the AEDM requirements at 10 CFR 429.70€ allow that, until July 1, 2024, non-space-constrained single-split-system CAC/HPs rated based on testing in accordance with appendix M1 are allowed to test a single-unit sample from 20 percent of the basic models distributed in commerce to validate the AEDM. On or after July 1, 2024, validation of the AEDM has to be based on complete testing of each basic model. *See* 10 CFR 429.70(e)(2)(i)(A). Corresponding provisions are also included at 10 CFR 429.16, paragraphs (b)(2)(i) and (c)(1)(i)(B).

Since amendments proposed in this NOPR are not expected to be finalized and made effective before July 1, 2024, the aforementioned AEDM exception for non-space-constrained single-split-system CAC/HPs would no longer apply at the time this rulemaking finalizes. As such, DOE is proposing to remove the date-based application of the AEDM requirement and instead clarifies that AEDM validation for all CAC/HPs, including non-space-constrained single-split-system CAC/HPs, must be based on complete testing of each basic model.

J. Enforcement Provisions

1. Verifying Cut-Out and Cut-In Temperatures

As discussed in section III.E.3 of this NOPR, appendix J of AHRI 210/240–202X Draft and AHRI 1600–202X Draft—which DOE is proposing to incorporate by reference—includes a test to determine cut-out and cut-in temperatures (*i.e.,* T_{off} and T_{on} respectively) that is applicable to all HPs. To enable DOE to verify certified cut-out and cut-in temperatures using the test methods in appendix K of the AHRI drafts, DOE is proposing product-specific provisions at 10 CFR 429.134(k)—specifically, DOE is proposing that for assessment and enforcement testing of CHP models, the cut-out and cut-in temperatures may be verified using the method in appendix J and that if this method is conducted, the cut-in and cut-out temperatures determined using this method will be used to calculate the relevant heating metric for purposes of compliance.

DOE will consider certification requirements for CAC/HPs, including the potential requirement for certification of cut-out and cut-in temperatures, in a separate rulemaking.

2. Controls Verification Procedure

As discussed in section III.E.1.d of this NOPR, appendix I of AHRI 210/240–202X Draft and AHRI 1600–202X Draft—which DOE proposes to incorporate by reference—includes a CVP to verify compliance of system operation with the variable-capacity compressor system definition and consistency of fixed-position settings for the compressor and indoor fan used in

[94] This paper is available for reference in Docket No. EERE–2022–BT–TP–0028.

steady-state tests with native control operation.

DOE is proposing provisions at 10 CFR 429.134(k) to establish requirements for DOE's use of the CVP for the purposes of assessment and enforcement testing. DOE is proposing that after conducting the CVP, which itself would be performed after an assessment or enforcement test using the DOE test procedure (*i.e.,* a certification test using Appendix M1 or Appendix M2, as applicable), if a unit is determined to be either a variable-capacity compressor system, variable capacity certified, single-capacity system, or variable capacity certified, two-capacity system, and meets the tolerances on capacity measurement (+/−6 percent) and efficiency[95] (+/−10 percent) for the full and minimum load CVP intervals, the efficiency metrics for the unit will be evaluated by conducting the prescribed DOE rating tests per Appendix M1 or Appendix M2 applicable to that system. These tests will be conducted based on the override instructions from the manufacturer for setting the appropriate compressor and fan speeds for each test.

However, if either of the full or minimum load CVP intervals fail to meet the required tolerances, and the control device allows adjustment of the compressor and indoor blower speeds,[96] DOE will conduct certification tests by setting the speeds for the tests to the average values observed during the corresponding failed CVP interval.[97] If either of the full or minimum load CVP intervals fail to meet the required tolerances, and the control device does not allow adjustment of the compressor and indoor blower speeds, DOE will use average capacity and power(s) or, for CVP intervals that do not meet the operating tolerances and condition tolerances, time averaged integrated capacity and time averaged integrated power(s), measured during the CVP, in order to calculate SEER2, HSPF2 and EER2 for appendix M1, and SCORE, SHORE and EER2, for appendix M2. For certification tests that do not have a corresponding CVP interval, the corresponding efficiency will be calculated by adjusting the capacity and efficiency, by application of a ratio to the corresponding CVP interval.[98]

For CHPs determined to be variable capacity certified, single capacity system, or variable capacity certified, two capacity system that are certified/marketed for use with only a proprietary control device, DOE may utilize two options, (1) contact the manufacturer to provide override control instructions consistent with the full and, if applicable, minimum speed operation observed during the CVP, to enable tests without a corresponding CVP interval to be conducted at the appropriate speeds, or (2) conduct the tests for $H_{1,Nom}$, $H_{2,Full}$, $H_{2,Low}$ and $H_{3,Low}$, as applicable, using the certified instructions, and for other certification tests, the corresponding efficiency will be calculated by adjusting the capacity and efficiency, by application of a ratio to the corresponding CVP interval.[99] Otherwise, the same simulated thermostat low voltage signal that resulted in in full speed compressor operation for the full load intervals shall be used for all certification full load tests (for variable capacity certified, single capacity system, or variable capacity certified, two capacity systems), and the same simulated thermostat low voltage signal that resulted in low speed compressor operation for the low load intervals, shall be used for all certification low load tests (for variable capacity certified, two capacity system).

DOE will address any associated certification requirements for the CVP in a separate rulemaking.

Issue 4: DOE requests comment on its proposals related to enforcement provisions when conducting the CVP.

K. Test Procedure Costs and Impact

EPCA requires that test procedures proposed by DOE not be unduly burdensome to conduct. (42 U.S.C. 6293(b)(3)) As discussed, DOE proposes to update the current Federal test procedure for CAC/HPs at appendix M1 consistent with the most recent draft version of the relevant industry consensus test procedure, AHRI 210/240–202X Draft. DOE is also proposing a new Federal test procedure at 10 CFR 430, subpart B, appendix M2, consistent with the draft version of the industry consensus test procedure, AHRI 1600–202X Draft. Appendix M2 would not be required for use until the compliance date of amended standards for CAC/HPs. DOE also proposes to amend its representation and enforcement provisions for CAC/HPs.

1. Appendix M1

In this NOPR, DOE proposes to update its regulations at 10 CFR part 430, subpart B, appendix M1 by incorporating by reference AHRI 210/240–202X Draft and relevant industry standards referenced in AHRI 210/240–202X Draft (ANSI/ASHRAE 37–2009, ANSI/ASHRAE 16–2016, and ANSI/ASHRAE 116–2010), and amending certain provisions for representations and enforcement in 10 CFR part 429, consistent with the changes proposed to the test procedure. The proposed revisions to appendix M1 would retain the current efficiency metrics (*i.e.,* EER2, SEER2, and HSPF2). The proposed testing requirements in appendix M1 are those in AHRI 210/240–202X Draft, which in turn references ANSI/ASHRAE 37–2009, ANSI/ASHRAE 16–2016, and ANSI/ASHRAE 116–2010.

DOE has tentatively determined that the proposed amendments to appendix M1 and the proposed representation and enforcement provisions would improve the representativeness, accuracy, and reproducibility of the test results and would not be unduly burdensome for manufacturers to conduct. DOE has also tentatively determined that the proposed amendments would not result in an increase in testing cost from the current test procedure. The proposed revisions to the test procedure in appendix M1 for measuring EER2, SEER2, and HSPF2 per AHRI 210/240–202X Draft would not increase third-party laboratory testing costs per unit relative to the current DOE test procedure. DOE estimates the current costs for physical testing, including off-mode testing, to range from $10,800 to $19,800, depending on the configuration of the CAC/HP (single-stage, two-stage, variable-capacity). Further, DOE has tentatively concluded that the proposed revisions to the test procedure in appendix M1 would not change efficiency ratings for CAC/HPs, and therefore would not require retesting or redesign solely as a result of DOE's adoption of the proposed amendments to the DOE test procedure, if made final.[100]

[95] EER2 for cooling load intervals, and COP2 for heating load intervals

[96] For the purpose of the CVP, ''adjustment'' means that the control device has the ability to make discrete adjustments, as required, to the compressor and indoor blower speeds without the need of any additional hardware or non-publicly available software.

[97] For tests that do not correspond to any load intervals of the CVP, DOE will adjust the compressor speed as follows: the compressor speeds for tests B_{full}, B_{low}, $H_{1,full}$, $H_{2,full}$, $H_{2,low}$ and $H_{0,low}$, will be set at the same speeds observed in the CVP load intervals associated with the A_{full}, F_{low}, $H_{3,full}$, $H_{3,full}$, and $H_{1,low}$ tests, respectively.

[98] As an example, the capacity at B_{full} condition, $Q_{B,Full,}$ will be calculated by the following equation: $Q_{B,Full,} = Q_{B,Full,Certification} \times Q_{CVP,A,Full} / Q_{A,Full,Certification}$, where $Q_{B,Full,Certification}$ is the capacity at B_{full} condition, $Q_{CVP,A,Full}$ is the full load interval capacity in cooling mode, and $Q_{A,Full,Certification}$ is the capacity at A_{full} condition.

[99] As an example, the capacity at HO_{Low} condition, $Q_{H0,Low}$, will be calculated by the following equation: $Q_{HO,Low,} = Q_{H0,Low,Certification} \times Q_{CVP,H1,Low} / Q_{H,Low,,Certification}$.

[100] Manufacturers are not required to perform laboratory testing on all basic models. In

As discussed in section III.E.1.(d) of this NOPR, DOE proposes to include a CVP in its enforcement regulations to validate whether override of modulating components in regulatory tests for variable-capacity compressor systems is consistent with native control operation. The proposed CVP for variable-capacity compressor systems in appendix I of AHRI 210/240–202X is not mandatory for manufacturers to perform, therefore, the proposed inclusion of this provision in DOE's enforcement regulations clarifies the approach DOE would follow for potential enforcement testing. To the extent that a manufacturer has not already verified the appropriateness of the fixed performance during regulatory tests as compared to native control operation (*i.e.,* the system may currently be improperly certified), a manufacturer may need to adjust fixed-speed overrides used in regulatory tests in accordance with the proposed CVP and subsequently re-run the regulatory tests. However, having no strong evidence to the contrary, DOE expects that current variable-capacity certifications are generally consistent with system performance. Thus, DOE concludes that any such cost to verify performance and potentially retest is negligible.

As explained in section III.E.2 of this NOPR, a new definition for CCHPs is introduced in AHRI 210/240–202X Draft, for which the $H4_{full}$ test (outdoor dry-bulb temperature of 5 °F) will be mandatory, which is otherwise optional for CHPs. However, this test and claim of CCHP status is optional. Also, DOE anticipates that units that will certify as CCHPs are most likely to be already testing at the 5 °F condition, and hence no added costs or test burden are expected to be associated with them.

The proposal for determination of cut-in and cut-out temperatures in DOE's enforcement provisions, as laid out in appendix J of the AHRI 210/240–202X Draft, would not be required for manufacturer testing. Thus, it will not cause manufacturers to incur any additional costs or burden.

As explained in section III.F.5 of this NOPR, AHRI 210/240–202X Draft introduced a definition for mandatory circulation systems. DOE is currently unaware of any CAC/HPs equipped with these systems, and they are anticipated to become more commonplace once A2L refrigerant regulations are enforced. CAC/HPs equipped with mandatory circulation systems will need to have their cyclic degradation coefficients evaluated using the respective cyclic tests, which are otherwise optional. Since cyclic tests are already often conducted by manufacturers to improve upon the default cyclic degradation coefficients, and because it is unclear whether any systems having such mandatory circulation will be introduced, DOE considers that there will be no significant increase in cost or test burden associated with the requirement for CAC/HPs equipped with mandatory circulation systems to conduct cyclic tests.

Issue 5: DOE requests comment on its tentative determination that the proposed amended appendix M1 would not require re-testing or result in any increase in test cost as compared to the existing appendix M1.

2. Appendix M2

As explained previously, DOE proposes to establish new regulations at 10 CFR 430, subpart B, appendix M2 as follows: (1) incorporate by reference AHRI 1600–202X Draft, and relevant industry standards referenced in AHRI 1600–202X Draft (ANSI/ASHRAE 37–2009, ANSI/ASHRAE 16–2016, and ANSI/ASHRAE 116–2010); and (2) establish provisions for determining SCORE and SHORE for CAC/HPs. Appendix M2 would not be required for testing until the compliance date of any future new standards for CAC/HPs based on the SCORE and SHORE metrics proposed in appendix M2. The proposed testing requirements in appendix M2 are those in AHRI 1600–202X Draft, which in turn references ANSI/ASHRAE 37–2009, ANSI/ASHRAE 16–2016, and ANSI/ASHRAE 116–2010.

DOE has tentatively determined that the proposed amendments in appendix M2 would be representative of average use cycle, not be unduly burdensome for manufacturers to conduct, and not result in increased testing cost as compared to the current test procedure. The proposed revisions to the test procedure in appendix M2 for measuring EER2, SCORE, and SHORE per AHRI 1600–202X Draft would not increase third-party laboratory testing costs per unit relative to the current DOE test procedure. DOE estimates the costs of physical testing, for the new metrics SCORE and SHORE to range from $10,800 to $19,800, same as that for appendix M1, depending on the configuration of the CAC/HP (*e.g.,* single-stage, two-stage, variable-capacity). DOE has tentatively concluded that the proposed revisions to the test procedure in appendix M2 would change efficiency ratings for CAC/HPs—however, testing and recertification based on appendix M2 would not be required until DOE adopts any amended CAC/HP standards in terms of the new metrics in a future energy conservation standards rulemaking.

As previously mentioned in this NOPR, the AHRI 1600–202X Draft introduces new cooling and heating performance metrics, SCORE and SHORE, as replacements for the current cooling, heating, and off-mode performance metrics, SEER2, HSPF2, and $P_{W,OFF}$, used to determine the measured efficiency of CAC/HPs. Unlike SEER2 and HSPF2, these new metrics account for the off-mode power consumption of auxiliary components, including crankcase heaters and indoor fans utilizing constant circulation for both SCORE and SHORE, as well as base pan heaters for SHORE.[101] The off-mode power consumption of auxiliary components is determined using appendix G of the AHRI 1600–202X Draft. This appendix includes measurement of power for base pan heaters and constant circulation fans, which are not included in the current test procedure measurements to determine off-mode power. The measurements are otherwise identical to those required by the current test, although the calculations used to determine off-mode power are different. Measurements of base pan heater power and constant circulation power may require separate power measurement instrumentation to be applied for the base pan heater, and may require a brief power measurement test period for constant circulation, both test method additions which represent minor test burden increase and would be applicable only for a minority of models. Hence, adoption of the new cooling and heating metric would not result in significant increase in testing costs as compared to the current test procedure.

The other proposed amendments mainly affect calculations and, other than potentially imposing limits on airflow settings (item (e) in this paragraph), will not affect testing. The proposed amendments are (a) revising

accordance with 10 CFR 429.16, CAC/HP manufacturers may elect to use AEDMs. An AEDM is a computer modeling or mathematical tool that predicts the performance of non-tested basic models. These computer modeling and mathematical tools, when properly developed, can provide a means to predict the energy usage or efficiency characteristics of a basic model of a given covered product or equipment and to reduce the burden and cost associated with testing.

[101] As described in section III.F.1.a of this NOPR, the off-mode power consumption definition in appendix M1 includes energy use for all operating modes not associated with times that the system is providing cooling or heating. Thus, off-mode in the context of the CAC/HP test procedure includes operating modes that would be interpreted as standby or active modes under IEC 62301.

the demand defrost credit for CHPs equipped with demand defrost systems; (b) accounting for the additional power use from supplementary heat during defrost by introducing defrost heat debit and the defrost overrun mode; (c) updating the building load lines and temperature bin hours for calculation of the new seasonal metrics SCORE and SHORE; (d) revising the default fan power coefficients for coil-only systems; and (e) imposing air flow limits to address inadequate dehumidification. Thus, DOE does not anticipate these additional amendments will cause any increased test procedure costs.

Issue 6: DOE requests comment on its tentative understanding of the impact of the test procedure proposals in this NOPR, particularly regarding DOE's initial estimates of the cost impacts associated with the proposed appendix M2. DOE also requests comment on the cost of testing CAC/HPs in accordance with AHRI 1600–202X Draft compared to DOE's estimated appendix M2 testing costs for physical testing ranging from $10,800 to $18,000, which are unchanged from the appendix M1 testing costs.

L. 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 were to publish 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 may 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.*)

Upon the compliance date of test procedure provisions of an amended test procedure, should DOE issue a such an amendment, 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). Recipients of any such waivers would be required to test the products subject to the waiver according to the amended test procedure as of the compliance date of the amended test procedure. The amendments proposed in this document pertain to issues addressed by the interim waiver granted to Samsung HVAC America LLC (88 FR 36558, Case No. 2022–009). To the extent that such an interim waiver permit the petitioner to test according to an alternate test procedure to appendix M1, the interim waiver will terminate on the date the amendments to the appendix M1 test procedure take effect (*i.e.,* 180 days after publication of the test procedure final rule in the **Federal Register**).

Notably, the amendments proposed in this document do not pertain to issues addressed by the interim waiver granted to Johnson Controls Inc. (''JCI'') (88 FR 72449, Case No. 2023–005). This interim waiver permits JCI to test certain basic models of CAC/HPs that use variable speed, oil-injected scroll compressors (''VSS systems'') with a 72-hour break-in period, in lieu of the 20-hour break-in limit prescribed in appendix M1. (*Id.*) Because the 72-hour break-in period permitted to VSS systems listed in JCI's petition is unique to the CAC/HP market, DOE surmises that amendments to address this issue do not belong in either of the proposed Federal test procedures for CAC/HPs (*i.e.,* appendix M1 or appendix M2). However, DOE notes that JCI may continue to request a waiver to extend the allowable break-in period for its VSS systems. To the extent the interim waiver permits JCI to test according to an alternate test procedure to appendix M1, the interim waiver will terminate on the date testing is required according to appendix M2, which will occur on the compliance date for updated efficiency standards. DOE notes that JCI may petition for another waiver at the time testing is required according to appendix M2.

IV. Procedural Issues and Regulatory Review

A. Review Under Executive Orders 12866, 13563, and 14094

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) and E.O. 14094, ''Modernizing Regulatory Review,'' 88 FR 21879 (April 11, 2023), 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 Executive Order 13272, ''Proper Consideration of Small Entities in Agency Rulemaking,'' 67 FR 53461 (August 16, 2002), DOE published procedures and policies on February 19, 2003, to ensure that the potential impacts of its rules on small entities are properly considered during the DOE rulemaking process. 68 FR 7990. DOE has made its procedures and policies available on the Office of the General Counsel's website: *www.energy.gov/gc/office-general-counsel.* DOE reviewed this proposed rule under the provisions of the Regulatory Flexibility Act and the procedures and policies published on February 19, 2003. The following sections detail DOE's IRFA for this test procedure proposed rulemaking.

1. Description of Reasons Why Action Is Being Considered

DOE proposes to update the current Federal test procedure for CAC/HPs at appendix M1 consistent with the most recent draft version of the relevant industry consensus test procedure, AHRI 210/240–202X Draft. DOE is also proposing a new Federal test procedure at 10 CFR part 430, subpart B, appendix M2, consistent with the draft version of the industry consensus test procedure, AHRI 1600–202X Draft. Appendix M2 would not be effective until new standards are established for CAC/HPs that rely on metrics present in appendix M2. In this NOPR, DOE is proposing amendments to the test procedure for CAC/HPs in satisfaction of the 7-year review statutory requirement specified in EPCA. (42 U.S.C. 6292(a)(3) and 6293(b)(1)(A))

2. Objectives of, and Legal Basis for, Rule

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 review test procedures for all type of covered products, including CAC/HPs, to determine whether amended test procedures would more accurately or fully comply with the requirements that the test procedures are: (1) reasonably designed to produce test results which reflect energy efficiency, energy use, and estimated operating costs during a representative average use cycle or period of use; and (2) not unduly burdensome to conduct. (42 U.S.C. 6293(b)(1)(A))

DOE is publishing this NOPR proposing amendments to the test procedure for CAC/HPs in satisfaction of the aforementioned obligations under EPCA.

3. Description and Estimated Number of Small Entities Regulated

For manufacturers of CAC/HPs, the Small Business Administration (''SBA'') has set a size threshold, which defines those entities classified as ''small businesses'' for the purposes of the statute. DOE used the SBA's small business size standards to determine whether any small entities would be subject to the requirements of the rule. (*See* 13 CFR part 121.) The equipment covered by this rule is classified under North American Industry Classification System (''NAICS'') code 333415,[102] ''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 publicly available information to identify potential small businesses that manufacture CAC/HPs. DOE identified manufacturers using DOE's Compliance Certification Database (''CCD'')[103] and the prior CAC/HP rulemakings. DOE used the publicly available information and subscription-based market research tools (*e.g.,* reports from Dun & Bradstreet)[104] to identify 22 original equipment manufacturers (''OEMs'') of the covered equipment. Of the 22 OEMs, DOE identified five domestic manufacturers of CAC/HPs.

DOE expects manufacturers that certify to AHRI Directory of Certified Product Performance (''AHRI Directory'')[105] to have different potential regulatory costs from manufacturers that do not certify to the AHRI Directory. All five small OEMs certify their CAC/HPs to the AHRI Directory.

4. Description and Estimate of Compliance Requirements

This NOPR proposes to adopt updated industry test standards for CAC/HPs. DOE proposes to update the current Federal test procedure for CAC/HPs at appendix M1, consistent with the most recent draft version of the relevant industry consensus test procedure, AHRI 210/240–202X Draft. DOE is also proposing a new Federal test procedure at 10 CFR part 430, subpart B, appendix M2, consistent with the draft version of the industry consensus test procedure, AHRI 1600–202X Draft. More specific amendments to the DOE test procedure are summarized in the following subsections.

(a) Cost and Compliance Associated With Appendix M1

In appendix M1, DOE proposes to incorporate by reference AHRI 210/240–202X Draft for CAC/HPs and to amend certain provisions for representations and enforcement in 10 CFR part 429, consistent with the changes proposed to the test procedure. The proposed revisions to appendix M1 would retain the current efficiency metrics—EER2, SEER2, and HSPF2. The proposed testing requirements in appendix M1 are generally consistent with those in AHRI 210/240–202X Draft, which in turn references ANSI/ASHRAE 37–2009, ANSI/ASHRAE 16–2016, and ASHRAE 116–2010. This proposed revision to the test procedure in appendix M1 for measuring EER2, SEER2, and HSPF2 would not increase third-party laboratory testing costs per unit relative to the current DOE test procedure. The proposed CVP'' for variable-capacity compressor systems in appendix I of AHRI 210/240–202X is not mandatory for manufacturers to perform, and DOE considers these developmental costs to be negligible and not burdensome to manufacturers. The $H4_{full}$ test (outdoor dry-bulb temperature of 5 °F) will be mandatory, but DOE anticipates no added costs as units that will certify as CCHPs are likely currently testing at the 5 °F condition. The proposal for determination of cut-in and cut-out temperatures in appendix J of the AHRI 210/240–202X Draft would be included in DOE's enforcement provisions and would not be mandatory for manufacturer testing, and thus manufacturers will not incur additional costs. Additionally, CAC/HPs equipped with mandatory circulation systems will have their cyclic degradation coefficients evaluated using respective cyclic tests, but DOE anticipates no added costs to manufacturers since cyclic tests are already often conducted on CAC/HPs (regardless of whether they are equipped with a mandatory constant circulation system) to improve the default cyclic degradation coefficients.

DOE has tentatively concluded that the proposed revisions to the test procedure in appendix M1 would not change efficiency ratings for CAC/HPs,

[102] The size standards are listed by NAICS code and industry description and are available at *www.sba.gov/document/support-table-size-standards* (last accessed Sept. 22, 2023).

[103] DOE's Compliance Certification Database is available at *www.regulations.doe.gov/ccms* (last accessed Sept. 19, 2023).

[104] Dun & Bradstreet login available at *https://app.dnbhoovers.com.*

[105] The AHRI Directory of Certified Product Performance is available at *www.ahridirectory.org.*

and therefore would not require retesting or redesign solely as a result of DOE's adoption of this proposed amendment to the DOE test procedure, if made final.[106] Further, the proposed test procedure in appendix M1 would not increase third-part laboratory testing costs per unit; DOE estimates current costs for physical testing to range from $10,800 to $19,800, depending on the configuration of the CAC/HP (single-stage, two-stage, variable-capacity). Therefore, DOE does not expect that the test procedure amendments in appendix M1 would result in manufacturers, including small manufacturers, incurring additional testing costs.

(b) Cost and Compliance Associated With Appendix M2

In appendix M2, DOE proposes to establish a new test procedure that references the draft industry test procedure, AHRI 1600–202X Draft, for measuring new efficiency metrics, SCORE and SHORE. Appendix M2 would not be effective until new standards are established for CAC/HPs that rely on metrics present in appendix M2, should DOE adopt such standards. The proposed testing requirements in appendix M2 are generally consistent with those in AHRI 1600–202X Draft, which in turn references ANSI/ASHRAE 37–2009, ANSI/ASHRAE 16–2016, and ASHRAE 116–2010. This proposed revision to the test procedure in appendix M2 for measuring EER2, SCORE, and SHORE would not increase third-party laboratory testing costs per unit relative to the current DOE test procedure. The standby and off-mode power consumption of auxiliary components is determined using appendix G of the AHRI 1600–202X Draft and does not differ substantially from the process to determine off-mode power from the current version of appendix M1, in section 3.13. The adoption of the new cooling and heating metric would not result in increased testing costs as compared to the current test procedure. Other proposed amendments will not affect testing cost, which include (a) building load lines and temperature bin hours for calculation of SCORE and SHORE, (b) default fan power coefficients for coil-only systems, and (c) air flow limits to address inadequate dehumidification.

The testing cost will not increase with appendix M2. DOE estimates the costs of physical testing for the new metrics SCORE and SHORE to range from $10,800 to $18,000, depending on the configuration of the CAC/HP (single-stage, two-stage, variable-capacity). Additionally, DOE allows the use of AEDMs in lieu of physically testing all basic models. The use of an AEDM is less costly than physical testing of CAC/HP models; DOE estimates the cost to develop an AEDM to be $16,860 per AEDM for a basic model, which includes the cost of physical testing done at a third-party laboratory to validate the AEDM.[107] The development of the AEDM would reduce the need for physical testing on the part of manufacturers. Once the AEDM is developed, DOE estimates that it would take 5 minutes of an engineer's time[108] to determine efficiency for each individual model within a basic model using the AEDM.

DOE understands all manufacturers currently certifying in the AHRI Directory (including small businesses) will be testing their models in accordance with AHRI 1600–202X Draft, the industry test procedure DOE is proposing to reference at appendix M2. As stated, testing and certification of the SCORE and SHORE metrics will not be required until the compliance date of any future energy conservation standards based on these metrics; however, DOE anticipates manufacturers will need to re-test their models to rate them in terms of the SCORE and SHORE metrics to comply with the AHRI certification program, and the re-rating will occur prior to a future energy conservation standards rulemaking. As a result, DOE has tentatively determined that the proposed test procedure amendments would not add any additional testing burden to manufacturers. Therefore, the proposed test procedure amendments in appendix M2 would not add any additional testing burden to the five small domestic manufacturers who certify in the AHRI database.

Issue 7: DOE requests comment on the number of small business OEMs of CAC/HPs, their participation in the AHRI Directory, and associated compliance costs.

5. Duplication, Overlap, and Conflict With Other Rules and Regulations

DOE is not aware of any rules or regulations that duplicate, overlap, or conflict with the rule being considered.

6. Significant Alternatives to the Rule

DOE proposes to amend the CAC/HPs test procedure in reference to industry standards in both appendices M1 and M2. DOE proposes to incorporate by reference AHRI 210/240–202X Draft and the subsequent relevant standards it references (ANSI/ASHRAE 16–2016, ANSI/ASHRAE 37–2009, and ASHRAE 116–2010) as the basis for the updated appendix M1 test procedure. Similarly, DOE proposes to incorporate by reference AHRI 1600–202X Draft and the subsequent relevant standards it references (ANSI/ASHRAE 16–2016, ANSI/ASHRAE 37–2009, and ASHRAE 116–2010) as the basis for the new appendix M2 test procedure. DOE considered alternative test methods and modifications to the proposed test procedures in appendices M1 and M2 for CAC/HPs. However, alternatives deviating from the industry standard would burden manufacturers with additional costs for separate test procedures. DOE has tentatively determined that there are no better alternatives than the proposed test procedures, in terms of both meeting the agency's objectives and reducing burden on manufacturers. Adoption of alternatives that do not incorporate the consensus industry test procedures would increase testing costs on small manufacturers. Therefore, DOE is proposing to amend the existing DOE test procedure for CAC/HPs through incorporation by reference of AHRI 210/240–202X Draft and AHRI 1600–202X Draft with the additional modifications as discussed throughout this NOPR.

In addition, individual manufacturers may petition for a waiver of the applicable test procedure. 10 CFR 431.401. Also, section 504 of the Department of Energy Organization Act, 42 U.S.C. 7194, provides authority for the Secretary to adjust a rule issued under EPCA in order to prevent ''special hardship, inequity, or unfair distribution of burdens'' that may be imposed on that manufacturer as a result of such rule. Manufacturers should refer to 10 CFR part 1003 for additional details.

C. Review Under the Paperwork Reduction Act of 1995

Manufacturers of CAC/HPs must certify to DOE that their products comply with any applicable energy conservation standards. To certify

[106] Manufacturers are not required to perform laboratory testing on all basic models. In accordance with 10 CFR 429.16, CAC/HP manufacturers may elect to use AEDMs. An AEDM is a computer modeling or mathematical tool that predicts the performance of non-tested basic models. These computer modeling and mathematical tools, when properly developed, can provide a means to predict the energy usage or efficiency characteristics of a basic model of a given covered product or equipment and to reduce the burden and cost associated with testing.

[107] AEDM = physical testing cost + (time to develop AEDM * engineering technician wage) = $14,400 + (60 hours * $41/hour).

[108] DOE estimates a fully-burdened wage rate of $41 per hour for an engineering technician based on Bureau of Labor Statistics median wage data for mechanical engineering technicians and benefits data for the private sector.

compliance, manufacturers must first obtain test data for their products according to the DOE test procedures, including any amendments adopted for those test procedures. DOE has established regulations for the certification and recordkeeping requirements for all covered consumer products and commercial equipment, including CAC/HPs. (*See generally* 10 CFR part 429.) The collection-of-information requirement for the certification and recordkeeping is subject to review and approval by OMB under the Paperwork Reduction Act (''PRA''). This requirement has been approved by OMB under OMB control number 1910–1400. Public reporting burden for the certification is estimated to average 35 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

DOE is not proposing to amend the certification or reporting requirements for CAC/HPs in this NOPR. DOE will address certification requirements for CAC/HPs in a separate rulemaking for certification, compliance, and enforcement. DOE will address changes to OMB Control Number 1910–1400 at that time, as necessary.

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 will be used to develop and implement future energy conservation standards for CAC/HPs. 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, subpart D, appendix A, sections A5, and A6. Accordingly, neither an environmental assessment nor an environmental impact statement is required.

E. Review Under Executive Order 13132

Executive Order 13132, ''Federalism,'' 64 FR 43255 (August 4, 1999) imposes certain requirements for agencies formulating and implementing policies or regulations that preempt State law or that have federalism implications. The Executive order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. DOE has examined this proposed rule and has determined that it would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the products that are the subject of this proposed rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297(d)) No further action is required by Executive Order 13132.

F. Review Under Executive Order 12988

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

G. Review Under the Unfunded Mandates Reform Act of 1995

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

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

Section 654 of the Treasury and General Government Appropriations Act, 1999 (Pub. L. 105–277) requires Federal agencies to issue a Family

Policymaking Assessment for any rule that may affect family well-being. This proposed rule would not have any impact on the autonomy or integrity of the family as an institution. Accordingly, DOE has concluded that it is not necessary to prepare a Family Policymaking Assessment.

I. Review Under Executive Order 12630

DOE has determined, under Executive Order 12630, ''Governmental Actions and Interference with Constitutionally Protected Property Rights,'' 53 FR 8859 (March 18, 1988), that this proposed 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

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

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

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

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

The proposed modifications to the test procedure for CAC/HPs would specifically reference testing methods contained in certain sections of the following commercial standards: AHRI 210/240–202X Draft, ANSI/ASHRAE 37–2009, ANSI/ASHRAE 16–2016, and ASHRAE 116–2010. 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 the following test standards:

AHRI Standard 210/240–202X Draft. This test standard is an update to AHRI 210/240–2023 (2020), and is a draft industry test procedure for measuring the heating and cooling capacity and efficiency of unitary air-source air conditioners and heat pumps with capacities less than 65,000 Btu/hour. The revised appendix M1 will be consistent with provisions in AHRI 210/240–202X Draft.

AHRI 1600–202X Draft. This test standard is a major update to AHRI 210/240–2023 (2020), and is a draft industry test procedure for measuring the heating and cooling capacity and efficiency of unitary air-source air conditioners and heat pumps with capacities less than 65,000 Btu/hour, including new seasonal cooling and heating efficiency metrics, namely SCORE and SHORE. The new appendix M2 will be consistent with provisions in AHRI 1600–202X Draft.

Copies of AHRI 210/240–202X Draft and AHRI 1600–202X Draft can be obtained from AHRI, 2311 Wilson Blvd., Suite 400, Arlington, VA 22201, (703) 524–8800, or found online at: *www.ahrinet.org.* Copies of the AHRI 210/240–202X Draft and AHRI 1600–202X Draft are also available in the docket for this proposed rulemaking.

If finalized versions of AHRI 210/240 and AHRI 1600 are not published before the test procedure final rule, or if there are substantive changes between the drafts and published versions of the standards that are not supported by stakeholder comments in response to this NOPR, DOE may adopt the substance of the AHRI 210/240–202X Draft and AHRI 1600–202X Draft or provide additional opportunity for comment on the final version of that industry consensus standard.

ANSI/ASHRAE 37–2009. This test standard is an industry-accepted test procedure that provides a method of test for many categories of air conditioning and heating equipment.

ANSI/ASHRAE 16–2016. This test standard is an industry-accepted test procedure that provides a method of test for room air conditioners, packaged terminal air conditioners, and packaged terminal heat pumps.

ASHRAE 116–2010. This test standard is an industry-accepted test procedure that provides a method of test for electrically driven, residential air-cooled air conditioners and heat pumps with cooling capacity of 65,000 Btu/hr. and less.

Copies of ANSI/ASHRAE 37–2009, ANSI/ASHRAE 16–2016 and ASHRAE 116–2010 are available on ASHRAE's website at *www.ashrae.org.*

V. Public Participation

A. Participation in the Webinar

The time and date of the webinar are listed in the **DATES** section at the beginning of this document. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's website *www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=48&action=viewlive.* Participants are responsible for ensuring their systems are compatible with the webinar software.

B. Procedure for Submitting Prepared General Statements for Distribution

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

C. Conduct of the Public Meeting

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

The public meeting 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 allow, 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 proposed rulemaking. The official conducting the public meeting will accept additional comments or questions from those attending, as time permits. The presiding official will announce any further procedural rules or modification of the previous procedures that may be needed for the proper conduct of the public meeting.

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

D. Submission of Comments

DOE will accept comments, data, and information regarding this proposed rule before or after the public meeting, but no later than the date provided in the **DATES** section at the beginning of this proposed rule.[109] Interested parties may submit comments, data, and other information using any of the methods described in the **ADDRESSES** section at the beginning of this document.

Submitting comments via 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 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 itself 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. Otherwise, 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

[109] 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 Executive Order 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 the United Canadian States (''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.

contact information in 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 telefacsimiles (''faxes'') will be accepted.

Comments, data, and other information submitted to DOE electronically should be provided in PDF (preferred), Microsoft Word or Excel, WordPerfect, or text (ASCII) file format. Provide documents that are not secured, written in English, and that are 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:

Issue 1: DOE requests feedback on its proposal to revise appendix M1 by making it consistent with the latest version of AHRI 210/240–202X Draft, for measuring the existing metrics, SEER2 and HSPF2.

Issue 2: DOE requests feedback on its proposal to establish a new appendix M2, to be consistent with the latest version of AHRI 1600–202X Draft, and to adopt the SCORE and SHORE metrics as determined under AHRI 1600–202X Draft in appendix M2 of the Federal test procedure for CAC/HPs.

Issue 3: DOE requests comment on its proposal to extend testing flexibility to P_1 (off-mode power in shoulder season) and P_2 (off-mode power in heating season) when determining SCORE and SHORE.

Issue 4: DOE requests comment on its proposals related to enforcement provisions when conducting the CVP.

Issue 5: DOE requests comment on its tentative understanding of the impact of the test procedure proposals in this NOPR, particularly regarding DOE's initial estimates of the cost impacts associated with the revised appendix M1.

Issue 6: DOE requests comment on its tentative understanding of the impact of the test procedure proposals in this NOPR, particularly regarding DOE's initial estimates of the cost impacts associated with the proposed appendix M2. DOE also requests comment on the cost of testing CAC/HPs in accordance with AHRI 1600–202X Draft compared to DOE's estimated appendix M2 testing costs for physical testing ranging from $10,800 to $18,000, which are unchanged from the appendix M1 testing costs.

Issue 7: DOE requests comment on the number of small business OEMs of CAC/HPs and their participation in the AHRI Directory.

Additionally, DOE welcomes comments on other issues relevant to the conduct of this rulemaking that may not specifically be identified in this document.

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, Imports, Incorporation by reference, Intergovernmental relations, Reporting and recordkeeping requirements, Small businesses.

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 February 27, 2024, by Jeffrey Marootian, 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 March 1, 2024.

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. Amend § 429.4 by:

■ a. Redesignating paragraphs (c)(2) through (c)(7) as paragraphs (c)(3) through (c)(8); and

■ b. Adding new paragraphs (c)(2) and (c)(9).

The additions read as follows:

§ 429.4 Materials incorporated by reference.

* * * * *

(c) * * *

(2) AHRI Standard 210/240–202X, *202X Standard for Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment,* [version

and date TBD]; IBR approved for § 429.134.

* * * * *

(9) AHRI 1600–202X, *202X Standard for Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment,* [version and date TBD]; IBR approved for § 429.134.

* * * * *

■ 3. Amend § 429.16 by revising paragraphs (a)(1), (2), and (3)(i), (b)(2), and (3)(ii), (c)(1)(i)(B), (c)(1)(ii), (c)(3), (d)(2), and (f) to read as follows:

§ 429.16 Central air conditioners and central air conditioning heat pumps.

(a) * * *

(1) *Required represented values.* Determine the represented values (including as applicable, SEER2, EER2, HSPF2, $P_{W,OFF}$, SCORE, SHORE, cooling capacity, and heating capacity) for the individual models/combinations (or ''tested combinations'') specified in the following table.

TABLE 1 TO PARAGRAPH (a)(1)

Category	Equipment subcategory	Required represented values
Single-Package Unit	Single-Package Air Conditioner (AC) (including space-constrained).	Every individual model distributed in commerce.
	Single-Package Heat Pump (HP) (including space-constrained).	Every individual model distributed in commerce.
Outdoor Unit and Indoor Unit (Distributed in Commerce by Outdoor Unit Manufacturer (OUM)).	Single-Split-System AC with Single-Stage or Two-Stage Compressor (including Space-Constrained and Small-Duct, High Velocity Systems (SDHV)).	Every individual combination distributed in commerce. Each model of outdoor unit must include a represented value for at least one coil-only individual combination that is distributed in commerce and which is representative of the least efficient combination distributed in commerce with that particular model of outdoor unit. For that particular model of outdoor unit, additional represented values for coil-only and blower-coil individual combinations are allowed, if distributed in commerce.
	Single-Split System AC with Other Than Single-Stage or Two-Stage Compressor (including Space-Constrained and SDHV).	Every individual combination distributed in commerce, including all coil-only and blower-coil combinations.
	Single-Split-System HP (including Space-Constrained and SDHV).	Every individual combination distributed in commerce.
	Multi-Split, Multi-Circuit, or Multi-Head Mini-Split Split System—non-SDHV (including Space-Constrained).	For each model of outdoor unit, at a minimum, a non-ducted ''tested combination.'' For any model of outdoor unit also sold with models of ducted indoor units, a ducted ''tested combination.'' The ducted ''tested combination'' must comprise the highest static variety of ducted indoor unit distributed in commerce (*i.e.,* conventional, mid-static, or low-static). Additional representations are allowed, as described in paragraphs (c)(3)(i) and (ii) of this section, respectively.
	Multi-Split, Multi-Circuit, or Multi-Head Mini-Split Split System—SDHV.	For each model of outdoor unit, an SDHV ''tested combination.'' Additional representations are allowed, as described in paragraph (c)(3)(iii) of this section.
Indoor Unit Only Distributed in Commerce by Independent Coil Manufacturer (ICM).	Single-Split-System Air Conditioner (including Space-Constrained and SDHV).	Every individual combination distributed in commerce.
	Single-Split-System Heat Pump (including Space-Constrained and SDHV).	
	Multi-Split, Multi-Circuit, or Multi-Head Mini-Split Split System—SDHV.	For a model of indoor unit within each basic model, an SDHV ''tested combination.'' Additional representations are allowed, as described in paragraph (c)(3)(iii) of this section.
Outdoor Unit with no Match		Every model of outdoor unit distributed in commerce (tested with a model of coil-only indoor unit as specified in paragraph (b)(2)(i) of this section.

(2) $P_{W,OFF}$. Represented values of $P_{W,OFF}$ are only required when determining represented values in accordance with 10 CFR part 430, subpart B, appendix M1. If individual models of single-package systems or individual combinations (or ''tested combinations'') of split systems that are otherwise identical are offered with multiple options for off mode-related components, determine the represented value for the individual model/combination with the crankcase heater and controls that are the most consumptive. A manufacturer may also determine represented values for individual models/combinations with less consumptive off mode options; however, all such options must be identified with different model numbers for single-package systems or for outdoor units (in the case of split systems).

(3) *Refrigerants.* (i) If a model of outdoor unit (used in a single-split, multi-split, multi-circuit, multi-head mini-split, and/or outdoor unit with no match system) is distributed in commerce and approved for use with multiple refrigerants, a manufacturer must determine all represented values for that model using each refrigerant that can be used in an individual combination of the basic model (including outdoor units with no match

or ''tested combinations''). This requirement may apply across the listed categories in the table in paragraph (a)(1) of this section. A refrigerant is considered approved for use if it is listed on the nameplate of the outdoor unit.

* * * * *

(b) * * *

(2) * * *

(i) The table identifies the minimum testing requirements for each basic model that includes multiple individual models/combinations; if a basic model spans multiple categories or subcategories listed in the table, multiple testing requirements apply. For each basic model that includes only one individual model/combination, test that individual model/combination.

TABLE 2 TO PARAGRAPH (b)(2)(i)

Category	Equipment subcategory	Must test:	With:
Single-Package Unit	Single-Package AC (including Space-Constrained). Single-Package HP (including Space-Constrained).	The individual model with the lowest seasonal energy efficiency ratio 2 (SEER2) (when testing in accordance with appendix M1 to subpart B of part 430) or SCORE (when testing in accordance with appendix M2 to subpart B of part 430).	N/A.
Outdoor Unit and Indoor Unit (Distributed in Commerce by OUM).	Single-Split-System AC with Single-Stage or Two-Stage Compressor (including Space-Constrained and Small- Duct, High Velocity Systems (SDHV)).	The model of outdoor unit	A model of coil-only indoor unit.
	Single-Split-System HP with Single-Stage or Two-Stage Compressor (including Space-Constrained and SDHV).	The model of outdoor unit	A model of indoor unit.
	Single-Split System AC or HP with Other Than Single-Stage or Two-Stage Compressor having a coil-only individual combination (including Space-Constrained and SDHV).	The model of outdoor unit	A model of coil-only indoor unit.
	Single-Split System AC or HP with Other Than Single-Stage or Two-Stage Compressor without a coil-only individual combination (including Space-Constrained and SDHV).	The model of outdoor unit	A model of indoor unit.
	Multi-Split, Multi-Circuit, or Multi-Head Mini-Split Split System—non-SDHV (including Space-Constrained).	The model of outdoor unit	At a minimum, a ''tested combination'' composed entirely of non-ducted indoor units. For any models of outdoor units also sold with models of ducted indoor units, test a second ''tested combination'' composed entirely of ducted indoor units (in addition to the non-ducted combination). The ducted ''tested combination'' must comprise the highest static variety of ducted indoor unit distributed in commerce (*i.e.,* conventional, mid-static, or low-static).
	Multi-Split, Multi-Circuit, or Multi-Head Mini-Split Split System—SDHV.	The model of outdoor unit	A ''tested combination'' composed entirely of SDHV indoor units.
Indoor Unit Only (Distributed in Commerce by ICM).	Single-Split-System Air Conditioner (including Space-Constrained and SDHV).	A model of indoor unit	The least efficient model of outdoor unit with which it will be paired where the least efficient model of outdoor unit is the model of outdoor unit in the lowest SEER2 combination (when testing under appendix M1 to subpart B of part 430) or SCORE combination (when testing under appendix M2 to subpart B of part 430) as certified by the OUM. If there are multiple models of outdoor unit with the same lowest SEER2 (when testing under appendix M1 to subpart B of part 430) or SCORE (when testing under appendix M2 to subpart B of part 430) represented value, the ICM may select one for testing purposes.

TABLE 2 TO PARAGRAPH (b)(2)(i)—Continued

Category	Equipment subcategory	Must test:	With:
	Single-Split-System Heat Pump (including Space-Constrained and SDHV).	Nothing, as long as an equivalent air conditioner basic model has been tested. If an equivalent air conditioner basic model has not been tested, must test a model of indoor unit.	
	Multi-Split, Multi-Circuit, or Multi-Head Mini-Split Split System—SDHV.	A model of indoor unit	A ''tested combination'' composed entirely of SDHV indoor units, where the outdoor unit is the least efficient model of outdoor unit with which the SDHV indoor unit will be paired. The least efficient model of outdoor unit is the model of outdoor unit in the lowest SEER2 combination (when testing under appendix M1 to subpart B of part 430) or SCORE combination (when testing under appendix M2 to subpart B of part 430) as certified by the OUM. If there are multiple models of outdoor unit with the same lowest SEER2 represented value (when testing under appendix M1 to subpart B of part 430) or SCORE represented value (when testing under appendix M2 to subpart B of part 430), the ICM may select one for testing purposes.
Outdoor Unit with No Match.		The model of outdoor unit	A model of coil-only indoor unit meeting the requirements of section 4 of appendix M1 (when testing under appendix M1 to subpart B of part 430); or meeting the requirements of section 3 of appendix M2 (when testing under appendix M2 to subpart B of part 430).

(ii) When testing in accordance with appendix M1 to subpart B of part 430, each individual model/combination (or ''tested combination'') identified in paragraph (b)(2)(i) of this section is not required to be tested for $P_{W,OFF}$. Instead, at a minimum, among individual models/combinations with similar off-mode construction (even spanning different models of outdoor units), a manufacturer must test at least one individual model/combination for $P_{W,OFF}$.

(iii) When testing in accordance with appendix M2 to subpart B of part 430 and determining SCORE and SHORE, each individual model/combination (or ''tested combination'') identified in paragraph (b)(2)(i) of this section is not required to be tested for values of P_1 (off-mode power in shoulder season) and P_2 (off-mode power in heating Season). Instead, at a minimum, among individual models/combinations with similar off-mode construction (even spanning different models of outdoor units), a manufacturer must test at least one individual model/combination, for which P_1 and P_2 are the most consumptive.

(3) * * *

(ii) *SEER2, EER2, HSPF2, SCORE and SHORE.* Any represented value of the energy efficiency or other measure of energy consumption for which consumers would favor higher values shall be less than or equal to the lower of:

(A) The mean of the sample, where:

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

and, $\bar{x}$ is the sample mean; n is the number of samples; and x_i is the ith sample; or,

(B) The lower 90 percent confidence limit (LCL) of the true mean divided by 0.95, where:

$$LCL = \bar{x} - t_{.90}\left(\frac{s}{\sqrt{n}}\right)$$

And $\bar{x}$ is the sample mean; s is the sample standard deviation; n is the number of samples; and $t_{0.90}$ is the t statistic for a 90 percent one-tailed confidence interval with n − 1 degrees of freedom (from appendix D). Round represented values of EER2, SEER2, HSPF2, SCORE and SHORE to the nearest 0.05.

* * * * *

(c) * * *

(1) * * *

(i) * * *

(B) The represented values of the measures of energy efficiency or energy consumption through the application of an AEDM in accordance with paragraph (d) of this section and § 429.70. An AEDM may only be used to determine represented values for individual models or combinations in a basic model (or separate approved refrigerants within an individual combination) other than the individual model or combination(s) required for mandatory testing under paragraph (b)(2) of this section.

(ii) When testing in accordance with appendix M1 to subpart B of part 430, for every individual model/combination within a basic model tested pursuant to paragraph (b)(2) of this section, but for which $P_{w,off}$ testing was not conducted, the represented value of $P_{w,off}$ may be assigned through, either:

(A) The testing result from an individual model/combination of similar off-mode construction; or

(B) The application of an AEDM in accordance with paragraph (d) of this section and § 429.70.

* * * * *

(3) *For multi-split systems, multi-circuit systems, and multi-head mini-split systems.* The following applies:

(i) When testing in accordance with appendix M1 to subpart B of part 430, or appendix M2 to subpart B of part 430, for basic models that include additional varieties of ducted indoor units (*i.e.,* conventional, low-static, or mid-static) other than the one for which representation is required in paragraph (a)(1) of this section, if a manufacturer chooses to make a representation, the manufacturer must conduct testing of a tested combination according to the requirements in paragraph (b)(3) of this section.

(ii) When testing in accordance with appendix M1 to subpart B of part 430, or appendix M2 to subpart B of part 430, for basic models that include mixed combinations of indoor units (any two kinds of non-ducted, low-static, mid-static, and conventional ducted indoor units), the represented value for the mixed combination is the mean of the represented values for the individual component combinations as determined in accordance with paragraph (b)(3) of this section.

(iii) When testing in accordance with appendix M1 to subpart B of part 430, or appendix M2 to subpart B of part 430, for basic models including mixed combinations of SDHV and another kind of indoor unit (any of non-ducted, low-static, mid-static, and conventional ducted), the represented value for the mixed SDHV/other combination is the mean of the represented values for the SDHV and other tested combination as determined in accordance with paragraph (b)(3) of this section.

(iv) All other individual combinations of models of indoor units for the same model of outdoor unit for which the manufacturer chooses to make representations must be rated as separate basic models, and the provisions of paragraphs (b)(1) through (3) and (c)(3)(i) through (iii) of this section apply.

(v) When testing in accordance with appendix M1 to subpart B of part 430, and with respect to $P_{w,off}$ only, for every individual combination (or ''tested combination'') within a basic model tested pursuant to paragraph (b)(2) of this section, but for which $P_{w,off}$ testing was not conducted, the representative values of $P_{w,off}$ may be assigned through either:

(A) The testing result from an individual model or combination of similar off-mode construction, or

(B) Application of an AEDM in accordance with paragraph (d) of this section and § 429.70.

(d) * * *

(2) *Energy efficiency.* Any represented value of the SEER2, EER2, HSPF2, SCORE, SHORE or other measure of energy efficiency of an individual model/combination for which consumers would favor higher values must be less than or equal to the output of the AEDM but no less than the standard.

* * * * *

(f) *Represented values for the Federal Trade Commission.* Use the following represented value determinations to meet the requirements of the Federal Trade Commission.

(1) *Annual Operating Cost—Cooling.* Determine the represented value of estimated annual operating cost for cooling-only units or the cooling portion of the estimated annual operating cost for air-source heat pumps that provide both heating and cooling, as follows:

(i) When using appendix M1 to subpart B of part 430, the product of:

(A) The quotient of the represented value of cooling capacity, in Btu's per hour as determined in paragraph (b)(3)(iii) of this section, and multiplied by 0.93 for variable speed heat pumps only, divided by the represented value of SEER2, in Btu's per watt-hour, as determined in paragraph (b)(3)(ii) of this section.

(B) The representative average use cycle for cooling of 1,000 hours per year;

(C) A conversion factor of 0.001 kilowatt per watt; and

(D) The representative average unit cost of electricity in dollars per kilowatt-hour as provided pursuant to section 323(b)(2) of the Act.

(ii) When using appendix M2 to subpart B of part 430, the product of:

(A) The quotient of the represented value of cooling capacity, in Btu's per hour as determined in paragraph (b)(3)(iii) of this section, and multiplied by 0.93 for variable speed heat pumps only, divided by the represented value of SCORE, in Btu's per watt-hour, as determined in paragraph (b)(3)(ii) of this section.

(B) The representative average use cycle for cooling of 1,457 hours per year;

(C) A conversion factor of 0.001 kilowatt per watt; and

(D) The representative average unit cost of electricity in dollars per kilowatt-hour as provided pursuant to section 323(b)(2) of the Act.

(2) *Annual Operating Cost—Heating.* Determine the represented value of estimated annual operating cost for air-source heat pumps that provide only heating or for the heating portion of the estimated annual operating cost for air-source heat pumps that provide both heating and cooling, as follows:

(i) When using appendix M1 to subpart B of part 430, the product of:

(A) The quotient of the represented value of cooling capacity (for air-source heat pumps that provide both cooling and heating) in Btu's per hour, as determined in paragraph (b)(3)(iii) of this section, or the represented value of heating capacity (for air-source heat pumps that provide only heating), as determined in paragraph (b)(3)(i)(D) of this section, divided by the represented value of HSPF2, in Btu's per watt-hour, calculated for Region IV, as determined in paragraph (b)(3)(ii) of this section;

(B) The representative average use cycle for heating of 1,572 hours per year;

(C) The adjustment factor of 1.15 (for heat pumps that are not variable speed) or 1.07 (for heat pumps that are variable speed), which serves to adjust the calculated design heating requirement and heating load hours to the actual load experienced by a heating system;

(D) A conversion factor of 0.001 kilowatt per watt; and

(E) The representative average unit cost of electricity in dollars per kilowatt-hour as provided pursuant to section 323(b)(2) of the Act;

(ii) When using appendix M2 to subpart B of part 430, the product of:

(A) The quotient of the represented value of cooling capacity (for air-source heat pumps that provide both cooling and heating) in Btu's per hour, as determined in paragraph (b)(3)(iii) of this section, or the represented value of heating capacity (for air-source heat pumps that provide only heating), as determined in paragraph (b)(3)(i)(D) of this section, divided by the represented value of SHORE, in Btu's per watt-hour, as determined in paragraph (b)(3)(ii) of this section;

(B) The representative average use cycle for heating of 972 hours per year;

(C) The adjustment factor of 1.15 (for heat pumps that are not variable speed) or 1.07 (for heat pumps that are variable speed), which serves to adjust the calculated design heating requirement and heating load hours to the actual load experienced by a heating system;

(D) A conversion factor of 0.001 kilowatt per watt; and

(E) The representative average unit cost of electricity in dollars per kilowatt-hour as provided pursuant to section 323(b)(2) of the Act;

(3) *Annual Operating Cost—Total.* Determine the represented value of estimated annual operating cost for air-source heat pumps that provide both heating and cooling by calculating the sum of the quantity determined in paragraph (f)(1) of this section added to the quantity determined in paragraph (f)(2) of this section.

(4) *Regional Annual Operating Cost—Cooling.* Determine the represented value of estimated regional annual operating cost for cooling-only units or the cooling portion of the estimated regional annual operating cost for air-source heat pumps that provide both heating and cooling as follows:

(i) When using appendix M1 to subpart B of part 430, the product of:

(A) The quotient of the represented value of cooling capacity, in Btu's per hour as determined in paragraph (b)(3)(iii) of this section, and multiplied by 0.93 for variable speed heat pumps only, divided by the represented value of SEER2, in Btu's per watt-hour, as determined in paragraph (b)(3)(ii) of this section;

(B) The estimated number of regional cooling load hours per year determined from the following table:

TABLE 4 TO PARAGRAPH (f)(4)(i)(B)

Climatic region	Regional cooling load hours
I	2,400
II	1,800
III	1,200
IV	800
V	400
VI	200

(C) A conversion factor of 0.001 kilowatts per watt; and

(D) The representative average unit cost of electricity in dollars per kilowatt-hour as provided pursuant to section 323(b)(2) of the Act.

(ii) When using appendix M2 to subpart B of part 430, regional annual operating cost for cooling-only units or the cooling portion of the estimated regional annual operating cost air-source heat pumps that provide both heating and cooling, does not apply.

(5) *Regional Annual Operating Cost—Heating.* Determine the represented value of estimated regional annual operating cost for air-source heat pumps that provide only heating or for the heating portion of the estimated regional annual operating cost for air-source heat pumps that provide both heating and cooling as follows:

(i) When using appendix M1 to subpart B of part 430, the product of:

(A) The estimated number of regional heating load hours per year determined from the following table:

TABLE 5 TO PARAGRAPH (f)(5)(i)(A)

Climatic region	Regional heating load hours
I	493
II	857
III	1,247
IV	1,701
V	2,202
VI	1,842

(B) The quotient of the represented value of cooling capacity (for air-source heat pumps that provide both cooling and heating) in Btu's per hour, as determined in paragraph (b)(3)(i)(C) of this section, or the represented value of heating capacity (for air-source heat pumps that provide only heating), as determined in paragraph (b)(3)(i)(D) of this section, divided by the represented value of HSPF2, in Btu's per watt-hour, calculated for the appropriate generalized climatic region of interest, and determined in paragraph (b)(3)(i)(B) of this section;

(C) The adjustment factor of 1.15 (for heat pumps that are not variable speed) or 1.07 (for heat pumps that are variable speed), which serves to adjust the calculated design heating requirement and heating load hours to the actual load experienced by a heating system;

(D) A conversion factor of 0.001 kilowatts per watt; and

(E) The representative average unit cost of electricity in dollars per kilowatt-hour as provided pursuant to section 323(b)(2) of the Act.

(ii) When using appendix M2 to subpart B of part 430, regional annual operating cost for air-source heat pumps that provide only heating or for the heating portion, does not apply.

(6) *Regional Annual Operating Cost—Total.* For air-source heat pumps that provide both heating and cooling, the estimated regional annual operating cost is the sum of the quantity determined in paragraph (f)(4) of this section added to the quantity determined in paragraph (f)(5) of this section.

(7) *Annual Operating Cost—Rounding.* Round any represented values of estimated annual operating cost determined in paragraphs (f)(1) through (6) of this section to the nearest dollar per year.

■ 4. Amend § 429.70 by revising paragraphs (e)(1) and (e)(2)(i)(A) to read as follows:

§ 429.70 Alternative methods for determining energy efficiency and energy use.

* * * * *

(e) * * *

(1) *Criteria an AEDM must satisfy.* A manufacturer may not apply an AEDM to an individual model/combination to determine its represented values (SEER2, EER2, HSPF2, SCORE, SHORE and/or $P_{W,OFF}$) pursuant to this section unless authorized pursuant to § 429.16(d) and:

(i) The AEDM is derived from a mathematical model that estimates the energy efficiency or energy consumption characteristics of the individual model or combination (SEER2, EER2, HSPF2, SCORE, SHORE and/or $P_{W,OFF}$) as measured by the applicable DOE test procedure; and

(ii) The manufacturer has validated the AEDM in accordance with paragraph (e)(2) of this section.

(2) * * *

(i) * * *

(A) *Minimum testing.* The manufacturer must test each basic model as required under § 429.16(b)(2).

* * * * *

■ 5. Amend § 429.134 by revising paragraph (k) to read as follows:

§ 429.134 Product-specific enforcement provisions.

* * * * *

(k) *Central air conditioners and heat pumps*—Before [*Date 180 days after publication of the final rule in the* **Federal Register**], the provisions in this section of this title as it appeared in the 10 CFR parts 200–499 edition revised as of January 1, 2023 are applicable. On and after [*Date 180 days after publication of the final rule in the* **Federal Register**], the following provisions apply.

(1) Verification of cooling capacity. The cooling capacity of each tested unit of the individual model (for single-package systems) or individual combination (for split systems) will be measured pursuant to the test requirements of § 430.23(m) of this chapter. The mean of the measurement(s) (either the measured cooling capacity for a single unit sample or the average of the measured cooling capacities for a multiple unit sample) will be used to determine the applicable standards for purposes of compliance.

(2) *Verification of C_D value.* (i) For central air conditioners and heat pumps other than models of outdoor units with no match, if manufacturers certify that they did not conduct the optional tests to determine the C_D^c and/or C_D^h value for an individual model (for single-package systems) or individual

combination (for split systems), as applicable, for each unit tested, the default C_D^c and/or C_D^h value will be used as the basis for the calculation of SEER2 or HSPF2 when testing in accordance with appendix M1 to subpart B of part 430, or SCORE or SHORE when testing in accordance with appendix M2 to subpart B of part 430. If manufacturers certify that they conducted the optional tests to determine the C_D^c and/or C_D^h value for an individual model (for single-package systems) or individual combination (for split systems), as applicable, the following provisions apply.

(A) If testing in accordance with appendix M1 to subpart B of part 430, the C_D^c and/or C_D^h value will be measured for each unit tested pursuant to appendix M1 to subpart B of part 430 and the result for each unit tested (either the tested value or the default value, as selected according to the criteria for the cyclic test in section E17 of AHRI 210/240–202X (incorporated by reference, see § 429.4)) will be used as the basis for calculation of SEER2 or HSPF2.

(B) If testing in accordance with appendix M2 to subpart B of part 430, the C_D^c and/or C_D^h value will be measured for each unit tested pursuant to appendix M2 to subpart B of part 430 and the result for each unit tested (either the tested value or the default value, as selected according to the criteria for the cyclic test in section E17 of AHRI 1600–202X (incorporated by reference, see § 429.4)) will be used as the basis for calculation of SCORE or SHORE.

(ii) For models of outdoor units with no match, DOE will use the default C_D^c and/or C_D^h pursuant to appendix M1 to subpart B of part 430 or appendix M2 to subpart B of part 430, as applicable.

(3) *Verification of cut-out and cut-in temperatures for central heat pumps.* (i) When testing in accordance with appendix M1 to subpart B of part 430, the cut-out and cut-in temperatures may be verified using the method in appendix J of AHRI 210/240–202X (incorporated by reference, see § 429.4). If this method is conducted, the tested $T_{OFF,T}$ and $T_{ON,T}$ values determined in the test shall be used as the cut-out and cut-in temperatures, respectively, to calculate HSPF2.

(ii) When testing in accordance with appendix M2 to subpart B of part 430, the cut-out and cut-in temperatures may be verified using the method in appendix J of AHRI 1600–202X (incorporated by reference, see § 429.4). If this method is conducted, the tested $T_{OFF,T}$ and $T_{ON,T}$ values determined in the test shall be used as the cut-out and cut-in temperatures, respectively, to calculate SHORE.

(4) *Verification of Variable Capacity Operation and of Fixed Settings for the Compressor and the Indoor Fan when Testing Variable Capacity Compressor Systems*—(i) *Conducting the Controls Verification Procedure.* A controls verification procedure (CVP) may be performed for any model certified as a variable capacity compressor system for the purposes of assessment or enforcement testing conducted according to appendix M1 to subpart B of part 430 or appendix M2 to subpart B of part 430 (*i.e.,* the certification tests), as applicable. For a heat pump, either a cooling mode CVP, a heating mode CVP, or both may be conducted, as elected by DOE. If a CVP is not conducted, the override instructions for the compressor and indoor fan, as specified by the manufacturer, will be used to conduct the tests per appendix M1 to subpart B of part 430 or, appendix M2 to subpart B of part 430, as applicable.

(A) *When testing in accordance with appendix M1 to subpart B of part 430.* The CVP will be conducted per appendix I of AHRI 210/240–202X (incorporated by reference, see § 429.4).

(B) *When testing in accordance with appendix M2 to subpart B of part 430.* The CVP will be conducted per appendix I of AHRI 1600–202X (incorporated by reference, see § 429.4).

(C) For systems determined to be variable capacity certified, single capacity systems as described in paragraph (k)(4)(ii)(B) of this section, the CVP cooling and heating minimum intervals may be omitted.

(ii) *Variable Capacity Determination.*(A) If the unit tested does meet the definition of a variable capacity compressor system based on performance of the CVP per paragraph (k)(4)(i)(A) or paragraph (k)(4)(i)(B) of this section, the efficiency metrics (SEER2, HSPF2, EER2, SCORE, SHORE, as applicable) shall be determined using the certification test applicable to variable capacity compressor systems.

(B) If the unit tested does not meet the definition of a variable capacity compressor system based on performance of the CVP per paragraph (k)(4)(i)(A) or paragraph (k)(4)(i)(B) of this section, and the tested unit is instead determined to be a variable capacity certified, single capacity system, the efficiency metrics (SEER2, HSPF2, EER2, SCORE, SHORE, as applicable) shall be determined using the certification test applicable to variable capacity certified, single capacity systems.

(C) If the unit tested does not meet the definition of a variable capacity compressor system based on performance of the CVP per paragraph (k)(4)(i)(A) or paragraph (k)(4)(i)(B) of this section, and the tested unit is instead determined to be a variable capacity certified, two capacity system, the efficiency metrics (SEER2, HSPF2, EER2, SCORE, SHORE, as applicable) shall be determined using the certification test applicable to variable capacity certified, two capacity systems.

(D) If, for a heat pump, a CVP is conducted for just one of the operating modes (heating or cooling), the system classifications for both modes will be based on the results of the one CVP conducted.

(iii) *CVP Tolerance Evaluation for Full and Minimum Load Intervals.*

(A) The data collected in the CVP per paragraph (k)(4)(i)(A) or paragraph (k)(4)(i)(B) of this section shall be evaluated for the duration of the individual CVP full or minimum load interval excluding the preliminary 30 minutes of equilibrium data, to determine compliance with test condition tolerances and test operating tolerances listed in section I5.1 of appendix I of AHRI 210/240–202X (incorporated by reference, see § 429.4) (if testing in accordance with appendix M1); or of AHRI 1600–202X (incorporated by reference, see § 429.4) (if testing in accordance with appendix M2).

(1) If the specified tolerances are met under system operation for 60 minutes, the average capacity and average power measured over this 60-minute test interval shall be recorded.

(2) If the four-hour time limit is reached by the system without maintaining the tolerances for a 60-minute period, but two successive test period sub-intervals are identified, each a minimum of 30 minutes, and comprised of a whole number of compressor cycles (either compressor on-off cycles or speed/capacity cycles) or in which minimal fluctuations of the compressor speed/capacity level are observed, where both the time averaged integrated capacity and time averaged integrated power for the full 60 minutes of the two periods are observed to be within two percent of each other, a single capacity average and a single power average shall be recorded, both averaged over compressor-on periods of the two 60-minute sub-intervals. These average capacity and power values shall be considered the capacity and power values recorded for the test interval.

(3) If the four-hour time limit is reached by the system without complying with either paragraph (k)(4)(iii)(A)*(1)* or (k)(4)(iii)(B)*(2)* of this section, the time averaged integrated

capacity and time averaged integrated power shall be recorded for only the compressor-on periods over the final 120 minutes of the test interval.

(B) The measured capacity for each full load interval, as evaluated per the CVP conducted in paragraph (k)(4)(i)(A) or paragraph (k)(4)(i)(B) of this section, shall agree with the corresponding certification test within 6%, as follows:

$$\text{Cooling full: } \frac{\dot{q}_{A,Full} - \dot{q}_{CVP,A,Full}}{\dot{q}_{A,Full}} \times 100 \leq 6.0$$

$$\text{Heating full (17°F): } \frac{\dot{q}_{H3,Full} - \dot{q}_{CVP,H(17)}}{\dot{q}_{H3,Full}} \times 100 \leq 6.0$$

$$\text{Heating full (5°F): } \frac{\dot{q}_{H4,Full} - \dot{q}_{CVP,H(5)}}{\dot{q}_{H4,Full}} \times 100 \leq 6.0$$

(C) The measured capacity for each minimum load interval, as evaluated per the CVP conducted in paragraph (k)(4)(i)(A) or paragraph (k)(4)(i)(B) of this section, shall agree with the corresponding certification test within 6% of the cooling or heating mode full load certification test capacity, as follows:

$$\text{Cooling minimum: } \frac{\dot{q}_{CVP,F,Low} - \dot{q}_{F,Low}}{\dot{q}_{A,Full}} \times 100 \leq 6.0$$

$$\text{Heating minimum: } \frac{\dot{q}_{CVP,H(47)} - \dot{q}_{H1,Low}}{\dot{q}_{H3,Full}} \times 100 \leq 6.0$$

(D) The measured efficiency for the full and minimum load interval, as evaluated per the CVP conducted in paragraph (k)(4)(i)(A) or paragraph (k)(4)(i)(B) of this section, shall agree with the corresponding certification test within 10%, as follows:

$$\text{Cooling full: } \frac{EER2_{A,Full} - EER2_{CVP,A,Full}}{EER2_{A,Full}} \times 100 \leq 10.0$$

$$\text{Cooling minimum: } \frac{EER_{F,Low} - EER_{CVP,F,Low}}{EER_{F,Low}} \times 100 \leq 10.0$$

$$\text{Heating full (5°F): } \frac{COP_{H4,Full} - COP_{CVP,H(5)}}{COP2_{H4,Full}} \times 100 \leq 10.0$$

$$\text{Heating full (17°F): } \frac{COP_{H3,Full} - COP_{CVP,H(17)}}{COP_{H3,Full}} \times 100 \leq 10.0$$

$$\text{Heating minimum: } \frac{COP_{H1,Low} - COP_{CVP,H(47)}}{COP_{H1,Low}} \times 100 \leq 10.0$$

(iv) *Evaluation of results when CVP tolerances are met.* If the tolerances for capacity and efficiency are met by the applicable full and minimum load intervals as per paragraphs (k)(4)(iii)(B), (k)(4)(iii)(C) and (k)(4)(iii)(D) of this section, the certified override instructions for the compressor and indoor fan, as specified by the manufacturer, shall be deemed valid, and the efficiency metrics (SEER2, HSPF2, EER2, SCORE, SHORE, as applicable), shall be determined based on these certification tests with no adjustments determined based on the CVP results.

(v) *Evaluation of results when CVP tolerances are not met.* If the tolerances for capacity and efficiency are not met by the applicable full and minimum load intervals as per paragraphs (k)(4)(iii)(B), (k)(4)(iii)(C) and (k)(4)(iii)(D) of this section, the unit shall be tested per instructions in paragraphs (k)(4)(v)(A) to (k)(4)(v)(C) of this section, as applicable. The instructions in paragraphs (k)(4)(v)(A) to (k)(4)(v)(C) of this section shall be followed, as applicable, only for the certification tests corresponding to the failed compressor speed interval based on the evaluations of paragraphs (k)(4)(iii)(B), (k)(4)(iii)(C) and (k)(4)(iii)(D) of this section. For all compressor speed intervals for which the capacity and EER/COP are in tolerance as per paragraphs (k)(4)(iii)(B), (k)(4)(iii)(C) and (k)(4)(iii)(D) of this section, the corresponding certification tests shall be used without adjustments.

(A) The instructions of this paragraph shall be applied to systems for which the same control device used as per the CVP conducted in paragraph (k)(4)(i)(A) or paragraph (k)(4)(i)(B) of this section is used as the means for overriding the controls, and both (a) monitoring of the compressor and indoor blower speed during native-control operation without otherwise impacting the control of the system, and (b) monitoring and adjustment of the compressor and indoor blower speed during certification tests, where monitoring and adjustment means the control device has the ability to display and make discrete adjustments, as required, to the compressor and indoor blower speeds without additional hardware or non-publicly available software, is supported by the control device. The compressor and indoor blower speed shall be monitored during the CVP conducted in paragraph (k)(4)(i)(A) or paragraph (k)(4)(i)(B) of this section. The average compressor and indoor blower speeds and indoor air volume rate shall be evaluated for the same time period(s) used as described in paragraph (k)(4)(iii)(A) to determine average capacity and power for the CVP test. The compressor speed for the certification test shall be set at this average value observed during the corresponding CVP test interval. The indoor blower speed shall be set as described in section 6.1.5 of AHRI 210/240–202X (incorporated by reference, see § 429.4) (if testing in accordance with appendix M1); or of AHRI 1600–202X (incorporated by reference, see § 429.4) (if testing in accordance with appendix M2), except the ''specified airflow'' shall be set as the average value observed during the corresponding CVP test interval. The same adjusted compressor speed shall be used for the other certification tests that require the same speed, as applicable, as detailed in the following table. Specifically, for each of the CVP tests listed in the first column for which either the capacity tolerances of paragraph (k)(4)(iii)(B) or paragraph (k)(4)(iii)(C) of this section are not met or the efficiency tolerances of paragraph (k)(4)(iii)(D) are not met, the certification tests to be conducted again using the compressor speed determined in the corresponding CVP test are listed in the last three columns of the table, depending on which of the three kinds of system the model is designated. If required, the adjusted $\dot{q}_{H3,Full}$ and $P_{H3,Full}$ shall be used to calculate $\dot{q}^{k=2}{}_{hcalc}$ (47) and $P^{k=2}{}_{hcalc}$ (47), respectively, to represent performance at 47 °F as described in section 11.2.2.4 of AHRI 210/240–202X (incorporated by reference, see § 429.4) (if testing in accordance with appendix M1), or of AHRI 1600–202X (incorporated by reference, see § 429.4) (if testing in accordance with appendix M2), and for use in calculating performance at 35 °F. If required, the adjusted $H_{1,Low}$ and $H_{3,Low}$ tests shall be used to calculate $\dot{q}_{thi,H2,Low}$ and $P_{H2,Low}$, respectively, as described in section 6.1.3.4 of AHRI 210/240–202X (incorporated by reference, see § 429.4) (if testing in accordance with appendix M1), or of AHRI 1600–202X (incorporated by reference, see § 429.4) (if testing in accordance with appendix M2). No adjustments are required for intermediate or nominal compressor speed tests or, if cyclic tests are conducted, for the degradation coefficient(s).

TABLE 1 TO PARAGRAPH (k)(4)(v)(A)

CVP Test	Certification Tests that use the Indicated CVP Test Compressor Speed or would have certification test results adjusted per Paragraph (k)(4)(v)(B) of this section, if the CVP Test is out of Capacity or EER/COP Tolerance per Paragraph (k)(4)(iii) of this section		
	Variable capacity certified, single capacity system	Variable capacity certified, two capacity system	Variable capacity system
A_{full}	A_{Full}, B_{Full}	A_{Full}, B_{Full}	A_{Full}, B_{Full}.
F_{low}	N/A	B_{Low}, F_{Low}	B_{Low}, F_{Low}.
$H_{1,low}$	N/A	$H_{0,Low}$, $H_{1,Low}$, $H_{3,Low}$	$H_{0,Low}$, $H_{1,Low}$.
$H_{3,full}$	$H_{2,Full}$, $H_{3,Full}$	$H_{3,Full}$	$H_{3,Full}$.
$H_{4,Full}$	$H_{4,Full}$	$H_{4,Full}$	$H_{4,Full}$.

(B) The instructions of this paragraph shall be applied to systems for which the means for overriding the compressor and indoor blower speed as discussed in paragraph (k)(4)(v)(A) of this section is not provided by the control used for conducting the CVP. For each of the CVP tests listed in the first column of Table 1 of this section for which either the capacity tolerances of paragraph (k)(4)(iii)(B) or paragraph (k)(4)(iii)(C) of this section are not met or the efficiency tolerances of paragraph (k)(4)(iii)(D) are not met, depending on which of the three kinds of system the model is designated, the certification test results to be adjusted based on the results of the CVP test are indicated by the last three columns of the table for each CVP test listed in the first column. The average capacities and power(s) measured during the CVP time period(s) described in paragraph (k)(4)(iii)(A) of this section shall be used. For the certification tests requiring adjustment with no CVP interval (any required certification test other than A_{full}, F_{low}, $H1_{low}$, $H3_{full}$ and $H4_{full}$), the capacity and power shall be adjusted. The capacity shall be adjusted by applying the ratio of the capacity measured during the CVP test interval divided by the capacity measured during the certification test (for the corresponding CVP interval). The power shall be adjusted by applying the ratio of the efficiency measured during the CVP test interval divided by the efficiency measured during the certification test (for the corresponding CVP interval), as follows:

Cooling full capacity:

$$\dot{q}_{B,Full} = \dot{q}_{B,Full,Certification} \times \frac{\dot{q}_{CVP,A,Full}}{\dot{q}_{A,Full,Certification}}$$

Cooling full power:

$$P_{B,Full} = P_{B,Full,Certification} \times \frac{EER2_{A,Full,Certification}}{EER2_{CVP,A,Full}}$$

Cooling minimum capacity:

$$\dot{q}_{B,Low} = \dot{q}_{B,Low,Certification} \times \frac{\dot{q}_{CVP,F,Low}}{\dot{q}_{F,Low,Certification}}$$

Cooling minimum power:

$$P_{B,Low} = P_{B,Low,Certification} \times \frac{EER_{F,Low,Certification}}{EER_{CVP,F,Low}}$$

Heating minimum capacity:

$$\dot{q}_{H0,Low} = \dot{q}_{H0,Low,Certification} \times \frac{\dot{q}_{CVP,H1,Low}}{\dot{q}_{H1,Low,Certification}}$$

$$\dot{q}_{H3,Low} = \frac{\dot{q}_{CVP,H1,Low}}{(1 + 30 \cdot CSF)}$$

Heating minimum power:

$$P_{H0,Low} = P_{H0,Low,Certification} \times \frac{COP_{H1,Low,Certification}}{COP_{CVP,H1,Low}}$$

$$P_{H3,Low} = \frac{P_{CVP,H1,Low}}{(1 + 30 \cdot PSF)}$$

Where:

CSF = 0.0204/°F, capacity slope factor for Split Systems

CSF = 0.0262/°F, capacity slope factor for Single Package Units

PSF = 0.00455/°F, power slope factor for all products

(C) If required, the measured $Q_{H3,Full}$ and $E_{H3,Full}$ from the CVP shall be used to calculate $\dot{q}^{k=2}{}_{hcalc}(47)$ and $P^{k=2}{}_{hcalc}(47)$, respectively, to represent performance at 47 °F as described in section 11.2.2.4 of AHRI 210/240–202X (incorporated by reference, see § 429.4) (if testing in accordance with appendix M1), or of AHRI 1600–202X (incorporated by reference, see § 429.4) (if testing in accordance with appendix M2), and for use in calculating performance at 35 °F. If required, the measured $H_{1,Low}$ from the CVP and the adjusted $H_{3,Low}$ tests shall be used to calculate $\dot{q}_{thi,H2,Low}$ and $P_{H2,Low}$, respectively, as described in section 6.1.3.4 of AHRI 210/240–202X (incorporated by reference, see § 429.4) (if testing in accordance with appendix M1) or of AHRI 1600–202X (incorporated by reference, see § 429.4) (if testing in accordance with appendix M2). No adjustments are required for intermediate or nominal compressor speed tests or, if cyclic tests are conducted, the degradation coefficient(s).

(D) If the test unit is determined to be variable capacity certified, single capacity system, or variable capacity certified, two capacity system and is not certified or marketed for use with only a proprietary control device, the same simulated thermostat low voltage signal that resulted in full speed compressor operation for the full load intervals shall be used for all certification full load tests. If the test unit is determined to be variable capacity certified, two capacity system, the same simulated thermostat low voltage signal that resulted in low-speed compressor operation for the low load intervals shall be used for all certification low load tests.

* * * * *

PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS

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

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

■ 7. Amend § 430.3 by revising paragraphs (b)(4), (c) and (g) to read as follows:

§ 430.3 Materials incorporated by reference.

* * * * *

(b) * * *

(4) ANSI/AMCA 210–07, ANSI/ASHRAE 51–07 (''AMCA 210–2007''), Laboratory Methods of Testing Fans for Certified Aerodynamic Performance

Rating, ANSI approved August 17, 2007, Section 8—Report and Results of Test, Section 8.2—Performance graphical representation of test results, IBR approved for appendix M to subpart B, as follows:

(i) Figure 2A—Static Pressure Tap, and

(ii) Figure 12—Outlet Chamber Setup—Multiple Nozzles in Chamber.

* * * * *

(c) *AHRI.* Air-Conditioning, Heating, and Refrigeration Institute, 2111 Wilson Blvd., Suite 500, Arlington, VA 22201, 703–524–8800, or go to *https://www.ahrinet.org.*

(1) ANSI/AHRI 210/240–2008 with Addenda 1 and 2 (''AHRI 210/240–2008''), 2008 Standard for Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment, ANSI approved October 27, 2011 (Addendum 1 dated June 2011 and Addendum 2 dated March 2012), IBR approved for appendix M to subpart B, as follows:

(i) Section 6—Rating Requirements, Section 6.1—Standard Ratings, 6.1.3—Standard Rating Tests, 6.1.3.2—Electrical Conditions;

(ii) Section 6—Rating Requirements, Section 6.1—Standard Ratings, 6.1.3—Standard Rating Tests, 6.1.3.4—Outdoor-Coil Airflow Rate;

(iii) Section 6—Rating Requirements, Section 6.1—Standard Ratings, 6.1.3—Standard Rating Tests, 6.1.3.5—Requirements for Separated Assemblies;

(iv) Figure D1—Tunnel Air Enthalpy Test Method Arrangement;

(v) Figure D2—Loop Air Enthalpy Test Method Arrangement; and

(vi) Figure D4—Room Air Enthalpy Test Method Arrangement.

(2) AHRI Standard 210/240–202X (''AHRI 210/240–202X''), *202X Standard for Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment* [version and date TBD]; IBR approved for appendix M1 to subpart B.

(3) AHRI Standard 1160–2009 (''AHRI 1160''), Performance Rating of Heat Pump Pool Heaters, 2009, IBR approved for appendix P to subpart B.

(4) ANSI/AHRI 1230–2010 with Addendum 2 (''AHRI 1230–2010''), 2010 Standard for Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment (including Addendum 1 dated March 2011), ANSI approved August 2, 2010 (Addendum 2 dated June 2014), IBR approved for appendix M to subpart B, as follows:

(i) Section 3—Definitions (except 3.8, 3.9, 3.13, 3.14, 3.15, 3.16, 3.23, 3.24, 3.26, 3.27, 3.28, 3.29, 3.30, and 3.31);

(ii) Section 5—Test Requirements, Section 5.1 (untitled), 5.1.3–5.1.4;

(iii) Section 6—Rating Requirements, Section 6.1—Standard Ratings, 6.1.5—Airflow Requirements for Systems with Capacities <65,000 Btu/h [19,000 W];

(iv) Section 6—Rating Requirements, Section 6.1—Standard Ratings, 6.1.6—Outdoor-Coil Airflow Rate (Applies to all Air-to-Air Systems);

(v) Section 6—Rating Requirements, Section 6.2—Conditions for Standard Rating Test for Air-cooled Systems < 65,000 Btu/h [19,000W] (except Table 8); and

(vi) Table 4—Refrigerant Line Length Correction Factors.

(5) AHRI 1600–202X (''AHRI 1600–202X''), *202X Standard for Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment,* [version and date TBD]; IBR approved for appendix M2 to subpart B.

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(g) *ASHRAE.* American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., 180 Technology Parkway NW, Peachtree Corners, GA 30092; (800) 527–4723 or (404) 636–8400; *www.ashrae.org.*

(1) ANSI/ASHRAE Standard 16–2016 (''ANSI/ASHRAE 16''), *Method of Testing for Rating Room Air Conditioners, Packaged Terminal Air Conditioners, and Packaged Terminal Heat Pumps for Cooling and Heating Capacity,* ANSI approved November 1, 2016; IBR approved for appendices F, M1, and M2 to subpart B.

(2) ANSI/ASHRAE 23.1–2010, (''ASHRAE 23.1–2010''), Methods of Testing for Rating the Performance of Positive Displacement Refrigerant Compressors and Condensing Units that Operate at Subcritical Temperatures of the Refrigerant, ANSI approved January 28, 2010, IBR approved for appendix M to subpart B, as follows:

(i) Section 5—Requirements;

(ii) Section 6—Instruments;

(iii) Section 7—Methods of Testing; and

(iv) Section 8—Compressor Testing.

(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 M1, M2, AA, CC, and CC1 to subpart B.

(4) ANSI/ASHRAE Standard 37–2009, (''ANSI/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 appendix M to subpart B, as follows:

(i) Section 5—Instruments, Section 5.1—Temperature Measuring Instruments: 5.1.1;

(ii) Section 5—Instruments, Section 5.2—Refrigerant, Liquid, and Barometric Pressure Measuring Instruments;

(iii) Section 5—Instruments, Section 5.5—Volatile Refrigerant Flow Measurement;

(iv) Section 6—Airflow and Air Differential Pressure Measurement Apparatus, Section 6.1—Enthalpy Apparatus (Excluding Figure 3): 6.1.1–6.1.2 and 6.1.4;

(v) Section 6—Airflow and Air Differential Pressure Measurement Apparatus, Section 6.2—Nozzle Airflow Measuring Apparatus (Excluding Figure 5);

(vi) Section 6—Airflow and Air Differential Pressure Measurement Apparatus, Section 6.3—Nozzles (Excluding Figure 6);

(vii) Section 6—Airflow and Air Differential Pressure Measurement Apparatus, Section 6.4—External Static Pressure Measurements;

(viii) Section 6—Airflow and Air Differential Pressure Measurement Apparatus, Section 6.5—Recommended Practices for Static Pressure Measurements;

(ix) Section 7—Methods of Testing and Calculation, Section 7.3—Indoor and Outdoor Air Enthalpy Methods (Excluding Table 1);

(x) Section 7—Methods of Testing and Calculation, Section 7.4—Compressor Calibration Method;

(xi) Section 7—Methods of Testing and Calculation, Section 7.5—Refrigerant Enthalpy Method;

(xii) Section 7—Methods of Testing and Calculation, Section 7.7—Airflow Rate Measurement, Section 7.7.2—Calculations—Nozzle Airflow Measuring Apparatus (Excluding Figure 10), 7.7.2.1–7.7.2.2;

(xiii) Section 8—Test Procedures, Section 8.1—Test Room Requirements: 8.1.2–8.1.3;

(xiv) Section 8—Test Procedures, Section 8.2—Equipment Installation;

(xv) Section 8—Test Procedures, Section 8.6—Additional Requirements for the Outdoor Air Enthalpy Method, Section 8.6.2;

(xvii) Section 8—Test Procedures, Section 8.6—Additional Requirements for the Outdoor Air Enthalpy Method, Table 2a—Test Tolerances (SI Units), and

(xviii) Section 8—Test Procedures, Section 8.6—Additional Requirements for the Outdoor Air Enthalpy Method, Table 2b—Test Tolerances (I–P Units);

(xix) Section 9—Data to be Recorded, Section 9.2—Test Tolerances; and

(xx) Section 9—Data to be Recorded, Table 3—Data to be Recorded.

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

(6) ANSI/ASHRAE 41.1–2013 (''ANSI/ASHRAE 41.1''), *Standard Method for Temperature Measurement,* ANSI approved January 30, 2013; IBR approved for appendices F and X1 to subpart B.

(7) ANSI/ASHRAE Standard 41.1–2013, (''ANSI/ASHRAE 41.1–2013''), *Standard Method for Temperature Measurement,* ANSI approved January 30, 2013, IBR approved for appendix M to subpart B, as follows:

(i) Section 4—Classifications;

(ii) Section 5—Requirements, Section 5.3—Airstream Temperature Measurements;

(iii) Section 6—Instruments; and

(iv) Section 7—Temperature Test Methods (Informative).

(8) ANSI/ASHRAE Standard 41.1–2020 (''ASHRAE 41.1–2020''), *Standard Methods for Temperature Measurement,* ANSI-approved June 30, 2020; IBR approved for appendix E to subpart B.

(9) ANSI/ASHRAE Standard 41.2–1987 (RA 92), (''ASHRAE 41.2–1987 (RA 1992)''), *Standard Methods for Laboratory Airflow Measurement,* ANSI reaffirmed April 20, 1992; IBR approved for appendix F to subpart B.

(10) ANSI/ASHRAE Standard 41.2–1987 (RA 1992), (''ASHRAE 41.2–1987 (RA 1992)''), *Standard Methods for Laboratory Airflow Measurement,* ANSI reaffirmed April 20, 1992, Section 5—Section of Airflow-Measuring Equipment and Systems, IBR approved for appendix M to subpart B, as follows:

(i) Section 5.2—Test Ducts, Section 5.2.2—Mixers, 5.2.2.1—Performance of Mixers (excluding Figures 11 and 12 and Table 1); and

(ii) Figure 14—Outlet Chamber Setup for Multiple Nozzles in Chamber.

(11) ANSI/ASHRAE Standard 41.3–2014, (''ASHRAE 41.3–2014''), *Standard Methods for Pressure Measurement,* ANSI approved July 3, 2014; IBR approved for appendix F to subpart B.

(12) ANSI/ASHRAE Standard 41.6–1994 (RA 2006) (''ASHRAE 41.6–1994''), *Standard Method for Measurement of Moist Air Properties,* ANSI-reaffirmed January 27, 2006; IBR approved for appendices CC and CC1 to subpart B.

(13) ANSI/ASHRAE Standard 41.6–2014, (''ASHRAE 41.6–2014''), *Standard Method for Humidity Measurement,* ANSI approved July 3, 2014; IBR approved for appendices E, F, and EE to subpart B.

(14) ANSI/ASHRAE Standard 41.6–2014, (''ASHRAE 41.6–2014''), *Standard Method for Humidity Measurement,* ANSI approved July 3, 2014, IBR approved for appendix M to subpart B, as follows:

(i) Section 4—Classifications;

(ii) Section 5—Requirements;

(iii) Section 6—Instruments and Calibration; and

(iv) Section 7—Humidity Measurement Methods.

(15) ANSI/ASHRAE 41.9–2011, (''ASHRAE 41.9–2011''), *Standard Methods for Volatile-Refrigerant Mass Flow Measurements Using Calorimeters,* ANSI approved February 3, 2011, IBR approved for appendix M to subpart B, as follows:

(i) Section 5—Requirements;

(ii) Section 6—Instruments;

(iii) Section 7—Secondary Refrigerant Calorimeter Method;

(iv) Section 8—Secondary Fluid Calorimeter Method;

(v) Section 9—Primary Refrigerant Calorimeter Method; and

(vi) Section 11—Lubrication Circulation Measurements.

(16) ANSI/ASHRAE Standard 41.11–2014, (''ASHRAE 41.11–2014''), *Standard Methods for Power Measurement,* ANSI approved July 3, 2014; IBR approved for appendix F to subpart B.

(17) ANSI/ASHRAE Standard 103–1993, (''ASHRAE 103–1993''), *Methods of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers,* (with Errata of October 24, 1996), except for sections 7.1, 7.2.2.2, 7.2.2.5, 7.2.3.1, 7.8, 8.2.1.3, 8.3.3.1, 8.4.1.1, 8.4.1.1.2, 8.4.1.2, 8.4.2.1.4, 8.4.2.1.6, 8.6.1.1, 8.7.2, 8.8.3, 9.1.2.2.1, 9.1.2.2.2, 9.5.1.1, 9.5.1.2.1, 9.5.1.2.2, 9.5.2.1, 9.7.1, 9.7.4, 9.7.6, 9.10, 11.5.11.1, 11.5.11.2 and appendices B and C, approved October 4, 1993; IBR approved for § 430.23 and appendix N to subpart B.

(18) ANSI/ASHRAE Standard 103–2007 (''ASHRAE 103–2007''), *Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers,* ANSI-approved March 25, 2008; IBR approved for appendix AA to subpart B.

(19) ANSI/ASHRAE Standard 103–2017 (''ASHRAE 103–2017''), *Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers,* ANSI-approved July 3, 2017; IBR approved for § 430.23 and appendices O and EE to subpart B.

(20) ANSI/ASHRAE Standard 116–2010, (''ASHRAE 116–2010''), *Methods of Testing for Rating Seasonal Efficiency of Unitary Air Conditioners and Heat Pumps,* ANSI approved February 24, 2010, Section 7—Methods of Test, Section 7.4—Air Enthalpy Method—Indoor Side (Primary Method), Section 7.4.3—Measurements, Section 7.4.3.4—Temperature, Section 7.4.3.4.5, IBR approved for appendix M to subpart B.

(21) ANSI/ASHRAE Standard 116–2010, (''ASHRAE 116–2010''), *Methods of Testing for Rating Seasonal Efficiency of Unitary Air Conditioners and Heat Pumps,* ANSI approved February 24, 2010; IBR approved for appendices M1 and M2 to subpart B.

(22) ANSI/ASHRAE Standard 118.2–2022 (''ASHRAE 118.2–2022''), *Method of Testing for Rating Residential Water Heaters and Residential-Duty Commercial Water Heaters,* ANSI-approved March 1, 2022; IBR approved for appendix E to subpart B.

(23) ANSI/ASHRAE Standard 146–2011 (''ASHRAE 146''), *Method of Testing and Rating Pool Heaters,* ASHRAE approved February 2, 2011; IBR approved for appendix P to subpart B.

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■ 8. Amend § 430.23 by revising paragraph (m) to read as follows:

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

* * * * *

(m) *Central air conditioners and heat pumps.* See the note at the beginning of appendices M1 and M2 to this subpart to determine the appropriate test method. Determine all values discussed in this section using a single appendix.

(1) Determine cooling capacity from the steady-state wet-coil test (A or A_{full} Test), as per instructions in section 2 of appendix M1 or M2 to this subpart, and rounded off to the nearest:

(i) To the nearest 50 Btu/h if cooling capacity is less than 20,000 Btu/h;

(ii) To the nearest 100 Btu/h if cooling capacity is greater than or equal to 20,000 Btu/h but less than 38,000 Btu/h; and

(iii) To the nearest 250 Btu/h if cooling capacity is greater than or equal to 38,000 Btu/h and less than 65,000 Btu/h.

(2) Determine seasonal energy efficiency ratio 2 (SEER2) as described in sections 2 and 4 of appendix M1 to this subpart or seasonal cooling and off-mode rating efficiency (SCORE) as described in sections 2 and 3 of appendix M2 to this subpart, and round off to the nearest 0.025 Btu/W-h.

(3) Determine energy efficiency ratio 2 (EER2) as described in section 2 of appendix M1 or M2 to this subpart, and round off to the nearest 0.025 Btu/W-h. EER2 is the efficiency from the A or A_{full} test, whichever applies.

(4) Determine heating seasonal performance factor 2 (HSPF2) as

described in sections 2 and 4 of appendix M1 to this subpart or seasonal heating and off-mode rating efficiency (SHORE) as described in sections 2 and 3 of appendix M2 to this subpart, and round off to the nearest 0.025 Btu/W-h.

(5) Determine average off mode power consumption as described in section 3 of appendix M1 to this subpart, and round off to the nearest 0.5 W. Average off mode power consumption is not required when testing in accordance with appendix M2 to this subpart.

(6) Determine all other measures of energy efficiency or consumption or other useful measures of performance using appendix M1 or M2 of this subpart.

* * * * *

■ 9. Appendix M1 to subpart B of part 430 is revised to read as follows:

Appendix M1 to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Central Air Conditioners and Heat Pumps

Note: Prior to [*Date 180 days after publication of the final rule in the* **Federal Register**], representations with respect to the energy use or efficiency of central air conditioners and heat pumps, including compliance certifications, must be based on testing conducted in accordance with:

(a) Appendix M1 to this subpart, in the 10 CFR parts 200 through 499 edition revised as of January 1, 2023; or

(b) This appendix.

Beginning [*Date 180 days after publication of the final rule in the* **Federal Register**], and prior to the compliance date of amended standards for central air conditioners and heat pumps based on Seasonal Cooling and Off-mode Rating Efficiency (SCORE) and Seasonal Heating and Off-mode Rating Efficiency (SHORE), representations with respect to energy use or efficiency of central air conditioners and heat pumps, including compliance certifications, must be based on testing conducted in accordance with this appendix.

Beginning on the compliance date of amended standards for central air conditioners and heat pumps based on SCORE and SHORE, representations with respect to energy use or efficiency of central air conditioners and heat pumps, including compliance certifications, must be based on testing conducted in accordance with appendix M2 to this subpart.

Manufacturers may also certify compliance with any amended energy conservation standards for central air conditioners and heat pumps based on SCORE or SHORE prior to the applicable compliance date for those standards, and those compliance certifications must be based on testing in accordance with appendix M2 to this subpart.

1. Incorporation by Reference

In § 430.3, DOE incorporated by reference the entire standard for AHRI 210/240–202X, ANSI/ASHRAE 16–2016, ANSI/ASHRAE 37–2009 and ANSI/ASHRAE 116–2010. However, certain enumerated provisions of AHRI 210/240–202X, ANSI/ASHRAE 16–2016, ANSI/ASHRAE 37–2009 and ANSI/ASHRAE 116–2010, as set forth in sections 1.1 through 1.4 of this appendix, are inapplicable. To the extent there is a conflict between the terms or provisions of a referenced industry standard and the CFR, the CFR provisions control.

1.1 AHRI 210/240–202X

(a) Section 1 Purpose is inapplicable,

(b) Section 2 Scope is inapplicable,

(c) The following subsections of Section 3 Definitions are inapplicable: 3.2.15 (Double-duct system), 3.2.19 (Gross capacity), 3.2.47 (Oil Recovery Mode), 3.2.52 (Published Rating), 3.2.64 (Standard Filter), 3.2.79 (Unitary Air-conditioner), 3.2.80 (Unitary Heat Pump),

(d) Section 4 Classifications is inapplicable,

(e) The following subsections of Section 6 Rating Requirements are inapplicable: 6.1.8, 6.2, 6.3, 6.4 and 6.5,

(f) Section 7 Minimum Data Requirements for Published Ratings is inapplicable,

(g) Section 8 Operating Requirements is inapplicable,

(h) Section 9 Marking and Nameplate Data is inapplicable,

(i) Section 10 Conformance Conditions is inapplicable,

(j) Appendix A References—Normative is inapplicable,

(k) Appendix B References—Informative is inapplicable,

(l) Appendix C Secondary Capacity Check Requirements—Normative is inapplicable,

(m) Appendix F Unit Configurations for Standard Efficiency Determination—Normative is inapplicable,

(n) Appendix H Verification Testing—Normative is inapplicable,

(o) Appendix I Controls Verification Procedure—Normative is inapplicable, and

(p) Appendix J Determination of Cut in and Cut out temperatures—Normative is inapplicable,

1.2 ANSI/ASHRAE 37–2009

(a) Section 1—Purpose is inapplicable,

(b) Section 2—Scope is inapplicable, and

(c) Section 4—Classification is inapplicable.

1.3 ANSI/ASHRAE 16–2016

(a) Section 1—Purpose is inapplicable,

(b) Section 2—Scope is inapplicable, and

(c) Section 4—Classification is inapplicable.

1.4 ANSI/ASHRAE 116–2010

(a) Section 1—Purpose is inapplicable,

(b) Section 2—Scope is inapplicable,

(c) Section 4—Classification is inapplicable,

(d) Section 7—Methods of Test is inapplicable,

(e) References is inapplicable,

(f) Appendix A—Example Bin Calculations is inapplicable, and

(g) Appendix B—Bibliography is inapplicable.

2. General

Determine the cooling capacity, heating capacity, and applicable energy efficiency metrics (SEER2, HSPF2, and EER2) in accordance with the specified sections of AHRI 210/240–202X and the applicable provisions of ANSI/ASHRAE 16–2016, ANSI/ASHRAE 37–2009, and ANSI/ASHRAE 116–2010. The A_{Full} (cooling mode) and $H_{1, Full}$ or $H_{1, Nom}$ (heating mode, if applicable) shall have a secondary capacity check completed. For all other tests in each mode, it is permissible to not use a secondary capacity check.

Sections 3, 4, and 5 of this appendix provide additional instructions for testing. In cases where there is a conflict, the language of this appendix takes highest precedence, followed, in order, by: AHRI 210/240–202X, ANSI/ASHRAE 37–2009, ANSI/ASHRAE 16–2016 and ANSI/ASHRAE 116–2010. Any subsequent amendment to a referenced document by the standard-setting organization will not affect the test procedure in this appendix, unless and until the test procedure is amended by DOE. Material is incorporated as it exists on the date of the approval, and a notice of any change in the incorporation will be published in the **Federal Register**.

3. Off-Mode Power

Determine off-mode power, $P_{W, OFF}$, in accordance with section 11.3 and appendix G of AHRI 210/240–202X.

4. Outdoor Units With No Match (OUWNM)

4.1 Definition

An Outdoor Unit that is not distributed in commerce with any indoor units, that meets any of the following criteria:

(a) Is designed for use with a refrigerant that makes the unit banned for installation when paired with an Indoor Unit as a system, according to EPA regulations in 40 CFR chapter I, subchapter C,

(b) Is designed for use with a refrigerant that has a 95 °F midpoint saturation absolute pressure that is ±18 percent of the 95 °F saturation absolute pressure for R–22, or

(c) Is shipped without a specified refrigerant from the point of manufacture or is shipped such that more than two pounds of refrigerant are required to meet the charge per section 5.1.8 of AHRI 210/240–202X. This shall not apply if either:

(1) The factory charge is equal to or greater than 70% of the outdoor unit internal volume times the liquid density of refrigerant at 95 °F, or

(2) An A2L refrigerant is approved for use and listed in the certification report.

4.2 Testing

An OUWNM shall be tested with an indoor coil having nominal tube diameter of 0.375 in and an NGIFS of 1.0 or less (as determined in section 5.1.6.3 of AHRI 210/240–202X).

5. Test Conditions

5.1 Test Conditions for Certifying Compliance With Standards

The following conditions specified in AHRI 210/240–202X apply when testing to certify to the SEER2 and HSPF2 energy conservation standards in § 430.32(c).

For cooling mode, use the rating conditions specified in table 8 of AHRI 210/240–202X and the fractional cooling bin hours in table 15 of AHRI 210/240–202X to determine SEER2, and EER2 for models subject to regional standards in terms of EER2.

For heat pump heating mode, use the rating conditions specified in table 8 of AHRI 210/240–202X and the fractional heating bin hours specified for Region IV in table 16 of AHRI 210/240–202X to determine the heating efficiency metric, HSPF2.

5.2 Optional Representations

Representations of EER2 made using the rating conditions specified in Table 8 of AHRI 210/240–202X are optional for models not subject to regional standards in terms of EER2. Representations of HSPF2 made using the rating conditions specified in table 8 of AHRI 210/240–202X and the fractional heating hours specified for Regions other than Region IV in Table 14 AHRI 210/240–202X are optional. Representations of COP_{peak} made using appendix K are optional.

■ 10. Appendix M2 to subpart B of part 430 is added to read as follows:

Appendix M2 to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Central Air Conditioners and Heat Pumps

Note: Prior to [*Date 180 days after publication of the final rule in the* ***Federal Register***], representations with respect to the energy use or efficiency of central air conditioners and heat pumps, including compliance certifications, must be based on testing conducted in accordance with:

(a) Appendix M1 to this subpart, in the 10 CFR parts 200 through 499 edition revised as of January 1, 2023; or

(b) Appendix M1 to this subpart.

Beginning [*Date 180 days after publication of the final rule in the* ***Federal Register***], and prior to the compliance date of amended standards for central air conditioners and heat pumps based on Seasonal Cooling and Off-mode Rating Efficiency (SCORE) and Seasonal Heating and Off-mode Rating Efficiency (SHORE), representations with respect to energy use or efficiency of central air conditioners and heat pumps, including compliance certifications, must be based on testing conducted in accordance with appendix M1 to this subpart.

Beginning on the compliance date of amended standards for central air conditioners and heat pumps based on SCORE and SHORE, representations with respect to energy use or efficiency of central air conditioners and heat pumps, including compliance certifications, must be based on testing conducted in accordance with this appendix.

Manufacturers may also certify compliance with any amended energy conservation standards for central air conditioners and heat pumps based on SCORE or SHORE prior to the applicable compliance date for those standards, and those compliance certifications must be based on testing in accordance with this appendix.

1. Incorporation by Reference

In § 430.3, DOE incorporated by reference the entire standard for AHRI 1600–202X, ANSI/ASHRAE 16–2016, ANSI/ASHRAE 37–2009, and ANSI/ASHRAE 116–2010. However, certain enumerated provisions of AHRI 1600–202X, ANSI/ASHRAE 16–2016, ANSI/ASHRAE 37–2009, and ANSI/ASHRAE 116–2010, as set forth in sections 1.1 through 1.4 of this appendix, are inapplicable. To the extent there is a conflict between the terms or provisions of a referenced industry standard and the CFR, the CFR provisions control.

1.1. AHRI 1600–202X

(a) Section 1 Purpose is inapplicable,

(b) Section 2 Scope is inapplicable,

(c) The following subsections of Section 3 Definitions are inapplicable: 3.1.15 (Double-duct system), 3.1.19 (Gross capacity), 3.1.47 (Oil Recovery Mode), 3.1.52 (Published Rating), 3.1.65 (Standard Filter), 3.1.80 (Unitary Air-conditioner), 3.1.81 (Unitary Heat Pump),

(d) Section 4 Classifications is inapplicable,

(e) The following subsections of Section 6 Rating Requirements are inapplicable: 6.1.8, 6.2, 6.3, 6.4 and 6.5

(f) Section 7 Minimum Data Requirements for Published Ratings is inapplicable,

(g) Section 8 Operating Requirements is inapplicable,

(h) Section 9 Marking and Nameplate Data is inapplicable,

(i) Section 10 Conformance Conditions is inapplicable,

(j) Appendix A References—Normative is inapplicable,

(k) Appendix B References—Informative is inapplicable,

(l) Appendix C Secondary Capacity Check Requirements—Normative is inapplicable,

(m) Appendix F Unit Configurations for Standard Efficiency Determination—Normative is inapplicable,

(n) Appendix H Verification Testing—Normative is inapplicable,

(o) Appendix I Controls Verification Procedure—Normative is inapplicable,

(p) Appendix J Determination of Cut in and Cut out temperatures—Normative is inapplicable, and

(q) Appendix M Outdoor Temperature Bin Hours—Informative is inapplicable.

1.2. ANSI/ASHRAE 37–2009

(a) Section 1—Purpose is inapplicable,

(b) Section 2—Scope is inapplicable, and

(c) Section 4—Classification is inapplicable.

1.3. ANSI/ASHRAE 16–2016

(a) Section 1—Purpose is inapplicable,

(b) Section 2—Scope is inapplicable, and

(c) Section 4—Classification is inapplicable.

1.4. 1.4. ANSI/ASHRAE 116–2010

(a) Section 1—Purpose is inapplicable,

(b) Section 2—Scope is inapplicable,

(c) Section 4—Classification is inapplicable,

(d) Section 7—Methods of Test is inapplicable,

(e) References is inapplicable,

(f) Appendix A—Example Bin Calculations is inapplicable, and

(g) Appendix B—Bibliography is inapplicable.

2. General

Determine the applicable energy efficiency metrics (SCORE, SHORE, and EER2) in accordance with the specified sections of AHRI 1600–202X and the applicable provisions of ANSI/ASHRAE 16–2016, ANSI/ASHRAE 37–2009, and ANSI/ASHRAE 116–2010. The A_{Full} (cooling mode) and $H_{1,\ Full}$ or $H_{1,\ Nom}$ (heating mode, if applicable) shall have a secondary capacity check completed. For all other tests in each mode, it is permissible to not use a secondary capacity check. Sections 3 and 4 of this appendix provide additional instructions for testing. In cases where there is a conflict, the language of this appendix takes highest precedence, followed, in order, by: AHRI 1600–202X, ANSI/ASHRAE 37–2009, ANSI/ASHRAE 16–2016, and ANSI/ASHRAE 116–2010. Any subsequent amendment to a referenced document by the standard-setting organization will not affect the test procedure in this appendix, unless and until the test procedure is amended by DOE. Material is incorporated as it exists on the date of the approval, and a notice of any change in the incorporation will be published in the **Federal Register**.

3. Outdoor Units With No Match (OUWNM)

3.1 Definition

An Outdoor Unit that is not distributed in commerce with any indoor units, that meets any of the following criteria:

(a) Is designed for use with a refrigerant that makes the unit banned for installation when paired with an Indoor Unit as a system, according to EPA regulations in 40 CFR chapter I, subchapter C,

(b) Is designed for use with a refrigerant that has a 95 °F midpoint saturation absolute pressure that is ±18 percent of the 95 °F saturation absolute pressure for R–22, or

(c) Is shipped without a specified refrigerant from the point of manufacture or is shipped such that more than two pounds of refrigerant are required to meet the charge per section 5.1.8 of AHRI 1600–202X. This shall not apply if either:

(1) The factory charge is equal to or greater than 70% of the outdoor unit internal volume times the liquid density of refrigerant at 95 °F or,

(2) An A2L refrigerant is approved for use and listed in the certification report.

3.2 Testing

An OUWNM shall be tested with an indoor coil having nominal tube diameter of 0.375 in and an NGIFS of 1.0 or less (as determined in section 5.1.6.3 of AHRI 1600–202X).

4. Test Conditions

4.1 Test Conditions for Certifying Compliance With Standards

The following conditions specified in AHRI 1600–202X apply when testing to certify to the SCORE and SHORE energy conservation standards, in § 431.97.

For cooling mode, use the rating conditions specified in table 8 of AHRI 1600–202X and the 'U.S. National Average' cooling conditioning hours and shoulder season hours in Table 15 of AHRI 1600–202X, to determine SCORE, and EER2 for models subject to regional standards in terms of EER2.

For heat pump heating mode, use the rating conditions specified in Table 8 of AHRI 1600–202X and the 'U.S. National Average' heating conditioning hours and shoulder season hours specified in Table 18 of AHRI 1600–202X to determine the heating efficiency metric, SHORE.

4.2 Optional Representations

Representations of EER2 made using the rating conditions specified in Table 8 of AHRI 1600–202X are optional for models not subject to regional standards in terms of EER2. Representations of SHORE made using the rating conditions specified in Table 8 of AHRI 1600–202X and the 'Cold Climate Average' heating conditioning hours and shoulder season hours in Table 18 of AHRI 1600–202X are optional. Representations of COP_{peak} made using appendix K are optional.

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