DEPARTMENT OF ENERGY

10 CFR Parts 429 and 431

[EERE–2021–BT–TP–0021]

RIN 1904–AF17

Energy Conservation Program: Test Procedure for Fans and Blowers

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

ACTION: Notice of proposed rulemaking, request for comment, and announcement of public meeting.

SUMMARY: The U.S. Department of Energy (''DOE'') proposes to establish a test procedure for fans and blowers, including air-circulating fans, and to adopt through reference the relevant industry test standards as the DOE test procedure for measuring the fan electrical input power (''FEP'') and for determining the fan energy index (''FEI''). DOE also proposes to establish supporting definitions, requirements for alternative energy use determination methods, and sampling requirements to determine the represented values of FEP and FEI. DOE is seeking comment from interested parties on the proposal.

DATES: DOE will accept comments, data, and information regarding this proposal no later than September 23, 2022. See section V, ''Public Participation,'' for details.

DOE will hold a webinar on Tuesday, August 2, 2022, from 1:00 p.m. to 4:00 p.m. See section V, ''Public Participation,'' for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

ADDRESSES: Interested persons are encouraged to submit comments using the Federal eRulemaking Portal at *www.regulations.gov,* under docket number EERE–2021–BT–TP–0021. Follow the instructions for submitting comments. Alternatively, interested persons may submit comments, identified by docket number EERE–2021–BT–TP–0021, by any of the following methods:

(1) *Email: FansBlowers2021TP0021@ee.doe.gov.* Include the docket number EERE–2021–BT–TP–0021 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 *www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/65.* 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. Jeremy Dommu, 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) 586–9879 Email: *ApplianceStandardsQuestions@ee.doe.gov.*

Ms. Amelia Whiting, U.S. Department of Energy, Office of the General Counsel, GC–33, 1000 Independence Avenue SW, Washington, DC 20585–0121. Telephone: (202) 586–2588. Email: *amelia.whiting@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 incorporate by reference the following industry standard into 10 CFR parts 429 and 431:

ANSI/AMCA Standard 214–21, ''Test Procedure for Calculating Fan Energy Index for Commercial and Industrial Fans and Blowers.''

Copies of AMCA 214–21 can be obtained from AMCA International at 30 West University Drive, Arlington Heights, IL 60004–1893, (847) 394–0150, or by going to *www.amca.org.*

DOE proposes to incorporate by reference the following industry standards into 10 CFR part 431:

American National Standard Institute (ANSI)/Air Movement and Control Association (AMCA) Standard 99–16 ''Standards Handbook.''

ANSI/AMCA Standard 210/American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 51–16, ''Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.''

ANSI/AMCA 230–15 with errata, ''Laboratory Methods of Testing Air Circulating Fans for Rating and Certification'', with technical errata sheet for ANSI/AMCA standard 230–15 density corrections.

ANSI/AMCA Standard 240–15 ''Laboratory Methods of Testing Positive Pressure Ventilators for Aerodynamic Performance Rating.''

Copies of AMCA 99–16, AMCA 210–16, AMCA 214–21, AMCA 230–15, with errata and AMCA 240–15, can be obtained from AMCA International at 30 West University Drive, Arlington Heights, IL 60004–1893, or by going to *www.amca.org.*

International Organization for Standardization (ISO) 5801:2017, ''Fans—Performance testing using standardized airways,'' approved 2017. ISO 80079–36:2016, ''Explosive atmospheres—Part 36: Non-electrical equipment for explosive atmospheres—Basic method and requirements,'' approved 2016.

Copies of ISO 5801:2017–2017 and ISO 80079–36:2016 can be obtained from the International Organization for Standardization, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, or by going to *www.iso.org.*

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

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I. Authority and Background

On August 19, 2021, DOE published a coverage determination classifying fans and blowers as a covered equipment under 42 U.S.C. 6311(2)(A) and 42 U.S.C. 6312(b). 86 FR 46579 (''August 2021 Final Coverage Determination''). DOE does not currently have a test procedure or energy conservation standards for fans and blowers. The following sections discuss DOE's authority to establish a test procedure for fans and blowers and relevant background information regarding DOE's consideration of test procedures for this equipment.

A. Authority

The Energy Policy and Conservation Act, as amended (''EPCA''),[1] authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. (42 U.S.C. 6291–6317) Title III, Part C[2] of EPCA, added by Public Law 95–619, Title IV, section 441(a), established the Energy Conservation Program for Certain Industrial Equipment, which sets forth a variety of provisions designed to improve energy efficiency. EPCA provides that DOE may include a type of industrial equipment, including fans and blowers, as covered equipment if it determines that to do so is necessary to carry out the purposes of Part A–1. (42 U.S.C. 6311(2)(B)(ii) and (iii); 42 U.S.C. 6312(b)). EPCA specifies the types of equipment that can be classified as industrial equipment. (42 U.S.C. 6311(2)(B)) The purpose of Part A–1 is to improve the efficiency of electric motors and pumps and certain other industrial equipment in order to conserve the energy resources of the Nation. (42 U.S.C. 6312(a)) As stated, on August 19, 2021, DOE published a final determination determining that fans and blowers meet the three statutory criteria for classifying industrial equipment as covered (42 U.S.C. 6311(2)(A)), because fans and blowers are a type of industrial equipment (1) which in operation consume, or are designed to consume, energy; (2) are to a significant extent distributed in commerce for industrial or commercial use; and (3) are not covered under 42 U.S.C. 6291(a)(2). 86 FR 46579, 46586. DOE also determined that coverage of fans and blowers is necessary to carry out the purposes of Part A–1. 86 FR 46579, 46588.

The energy conservation program under EPCA consists essentially of four parts: (1) testing, (2) labeling, (3) Federal energy conservation standards, and (4) certification and enforcement procedures. Relevant provisions of EPCA include definitions (42 U.S.C. 6311), test procedures (42 U.S.C. 6314), labeling provisions (42 U.S.C. 6315), energy conservation standards (42 U.S.C. 6313), and the authority to require information and reports from manufacturers. (42 U.S.C. 6316; 42 U.S.C. 6296)

The Federal testing requirements consist of test procedures that manufacturers of covered equipment must use as the basis for: (1) certifying to DOE that their equipment complies with the applicable energy conservation standards adopted pursuant to EPCA (42 U.S.C. 6316(a); 42 U.S.C. 6295(s)), and (2) making other representations about the efficiency of that equipment. (42 U.S.C. 6314(d)) Similarly, DOE must use these test procedures to determine whether the equipment complies with relevant standards promulgated under EPCA.[3] (42 U.S.C. 6316(a); 42 U.S.C. 6295(s))

Federal energy efficiency requirements for covered equipment established under EPCA supersede State laws and regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6316(a); 42 U.S.C. 6316(b); 42 U.S.C. 6297) With respect to industrial equipment for which coverage is established under 42 U.S.C. 6312(b), *e.g.,* fans and blowers, the preemption provisions in EPCA apply beginning on the date on which a final rule establishing an energy conservation standard is issued by the Secretary,

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

[2] For editorial reasons, upon codification in the U.S. Code, Part C was redesignated Part A–1 and hereafter referred to as ''Part A–1''.

[3] There are currently no energy conservation standards for fans and blowers.

except that any State or local standard prescribed or enacted or the equipment before the date on which the final rule is issued shall not be preempted until the energy conservation standard established by the Secretary for the equipment takes effect. (42 U.S.C. 6316(a)(10)) DOE may, however, grant waivers of Federal preemption for particular State laws or regulations, in accordance with the procedures and other provisions of EPCA. (42 U.S.C. 6316(b)(2)(D))

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

If the Secretary determines that a test procedure amendment is warranted, the Secretary must publish proposed test procedures in the **Federal Register** and afford interested persons an opportunity (of not less than 45 days' duration) to present oral and written data, views, and arguments on the proposed test procedures. (42 U.S.C. 6314(b))

B. Background

As discussed, on August 19, 2021, DOE published in the **Federal Register** a final coverage determination classifying fans and blowers as covered equipment. 86 FR 46579. DOE determined that the term ''blower'' is interchangeable with the term ''fan''. 86 FR 46579, 46583. DOE defines a fan (or blower) as a rotary bladed machine used to convert electrical or mechanical power to air power, with an energy output limited to 25 kilojoule (''kJ'') per kilogram (''kg'') of air. A fan (or blower) consists of an impeller, a shaft and bearings and/or driver to support the impeller, as well as a structure or housing. A fan (or blower) may include a transmission, driver, and/or motor controller. 10 CFR 431.172.

Prior to the August 2021 Final Coverage Determination, DOE published a notice of intent to establish an Appliance Standards and Rulemaking Federal Advisory Committee (''ASRAC'') Working Group (''Working Group'') for fans and blowers. 80 FR 17359 (April 1, 2015). The Working Group [4] commenced negotiations at an open meeting on May 18, 2015 and held 16 meetings and three webinars to discuss scope, metrics, test procedures, and standard levels for fans.[5] The Working Group concluded its negotiations on September 3, 2015, and, by consensus vote,[6] approved a term sheet containing recommendations for DOE on the scope of a test procedure, and energy conservation standards for fans. The term sheet containing the Working Group recommendations (''term sheet'') is available in the fans energy conservation standard rulemaking docket. (Docket No. EERE–2013–BT–STD–0006, No. 179) [7] ASRAC approved the term sheet on September 24, 2015. (Docket No. EERE–2013–BT–NOC–0005; Public Meeting Transcript, No. 58, at p. 29) Comments received on issues related to the test procedure during the Working Group negotiations and not resolved in the term sheet are discussed in this proposed rulemaking. Discussion of these comments will include a reference to Docket No. EERE–2013–BT–NOC–0005.

On January 10, 2020, DOE received a notice of petition received from the Air Movement and Control Association (''AMCA''), Air Conditioning Contractors of America, and Sheet Metal & Air Conditioning Contractors of America (''the Petitioners'') requesting that DOE establish test procedures for certain categories of commercial and industrial fans based on an industry test method in development, AMCA 214, which was published with a request for public comment on April 23, 2020; [8] 85 FR 22677 (''April 2020 Notice of Petition''). As part of the April 2020 Notice of Petition, DOE sought data and information pertinent to whether an amended test procedures would (1) accurately measure energy efficiency, energy use, or estimated annual operating cost of fans during a representative average use cycle; and (2) not be unduly burdensome to conduct. 85 FR 22677, 22679.

On October 1, 2021, DOE published a request for information (''RFI'') pertaining to potential test procedures for fans and blowers. 86 FR 54412 (''October 2021 RFI''). In the October 2021 RFI, DOE identified a variety of issues on which it sought input to determine whether, and if so how, potential test procedures for fans and blowers, including air circulating fans, would (1) comply with the requirements in EPCA that test procedures be reasonably designed to produce test results which reflect energy use during a representative average use cycle, and (2) not be unduly burdensome to conduct. *Id.* In response to requests from stakeholders,[9] DOE extended the comment period 14 days to November 15, 2021. 86 FR 59308 (Oct. 27, 2021).

DOE also received comments related to the test procedure from its February 8, 2022, Energy Conservation Standards for Fans and Blower RFI (''February 2022 ECS RFI''). 87 FR 7048. Discussion of these comments will include a

[4] The Working Group was comprised of representatives from AAON, Inc.; AcoustiFLO LLC; AGS Consulting LLC; AMCA; AHRI, Appliance Standards Awareness Project; Berner International Corp; Buffalo Air Handling Company; Carnes Company; Daikin/Goodman; ebm-papst; Greenheck; Morrison Products; Natural Resources Defense Council; Newcomb & Boyd; Northwest Energy Efficiency Alliance; CA IOUs; Regal Beloit Corporation; Rheem Manufacturing Company; Smiley Engineering LLC representing Ingersoll Rand/Trane; SPX Cooling Technologies/CTI; The New York Blower Company; Twin City Companies, Ltd; U.S. Department of Energy; and United Technologies/Carrier.

[5] Details of the negotiation sessions can be found in the public meeting transcripts that are posted to the docket for the energy conservation standard rulemaking at: *www.regulations.gov/docket?D=EERE-2013-BT-STD-0006.*

[6] At the beginning of the negotiated rulemaking process, the Working Group defined that before any vote could occur, the Working Group must establish a quorum of at least 20 of the 25 members and defined consensus as an agreement with less than 4 negative votes. Twenty voting members of the Working Group were present for this vote. Two members (Air-Conditioning, Heating, and Refrigeration Institute and Ingersoll Rand/Trane) voted no on the term sheet.

[7] The references are arranged as follows: (commenter name, comment docket ID number, page of that document). If one comment was submitted with multiple attachments, the references are arranged as follows: (commenter name, comment docket ID number. Attachment number, page of that document). The attachment number corresponds to the order in which the attachment appears in the docket. The parenthetical reference provides a reference for information located in DOE Docket No. EERE–2021–BT–TP–0021. If the information was submitted to a different DOE docket, the DOE Docket number is additionally specified in the reference.

[8] At the time of the petition, AMCA 214–21 was available as a draft version (AMCA 214).

[9] AMCA requested at 21-day extension (AMCA, No. 2 at p. 1).

reference to the docket (EERE–2022–BT–STD–0002).

Stakeholders that submitted written comment in response to the April 2020 Notice of Petition, the October 2021 RFI, and the February 2022 ECS RFI are listed in Table I–1 of this document.

TABLE I–1—LIST OF COMMENTERS WITH WRITTEN SUBMISSIONS IN RESPONSE TO THE APRIL 2020 NOTICE OF PETITION AND OCTOBER 2021 RFI

Organization(s)	Reference in this NOPR	Organization type	April 2020 notice of petition [10]	October 2021 TP RFI [11]	February 2022 ECS RFI [12]
Air-Conditioning, Heating, and Refrigeration Institute.	AHRI	Trade Association	X	X	
Air Movement and Control Association International.	AMCA	Trade Association	X	X	
Appliance Standards Awareness Project, American Council for an Energy-Efficient Economy, Natural Resources Defense Council.	ASAP, ACEEE, NRDC.	Efficiency Organizations.	X	X	
Appliance Standards Awareness Project, American Council for an Energy-Efficient Economy, Natural Resources Defense Council, Northwest Energy Efficiency Alliance.	ASAP, ACEEE, NRDC, NEEA.	Efficiency Organizations.			X
China World Trade Organization/Technical Barriers to Trade.	China WTO/TBT	Government Agency	X		
Cooling Technology Institute	CTI	Trade Association	X		
N/A	Corvino	Individual		X	
Daikin Applied	Daikin	Manufacturer	X		
ebm-papst Inc	ebm-papst	Manufacturer	X		X
Greenheck Group	Greenheck	Manufacturer	X		
Harry Graves	Graves	Individual	X		
Johnson Controls	Johnson Controls	Manufacturer	X		
Lennox International Inc	Lennox	Manufacturer	X		
Marley Engineering Products LLC	MEP	Manufacturer		X	
Morrison Products Inc	Morrison	Manufacturer		X	
Northwest Energy Efficiency Alliance	NEEA	Efficiency Organization.		X	
Northwest Energy Efficiency Alliance and Northwest Power and Conservation Council.	NEEA and NWPCC	Efficiency Organizations.	X		
Pacific Gas and Electric Company, San Diego Gas and Electric, and Southern California Edison; collectively, the California Investor-Owned Utilities.	CA IOUs	Utilities		X	X

Note: "X" indicates the notice(s) that each stakeholder commented on.

In response to the April 2020 Notice of Petition, Lennox commented that DOE should reject the fan test procedure petition because no coverage determination had been finalized. (Docket No. EERE–2020–BT–PET–0003, Lennox, No. 5 at p. 1) AHRI and Johnson Controls commented that DOE would first need to establish fans as covered equipment before initiating a test procedure rulemaking. (Docket No. EERE–2020–BT–PET–0003, AHRI, No. 14 at p. 3; Johnson Controls, No. 10 at p. 1) In response to the October 2021 TP RFI, AHRI and Morrison commented that they appreciate DOE's efforts to define fans and blowers and commented that DOE should finalize the coverage determination process to determine if a stand-alone commercial and industrial fans regulation is "necessary or appropriate" to the achievement of EPCA's purposes. (AHRI, No. 10 at p. 3; Morrison, No. 8 at p. 2)

DOE is publishing this NOPR following the publication of the August 2021 Final Coverage Determination.

Corvino commented that there is a need for fan test procedures and suggested that DOE investigate costs related to testing. (Corvino, No. 3 at p. 1) MEP commented generally that the steps required to create new regulations place a tremendous burden upon the industry, especially for newly covered products. MEP asserted that the first efficiency rulemaking places a burden on the industry in preparation for the rulemaking that is larger than the average burden attributed to subsequent rulemakings during the life cycle cost analysis used in determining the minimum allowable efficiencies. (MEP, No. 5 at p. 2)

DOE analyzes the costs of any potential test procedure, as discussed in section III.M. DOE is proposing test procedures for fans and blowers. DOE is not proposing to establish energy conservation standards for such covered equipment in this proposed rule. To the extent that DOE were to propose energy conservation standards for fans and blowers, DOE would conduct a manufacturer impact analysis in that rulemaking.

[10] *See* Docket No. EERE–2020–BT–PET–0003.

[11] The parenthetical reference provides a reference for information located in the docket of DOE's rulemaking to develop test procedures for fans and blowers. Unless otherwise noted, all comments referenced in this notice are available in DOE's docket for this test procedure rulemaking. (Docket No., EERE–2021–BT–TP–0021 which is maintained at *www.regulations.gov/docket EERE-2021-BT-TP-0021/*). The references are arranged as follows: (commenter name, comment docket ID number, page of that document).

[12] *See* Docket No. EERE–2022–BT–STD–0002.

II. Synopsis of the Notice of Proposed Rulemaking

In this NOPR, DOE proposes to establish a test procedure for fans and blowers in subpart J of part 431 and to modify part 429, as follows:

(1) Establish the scope of the test procedure for fans and blowers as to include standalone and embedded fans and blowers (*i.e.,* fans and blowers incorporated into other equipment), with fan shaft input power equal to or greater than 1 horsepower and fan airpower equal to or less than 150 horsepower that are either: (1) axial inline fans; (2) axial panel fans; (3) centrifugal housed fans; (4) centrifugal unhoused fans; (5) centrifugal inline fans; (6) radial-housed fans; or (7) power roof/wall ventilators (''PRVs''); air-circulating fans; and excluding some fans that are exclusively embedded in other products of equipment; and excluding radial housed unshrouded fans with diameter less than 30 inches or a blade width of less than 3 inches, safety fans, induced flow fans, jet fans, and cross-flow fans.

(2) Define ''axial inline fan'', ''axial panel fan'', ''centrifugal housed fan'', ''centrifugal unhoused fan'', ''centrifugal inline fan'', ''radial-housed fan'', ''power roof ventilator'', ''cross-flow fan'', ''induced flow fan'', ''jet fan'', ''basic model,'' ''safety fan,'' ''air circulating fan,'' and related terms. Define terms related to heat rejection equipment;

(3) Adopt through reference in newly proposed appendix A to subpart J of 10 CFR part 431 (''appendix A'') certain provions of ANSI/AMCA 214–21, ''Test Procedure for Calculating Fan Energy Index for Commercial and Industrial Fans and Blowers'' (''AMCA 214–21''), with modifications, as the test procedure for determining FEP and FEI of fans and blowers other than circulating fans;

(4) Adopt through reference in newly propsoed appendix B to subpart J of 10 CFR part 431 (''appendix B'') certain provisions of AMCA 214–21, with modifications, as the test procedure for determining FEP and FEI of air circulating fans;

(5) Adopt through reference certain provisions of the following industry standards referenced by AMCA 214–21: ANSI/AMCA 210–16, (''AMCA 210–16'') ''Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating''; ANSI/AMCA 230–15, (''AMCA 230–15 with errata'') ''Laboratory Methods of Testing Air Circulating Fans for Rating and Certification'' with errata; and ISO 5801:2017, ''Fans—Performance testing using standardized airways'';

(6) Establish fan and blower sampling requirements and provisions related to determining represented values in 10 CFR 429.64;

(7) Establish an alternative effiency determination method (''AEDM'') for fans and blowers in 10 CFR 429.70; and

(8) Establish enforcements provisions for fan and blower basic models.

The proposal is summarized in Table II.2.

TABLE II.2—SUMMARY OF PROPOSALS IN THIS TP NOPR, THEIR PROPOSED LOCATION WITHIN THE CODE OF FEDERAL REGULATIONS, AND THE APPLICABLE PREAMBLE DISCUSSION

Topic	Location in CFR	Summary of proposals	Applicable preamble discussion
Scope	10 CFR 431.174	Establish the scope of the test procedure for fans and blowers as to include standalone and embedded fans and blowers (*i.e.,* fans and blowers incorporated into other equipment), with fan shaft input power equal to or greater than 1 horsepower and fan airpower equal to or less than 150 horsepower that are either: (1) axial inline fans; (2) axial panel fans; (3) centrifugal housed fans; (4) centrifugal unhoused fans; (5) centrifugal inline fans; (6) radial-housed fans; or (7) power roof/wall ventilators (''PRVs''); air-circulating fans; and excluding some fans that are exclusively embedded in other products of equipment; and excluding radial housed unshrouded fans with diameter less than 30 inches or a blade width of less than 3 inches, safety fans, induced flow fans, jet fans, and cross-flow fans.	Section III.A.
Definitions	10 CFR 431.172	Define ''axial inline fan'', ''axial panel fan'', ''centrifugal housed fan'', ''centrifugal unhoused fan'', ''centrifugal inline fan'', ''radial-housed fan'', ''power roof ventilator'', ''cross-flow fan'', ''induced flow fan'', ''jet fan'', ''basic model,'' ''safety fan,'' ''air circulating fan,'' and related terms. Define terms related to heat rejection equipment;	Section III.B.
Test Procedure	10 CFR 431.174	Establish FEI as the metric for fans and blowers, incorporate by reference AMCA 214–21, AMCA 210–16, AMCA 230–15 (with errata) and provide additional instructions for determining the FEI (and other applicable performance characteristics) for fans and blowers.	Sections III.C, III.D, and III.F.
Sampling Plan	10 CFR 429.66	Specify the minimum number of fans or blowers to be tested to rate a basic model and determine representative values.	Section III.K.
AEDM	10 CFR 429.70	Establish requirements for applying an alternative energy use determination method.	Section III.J.
Enforcement Provisions.	10 CFR 429.110 & 10 CFR 429.134.	Establish a method for determining compliance of fan and blower basic models.	Section III.L.

DOE's proposed test method for fans and blowers includes measurements of pressure, flow rate, and fan shaft or electrical input power, all of which are required to calculate FEP and FEI, as well as other quantities to characterize rated fans and blowers performance (*e.g.,* speed). DOE has tentatively determined that the relevant sections of AMCA 214–21, AMCA 210–16 and AMCA 230–15 with errata, in conjunction with the additional provisions proposed in this test procedure, would produce test results that reflect the energy efficiency and energy use of a fan or blower during a representative average use cycle. (42 U.S.C. 6314(a)(2)) Additionally, DOE has tentatively determined that the proposed test procedure, which is based on the relevant industry testing standard, would not be unduly burdensome to conduct. (42 U.S.C. 6314(a)(2)) DOE's analysis of the burdens associated with the proposed test procedure is presented in section III.M of this document.

III. Discussion

In the following sections, DOE proposes to establish test procedures and related definitions for fans and blowers in subpart J of part 431, to establish sampling plans for this equipment, to establish an alternative energy determination method for this equipment, and to establish enforcement provisions for this equipment. In the following section, DOE provides relevant background information, explains why the proposal merits consideration, discusses relevant public comments, and proposes a potential approach.

A. Scope of Applicability

This rulemaking applies to fans and blowers. A fan or blower is defined as a rotary bladed machine that is used to convert electrical or mechanical power to air power with an energy output limited to 25 kilojoule (''kJ'')/kilogram (''kg'') of air. 10 CFR 431.172. It consists of an impeller, a shaft and bearings and/ or driver to support the impeller, as well as a structure or housing. *Id.* A fan or blower may include a transmission, driver, and/or motor controller. *Id.* As discussed, DOE has classified fans and blowers as covered equipment. 86 FR 46579. ''Covered equipment'' consists of certain industrial equipment, which in turn excludes covered products, other than industrial equipment that is a component of a covered product. (42 U.S.C. 6311(1) and (2)(A)(iii)). DOE explained in the coverage determination that the fans and blowers, the subject to this rulemaking, do not include ceiling fans and furnace fans, as defined at 10 CFR 430.2. *See* 86 FR 46579, 46586.

In the August 2021 Final Coverage Determination, DOE did not establish definitions for specific categories of fans and blowers. DOE stated that it would consider specific categories of fans and blowers and the scope of applicability of test procedures and energy conservation standards in their respective rulemakings. 86 46579, 46585.

This section discusses the fans and blowers that DOE is proposing to include in the scope of applicability of the test procedure as well as proposed exemptions.

1. Proposed Test Procedure Scope

This section discusses fans and blowers, other than air circulating fans, proposed for inclusion in the scope of applicability of the test procedure. Air circulating fans are discussed in section III.A.4 of this document.

The Working Group recommended that the test procedure be applicable to certain classifications of fans and blowers, listed in Table III–1 of this document. (Docket No. EERE–2013–BT–STD–0006, No. 179, Recommendation #1 at p. 1) The Working Group did not provide definitions for the specified classifications of the fans and blowers identified for inclusion in the scope of a test procedure. AMCA 214–21 provides terms and associated definitions for certain classifications of fans and blowers that DOE has tentatively determined correspond to the Working Group recommendation. The Working Group further recommended that the test procedure apply only to fans with a fan shaft power equal to or greater than 1 horsepower (''hp'') and fan air power [13] equal to or less than 150 hp. The Working Group recommended that airpower be calculated using static pressure for unducted fans (''static airpower'') and total pressure for ducted fans (''total airpower'').[14] (Docket No. EERE–2013–BT–STD–0006, No. 179, Recommendation #5, at p. 4)

On February 24, 2022, the California Energy Commission (''CEC'') published a proposed rulemaking for fans and blowers that includes terms and definitions that DOE has tentatively determined correspond to the Working Group recommendations.[15] CEC proposes to cover the following fan categories: axial inline, axial panel, centrifugal housed, centrifugal unhoused, centrifugal inline, radial housed, and power roof/wall ventilators, and to define these terms largely based on the definitions in AMCA 214–21, with revisions to indicate a fan's intended application and if a fan's inlet or outlet can be (optionally, as applicable) ducted. In addition, the CEC proposal considers fans and blowers that have a rated fan shaft power greater than or equal to 1 horsepower, or, for fans without a rated shaft input power, an electrical input power greater than or equal to 1 kW, and a fan output power less than or equal to 150 horsepower.[16]

The classification of fans and blowers recommended by the Working Group for coverage under a test procedure and the corresponding terms and definitions in AMCA 214–21 and the proposed CEC regulations are presented in Table III–1 of this document.

TABLE III–1—SCOPE RECOMMENDED BY THE WORKING GROUP, CORRESPONDING TERMS AND DEFINITIONS

Working group scope recommendations	Corresponding term and definition in AMCA 214–21	Corresponding CEC definitions
Axial cylindrical housed fan.	''Axial inline fan'' means a fan with an axial impeller and a cylindrical housing with or without turning vanes.	''Axial-inline fan'' means a fan with an axial impeller and a cylindrical housing with or without turning vanes. Inlets and outlets can optionally be ducted.
Panel fan	''Axial panel fan'' means an axial fan, without cylindrical housing, that is mounted in a panel, an orifice plate or ring.	''Axial-panel fan'' means a fan with an axial impeller mounted in a short housing, non-cylindrical, that can be a panel, ring, or orifice plate. The housing is typically mounted to a wall separating two spaces, and the fans are used to increase the pressure across this wall. Inlets and outlets are not ducted.

[13] The air power of a fan is the fan's output power. It is proportional to the product of the fan airflow rate and the fan pressure.

[14] The terms ''ducted'' and ''unducted'' refer to the recommended test configuration used when conducting a fan test. Appendix C of the term sheet specifies which fan categories are typically ducted (*i.e.,* tested using a ducted outlet and for which the FEI is calculated on a total pressure basis): axial cylindrical housed, centrifugal housed, excluding inline and radial, inline and mixed flow, radial housed; and which fan types are considered unducted (*i.e.,* tested with a free outlet and for which the FEI is calculated on a static pressure basis): panel, centrifugal unhoused, excluding inline and radial, and power roof ventilators.

[15] All documents related to this rulemaking can be found in the rulemaking Docket 22–AAER–01 accessible at: *www.energy.ca.gov/rules-and-regulations/appliance-efficiency-regulations-title-20/appliance-efficiency-proceedings-11.*

[16] *See* Proposed regulatory language for Commercial and Industrial Fans and Blowers available in the following Docket: 22–AAER–01 at: *efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=22-AAER-01.*

TABLE III–1—SCOPE RECOMMENDED BY THE WORKING GROUP, CORRESPONDING TERMS AND DEFINITIONS—Continued

Working group scope recommendations	Corresponding term and definition in AMCA 214–21	Corresponding CEC definitions
Centrifugal housed fan, excluding inline fan and radial fan.	''Centrifugal housed fan'' means a fan with a centrifugal or mixed flow impeller in which airflow exits into a housing that is generally scroll-shaped to direct the air through a single fan outlet. A centrifugal housed fan does not include a radial impeller *.	''Centrifugal housed fan'' means a fan with a centrifugal or mixed flow impeller in which airflow exits into a housing that is generally scroll-shaped to direct the air through a single fan outlet. Inlets and outlets can optionally be ducted. It does not include a radial impeller.
Centrifugal unhoused fan, excluding radial fan.	''Centrifugal unhoused fan'' means a fan with a centrifugal or mixed flow impeller in which airflow enters through a panel and discharges into free space. Inlets and outlets are not ducted. This fan type also includes fans designed for use in fan arrays that have partition walls separating the fan from other fans in the array **.	''Centrifugal unhoused fan'' means a fan with a centrifugal or mix-flow impeller in which airflow enters through a panel and discharges into free space. Inlets and outlets are not ducted. This fan type also includes fans designed for use in fan arrays that have partition walls separating the fan from other fans in the array.
Inline and mixed-flow fan.	''Centrifugal inline fan'' means a fan with a centrifugal or mixed flow impeller in which airflow enters axially at the fan inlet and the housing redirects radial airflow from the impeller to exit the fan in an axial direction.	''Centrifugal inline fan'' means a fan with a centrifugal or mixed-flow impeller in which airflow enters axially at the fan inlet and the housing redirects radial airflow from the impeller to exit the fan in an axial direction. Inlets and outlets can optionally be ducted.
Radial housed fan	''Radial-housed fan'' means a fan with a radial impeller in which airflow exits into a housing that is generally scroll-shaped to direct the air through a single fan outlet. Inlets and outlets can optionally be ducted.	''Radial-housed fan'' means a fan with a radial impeller in which airflow exits into a housing that is generally scroll-shaped to direct the air through a single fan outlet. Inlets and outlets can optionally be ducted.
Power roof ventilator	''Power roof/wall ventilator (PRV)'' means a fan with an internal driver and a housing to prevent precipitation from entering the building. It has a base designed to fit over a roof or wall opening, usually by means of a roof curb.	''Power roof ventilator (PRV)'' or ''power wall ventilator (PWV)'' means a fan with an internal driver and a housing to prevent precipitation from entering the building. It has a base designed to fit over a roof or wall opening, usually by means of a roof curb.

* The inclusion of ''scroll-shaped'' in this definition excludes inline fans.
** Radial fans are housed and therefore not included in this definition.

In response to the April 2020 Notice of Petition, ebm-papst commented in favor of a broader test procedure scope and stated that any limitation on scope should be made in future labeling requirements, certification requirements, or energy conservation standards. ebm-papst stated that AMCA 214–21 was designed for fans above 0.745 mechanical kilowatts shaft power (equivalent to 1 hp) or 0.890 electrical kilowatts, and below 112 kilowatts (equivalent to 150 hp) air power, and that these requirements should be the only scope restrictions on the test procedure. (Docket No. EERE–2020–BT–PET–0003, ebm-papst, No. 9)

In response to the April 2020 Notice of Petition for Rulemaking, AHRI commented that the scope of the DOE test procedure should ideally align with the scope of AMCA 214 as finalized and that AHRI was working with AMCA to resolve scope concerns in AMCA 214 (Docket No. EERE–2020–BT–PET–0003, AHRI, No. 14 at p. 2).

In this NOPR, DOE proposes to include all fans and blowers that are included within the scope of AMCA 210–16 (referenced by AMCA 214–21) and proposes that the test procedure would be applicable to the following fans and blowers, as proposed in section III.A.10 of this document and subject to the exclusions discussed in section III.A.2 of this document: (1) axial inline fan; (2) axial panel fan; (3) centrifugal housed fan; (4) centrifugal unhoused fan; (5) centrifugal inline fan; (6) radial-housed fan; and (7) power roof/wall ventilator (''PRV'').[17]

DOE is proposing that the scope of the test procedure cover fans and blowers with a fan shaft input power equal to or greater than 1 horsepower and a fan static or total air power equal to or less than 150 horsepower.

DOE has tentatively determined that the 1 hp fan shaft power lower limit may not be a practical unit of measurement for all fans because some fans are designed such that the measurement of the shaft input power is not feasible, and the only feasible measurement is the FEP, which is measured in units of kW. For example, some fans incorporate the bare-shaft and the motor in the same enclosed housing and do not provide access to the fan shaft (*i.e.,* between the motor and the fan), where the measurement of the fan shaft power would be conducted. DOE relied on the motor efficiency equations provided in Section 6.4.2.3 of AMCA 214–21 to convert the fan shaft power into electrical input power[18] and has tentatively determined that 0.89 kW is appropriate to establish a standardized equivalent to the 1 hp fan shaft input power limit. Additionally, Section 6.5.3.1.3 ''Fan Efficiency Requirements'' of ANSI/ASHRAE/IES 90.1, ''Energy Standard for Buildings except Low-Rise Residential Buildings (2019)'' (''ASHRAE 90.1–2019'') relies on the value of 0.89 kW as the corresponding threshold to a value of 1 hp of shaft input power.

Accordingly, DOE proposes that the test procedure would be applicable to a fan or blower with duty points[19] with the following characteristics: (1) a fan shaft input power equal to or greater than 1 horsepower and a fan static or total air power equal to or less than 150 horsepower, or (2) a FEP equal to or greater than 0.89 kW and a fan static or total airpower equal to or less than 150 horsepower.

DOE further proposes to establish the 150 hp upper limit in terms of total airpower for fans and blowers that use a total pressure basis FEI and would be required to be tested with a ducted outlet according to the proposed provisions adopted through reference to AMCA 214–21. For fans and blowers that use a static pressure basis FEI and that would be required to be tested using a free outlet under the provisions of AMAC 214–21 proposed to be adopted by reference, DOE proposes to establish the airpower limit in terms of

[17] PRVs include: Centrifugal PRV exhaust fans; Centrifugal PRV supply fans; and Axial PRVs, as defined in AMCA 214–21.

[18] The electrical input power is equal to the fan shaft input power divided by the motor efficiency.

[19] A duty point is characterized by a given airflow and pressure and has a corresponding operating speed.

static airpower. Table III–9 of this document lists the fan and blower categories that rely on a total or static pressure basis in accordance with AMCA 214–21.

DOE proposes the lower 1 hp limit to match the technical applicability of the AMCA 214–21 and AMCA 210–16 test procedures. DOE is proposing the upper air power limit at this time because fans that operate above the proposed upper limit are typically custom orders and are too large to be tested in a laboratory setting. In addition, these limits are in line with the Working Group recommendations and the CEC scope. DOE may consider methods for test for these fans in a future rulemaking.

Finally, to define total airpower, DOE proposes to rely on the definition of ''fan output power'' in AMCA 210–16. DOE proposes to define ''total airpower'' as the total power delivered to air by the fan; it is proportional to the product of the fan airflow rate, the fan total pressure, and the compressibility coefficient and is calculated in accordance with Section 7.8.1 of AMCA 210–16. See the definition of ''fan output power'' in Section 3.1.31 of AMCA 210–16 and calculation formulas in Section 7.8.1 of AMCA 210–16. DOE also proposes to define ''static air power'' as the static power delivered to air by the fan; it is proportional to the product of the fan airflow rate, the fan static pressure, and the compressibility coefficient and is calculated in accordance with Section 7.8.1 of AMCA 210–16, using static pressure instead of total pressure.

Fan and blower categories proposed to be exempted from the scope of this test procedure are discussed in section III.A.2 of this document.

DOE requests comment on the fans and blowers, other than air circulating fans, proposed for inclusion in the DOE test procedure.

DOE requests comment on the proposed limits based on fan airpower, fan shaft input power and fan electrical input power for fans other than air circulating fans. Specifically, DOE requests comment on the proposed definitions of ''static airpower'' and ''total airpower'' used to characterize the upper 150 horsepower limit for fans other than air circulating fans.

2. Proposed Fan and Blower Exclusions

DOE proposes to explicitly exclude certain fans and blowers from the scope of the test procedure.

The Working Group recommended to exclude circulating fans (also known as air circulating fans), induced flow fans, jet fans, and cross-flow fans. (Docket No. EERE–2013–BT–STD–0006, No. 179, Recommendation #2, at pp. 2–3) The Working Group also recommended to exclude safety fans due to low operating hours and specific design features that impair efficiency (*e.g.,* high tip clearance), and a subset of radial fans that are used for material handling applications [20] (*e.g.,* to move paper dust, sand).[21] (Docket No. EERE–2013–BT–STD–0006, No. 179, Recommendation #2, at pp. 2–3) Table III–2 of this document presents the exclusions recommended by the Working Group.

TABLE III–2—FAN CATEGORIES RECOMMENDED FOR EXCLUSION BY THE WORKING GROUP

Fan category recommended for exclusion by the working group *	Definition in AMCA 214–21
Radial housed unshrouded fan with diameter less than 30 inches or a blade width of less than 3 inches.	Included in the definition ''radial housed fan'' as noted in Table III–1.
Safety fan	Not defined in AMCA 214–21.
Induced flow fan	''Induced flow fan'' means a type of laboratory exhaust fan with a nozzle and windband; the fan's outlet airflow is greater than the inlet airflow due to induced airflow. All airflow entering the inlet exits through the nozzle. Airflow exiting the windband includes the nozzle airflow plus the induced airflow.
Jet fan	''Jet fan'' means a fan designed and marketed specifically for producing a high velocity air jet in a space to increase its air momentum. Jet fans are rated using thrust. Inlets and outlets are not ducted but may include acoustic silencers.
Cross-flow fan	''Cross-flow fan'' means a fan with a housing that creates an airflow path through the impeller in a direction at right angles to its axis of rotation and with airflow both entering and exiting the impeller at its periphery. Inlets and outlets can optionally be ducted.**

* **Note:** the Working Group also recommended to exclude circulating fans, (Docket No. EERE–2013–BT–STD–0006, No. 179, Recommendation #2, at pp. 2–3) which are defined in AMCA 214–21 as a fan that is not a ceiling fan that is used to move air within a space that has no provision for connection to ducting or separation of the fan inlet from its outlet. The fan is designed to be used for the general circulation of air. Circulating fans are discussed in Section III.A.4 of this document.

** Excluded from AMCA 214–21 and defined in ANSI/AMCA Standard 208, ''Calculation of the Fan Energy Index for calculating FEI'' (''AMCA 208–18'').

The Petitioners requested that the scope of any future DOE test procedure be consistent with the scope described in the term sheet, and requested to exclude fans that cannot be tested per AMCA 210–16 (*i.e.,* the physical test method referenced in AMCA 214–21).[22] The Petitioners also requested that the scope of the test procedure be consistent with ASHRAE 90.1–2019. (Docket No. EERE–2020–BT–PET–0003, The Petitioners, No. 1, attachment ''AMCA Petition to DOE Cover Letter and Petition [sic] 2020110'' at pp. 7–8)

Table III–3 of this document compares the scope exclusions requested by the Petitioners in accordance with the commercial and industrial fan and blower requirements in ASHRAE 90.1–2019 and the scope of exclusions as recommended by the Working Group (other than embedded fans and blowers). DOE reviewed the fan and blower exclusions to Section 6.5.3.1.3 of ASHRAE 90.1–2019 ''Fan Efficiency Requirements'' as listed in Table III–3 of this document and has tentatively

[20] Specifically, radial housed unshrouded fans, which means a radial housed fan for which the impeller blades are attached to a backplate and hub (*i.e.,* open radial blade), or to a hub only (*i.e.,* open paddle wheel), and with an open front at the impeller's inlet. These are different than radial shrouded fans, for which the impeller blades are attached to a backplate and to a ring or ''shroud'' at the impeller's inlet.

[21] The discussions of the Working Group related to these exclusions can be found in the meeting transcripts, available in the fans energy conservation standard rulemaking docket. (Docket No. EERE–2013–BT–STD–0006; Public Meeting Transcript, No. 161 at pp. 63–70; Public Meeting Transcript, No. 85 at pp. 60–62).

[22] For example, circulating fans, ceiling fans, desk fans, jet tunnel fans, and induced flow fans (*e.g.,* used in laboratory exhaust systems). This is consistent with the scope of the terms sheet.

determined that these exclusions are covered by the exclusions recommended by the Working Group.

TABLE III–3—EXCEPTIONS TO SECTION 6.5.3.1.3 OF ASHRAE 90.1–2019 "FAN EFFICIENCY REQUIREMENTS"

[Other than for embedded fans and blowers]

Exceptions to Section 6.5.3.1.3 of ASHRAE 90.1–2019 "Fan Efficiency Requirements"	Included in the exclusions recommended by the Working Group?
Fans that are not embedded fans with a motor nameplate horsepower of less than 1.0 hp or with a fan nameplate electrical input power of less than 0.89 "kW".	Yes.
Ceiling fans	Yes (Note: ceiling fans are not within the scope of the definition of fans and blowers).
Fans used for moving gases at temperatures above 482 °F	Yes (safety fans).
Fans used for operation in explosive atmospheres	Yes (safety fans).
Reversible fans used for tunnel ventilation	Yes (jet fans, safety fans).
Fans outside the scope of AMCA 208–18	Yes (AMCA 208–18 references the scope of AMCA 210–16).
Fans that are intended to operate only during emergency conditions	Yes (safety fans).

In response to the April 2020 Notice of Petition, Greenheck commented in support of a scope consistent with the term sheet and with ASHRAE 90.1–2019. (Docket No. EERE–2020–BT–PET–0003, Greenheck, No. 6.1 at p. 2) Johnson Controls commented in support of the exclusions requested by the Petitioners. (Docket No. EERE–2020–BT–PET–0003, Johnson Controls, No. 10 at pp. 1–2)

In its proposed rulemaking for commercial and industrial fans and blowers, the CEC proposes to exclude the following categories of fans: (1) safety fans (see section III.B.3 of this document for more details on this definition), (2) ceiling fans as defined in 10 CFR 430.2; (3) circulating fans; (4) induced-flow fans; (5) jet fans; (6) cross-flow fans; (7) embedded fans as defined in ANSI/AMCA 214–21;[23] (8) fans mounted in or on motor vehicles or other mobile equipment; (9) fans that create a vacuum of 30 in. water gauge or greater;[24] and (10) air curtain unit.[25] See Table III–4 of this document; section III.A.3 of this document for a discussion of embedded fans and air curtain units; and section III.A.5 of this document for a discussion of fans mounted in or on motor vehicles or other mobile equipment.

TABLE III–4 FANS RECOMMENDED FOR EXCLUSION BY THE WORKING GROUP AND THE CORRESPONDING CEC PROPOSED EXCLUSIONS

Fans recommended for exclusion by the working group *	Corresponding term and definition proposed for exclusion in CEC proposed regulatory text
Radial housed unshrouded fan with diameter less than 30 inches or a blade width of less than 3 inches.	Not excluded by the CEC proposed regulatory text.
Safety fan	"Safety Fan" See section III.B.3 of this document.
Induced flow fan	"Induced-flow fan" means a type of laboratory exhaust fan with nozzle and windband; the fan's outlet airflow is greater than the inlet airflow due to induced airflow. All airflow entering the inlet exits through the nozzle. Airflow exiting the windband includes the nozzle airflow as well as the induced airflow.
Jet fan	"Jet fan" means a fan designed and marketed specifically to produce a high-velocity air jet in a space to increase its air momentum. Jet fans are rated using thrust. Inlets and outlets are not ducted but may include acoustic silencers.
Cross-flow fan	"Cross-flow fan" means a fan with a housing that creates an airflow path through the impeller, in a direction at right angles to the axis of rotation and with airflow both entering and exiting the impeller at the periphery. Inlets and outlets can optionally be ducted.

* **Note:** The Working Group also recommended to exclude circulating fans, which are also excluded from the CEC proposed regulation and defined as a fan that is not a ceiling fan that is used to move air within a space, that has no provision for connection to ducting or separation of the fan inlet from its outlet. The fan is designed to be used for the general circulation of air. Circulating fans are discussed in Section III.A.4 of this document.

DOE reviewed the exclusions recommended by the Working Group, the exclusions requested by Petitioners, the exclusions provided in the proposed CEC regulations, and comments received. DOE is proposing to exclude from the proposed DOE test procedure the following fans and blowers: (1) radial housed unshrouded fans with a diameter less than 30 inches or a blade width of less than 3 inches; (2) safety fans; (3) induced flow fans; (4) jet fans; and (5) cross-flow fans.

Based on input from AMCA during the ASRAC negotiations, DOE has tentatively determined that radial housed unshrouded fans with a diameter less than 30 inches or a blade width of less than 3 inches are designed for materials handling applications.

[23] As defined in ANSI/AMCA 214–21: "A fan that is part of a manufactured assembly where the assembly includes functions other than air movement."

[24] CEC proposed excluding these fans because AMCA 214–21 is not applicable to this equipment. See CEC's Initial Statement of Reason, available at: *efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=22-AAER-01.*

[25] The CEC defines an air curtain unit as equipment providing a directionally controlled stream of air moving across the entire height and width of an opening that reduces the infiltration or transfer of air from one side of the opening to the other and/or inhibits the passage of insects, dust, or debris.

These fans have specific design features (*e.g.,* built to resist the impact and erosive wear from large quantities of various materials passing through the fan housing) that generally limit the opportunity for improved efficiency. (Docket No. EERE–2013–BT–STD–0006; Public Meeting Transcript, No. 85 at p. 60). Furthermore, testing these fans based on the test method for clean air fans would not provide a measurement of energy use or energy efficiency that is representative of an average use cycle. For these reasons, DOE proposes to exclude radial housed unshrouded fans with a diameter less than 30 inches or a blade width of less than 3 inches at this time.

DOE proposes to exclude safety fans at this time, which operate intermittently and may have specific design features that generally limit the opportunity for improved efficiency.

DOE also proposes to exclude induced flow fans; jet fans; and cross-flow fans because a test using AMCA 210–16 would not provide a measurement of energy use or energy efficiency that is representative of an average use cycle, as described further in the following paragraphs.

Induced flow fans are used for laboratory exhaust applications, and their performance is tested based on AMCA Standard 260–20, ''Laboratory Methods of Testing Induced Flow Fans for Rating.'' AMCA 260–20 is an adjunct to AMCA 210–16 in order to accommodate the induced flow fans' unique characteristics, namely the impact of the windband on performance. The windband is a component of induced flow fans used to direct the fume exhaust and maximize plume height and the amount of air mixed with the lab exhaust to increase the dilution ratio. Induced flow fans produce a high plume of air at the outlet in order to exhaust laboratory fumes and hazardous chemicals in such a manner that diminishes the likelihood that exhausted air will be re-entrained into the building's intake air. Their performance does not only depend on the flow of air that they provide, but also on the ''effective plume height,'' which is the plume rise provided by the induced flow fan added to the stack height of the fan (*i.e.,* from the roof to the outlet of the windband). DOE has tentatively determined that a test using AMCA 210–16 would not provide a measurement of energy use or energy efficiency during a representative average use cycle for induced flow fans and proposes to exclude these fans from the scope of the test procedure at this time.

Jet fans are typically used in vehicular tunnels to provide ventilation and improve air quality. Jet fans can also be used in the event of a fire in the tunnel to remove the smoke and fumes from the source of the incident, if necessary, by reversing their airflow. Jet fan performance is characterized by thrust and horsepower and not based on the airflow and pressure they can provide. AMCA 250–22 [26] provides methods of measuring thrust, volume airflow, and power and includes provisions for deriving efficiency in terms of ''thrust power ratio''. Therefore, DOE has tentatively determined that a test using AMCA 210–16 would not provide a measurement of energy use or energy efficiency during a representative average use cycle of jet fans and proposes to exclude these fans from the scope of the test procedure.

Cross-flow fan performance is related to the ability to produce a wide, uniform airflow as opposed to the airpower output, which is what is accounted for in AMCA 210–16. Therefore, DOE has tentatively determined that cross-flow fans would necessitate consideration of a different metric to better capture the energy use of these under a representative cycle of use. Therefore, DOE proposes that cross-flow fans will not be addressed in its test procedure at this time.

DOE is considering including an exclusion, consistent with the findings of the CEC, for fans that create a vacuum of 30 inches water gauge or greater. DOE has tentatively determined that a test using AMCA 210–16 may not result in a measurement of energy use or energy efficiency during a representative average use cycle for fans that are exclusively used to create a vacuum rather than produce airflow. DOE requests additional information on fans exclusively used to create a vacuum and on the 30 inches water gauge criteria used by the CEC.

DOE requests comment on its proposed exclusions from the proposed scope of applicability of the test procedure, listed as follows: (1) radial housed unshrouded fans with a diameter less than 30 inches or a blade width of less than 3 inches; (2) safety fans; (3) induced flow fans; (4) jet fans; and (5) cross-flow fans. DOE seeks additional information to support exclusion from the scope of potential test procedures.

DOE seeks comment and input on the applicability of AMCA 214–21 and AMCA 210–16 to fans that create a vacuum of 30 inches water gauge or greater. DOE requests comment on the 30 inches water gauge limit used by the CEC.

3. Proposed Exclusion of Embedded Fans and Blowers

In addition to the specific exclusions discussed in the prior section, DOE has also considered excluding certain ''embedded'' fans from the scope of the test procedure. Fans can be distributed in commerce as standalone equipment or can be distributed in commerce incorporated into other equipment that requires a fan to operate.

Section 3.25.3 of AMCA 214–21 defines a ''standalone fan'' as ''a fan in at least a minimum testable configuration. This includes any driver, transmission or motor controller if included in the rated fan. It also includes any appurtenances included in the rated fan, and it excludes the impact of any surrounding equipment whose purpose exceeds or is different than that of the fan.'' [27] Section 3.25.4 of AMCA 214–21 defines the term ''embedded fan'' in section 3.25.4 as ''a fan that is part of a manufactured assembly where the assembly includes functions other than air movement.''

The Working Group recommended excluding certain embedded fans. See Table III–5 of this document. (Docket No. EERE–2013–BT–STD–0006, No. 179, Recommendations #2 and #3 at pp. 2–4)

TABLE III–5—EMBEDDED FANS RECOMMENDED FOR EXCLUSION BY THE WORKING GROUP

Fans embedded in:
Single-phase central air conditioners and heat pumps rated with a certified cooling capacity less than 65,000 British thermal units per hour (''Btu/h''), that are subject to DOE's energy conservation standard at 10 CFR 430.32(c).
Three-phase, air-cooled, small commercial packaged air-conditioning and heating equipment rated with a certified cooling capacity less than 65,000 Btu/h, that are subject to DOE's energy conservation standard at 10 CFR 431.97(b).

[26] ANSI/AMCA 250–22: Laboratory Methods of Testing Jet Tunnel Fans for Performance. Available at *www.amca.org.*

[27] Additionally, AMCA 214–21 defines a minimum testable configuration as ''A fan having at least an impeller; shaft and bearings and/or driver to support the impeller; and its structure or its housing''. *See* Section 3.53 of AMCA 214–21.

TABLE III–5—EMBEDDED FANS RECOMMENDED FOR EXCLUSION BY THE WORKING GROUP—Continued

Residential furnaces that are subject to DOE's energy conservation standard at 10 CFR 430.32(y).
Transport refrigeration (*i.e.,* Trailer refrigeration, Self-powered truck refrigeration, Vehicle-powered truck refrigeration, Marine/Rail container refrigerant), and fans exclusively powered by internal combustion engines.
Vacuum cleaners.*
Heat Rejection Equipment:
• Packaged evaporative open circuit cooling towers.
• Evaporative field-erected open circuit cooling towers.
• Packaged evaporative closed-circuit cooling towers.
• Evaporative field-erected closed-circuit cooling towers.
• Packaged evaporative condensers.
• Field-erected evaporative condensers.
• Packaged air-cooled (dry) coolers.
• Field-erected air-cooled (dry) coolers.
• Air-cooled steam condensers.
• Hybrid (water saving) versions of all of the previously listed equipment that contain both evaporative and air-cooled heat exchange sections.
Air curtains:
Air-cooled commercial package air conditioners and heat pumps (CUAC, CUHP) with a certified cooling capacity between 5.5 tons (65,000 Btu/h) and 63.5 tons (760,000 Btu/h) that are subject to DOE's energy conservation standard at 10 CFR 431.97(b).**
Water-cooled and evaporatively-cooled commercial air conditioners and water-source commercial heat pumps that are subject to DOE's energy conservation standard at 10 CFR 431.97(b).**
Single package vertical air conditioners and heat pumps that are subject to DOE's energy conservation standard at 10 CFR 431.97(d).**
Packaged terminal air conditioners (PTAC) and packaged terminal heat pumps (PTHP) that are subject to DOE's energy conservation standard at 10 CFR 431.97(c).**
Computer room air conditioners that are subject to DOE's energy conservation standard at 10 CFR 431.97(e).**
Variable refrigerant flow multi-split air conditioners and heat pumps that are subject to DOE's energy conservation standard at 10 CFR 431.97(f).**

* Although the term sheet specifies ''vacuum'', the term was intended to designate vacuum cleaners. (Docket No. EERE–2013–BT–STD–0006; AHRI, Public Meeting Transcript, No. 166 at p. 11).

** The recommendation only applies to supply and condenser fans embedded in this equipment.

Stated more generally, the exclusions recommended by the Working Group would exclude from the scope of the test procedure, fans that are embedded in regulated equipment for which the DOE metric captures the energy consumption of the fan.[28]

The Working Group further recommended for fans embedded in non-regulated equipment, and/or embedded in regulated equipment other than listed in appendix B, and/or any fans that are not supply and condense fans in regulated equipment listed in appendix B that the first manufacturer of a testable configuration[29] would be responsible for certifying the standalone fan performance to DOE. (Docket No. EERE–2013–BT–STD–0006, No. 179, Recommendation #4 at pp. 4)[30]

The Petitioners requested that the scope of any DOE test procedure be consistent with the scope of the term sheet. Petitioners also requested the test-procedure scope for commercial fans be consistent with ASHRAE 90.1–2019, and additionally exclude embedded fans that are part of equipment listed in Section 6.4.1.1 of ASHRAE 90.1–2019. ASHRAE 90.1–2019 (*See* Table III–7 of this document). (Docket No. EERE–2020–BT–PET–0003, The Petitioners, No. 1, attachment ''AMCA Petition to DOE Cover Letter and Petition [sic] 2020110'' at pp. 7–8)

The additional exclusions for embedded fans that are part of equipment listed in Section 6.4.1.1 of ASHRAE 90.1–2019 as requested by AMCA is included in the fan and blower exclusions to Section 6.5.3.1.3 of ASHRAE 90.1–2019 ''Fan Efficiency Requirements'' as listed in section in Section 6.5.3.1.3 of ASHRAE 90.1–2019 and presented in Table III–6 of this document.

TABLE III–6—EMBEDDED FAN AND BLOWERS EXCLUSIONS TO SECTION 6.5.3.1.3 OF ASHRAE 90.1–2019 ''FAN EFFICIENCY REQUIREMENTS''

Embedded fan and blowers exclusions to Section 6.5.3.1.3 of ASHRAE 90.1–2019 ''Fan Efficiency Requirements''	Included in the exclusion recommended by the Working Group?
Embedded fans and fan arrays with a combined motor nameplate horsepower of 5 hp or less or with a fan system electrical input power of 4.1 kW or less.	No.
Embedded fans that are part of equipment listed under Section 6.4.1.1	See Table III–7.
Embedded fans included in equipment bearing a third party-certified seal for air or energy performance of the equipment package.	No.

[28] The Working Group created a subgroup to propose potential embedded fan exclusions, which were subsequently voted on by the Working Group. The information used by the subgroup to develop the proposal is available in the fans energy conservation standard rulemaking docket. (Docket No. EERE–2013–BT–STD–0006, No. 125.2).

[29] AMCA 214–21 defines the ''minimal testable configuration'' as a fan having at least an impeller; shaft and bearings and/or driver to support the impeller; and its structure or its housing.

[30] As part of this recommendation, the Working Group also recommended that if a manufacturer purchases a standalone fan to incorporate in a product or in equipment, that manufacturer must ensure that the design operating range (or design point) of the embedded fan is within the certified operating range of the standalone fan and disclose the design operating range (or design point) of the embedded fan to the end-user. This issue does not relate to the test procedure and is not discussed in this document.

TABLE III–7—EQUIPMENT LISTED IN SECTION 6.4.1.1 OF ASHRAE 90.1–2019 "MINIMUM EQUIPMENT EFFICIENCIES—LISTED EQUIPMENT—STANDARD RATING AND OPERATING CONDITIONS"

Fans embedded in:	Included in the embedded fan exclusions recommended by the Working Group?
Electrically Operated Unitary Air Conditioners	Partially. This category includes equipment above 760,000 Btu/h. The exclusions in the term sheet apply only to fans embedded in equipment above 65,000 Btu/h and below 760,000 Btu/h (equivalent to 5.5 tons and 63.5 tons, respectively as stated in the term sheet). In addition, the term sheet specifies that the exclusions would apply only to embedded "supply and condenser fans."
Electrically Operated Air-Cooled Unitary Heat Pumps	Partially. This category includes equipment above 760,000 Btu/h. The exclusions in the term sheet apply only to fans embedded in equipment below 760,000 Btu/h. In addition, the term sheet specifies that the exclusion would apply only to embedded "supply and condenser fans."
Air-, water-, and evaporatively cooled Condensing Units	Yes, these fans are below 1 hp. In addition, it is specified in Table 6.8.1–1 of ASHRAE 90.1–2019 that this category only includes equipment greater than or equal to 135,000 Btu/h.
Water-Chilling Packages	No.
Electrically Operated Packaged Terminal Air Conditioners, Packaged Terminal Heat Pumps, Single-Package Vertical Air Conditioners, and Single-Package Vertical Heat Pumps.	Yes. However, the term sheet specifies that the exclusion would apply only to embedded "supply and condenser fans."
Room Air-conditioners and Air-conditioner Heat pumps	Yes. These fans are below 1 hp.
Warm-Air Furnaces and Combination Warm-Air Furnaces/Air-Conditioning Units, Warm-Air Duct Furnaces, and Unit Heaters.	No.
Gas- and Oil-Fired Boilers	Partially. Some of these fans are below 1 hp.
Heat-Rejection Equipment	Yes.
Electrically Operated Variable-Refrigerant-Flow Air Conditioners	Yes. However, the term sheet specifies that the exclusion would apply only to embedded "supply and condenser fans."
Electrically Operated Variable-Refrigerant-Flow and Applied Heat Pumps.	Partially. This category includes ground water source and ground source equipment that is not regulated by DOE and that was not included in the term sheet exclusions. In addition, the term sheet specifies that the exclusion would apply only to embedded "supply and condenser fans."
Floor-Mounted Air Conditioners and Condensing Units Serving Computer Rooms.	Partially. This category includes equipment greater than or equal to 760,000 Btu/h, which are not regulated by DOE.
Commercial Refrigerators, Commercial Freezers, and Refrigeration	Yes, these fans are below 1 hp.
Vapor-Compression-Based Indoor Pool Dehumidifiers	Yes, these fans are below 1 hp.
Electrically Operated direct-expansion dedicated outdoor air system Units, Single-Package and Remote Condenser, without Energy Recovery.	No.
Electrically Operated direct-expansion dedicated outdoor air system Units, Single-Package and Remote Condenser, with Energy Recovery.	No.
Electrically Operated Water-Source Heat Pumps	Partially. This category includes ground water source and ground source equipment that is not regulated by DOE and was not included in the term sheet exclusions. In addition, the term sheet specifies that the exclusion would apply only to embedded "supply and condenser fans."
Heat Pump and Heat Recovery Chiller Packages	No.
Ceiling-Mounted Computer-Room Air Conditioners	Partially. The term sheet only excludes embedded fans in computer room air conditioners that are subject to DOE energy conservation standards.
Walk-In Cooler and Freezer Display Door	Yes, these fans are below 1 hp.
Walk-In Cooler and Freezer Non-Display Door	Yes, these fans are below 1 hp.
Walk-In Cooler and Freezer Refrigeration System	Yes, these fans are below 1 hp.

As previously noted, in response to the April 2020 Notice of Petition, Greenheck commented in support of a scope consistent with the term sheet and with ASHRAE 90.1–2019 (Docket No. EERE–2020–BT–PET–0003, Greenheck, No. 6.1 at p. 2) Johnson Controls commented in support of the exclusions requested by the Petitioners (Docket No. EERE–2020–BT–PET–0003, Johnson Controls, No. 10 at pp. 1).

CTI commented in support of the exclusion of fans used in heat rejection equipment as requested by the Petitioners. CTI commented that this exclusion was included in the term sheet scope recommendation based on the widespread usage of equipment-level energy efficiency metrics; the low potential for energy savings; the potential unintended increases in fan and system energy use ; and the associated design challenges due to the very large size of fans used in heat rejection equipment. (Docket No. EERE–2020–BT–PET–0003, CTI, No. 11 at pp. 1–2)

AHRI commented in support of the Petitioners' request to exclude from the scope of the test procedure condenser fans embedded in commercial and industrial chillers, condensing units, and unregulated packaged air conditioners and heat pumps with cooling capacity greater than 760,000 Btu/h, consistent with Section 6.4.1.1 of ASHRAE 90.1–2019. AHRI also supported the exclusions listed in the term sheet for heat rejection equipment, including but not limited to air cooled condensers, dry coolers, cooling towers, evaporative condensers, and hybrid wet/dry units. (Docket No. EERE–2020–BT–PET–0003, AHRI, No. 14 at p. 2) Further, AHRI commented in support of additional exclusions to exclude all fans in all regulated equipment and asserted that EPCA does not permit two standards to be applied to regulated equipment. AHRI stated that the list of equipment in Section 6.4.1.1 of ASHRAE 90.1–2019 strictly applies to air distribution equipment and does not include all regulated equipment incorporating fans, such as boilers. (Docket No. EERE–2020–BT–PET–0003, AHRI, No. 14 at p. 2) In addition, AHRI questioned the representativeness of applying a standalone fan metric for embedded fans in regulated equipment.[31] AHRI asserted that the standalone fan metric, after accounting for system effect, would not provide an appropriate basis for comparison of performance. (Docket No. EERE–2020–BT–PET–0003, AHRI, No. 14 at p. 2) Daikin commented in support of all of AHRI's comments on the petition. (Daikin, No. 8 at p. 1).

Lennox commented that fans embedded in DOE regulated HVACR equipment should be excluded from the scope to avoid duplicative burdens for HVACR equipment already subject to DOE regulation. (Docket No. EERE–2020–BT–PET–0003, Lennox, No. 5 at p. 3)

Several interested parties commented in support of an equipment level approach (*i.e.,* system approach) that would regulate the HVACR equipment rather than what they described as a component level approach. CTI commented that energy conservation standards based on already established equipment-level metrics are more effective at reducing energy consumption compared to energy savings obtained by using a fan efficiency metric, and at a lower regulatory burden. (Docket No. EERE–2020–BT–PET–0003, CTI, No. 11 at p. 2) Daikin commented that DOE had recently stated that it may seek to establish regulatory coverage over equipment, rather than the components in such equipment. (Docket No. EERE–2020–BT–PET–0003, Daikin, No. 8 at p. 1) In addition, Daikin commented that the purpose of the FEI established by AMCA 214 is to help drive fan sizing and better fan selection. Daikin commented that while there were benefits to improving fan sizing and incentivizing better fan selection for standalone fans, not all possible FEI improvement approaches are practical for embedded fans (*e.g.,* increasing fan size or increasing the number of fans). Daikin stated that certain equipment incorporating embedded fans must comply with multiple safety standards and performance standards. Daikin commented that embedded fans are carefully selected to adhere to such safety and performance standards, and that component sizes or the number of components cannot be altered to meet the needs of a component level test procedure. (Docket No. EERE–2020–BT–PET–0003, Daikin, No. 8 at p. 1)

Daikin generally supported the exclusions requested by the Petitioners, stating that such exclusions should be reflected in the scope of AMCA 214. (Docket No. EERE–2020–BT–PET–0003, Daikin, No. 8 at p. 1). CTI also commented that the exclusions requested by the Petitioners should be reflected in the scope of AMCA 214 and expressed concern that the draft AMCA 214 test standard[32] could allow for the inclusion of embedded fans at some point in the future. CTI further stated that AMCA 214 is not suitable for inclusion in a regulatory program due to testing and accuracy issues. CTI did not provide a description of these issues. (Docket No. EERE–2020–BT–PET–0003, CTI, No. 11 at p. 3)

In response to the October 2021 RFI, AHRI commented that there have been many changes since the conclusion of the Working Group. For example, the introduction of FEI in ASHRAE 90.1, the development of a new test procedure for FEI, and the publication of AMCA 214. AHRI commented that itis chiefly concerned with ensuring that the scope of coverage does not impose double regulation on covered equipment. AHRI commented that AMCA 214–21 does not specifically exclude embedded fans other than in the foreword (which states that ''AMCA Standard 214 primarily is for fans that are tested alone or with motors and drives; it does not apply to fans tested embedded inside of other equipment''); however, AHRI stated that there is no normative procedure for applying a stand-alone fan metric to embedded applications. (AHRI, No. 10 at p. 2)

In response to the October 2021 RFI, AHRI and Morrison commented that any fan and blower regulations should exclude all fans and blowers used in regulated equipment because EPCA does not permit two standards to be applied to a single federally regulated product. AHRI and Morrison cited DOE's discussion in a final rule published July 22, 2009[33] in which DOE stated, ''EPCA authorizes DOE to establish a performance standard or a single design standard. As such, a standard that establishes both a performance standard and a design requirement remain beyond the scope of DOE's legal authority.'' AHRI and Morrison, citing 42 U.S.C. 6313(a)(6)(C), asserted that introducing component regulation on regulated products creates a secondary redesign cycle contrary to EPCA. AHRI and Morrison also asserted that EPCA is clear that DOE is prohibited from setting a new efficiency standard on products within certain defined time limits. Specifically, AHRI and Morrison commented that DOE cannot set new efficiency standards for products manufactured after a date that is the later of (1) the date that is three years after publication of the final rule establishing a new standard; or (2) the date that is six years after the effective date of the current standard for a covered product, citing 42 U.S.C. 6313(a)(6)(C)(iv). AHRI and Morrison commented that introducing a fan regulation on top of a regulation for covered equipment would complicate the regulatory, design and compliance cycles. AHRI and Morrison added that clearly excluding fans in regulated products will help DOE comply with the legally mandated schedule and parameters laid out under EPCA. AHRI and Morrison additionally commented that DOE should maintain consistency in its rulemaking process and seek to establish regulatory coverage over equipment rather than the components in such equipment. (AHRI, No. 10 at pp. 3–4; Morrison, No. 8 at p. 2)

Morrison added that DOE should only regulate standalone fans and not those embedded in equipment since none of the referenced test methods are for embedded fans. Further, Morrison commented that the vast majority of fans manufactured by √Morrison are incorporated in HVAC equipment that already have energy efficiency measures that account for the fan energy, and thus should continue to be out of scope for this regulation. (Morrison, No. 8 at p. 1)

In its proposed regulation, the CEC proposes to exclude embedded fans, as defined in AMCA 214–21, including embedded fans in air curtain units.[34] In

[31] The AMCA 214–21 metric describes fan performance as tested in a standalone configuration (*i.e.* not installed inside other equipment).

[32] AMCA 214–21 had not yet published at the time of these comments.

[33] Energy Conservation Program for Certain Industrial Equipment: Energy Conservation Standards and Test Procedures for Commercial Heating, Air-Conditioning, and Water-Heating Equipment. 74 FR 36312, 36322 (July 22, 2009).

[34] *See* Proposed regulatory language for Commercial and Industrial Fans and Blowers

its staff report, the CEC stated that its proposal would exclude fans embedded in regulated and nonregulated equipment where the main function is other than the movement of air, as long as the fan is not sold or offered for sale as a standalone product.[35] As reasons for exclusion, the CEC stated that these fans are either manufactured by an original equipment manufacturer (OEM), who embeds the fan in a piece of equipment where the main function is something other than the movement of air, or because they are manufactured for the purpose of being embedded into an appliance after market.[36] The CEC also discussed the potential complexity of testing embedded fans and the accuracy of the results. See section III.D.8 of this document for further discussion related to testing.[37]

DOE proposes to exclude fans embedded in equipment listed in Table III–5, as long as the fan is not distributed in commerce as a standalone product, consistent with the Working Group term sheet scope recommendations related to embedded fans. The equipment listed in Table III–5 includes equipment that is separately regulated by DOE (''covered equipment'') as well as non-covered equipment (*i.e.,* transportation refrigeration equipment, vacuum cleaners, heat rejection equipment, and air curtains).

Fans used in transportation equipment are often designed to accommodate the limited space available and are built following specific construction requirements to withstand shock and vibrations. These design constraints significantly limit potential opportunities for improvements in efficiency. Consistent with the Working Group term sheet (Docket No. EERE–2013–BT–STD–0006–0179, Recommendation #2 at p. 2), DOE proposes to exclude fans that are exclusively embedded in transport refrigeration (*i.e.,* trailer refrigeration, self-powered truck refrigeration, vehicle-powered truck refrigeration, and marine/rail container refrigeration) at this time.

DOE proposes to exclude fans that are exclusively embedded in vacuum cleaners. AHRI initially made this recommendation on the basis that these fans represent low energy savings potential due to their low operating hours. (Docket No. EERE–2013–BT–STD–0006; AHRI, Public Meeting Transcript, No. 166 at p. 11) Fans embedded in vacuums cleaners are not used to produce airflow. Rather, they are used to create a vacuum for material handling purposes (*i.e.,* moving dust, small particles etc.). DOE has tentatively determined that a clean air test using AMCA 210–16 would not result in a measurement of energy use or energy efficiency during a representative average use cycle. For this reason, and consistent with the Working Group term sheet scope recommendations, DOE proposes to exclude fans embedded in vacuum cleaners from the scope of the test procedure.

Fans used in heat rejection equipment are primarily fabricated in-house by the heat rejection equipment manufacturer and that these fans are not sold in a standalone configuration.[38] For this reason, and consistent with the Working Group term sheet scope recommendations, DOE proposes to exclude fans embedded in heat rejection equipment from the scope of the test procedure.

Air curtains are used in entrances to buildings or openings between two spaces conditioned at different temperatures. Their performance does not depend on the airpower alone, but on their ability to create a uniform airstream that separates two spaces from each other. Air curtains are subject to a separate AMCA testing standard.[39] This standard establishes uniform methods for the testing of an air curtain to determine aerodynamic performance in terms of airflow rate, outlet air velocity uniformity, power consumption, and air velocity projection. Air curtains include fans packaged with a motor, filter, outlet section (a nozzle, discharge grille, etc.), and in some cases a mounting plate, and/or an electric heater or water heater. The performance of fans embedded in air curtains is related to airflow rate, outlet air velocity uniformity, and air velocity projection as opposed to the airpower output alone, which is what is accounted for in AMCA 210–16. Therefore, DOE has tentatively determined that fans embedded in air curtain fans would necessitate consideration of a different metric to better capture the energy use of air curtain fans under a representative cycle of use. Therefore, DOE proposes that fans embedded in air curtains not be addressed in the proposed test procedure.

In addition, at this time, DOE proposes that the test procedure would exclude fans in covered equipment in which the fan energy use is already captured in the equipment specific test procedures. DOE is proposing to adopt an exclusion for fans embedded in equipment listed in Table III–5,[40] as long as the fan is not distributed in commerce as a standalone product. DOE proposes to also exclude fans embedded in direct-expansion dedicated outdoor systems (''DX–DOAS'') to reflect the DOE proposed test procedure and metric for DX–DOAS that, if adopted, would incorporate fan energy use. *See* 86 FR 72874, 72889–72890 (December 23, 2021). These proposed exclusions are consistent with the recommendations of the Working Group. The proposed approach would avoid regulating fans for which existing DOE regulations account for their energy use by excluding such fans from the test procedure if distributed solely embedded in the listed equipment. To the extent a fan is distributed in commerce as a stand-alone fan, and therefore is not limited to use in specific equipment, or embedded in equipment in which its energy use is not addressed in a DOE test procedure, such a fan would be subject to the DOE test procedure.

Table III–8 summarizes the exclusively embedded fans proposed for exclusions from the scope of the test procedure.

available in the following Docket: 22–AAER–01 at: *efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=22-AAER-01.*

[35] *See* CEC Commercial and Industrial Fans and Blowers Staff Report, Docket No. 22–AAER–01, TN# 241951, at p. 16.

[36] *Id.*

[37] See CEC Commercial and Industrial Fans and Blowers Staff Report, Docket No. 22–AAER–01, TN# 241951, at p. 30

[38] In some cases, the heat rejection equipment manufacturer may purchase the impeller and assemble the fan in a housing which is tied to the structure of the heat rejection equipment.

[39] AMCA, Standard 220–21, ''Laboratory Methods of Testing Air Curtains for Aerodynamic Performance Ratings,'' 2021. Available at *www.amca.org.*

[40] DOE notes that while the Working Group recommended to exclude fans in residential furnaces that are subject to DOE's energy conservation standard at 10 CFR 430.32(y), furnace fans are excluded from the definition of ''fan and blower'' and therefore do not need to be listed as a proposed exclusion.

TABLE III–8—EXCLUSIVELY EMBEDDED FANS PROPOSED FOR EXCLUSION FROM THE SCOPE OF THE TEST PROCEDURE

Fans exclusively embedded in:
Direct-expansion dedicated outdoor systems (''DX–DOASes'') subject to any DOE test procedures in appendix B to subpart F of part 431.*
Single-phase central air conditioners and heat pumps rated with a certified cooling capacity less than 65,000 British thermal units per hour (''Btu/h''), that are subject to DOE's energy conservation standard at 10 CFR 430.32(c).
Three-phase, air-cooled, small commercial packaged air-conditioning and heating equipment rated with a certified cooling capacity less than 65,000 Btu/h, that are subject to DOE's energy conservation standard at 10 CFR 431.97(b).
Transport refrigeration (*i.e.,* Trailer refrigeration, Self-powered truck refrigeration, Vehicle-powered truck refrigeration, Marine/Rail container refrigerant), and fans exclusively powered by fan combustion engines.
Vacuum cleaners.
Heat Rejection Equipment:
• Packaged evaporative open circuit cooling towers.
• Evaporative field-erected open circuit cooling towers.
• Packaged evaporative closed-circuit cooling towers.
• Evaporative field-erected closed-circuit cooling towers.
• Packaged evaporative condensers.
• Field-erected evaporative condensers.
• Packaged air-cooled (dry) coolers.
• Field-erected air-cooled (dry) coolers.
• Air-cooled steam condensers.
• Hybrid (water saving) versions of all of the previously listed equipment that contain both evaporative and air-cooled heat exchange sections.
Air curtains.
** Air-cooled commercial package air conditioners and heat pumps (CUAC, CUHP) with a certified cooling capacity between 5.5 tons (65,000 Btu/h) and 63.5 tons (760,000 Btu/h) that are subject to DOE's energy conservation standard at 10 CFR 431.97(b).
** Water-cooled and evaporatively-cooled commercial air conditioners and water-source commercial heat pumps that are subject to DOE's energy conservation standard at 10 CFR 431.97(b).
** Single package vertical air conditioners and heat pumps that are subject to DOE's energy conservation standard at 10 CFR 431.97(d).
** Packaged terminal air conditioners (PTAC) and packaged terminal heat pumps (PTHP) that are subject to DOE's energy conservation standard at 10 CFR 431.97(c).
** Computer room air conditioners that are subject to DOE's energy conservation standard at 10 CFR 431.97(e).
** Variable refrigerant flow multi-split air conditioners and heat pumps that are subject to DOE's energy conservation standard at 10 CFR 431.97(f).

** DX–DOASes are not currently subject to a DOE test procedure. However, there is an ongoing rulemaking to establish a test procedure for DX–DOASes that DOE anticipates will be finalized before the final rule of the fans and blowers rulemaking. Information about this rulemaking can be found at *regulations.gov* under the Docket Number EERE–2017–BT–TP–0018.

* The exclusion only applies to supply and condenser fans embedded in this equipment.

As discussed, DOE is proposing to exclude embedded fans that are not distributed in commerce as standalone fans. DOE acknowledges that in a number of instances, a standalone fan purchased by a manufacturer for incorporation into a unit of listed equipment may be indistinguishable based on physical features from a fan that is purchased by a manufacturer for incorporation into non-listed equipment or from a fan used as a standalone fan. During the ASRAC negotiations, AHRI conducted a survey of its members to determine the number of fans purchased versus manufactured by the equipment manufacturer. (Docket No. EERE–2013–BT–STD–0006, AHRI, No. 125.3, at p. 1) AHRI estimated that over 80 percent of all fans that are used as components across all commercial regulated equipment are manufactured by the equipment manufacturer. *Id.* This percentage was higher for commercial air-conditioning and heat pump equipment and was estimated to be between 94 and 99 percent. *Id.*

In order to provide additional specificity as to the fans that would be subject to the embedded fan exclusion, DOE proposes to use the term ''exclusively embedded fans'' to designate the fans covered by the embedded fan exclusion. DOE proposes to define ''exclusively embedded fan'' as: a fan or blower that is manufactured and incorporated into a product or equipment manufactured by the same manufacturer and that is exclusively distributed in commerce embedded in another product or equipment. Based on this information, DOE has tentatively determined that the vast majority of fans used as components in regulated commercial HVACR equipment would meet the proposed definition of exclusively embedded fan and would not be subject to the test procedure as proposed in this NOPR.

The following examples illustrate how the proposed definition of exclusively embedded fan would impact whether a fan must be tested and certified to DOE:

• If a manufacturer makes a fan and incorporates it into equipment that the manufacturer also makes, that fan would meet the definition of exclusively embedded fan. If the embedded fan is part of equipment listed in Table III–8 of this document, that fan would be excluded from the proposed scope of the test procedure so long as the manufacturer does not also sell that fan as a standalone fan. If the embedded fan is not part of equipment listed in Table III–8 of this document, the embedded fan would be included in the proposed scope of the test procedure and the fan would be subject to the test procedure.

• If Manufacturer A makes (or imports) a fan and then only sells it to Manufacturer B who then only distributes that fan in commerce embedded within a larger piece of equipment, that fan would not meet the definition of exclusively embedded fan (even if the equipment is listed in Table III–8 of this document), as it would be distributed in commerce as a standalone fan by Manufacturer A, and therefore the fan would be subject to the test procedure under the proposal.

• If a fan is exclusively imported as part of a larger piece of equipment, that fan would meet the definition of exclusively embedded fan. If the embedded fan is part of equipment listed in Table III–8 of this document, that fan would be excluded from the proposed scope of applicability of the test procedure. If the embedded fan is not part of equipment listed in Table III–8 of this document, the embedded fan would be included in the proposed scope of applicability of the test procedure.

DOE requests comment on the proposed exclusively embedded fan exclusions listed in Table III–8 of this document.

DOE seeks information on whether it is common practice for standalone fan manufacturers that supply fans to HVACR equipment manufacturers to test these fans in accordance with AMCA 214–21 or AMCA 210–16 in a standalone configuration, and to provide fan performance data for these fans.

DOE seeks information on whether it is common practice for manufacturers of HVACR equipment that manufacture and incorporate fans into their equipment to test these fans in accordance with AMCA 214–21 or AMCA 210–16 in a standalone configuration, and to provide fan performance data to their customers.

DOE seeks comment on the estimates provided for the percentage of fans that are incorporated in HVACR equipment that are purchased by the HVACR equipment manufacturer vs. manufactured in-house.

DOE seeks comment and input regarding any physical features that could be used to distinguish a fan that is exclusively designed for use in equipment listed in Table III–8 of this document.

DOE seeks comment on the proposed definition of ''exclusively embedded fan''.

4. Air Circulating Fans

In the October 2021 RFI, DOE requested information regarding potential test procedures for fans and blowers, including air circulating fans, specifically air circulating fan heads (''ACFHs''), and requested feedback on definitions provided in AMCA 230–15 and on the scope of any potential test procedure for air circulating fans. 86 FR 54412, 54414–54415. DOE described ACFHs as designed to provide concentrated directional airflow and consisting of a motor, impeller and guard for mounting on a pedestal, wall mount bracket, ceiling mount bracket, I-beam bracket or other mounting means. 86 FR 54412, 54414. DOE stated that ACFHs are different from ceiling fans, which are designed to circulate air rather than provide concentrated directional airflow; and as a result, ACFHs have lower diameter-to-maximum operating speed ratio (expressed in inches per revolutions per minute (''in/RPM'')) than ceiling fans. *Id.* Comments received related to definitions are discussed in section III.B.4 of this document. As discussed in section III.B.4, DOE proposes to define air circulating fans and related terms.

AMCA commented in support of developing test procedures for ACFHs. AMCA recommended that for clarity, repeatability, and market confidence, DOE should harmonize with IEC 60879:2019 ''Comfort fans and regulators for household and similar purposes—Methods for measuring performance,'' and set a simple electrical-input-power threshold by excluding ACFHs less than 125 Watts (''W'') from a commercial and industrial ACFH test procedure. AMCA stated this would cover the vast majority of fans used in commercial and industrial applications and would exclude fans mostly used for residential applications. (AMCA, No. 6 at p. 6) In addition, AMCA commented in support of developing a test procedure for additional categories of air circulating fans defined in AMCA 230–15 (*i.e.,* personnel coolers, box fans, and table fans),[41] using AMCA 230–15 as the basis for a test procedure and including fans of greater than or equal to 125 W electrical input power. AMCA also stated that, should DOE develop energy conservation standards for air circulating fans, all categories of circulating fans should be subject to the same efficiency standard and lower wattage scope limit. (AMCA, No. 6 at p. 6) AMCA commented that impeller diameter is not an appropriate criteria to use to delimit the scope of a potential test procedure for ACF, specifically for ACFHs. AMCA commented that typical impeller diameters for ACFHs offered for sale in the United States range from 12 inches to 36 inches; however, there is no practical reason that an ACFH with a diameter outside that range could not be manufactured and/or sold. AMCA stated that limiting the DOE test procedure to specific diameters could encourage the introduction of fans outside of the covered diameters into the marketplace. AMCA added that typical motor sizes range from 1⁄10 hp to 2⁄3 hp, with 1⁄10, 1⁄8, 1⁄4, 1⁄3, 1⁄2, and 2⁄3 hp being the most common; but because there is no mandated test procedure and reporting requirements, fan electrical-input-power data is not readily available for the majority of ACFHs and cannot be estimated using the motor horsepower. AMCA commented that ACFH motors typically are loaded above their nameplate horsepower, such that simply multiplying the published hp by the conversion factor of 746 Watts per hp and dividing by a nominal motor efficiency does not provide a useful input-power estimate. (AMCA, No. 6 at p. 7) AMCA stated that IEC 60879:2019 covers additional product classes, such as ''tower fans'' and ''bladeless fans'' and that these categories of fans should be excluded from the test procedure. (AMCA, No. 6 at p. 6)

ASAP, ACEEE, NRDC commented that additional categories of air circulating fans other than ACFHs, such as personnel coolers, box fans, and table fans, meet the definition of ''fan and blower'' and thus should be included in the test procedure. ASAP, ACEEE, NRDC added that these additional air circulating fan categories are covered in the existing AMCA 230–15 test procedure for air circulating fans, such that it is feasible to include them within the scope of the DOE test procedure. ASAP, ACEEE, NRDC commented that generally, air circulating fans are fans used to circulate air within a confined space for use in agriculture, manufacturing, etc. and estimated the total global market for all fans and blowers to be approximately $20 billion, while agricultural ventilation, a major market for air circulating fans, is expected to reach $1.3 billion by 2027. ASAP, ACEEE, NRDC commented that establishing standardized DOE test procedures and efficiency ratings for air circulating fans will ensure that purchasers have access to comparable information about efficiency, enabling informed purchasing decisions. (ASAP, ACEEE, NRDC, No. 7 at p. 1) ASAP, ACEEE, NRDC supported limiting the definition of air circulating fans to input powers of 125 W and above, stating that this would be consistent with IEC 60879:20195 and fan standards in the European Union. ASAP, ACEEE, NRDC added that a minimum input power cut-off of 125 W is sufficient to reasonably distinguish air circulating fans that are to any significant extent distributed in commerce for industrial or commercial use. (ASAP, ACEEE, NRDC, No. 7 at p. 2)

The CA IOUs recommended that DOE regulate all commercial air circulating fans not currently covered, which could be defined as having a minimum power draw threshold such as 125 W. Additionally, the CA IOUs stated that personnel and agricultural fans that have solid housings or that may not meet the diameter-to maximum

[41] AMCA 230–15 defines ''personnel cooler'' as a fan used in shops, factories, etc., generally supplied with wheels or casters on the housing or frame to aid in portability, and with motor and impeller enclosed in a common guard and shroud; ''box fan'' as a fan used in an office or residential application and having the motor and impeller enclosed in an approximately square box frame having a handle; and ''table fan'' as a fan intended for use on a desk, table or countertop, and which may also be provided with the means for mounting to a wall. *See* Sections 5.1.2 through 5.1.5 of AMCA 230–15.

operating speed ratio[42] should be regulated, but are not considered ACFHs. The CA IOUs further commented that there is support by the industry to regulate all commercial air circulating fans, and they recommended that DOE undertake an additional rulemaking(s) to cover them. (CA IOUs, No. 9 at p. 3)

NEEA recommended that DOE consider evaluating efficiency standards and test procedures for additional categories of air circulating fans, such as industrial personnel coolers, box fans, and table fans that meet the definition of circulating fan. NEAA stated that the RFI focused primarily on ACFHs, and that other, non-ceiling categories of air circulating fans such as industrial personnel coolers, box fans, and table fans fall within the definition of a ''fan'' as defined in the final determination published on August 19, 2021. NEEA asserted that DOE has the authority to develop an efficiency standard for these types of equipment. NEEA supports the development of efficiency standards and test procedures for these industrial equipment categories and recommended that DOE consider regulating other fans listed in AMCA 230–15 under the same standard and utilize the same test procedure. NEEA additionally commented that with this scope expansion, DOE has the potential to influence the market towards more efficient technologies where possible and could realize significant energy savings for these equipment categories. (NEEA, No. 11 at p. 2)

MEP recommended that the definition for an ACFH should include a requirement for polyphase electric current with a fan shaft power greater than 3 hp, to avoid including ''residential fans'' in regulations and to align ACFHs with the upper limit of the small electric motors hp range as presented in § 431.446(a). (MEP, No. 5 at p. 1)

In response to an energy conservation standards RFI published on February 8, 2022 (''February 2022 ECS RFI''; 87 FR 7048), ASAP, ACEEE, NRDC, and NEEA stated that, should very small-diameter (''VSD'') ceiling fans not be included in the scope of the ongoing ceiling fan rulemaking, DOE should cover them as ACFHs under the fans and blowers rulemaking. These commenters supported this by stating that, since the diameter-to-maximum operating speed ratios of VSDs are often less than 0.06, they would not qualify as ceiling fans according to the ceiling fan definition in the proposed ceiling fan scope, but would qualify as ACFHs. They also commented that VSDs and ACFHs have similar physical characteristics. (Docket No. EERE–2022–BT–STD–0002, ASAP, ACEEE, NRDC, and NEEA, No. 6 at pp. 2–3)

In response to the February 2022 ECS RFI, ebm papst stated that fan airflow rate can be reliably determined for air circulating fans using the AMCA 230 testing method, particularly for air circulating fans with an input power greater than 125 W. (Docket No. EERE–2022–BT–STD–0002, ebm-papst, No. 8 at p. 2)

AMCA 230–15 (with errata) does not include any limitation in terms of input power of the air circulating fans that can be tested in accordance with the test procedure. The AMCA committee is considering limiting the scope of AMCA 230–15 (with errata) to air circulating fans with input power of 125 W and above to focus on commercial and industrial fan applications and exclude residential fans such as tower fans and bladeless fans.

DOE has tentatively determined that the proposed test procedure would provide a representative measurement of energy use or energy efficiency during a representative average use cycle for all air circulating fans as defined as proposed in section III.B.4 of this document. Therefore, at this time, DOE proposes to include all categories of air circulating fans in the scope of the proposed test procedure; *i.e.,* including equipment with input power less than 125 W. Should DOE identify additional information to justify excluding fans with input power less than 125 W from the scope (or any other power limit that may be justified), DOE may consider applying a power limit in the final rule as considered by the AMCA committee and supported by stakeholders. In addition, DOE may consider specifying that the 125 W corresponds to the air circulating fan's input power at maximum speed.

MEP recommended that the scope of a DOE test procedure should only include products exclusively used to move air. MEP commented that products that perform additional combustion, humidification, dehumidification, heating, or cooling functions should be excluded from this test procedure. MEP added that the rationale for this recommendation is found in the foreword of AMCA 214–21, which states, ''AMCA Standard 214 primarily is for fans that are tested alone or with motors and drives; it does not apply to fans tested embedded inside of other equipment''. MEP also stated that fans used in supplementary electric heater products and portable electric heaters should also be excluded from the fan regulations, asserting that any inefficiencies of supplementary electric heater products and portable electric heaters would serve to provide heat to a space in addition to that which is supplied by a primary electric heater.[43] (MEP, No. 5 at p. 2)

DOE's proposed test procedure for air circulating fans, if finalized, would apply to the equipment that meets the definition of fan and blower. The air circulating fan would be tested in a standalone configuration (*i.e.,* not incorporated inside other equipment) in accordance with the proposed DOE test procedure, which would be based on AMCA 214–21.

DOE requests comments on the proposed scope of applicability of the test procedure for air circulating fans.

5. Non-Electric Drivers

Some fans operate with non-electric drivers, such as engines or generators, and such fans may be used in non-stationary applications or stationary applications. The Working Group recommended that DOE exclude fans that are exclusively powered by internal combustion engines from the test procedure and related energy conservation standards. (Docket No. EERE–2013–BT–STD–0006; No. 179, Recommendation #2, at p. 2)

AMCA 214–21 does not provide for the testing of fans and blowers powered by internal combustion engines. In order to measure the energy efficiency or energy use the energy performance of non-electric drivers during a representative average use cycle, separate test methods would be necessary for each type of driver (*e.g.,* engine, generators). DOE is not currently aware of a relevant industry test procedure and does not have information regarding the test set-up required to test fans powered by internal combustion engines. As such, DOE is not proposing test procedures for fans and blowers powered exclusively by an internal combustion engine at this time, regardless of whether such fan or blower is used in a stationary or non-stationary application.

Certain bare-shaft fans can be powered by either electric drivers (*i.e.,* motors) or non-electric drivers. DOE has tentatively determined that to the extent that such a fan is powered by an electric driver, the proposed test procedure would provide for measurement of the energy efficiency or energy use the

[42] As discussed in section I.A.4 of this document, ACFH have a maximum diameter-to maximum operating speed ratio of 0.06 inches per rotations per minute (''in/RPM'').

[43] MEP referenced Direct Heating equipment rulemakings: 85 FR 77017 and 86 FR 20053.

energy performance of non-electric drivers during a representative average use cycle when powered by an electric driver. As such, DOE is proposing that such a fan would be subject to the proposed test procedure.

DOE requests comment on excluding fans and blowers that are exclusively powered by internal combustion engines from the scope of this test procedure and associated energy conservation standards.

DOE requests feedback and information on the physical features that would help distinguish fans and blowers that are exclusively powered by internal combustion engines from other fans and blowers.

6. Replacement Parts

The Working Group did not address the issue of replacement parts in the term sheet. (Docket EERE–2013–BT–TP–0055; No. 179, Appendix F at p. 19).

Clarage commented that no exemptions should be made for replacement parts. (Docket EERE–2013–BT–STD–0006; Clarage, Public Meeting Transcript, No. 161 at p. 43) The CA IOUs commented that no exemptions should be made for replacement fans (Docket EERE–2013–BT–STD–0006; CA IOUs, Public Meeting Transcript, No. 163 at p. 185)

ebm-papst commented that replacements for identical fan models that are not compliant should be exempt from the regulation for no more than 5 years. (Docket EERE–2013–BT–STD–0006; ebm-papst, No. 152 at p. 3)

Several stakeholders commented that replacement fans for fans embedded in larger pieces of equipment should be exempted from the test procedure and energy conservation standard rulemaking. Ingersoll Rand/Trane commented that replacement fans used as components should be exempted. Ingersoll Rand/Trane stated that replacement fans under the new regulation may not be suitable for the existing equipment, and thus replacement of the equipment may be required in order for the fan to comply. In addition, Ingersoll Rand/Trane expressed safety concerns that could arise from using replacement fans on existing equipment that serves applications such as combustion air, or heating applications. (Docket EERE–2013–BT–STD–0006; Ingersoll Rand/Trane, No. 153 at p. 5) AHRI commented that replacement fans for fans embedded in equipment made before the compliance date should be exempt because the life of the equipment is longer than the life of the fan. In addition, AHRI noted that most replacement fan parts are supplied from the original equipment manufacturers and are not sold in a testable configuration; therefore the exemption of replacement fans is unlikely to create enforcement loopholes. (Docket EERE–2013–BT–STD–0006; AHRI, No. 158 at p. 7)

AMCA commented that no consensus was obtained amongst AMCA's membership regarding an approach for replacement fans. (Docket EERE–2013–BT–TP–0006; AMCA, Public Meeting Transcript, No. 164 at p. 325) In response to the October 2021 RFI, AHRI and Morrison commented that the scope of any fan regulation should be limited to standalone fans and should recognize the utility of replacement parts. These commenters stated that HVACR and water heating equipment are built, tested, rated, and certified as a completed design, which is reliant upon a specific set of components, and that modifying these components changes the performance of the equipment. AHRI and Morrison also commented that in many cases, such as supply air fans for gas fired heat exchangers, hot water coils or electric resistance units, there are a variety of equipment safety and performance standards affected by the precisely engineered fan performance. AHRI and Morrison stated that if a replacement fan is made non-compliant because of new regulations, the continued safe use of the system would be called into question and the negative consequences could be catastrophic. (AHRI, No. 10 at p. 3; Morrison, No. 8 at p. 2) Morrison commented that replacement parts used in HVAC equipment should therefore be out of scope for safety reasons. (Morrison, No. 8 at p. 2)

As discussed, fans and blowers as defined consist of an impeller, a shaft and bearings and/or driver to support the impeller, as well as a structure or housing. They may include a transmission, driver, and/or motor controller. The proposed test procedure would apply to the fan and blower as complete equipment (*i.e.,* inclusive of all the parts listed in the definition) and not to a single component of the fan (*e.g.,* the impeller alone). DOE proposes to include all fans and blowers that: (1) meet the criteria for scope inclusion as described in section III.A.1 of this document, and (2) are not proposed for exclusion as listed in section III.A.2 of this document or Table III–8 of this document, regardless of whether that fan is a replacement fan. DOE is not proposing to include fan parts (*e.g.,* impeller, housing) in the scope of the test procedure, as such components do not meet the definition of fan and blower. At this time, DOE is not proposing energy conservation standards for fans and blowers, and the proposed test procedure would not impact the availability of current models. The proposed test procedure, if final, would not set any energy conservation standards and would not result in any non-compliant fans.

B. Definitions

This section discusses DOE's proposed definitions for specific terms used in the proposed test procedure.

1. Fan and Blower Categories

DOE proposes to define several fan and blower categories to support the scope proposals described in section III.A of this document.

As previously discussed, the classification of fans and blowers recommended by the Working Group for coverage under a test procedure and the corresponding terms and definitions in AMCA 214–21 and in the CEC proposed regulations are presented in Table III–1 of this document. The CEC definitions are similar to the AMCA 214–21 definitions. The inclusion of additional language in the CEC definitions to indicate a fan's intended application or whether a fan's inlet or outlet is (optionally, as relevant) ducted is informative, but does not further distinguish the terms. In addition, for axial panel fans, the CEC definitions specifies that the housing is typically mounted to a wall separating two spaces, and the fans are used to increase the pressure across this wall. Inlets and outlets are not ducted.

DOE proposes to utilize the terminology and definitions specified in AMCA 214–21 to define the categories of fans and blowers proposed in the scope of applicability of the test procedure and tested using AMCA 210–16 as follows: (1) axial inline fan; (2) centrifugal housed fan; (3) centrifugal unhoused fan; (4) centrifugal inline fan; (5) radial-housed fan; and (6) PRVs. (See Table III–1 of this document). DOE proposes to modify the definition of axial panel fan as provided in AMCA 214–21 to distinguish these fans from air circulating axial panel fans.[44] The addition in the CEC definitions specifies that axial panel fans are typically mounted to a wall separating two spaces, and the fans are used to increase the pressure across this wall. This description distinguishes axial panel fans from axial air circulating panel fans, which do not have provisions for connection to ducting or separation of the fan inlet from its outlet. However,

[44] The AMCA 214–21 and CEC definitions for these terms appear in Table III–1 of this document.

the CEC distinction is based on how the fan is installed. Instead, DOE proposes to rely on physical features and to define axial panel fans as follows:

Axial panel fans means an axial fan, without cylindrical housing, that includes a panel, orifice plate, or ring with brackets for mounting through a wall, ceiling, or other structure that separates the fan's inlet from its outlet.

In addition, to support the exclusions proposed in section III.A.2 of this document, and clarify which fans would fall under the proposed exclusions. DOE proposes a definition of ''safety fan'', as discussed in section III.B.3 of this document. DOE also proposes to adopt definitions of the terms ''induced flow fan'' and ''jet fan'' as established in AMCA 214–21. In addition, DOE proposes to define ''cross-flow fan'' as defined in AMCA 208–18. See section III.A.2 of this document.

DOE requests comment on the definitions proposed for the following fan categories: (1) axial inline fan; (2) axial panel fan; (3) centrifugal housed fan; (4) centrifugal unhoused fan; (5) centrifugal inline fan; (6) radial-housed fan; and (7) PRVs, consistent with AMCA 214–21. If any of the definitions are not appropriate, DOE seeks input on how they should be amended and why.

DOE seeks input and comments on the proposed definitions of (1) induced flow fan, (2) jet fan, and (3) cross-flow fan consistent with AMCA 214–21 and AMCA 208–18. If any of the definitions are not appropriate, DOE seeks input on how they should be amended and why.

2. Basic Model

The basic model concept allows manufacturers to group like models for the purpose of making representations of energy efficiency and/or energy use, including for the purpose of demonstrating compliance with DOE's energy conservation standards to the extent DOE has established such standards. The concept of basic model may allow manufacturers to reduce the amount of testing they must do to rate the energy use or efficiency of their product. DOE's current regulations provide equipment-specific basic model definitions, which typically state that models within the same basic model group have ''essentially identical'' energy or water use characteristics; as well as a general definition that provides (with some exceptions noted in the regulatory text) that a basic model means ''all units of a given type of product (or class thereof) manufactured by one manufacturer, having the same primary energy source, and which have essentially identical electrical, physical, and functional characteristics that affect energy consumption, energy efficiency, water consumption, or water efficiency.'' *See for example* 10 CFR 430.2; 431.62, 431.152, 431.192, 431.202, 431.222, and 431.292.

DOE proposes to add a definition of basic model specific to fans and blowers that specifies a ''basic model'' as ''all units of fans and blowers manufactured by one manufacturer, having the same primary energy source, and having essentially identical electrical, physical, and functional (*e.g.,* aerodynamic) characteristics that affect energy consumption.''

Fan and blower manufacturers may offer for sale the same bare shaft fan assembled, packaged, or integrated with different motor, transmission, and control combinations. Based on DOE's proposed basic model definition, the same bare shaft fan, sold with different combinations of motor, transmission, and controls (or as a bare shaft fan) could be grouped under the same basic model. In addition, fan manufacturers would be able to elect to group similar individual fan models within the same basic model under the same ratings to reduce testing burden, provided that all representations regarding the energy use of fans within that basic model are identical and are based on the most consumptive unit. *See* 76 FR 12422, 12428–12429 (March 7, 2011).[45] Manufacturers would have the option to certify separate ratings for each combination of bare shaft fan, motor, transmission and/or control in order to make separate representations of the performance of each specific combination.

In view of the substantial number of fans that could be subject to an individual certification requirement for each basic model, the Working Group discussed various options to reduce the burden of certification when the basic models only differed in terms of a single bare shaft fan feature, *e.g.,* number of blades on the impeller, wheel width, or pitch angle as opposed to a different motor, transmission or control combination. (Docket No. EERE–2013–BT–STD–0006; Public Meeting Transcript, No. 162 at pp. 24–63. One option discussed was to only require testing and certifying a fan model based on a single value or setting of the bare shaft fan feature, and only publishing one rating for that fan model, without differentiating for the variations in the given bare shaft fan feature. However, because this would provide inaccurate performance information, this option was not further considered. (Docket No. EERE–2013–BT–STD–0006; Public Meeting Transcript, No. 162, at pp. 45–46)

A second option that was discussed was to require that manufacturers certify a limited number of basic models and provide DOE with a mathematical formula to enable interpolating results for non-certified models. However, because these formulas can be proprietary algorithms, this option was not further considered. (Docket No. EERE–2013–BT–STD–0006; Public Meeting Transcript, No. 162 at p. 38 and at p. 48)

A third option that was discussed was to require manufacturers to certify a limited number of basic models and to provide DOE with a statement that all other fan variations based on changing one of the bare shaft fan's features was also compliant. (Docket No. EERE–2013–BT–STD–0006; Public Meeting Transcript, No. 162 at pp. 48, 61) For example, a manufacturer would be required to certify one basic model at the feature-setting corresponding to the highest energy consumption and to submit to DOE a statement certifying that all other fan variations based on changing that one feature were also compliant. Another example would be to require manufacturers to certify the bounds of a range, for example maximum and minimum impeller width, and submit a statement that any fan model in between would be compliant. Under this option, manufacturers would still be allowed to make representations of the FEP and FEI of the non-certified basic models. (Docket No. EERE–2013–BT–STD–0006; Public Meeting Transcript, No. 162 at p. 61)

A fourth option discussed was to allow manufacturers to be able to submit an executable version of their selection programs to DOE for certification instead of submitting a separate compliance statement and certification report for each individual basic model, or variation of a basic model which would constitute a new basic model. In addition, because all manufacturers may not have a selection software, the Working Group discussed that the equivalent alternative would be to have to submit individual

[45] These provision would allow manufacturers to group individual models with essentially identical, but not exactly the same, energy performance characteristics into a basic model to reduce testing burden. Under DOE's certification requirements, all the individual models within a basic model identified in a certification report as being the same basic model must have the same certified efficiency rating and use the same test data underlying the certified rating. The March 7, 2011, final rule also established that the efficiency rating of a basic model must be based on the least efficient or most energy consuming individual model *(i.e.,* all individual models within a basic model must be at least as energy efficient as the certified rating). 76 FR 12422, 12428–12429.

certification statements and reports for each individual basic model and any of their variations that would constitute a new basic model. Test results for each basic model would need to be provided in a tabular format, with the possibility of replacing the tabular format by equations providing equivalent results (Docket No. EERE–2013–BT–STD–0006; Public Meeting Transcript, No. 162, at pp. 62–77)

This fourth and last option was the one recommended by the Working Group. (Docket No. EERE–2013–BT–STD–0006; No. 179, Recommendation #26, at p. 13) Specifically, AMCA recommended that DOE use a process similar to the Electronic Catalog Checking System (referred to as ''ECAT'') used by AMCA to check the validity of fans offered for sale in manufacturer selection programs. AMCA suggested that DOE use ECAT or a comparable system to evaluate selection software that represents what manufacturers offer for sale. (Docket No. EERE–2013–BT–STD–0006; AMCA, No. 168 at p. 2) AMCA added that their members are especially concerned with how manufacturers would certify fans with partial-width wheels and reiterated that their preference is to allow submission of selection software, or to tie each sale to a certified full width model with an AEDM to simplify certification of a modified certified fan after production. AMCA explained that very few partial-width wheel fans are likely to ever be produced twice, however, manufacturers offer them for sale using selection programs, displaying and documenting their performance to customers. (Docket No. EERE–2013–BT–STD–0006; AMCA, No. 169 at p. 5)

Some manufacturers may distribute in commerce a fan model that can be ''configured.'' For example, an adjustable-pitch axial fan of a given size may be offered at 30 different blade pitches. Similarly, a centrifugal fan of a given size may be offered in small increments of impeller widths and impeller diameters without changing the housing size. As each blade pitch angle is a variation of the same fan model, DOE proposes that all blade pitches of a certain size adjustable-pitch axial fan may be represented as a single basic model.

Similar to the approach taken for pumps for trimmed impellers (*see* 81 FR 4086, 4092–4093 (January 26, 2016), DOE proposes that, for centrifugal fans, manufacturers represent efficiency at the full-impeller width (*i.e.,* 100 percent impeller width) and full-impeller diameter (*i.e.,* 100 percent impeller diameter). Fan performance information is typically provided at 100 percent impeller width and 100 percent impeller diameter in manufacturer product literature. Additionally, DOE proposes that all variations of a given full-size impeller width and full-size impeller diameter may be considered to be part of a single basic model represented by the fan with the full-size impeller width and full-size diameter. As such, DOE proposes to define ''full-width impeller'' and ''full-diameter impeller'' as ''the maximum impeller width and the maximum impeller diameter with which a given fan basic model is distributed in commerce.'' The grouping of impeller diameter variation under the same basic model would not allow grouping of fans of different full-impeller size together. Rather, the proposal would capture small increments of impeller widths and impeller diameters (without changing the housing or structure of the fan). For example, if a manufacturer offers the same fan model in the following full-impeller sizes: 60, 70, 80, and 90 inches, each full-impeller size would constitute a separate basic model. However, a fan with an impeller trimmed to 69 inches could be grouped with the same 70-inch untrimmed fan.

In summary, DOE proposes to define ''basic model'' as meaning ''all units of fans and blowers manufactured by one manufacturer, having the same primary energy source, and having essentially identical electrical, physical, and functional (*e.g.,* aerodynamic) characteristics that affect energy consumption. In addition: (1) all variations of blade pitches of an adjustable-pitch axial fan may be considered a single basic model; and (2) all variations of impeller widths and impeller diameters of a given full-width impeller and full-diameter impeller centrifugal fan may be considered a single basic model.''

DOE believes this approach will address concerns expressed by commenters regarding the potentially large number of models that would need to be considered.

DOE requests comment on the proposed definition of basic model, with respect to fans and blowers.

3. Safety Fans

DOE proposes a definition of safety fan to support the exclusion for safety fans proposed in section III.A.2 of this document.

In the energy conservation standards framework document published February 1, 2013, DOE presented a definition for safety fans, as follows: ''an axial or centrifugal fan designed for use in applications requiring extra safety measures, such as: (a) those designed to operate in potentially explosive atmospheres; (b) those designed for emergency use only, at short-time duty, with regard to fire safety requirements; (c) those designed specifically to operate where the temperature of gases being moved exceed 500 °F; and (d) those designed for toxic, highly corrosive, or flammable environments with abrasive substances.'' (Docket No. EERE–2013–BT–STD–0006, No. 1, at p. 9) This definition was based on the European Commission Regulation No. EU 327/2011.[46]

The Working Group recommended to exclude safety fans and further included a recommended definition for these fans, consistent with the European definition as follows: fans designed for use in applications requiring extra safety measures, such as: (a) those designed to operate in potentially explosive atmospheres (''ATEX'' fans);[47] (b) those designed for emergency use only, at short-time duty, with regard to fire safety requirements (*e.g.,* smoke extraction fans, emergency reversible tunnel fans); (c) those designed specifically to operate where the temperature of gases being moved exceed 200 °F;[48] or (d) those designed for use in toxic, highly corrosive, or flammable environments [or in environments] with abrasive substances (*e.g.* NQ–1).[49] (Docket No. EERE–2013–

[46] The definition from the European Commission Regulation No. EU 327/2011 is provided in Article 1, Section 3 of the European Commission Regulation No. EU 327/2011 which defines safety fans as (1) Fans designed specifically to operate in potentially explosive atmospheres; (2) Fans designed for emergency use only, at short-time duty, with regard to fire safety requirements; (3) Fans designed specifically to operate: (a) Where temperatures of the gas being moved exceed 100 °C; (b) Where ambient temperatures for the motor, if located outside the gas airstream, driving the fan exceed 65 °C; (c) Where the annual average temperature of the gas being moved and/or the operating ambient temperature for the motor, if located outside the gas stream, are lower than −40 °C; (d) In toxic, highly corrosive or flammable environments or in environments with abrasive substances. *See eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32011R0327.*

[47] ATEX Directive 2014/34/EU covers equipment and protective systems intended for use in potentially explosive atmospheres or ''Atmosphere Explosive'' (''ATEX'').

[48] The temperature limit in the safety fan definition as written in the term sheet should have been of 200 °C (392 °F), and not 200 °F. As specified in the term sheet, the intent of the Working Group was to align the safety fan definition with the European definition. The limit of 200 °C corresponds to ''high temperature fans'' as defined in EN 12101–3:2002 ''Smoke and heat control systems. Specification for powered smoke and heat exhaust ventilators'', class F200 (resistant to 200 °C during 20 minutes) and to the ''T3'' temperature classification in NFPA 70 (National Electrical Code, NEC) article 500 and 505.

[49] Fans for nuclear applications were discussed during the July 21, 2015 meeting of the Working

Continued

BT–STD–0006; No. 179, Recommendation #2, at p. 2; No. 179, Appendix D, at p. 17)

To help identify safety fans, the Working Group relied on the description of physical characteristics, third party testing, or third party verification terms such as ATEX and NQA–1 to identify nuclear fans. The Working Group stated that the definition recommended in appendix D may be subject to potential edits necessary to accomplish the same intent. *Id.*

After publication of the term sheet, AMCA commented, with regard to safety fans, that fans for nuclear installations should be exempted from the rulemaking scope. (Docket No. EERE–2013–BT–STD–0006; AMCA, No. 169 at p. 3). In addition, AMCA noted that Working Group members agreed that the high temperature limit for fans should be set at 200 °C, rather than 200 °F, which is the temperature limit in the term sheet. (Docket No. EERE–2013–BT–STD–0006; AMCA, No. 169 at p. 4).

As discussed in section III.A.2 of this document, the exceptions to section 6.5.3.1.3 (''Fan Efficiency Requirements'') of ASHRAE 90.1–2019 related to safety fans include: fans used for moving gases at temperatures above 482 °F (equivalent to 250°C); reversible fans used for tunnel ventilation; and fans that are intended to only operate during emergency conditions.

The CEC has proposed the following definition of safety fan: (1) a fan that is designed and marketed to operate only at or above 482 °F (250 °C); (2) a reversible axial fan in cylindrical housing that is designed and marketed for use in ducted tunnel ventilation that will reverse operations under emergency ventilation conditions; (3) a fan bearing an Underwriter Laboratories or Electric Testing Laboratories listing for ''Power Ventilators for Smoke Control Systems''; (4) an open discharge exhaust fan with integral discharge nozzles which develop or maintain a minimum discharge velocity of 3000 feet per minute (''FPM''); (5) a fan constructed in accordance with AMCA type A or B spark resistant construction as defined in ANSI/AMCA Standard 99–16 Standards Handbook; (6) a fan designed and marketed for use in explosive atmospheres and tested and marked according to EN 13463–1:2001 Non-electrical Equipment for Potentially Explosive Atmospheres; or (7) an electric-motor-driven- Positive Pressure Ventilator as defined in ANSI/AMCA Standard 240–15 Laboratory Methods of Testing Positive Pressure Ventilators for Aerodynamic Performance Rating.[50]

Regarding item (1) of the CEC definition, the temperature limit in the CEC definition is 250 °C, compared to 200 °C recommended in the term sheet. This higher temperature aligns with the exceptions to Section 6.5.3.1.3 of ASHRAE 90.1–2019 ''Fan Efficiency Requirements,'' which excludes fans used for moving gases at temperatures above 482 °F (equivalent to 250°C). Items (2), (3), (5),[51] and (6) of the CEC definition describe fans that are used in explosive atmospheres or for smoke extraction. Item (4) of the CEC definition includes the minimum discharge velocity of 3000 FPM, which corresponds to the minimum safe discharge velocity per ANSI Z9.5–2012 ''Laboratory Ventilation,'' [52] which describes fans that are used in laboratory environments. Finally, item (7) of the CEC definition, which relates to positive pressure ventilator fans, describes fans that are used (typically by firefighters) to remove heat and combustion products from a structure. Positive pressure ventilator fans are excluded from AMCA 210–16 and are tested per AMCA 240–15, Laboratory Methods of Testing Positive Pressure Ventilators for Aerodynamic Performance Rating.

Based on a review of the existing industry and regulatory definitions of ''safety fan,'' DOE has tentatively determined that the definition proposed by the CEC is representative of the equipment considered ''safety fans''; *i.e.,* fans that can operate at high temperatures, fans that are used in explosive atmospheres or for smoke extraction, fans that are used in laboratory environments, and fans used to remove heat and combustion products from a structure. Therefore, DOE proposes to adopt a definition in line with the definition proposed by the CEC with the following edits. Regarding item (1) of the CEC definition: DOE proposes not to include the term ''only'' from ''a fan that is designed and marketed to operate only at or above 482 degrees Fahrenheit (250 degrees Celsius)'' because DOE has tentatively determined that a fan that can operate at or above a certain temperature can also operate below. Regarding item (4) DOE has tentatively determined that the definition of safety fans is equivalent to ''laboratory exhaust fans'' as defined in Section 3.52 of AMCA 214–21: fans designed and marketed specifically for exhausting contaminated air vertically away from a building using a high-velocity discharge. DOE is considering replacing item (4) with ''laboratory exhaust fans'' and to define it in accordance with AMCA 214–21. DOE also reviewed item (6) and notes that the referenced industry standard is no longer current has been replaced. In 2008, the International Electrotechnical Commission System for Certification to Standards Relating to Equipment for Use in Explosive Atmospheres replaced EN 13463–1 by ISO 80079–36,'' Explosive atmospheres—Part 36: Non-electrical equipment for explosive atmospheres—Basic method and requirements''.[53] The latest version of ISO 80079–36 is the 2016 edition. Therefore, DOE proposes to reference ISO 80079–36:2016, instead of EN 13463–1:2001. In addition, DOE notes that AMCA 230–15 is under review and DOE proposes to update the reference to the latest version of AMCA 230 available at the time of publication of the test procedure final rule.

DOE requests comments on its proposed definition of safety fans. Specifically, DOE requests comments in whether item (4) of the CEC definition of safety fans is equivalent to ''laboratory exhaust fans'' as defined in Section 3.52 of AMCA 214–21.

4. Air Circulating Fans

In the October 2021 RFI, DOE published a request for information regarding potential test procedures for fans and blowers, specifically for air circulating fans and ACFHs. 86 FR 54412. DOE noted that Section 5.1 of AMCA 230–15 defines an ''air circulating fan'' as ''a non-ducted fan used for the general circulation of air within a confined space.'' 86 FR 54412, 54414. Further, AMCA 230–15 classifies ACFHs as a category of air circulating

Group. (Docket No. EERE–2013–BT–STD–0006, No. 161, Public Meeting transcript, at p. 75) There was a typographic error in the public meeting transcript and the term sheet. The intent of ''NQ–1'' as written in the term sheet was to refer to nuclear fans and refers to ''NQA–1'' or fans that meet the requirements in American Society of Mechanical Engineering (''ASME'') NQA–1 certification program ''Quality Assurance Requirements for Nuclear Facility Applications.''

[50] See CEC Docket No. 22–AAER–01, TN # 241950, Proposed regulatory language for Commercial and Industrial Fans and Blowers, at pp. 7–8.

[51] Fan applications with airstreams of explosive or flammable particles or gases require spark resistant construction in accordance with AMCA spark resistant specifications as described in ANSI/AMCA Standard 99–16 ''Standards Handbook''. Spark resistant construction is intended to prevent any two or more fan components from generating sparks within the airstream by rubbing or striking during operation. AMCA 99–16 defines three classes of spark construction resistant constructions: A, B and C, with level C being the ''entry level'' and level A offering the highest degree of spark resistance.

[52] ANSI/AIHA/ASSE Z9.5–2012, ''Laboratory Ventilation'' provides laboratory ventilation requirements and practices.

[53] *See www.intertek.com/blog/2019-03-14-hazloc/.*

fans and defines ACFHs in Section 5.1.1 of AMCA 230–15 as follows: ''an assembly consisting of a motor, impeller and guard for mounting on a pedestal having a base and column, wall mount bracket, ceiling mount bracket, I-beam bracket or other commonly accepted mounting means.'' Section 5.1.1 of AMCA 230–15. DOE noted that Section 3.15 of AMCA 214–21 defines the term ''circulating fan'' as ''a fan that is not a ceiling fan that is used to move air within a space that has no provision for connection to ducting or separation of the fan inlet from its outlet. The fan is designed to be used for the general circulation of air.'' *Id.* DOE also noted that AMCA 214–21 does not include a definition for ACFH. *Id.* DOE requested feedback on the definitions of air circulating fan and ACFHs as provided in AMCA 230–15, and of other categories of air circulating fans (*i.e.,* personnel coolers, box fans, and table fans). 86 FR 54412, 54414.

AMCA commented that it did not support using the AMCA 230–15 definition of ''air circulating fan'' because it had been updated in AMCA 214–21. In addition, AMCA recommended adding ''air'' to the defined term (*i.e.,* ''air circulating fan''). (AMCA, No. 6 at p. 3)

In response to the February 2022 ECS RFI, ebm papst commented that the descriptions of the different types of ACFs in AMCA 230 were not intended to be used for delineating ACFs into different classes in DOE regulations. (Docket No. EERE–2022–BT–STD–0002, ebm-papst, No. 8 at p. 2)

Since the end of the comment period, the AMCA 230 committee [54]has been considering a revised definition of air circulating fan as follows: a fan that has no provision for connection to ducting or separation of the fan inlet from its outlet using a pressure boundary, operates against zero external static pressure loss, and is not a jet fan (as defined in AMCA 214–21).

DOE reviewed the definition of ''air circulating fan'' in AMCA 214–21 and notes that the description of the intended application is unnecessary and may create confusion with the proposed ceiling fan definition, as discussed further in this section. In addition, as noted previously, DOE does not consider ceiling fans as fans and blowers, and therefore ceiling fans are not included as ''air circulating fans''. For this reason, DOE has determined that it is unnecessary to specify that an air circulating fan is not a ceiling fan within the definition of air circulating fan. DOE also reviewed the definition being considered by the AMCA 230 committee which adds the following terms '' using a pressure boundary'' and ''operates at zero static pressure'' to further specify that air circulating fans do not have any provision for connection to ducting or separation of the fan inlet from its outlet that would create a static pressure differential between the inlet and the outlet of the fan. In addition, DOE agrees that jet fans should be excluded as discussed in section III.A.2 of this document.

Therefore, DOE proposes to define air circulating fan using the definition being considered by the AMCA 230 committee as it provides further specificity and proposes to define air circulating fans as ''a fan that has no provision for connection to ducting or separation of the fan inlet from its outlet using a pressure boundary, operates against zero external static pressure loss, and is not a jet fan.''

Air circulating fans exist in different configurations depending on the impeller design (axial or centrifugal), presence or absence of a guard and/or housing, and the shape of the housing. As discussed, AMCA 230–15 (with errata) includes the following equipment categories discussed in the remainder of this section: (1) ACFHs; (2) personnel coolers; (3) box fans; and (4) table fans.

In response to the October 2021 RFI, AMCA commented that it does not support DOE using the AMCA 230–15 definition of ACFH because AMCA believes the definition seems insufficient to distinguish ACFHs from ceiling fans. AMCA additionally commented that because ACFHs can be sold with mounting kits for installation onto ceilings, I-beams, or other overhead structures, there is confusion in the industry as to whether they meet the statutory definition of ceiling fan. Instead, AMCA recommended adopting a modified ACFH definition as follows: ''An assembly consisting of a motor, impeller and guard for mounting on a pedestal having a base and column, wall mount bracket, ceiling mount bracket, I-beam bracket or other commonly accepted mounting means. ACFH do not have housings with solid walls, such as tubes, boxes or panels. An ACFH has a maximum value of diameter-to-maximum-operating-speed ratio (*e.g.,* 0.06 inches per rotations per minute (''in/RPM'')) to distinguish ACFH from ceiling fans. ACFH are known by other names in the various industries in which they are used, including basket fan, horizontal-airflow fan, and stir fan''. AMCA suggested that the revisions would ensure the definition separates ACFHs from other types of air circulating fans and that including the maximum-value threshold of 0.06 in/RPM would separate ACFHs from ceiling fans. AMCA additionally commented that the suggested revisions further highlight alternative names for ACFHs used in industry. (AMCA, No. 6 at p. 4) AMCA also provided supporting analysis of the performance data of 178 models of air circulating fan heads, all of which had a diameter-to-maximum-operating-speed ratio less than 0.06 in/RPM, as recommended in the ACFH definition. (AMCA, No. 6 at p. 5)

The CA IOUs recommended that DOE add the following sentence to the definition of ACFH to the existing definition in AMCA 230–15 to distinguish ACFHs from ceiling fans and other air circulating fans such as personnel and livestock coolers: ''ACFHs do not have housings with solid walls such as tubes, boxes, or panels. An ACFH has a maximum value of diameter-to-maximum operating speed ratio of 0.06 in/RPM (inch per revolution per minute)''. The CA IOUs explained that the addition would clarify that ACFHs are basket-type fans that do not have solid housings. (CA IOUs, No. 9 at pp. 1–2)

NEEA commented in support of AMCA's analysis of the existing market and of using 0.06 in/RPM as the maximum value for ACFHs. (NEEA, No. 11 at p.1)

AHRI supported the explicit inclusion of ACFHs under fans and blowers, with modifications to the definition of ACFHs as recommended by AMCA. AHRI commented in support of AMCA's proposed additions to the ACFH definition to specify that an ACFH ''do(es) not have housings with solid walls, such as tubes, boxes or panels.'' AHRI commented that the inclusion of this text is important, stating that it not only helps define the product, but it also clearly fits within the scope of AMCA 214–21. AHRI stated that AMCA 214–21 specifies that ''AMCA Standard 214 primarily is for fans that are tested alone or with motors and drives; it does not apply to fans tested embedded inside of other equipment,'' and as such, that it is only necessary to regulate standalone fans. (AHRI, No. 10 at p. 2)

MEP commented that broad definitions result in significant and undue burden on manufacturers that use any type of fan in any of their products, as those manufacturers have to evaluate each product against each proposed aspect of each step in the regulatory process. MEP recommended that DOE establish ACFH as a product

[54] A technical Committee was formed to review AMCA 230–15. For more information see *https://www.cognitoforms.com/AMCA1/_230TechnicalCommitteeInvitation10132021.*

category of fans as defined at 10 CFR 431.172 with the following definition: ''ACFHs are fans powered by poly-phase electric current with a fan shaft power greater than 3 hp and which only provide concentrated directional airflow and where the construction consists of a motor, impeller, guard, and may include connections for mounting or support and which are exclusive of other covered products or fans embedded inside of other equipment or products.'' MEP commented that the definition of ceiling fan is obvious and exclusionary from an ACFH. MEP further stated that AMCA recognizes the definition of ''embedded fan'' in Section 3.25.4 of ANSI/AMCA 214–21 as ''a fan that is part of a manufactured assembly where the assembly includes functions other than air movement'' and recommended that DOE include this qualification in the Federal definition of ACFH to clarify the separation between ceiling fans and other products that use fans for purposes other than air circulation (*e.g.,* combustion, humidification, dehumidification, heating, or cooling to name a few). (MEP, No. 5 at p. 1) .

Since the end of the comment period, the AMCA 230 committee has considered a revised definition of ACFH, under the term ''ACFH, unhoused'' as follows: an air circulating fan without housing, having an axial impeller with a ratio of fan-blade span (in inches) to maximum rate of rotation (in revolutions per minute) less than or equal to 0.06. The impeller may or may not be guarded.

On December 7, 2021, DOE published a supplemental notice of proposed test procedures for ceiling fans. 86 FR 69544 (''December 2021 Ceiling Fans SNOPR''). In the December 2021 Ceiling Fans SNOPR, DOE proposed a definition of ceiling fan that specifies the term ''circulating air'' based on diameter-to-maximum operating speed ratio: a fan for ''circulating air'' is one with a ratio of fan blade span (in inches) to maximum rotation rate (in revolutions per minute) greater than 0.06. 86 FR 69544, 69551. To support this proposed definition, DOE performed an independent analysis and tentatively determined that ACFHs have a diameter-to-maximum operating speed ratio of less than or equal to 0.06 in/RPM. 86 FR 69544, 69550.

ACFHs are air circulating fans without a housing (*i.e.,* cylindrical housing, box housing, or panel). They have an axial impeller which is typically surrounded by a guard and are commonly called ''basket fans''. Therefore, the added specification of ''unhoused'' in the definition from the AMCA 230 committee is helpful to further distinguish these fans. DOE reviewed comments from stakeholders and has tentatively determined that the definition being considered by the AMCA 230 committee would address stakeholder comments and would ensure that ACFH are distinguished from other types of fans and blowers and air circulating fans. Therefore, DOE proposes to define an unhoused ACFH as follows: ''An air circulating fan without housing, having an axial impeller with a ratio of fan-blade span (in inches) to maximum rate of rotation (in revolutions per minute) less than or equal to 0.06. The impeller may or may not be guarded. '' The 0.06 in/RPM threshold is appropriate to differentiate ACFHs from ceiling fans and aligns with the December 2021 Ceiling Fans SNOPR. In addition, the additional description of the absence of a housing would ensure that ACFHs are distinguished from other categories of fans and blowers and air circulating fans. Table fans would be included in the proposed definition of unhoused ACFHs.

As previously noted, air circulating fans also come with housings. To describe air circulating fans with housings, the AMCA 230 committee is considering a definition of housed ACHFs as: an air circulating fan with an axial or centrifugal impeller, and a housing. DOE has tentatively determined that the definition considered by the AMCA 230 committee accurately describes all categories of equipment that fall under housed ACFHs, therefore, DOE proposes to adopt the definition established by the AMCA 230 committee. The AMCA 230 committee is further considering establishing definitions for four categories of housed ACFHs, as follows: (1) an air circulating axial panel fan means an axial air circulating fan without a cylindrical housing or box housing that is mounted on a panel, orifice plate or ring (also commonly known as panel fan, cow cooler, livestock cooler); (2) a box fan means an axial air circulating fan without a cylindrical housing that is mounted on a panel, orifice plate or ring and is mounted in a box housing; (3) a cylindrical air circulating fan means an axial air circulating fan in a cylindrical housing that is not a positive pressure ventilator (''PPV'') (also commonly known as personnel cooler, barrel fan, drum fan, high velocity fan, portable cooler, thermal mixing fan, destratification fan, downblast fan); and (4) a housed centrifugal air circulator means a fan with a centrifugal or radial impeller in which airflow exits into a housing that is generally scroll shaped to direct the air through a single, narrow fan outlet (also commonly known as utility blower, loading dock fan, carpet dryer, floor fan).

DOE reviewed additional air circulating fans with housing distributed in commerce and has tentatively identified four categories of air circulating fans based on the blade design (*i.e.,* axial or centrifugal) and housing configuration (*i.e.,* panel, box, cylindrical, or scroll shaped), matching the equipment segmentation considered by the AMCA 230 committee. In addition, as discussed in section III.B.3, DOE proposes to exclude PPVs and proposes to add this clarification when defining cylindrical air circulating fans. DOE has tentatively determined that the definitions considered by the AMCA 230 committee accurately describes the four categories of equipment that DOE identified as meeting the definition of housed ACFH. Therefore, DOE proposes to adopt the definitions of air circulating axial panel pan, box fan, cylindrical air circulating fan, and housed centrifugal air circulator as considered by the AMCA 230 committee, with the following clarifications: (1) DOE proposes to replace ''air circulating fan'' by ''housed air circulating fan head'' to explicitly indicate that each of these fans are housed ACFHs; (2) replace the term ''circulator'' by '' circulating fan'' for consistency in terminology; (3) remove the examples of additional terms used commonly by industry. Personnel coolers (as defined in AMCA 230–15 (with errata)) would be included under the proposed cylindrical air circulating fan definition.

In response to the February 2022 ECS RFI, the CA IOUs commented that DOE should include panel fans as ACFs and that panel fans are often used as ACFs for air circulation and cooling for residential, commercial, and agricultural spaces. They also stated that most of the ACFs in the Bioenvironmental and Structural System Lab (''BESS Lab'') database are panel fans. (Docket No. EERE–2022–BT–STD–0002, CA IOUs, No. 7 at p. 5–6) ebm papst recommended that the DOE test procedure should clearly state that basket fans (consisting of a motor, axial impeller, and a basket-style guard that partially or completely encloses the rotating parts) should be tested according to AMCA 230. (Docket No. EERE–2022–BT–STD–0002, ebm-papst, No. 8 at p. 2)

As noted previously, DOE proposes to include axial panel air circulating fan as a category of housed ACFH. In addition, DOE notes that basket fans meet the proposed definition of unhoused ACFH and would therefore be tested in accordance with AMCA 214–21, referencing AMCA 230–15 (with errata) and modifications proposed in this notice.

For all definitions related to air circulating fans, DOE is aware that the revisions being considered by the AMCA 230 committee are subject to change and could further be revised in the next version of AMCA 230. Should the revised version of AMCA 230 publish prior to the publication of any DOE test procedure final rule, DOE intends, after considering stakeholder feedback received in response to the proposals in this document, to revise the definitions in line with the latest AMCA 230 standard, provided the updates in this standard are consistent with the definitions DOE is proposing in this NOPR or the updates are related to topics that DOE has discussed and for which DOE has solicited comments in this NOPR.

DOE requests comment on the proposed definitions for air circulating fan and related terms.

5. Definitions Related to Heat Rejection Equipment

As stated, DOE is proposing to exclude from the scope of the test procedure fans and blowers exclusively embedded in heat rejection equipment, specifically fans and blowers exclusively embedded in packaged evaporative open circuit cooling towers; evaporative field-erected open circuit cooling towers; packaged evaporative closed-circuit cooling towers; evaporative field-erected closed-circuit cooling towers; packaged evaporative condensers; field-erected evaporative condensers; packaged air-cooled (dry) coolers; field-erected air-cooled (dry) cooler; air-cooled steam condensers; and hybrid (water saving) versions of such listed equipment that contain both evaporative and air-cooled heat exchange sections. The Working Group provided the following definitions for these equipment:

• *Packaged evaporative open-circuit cooling tower:* a device which rejects heat to the atmosphere through the direct cooling of a water stream to a lower temperature by partial evaporation;

• *Evaporative field erected open-circuit cooling tower:* a structure which rejects heat to the atmosphere through the direct cooling of a water stream to a lower temperature by partial evaporation;

• *Packaged evaporative closed-circuit cooling tower:* a device which rejects heat to the atmosphere through the indirect cooling of a process fluid stream in an internal coil to a lower temperature by partial evaporation of an external recirculating water flow;

• *Evaporative field erected closed-circuit cooling tower:* a structure which rejects heat to the atmosphere through the indirect cooling of a process fluid stream to a lower temperature by partial evaporation of an external recirculating water flow;

• *Packaged evaporative condenser:* a device which rejects heat to the atmosphere through the indirect condensing of a refrigerant in an internal coil by partial evaporation of an external recirculating water flow;

• *Field erected evaporative condenser:* a structure which rejects heat to the atmosphere through the indirect condensing of a refrigerant in an internal coil by partial evaporation of an external recirculating water flow;

• *Packaged air-cooled (dry) cooler:* a device which rejects heat to the atmosphere from a fluid, either liquid, gas or a mixture thereof, flowing through an air-cooled internal coil;

• *Field erected air-cooled (dry) cooler:* a structure which rejects heat to the atmosphere from a fluid, either liquid, gas or a mixture thereof, flowing through an air-cooled internal coil; and

• *Air-cooled steam condensers:* a device for rejecting heat to the atmosphere through the indirect condensing of steam inside air-cooled finned tubes. (Docket No. EERE–2013–BT–STD–0006, No. 179, Recommendation #2, at pp. 2–3)

As discussed in of this document. DOE proposes to exclude fans exclusively embedded in heat rejection equipment, consistent with the recommendation of the Working Group. To support these exclusions, DOE proposes to adopt definitions of the terms used to specify the relevant heat rejection equipment. The proposed definitions are based on the recommendations of the Working Group. (Docket No. EERE–2013–BT–STD–0006, No. 179, Recommendations #2, at pp. 2–3)

DOE requests comment on the proposed definitions related to heat rejection equipment.

6. Outlet Area

The equations in Section A.2 of AMCA 208–18, discussed in section III.D.10 of this document, require determination of the fan outlet or discharge area. Section 5.5.4 of AMCA 230–15 (with errata), defines the discharge area as the area of a circle having a diameter equal to the blade tip diameter. DOE notes that this definition is only applicable to unhoused ACFHs as the discharge area of a housed ACFH is determined based on the surface area at the exit of the housing and is not based on the fan blade tip diameter. In contrast, Section 3.57 of AMCA 214–21 provides the following definition of outlet area: the area in contact with the fan's outlet. AMCA 99–16 provides the following definitions of fan outlet and fan outlet area: (1) fan outlet means the plane perpendicular to the airstream at the outlet opening of the fan or the manufacturer-supplied evasé or diffuser; (2) fan outlet area means the gross inside area measured at the plane of the outlet opening. For a roof ventilator, it is the gross impeller outlet area for centrifugal types or the gross housing area at the impeller for axial types (see Section 0066 of AMCA 99–16).

The AMCA 230 committee is considering revising the definition of discharge area to include housed ACFHs, and to replace the term ''discharge area'' by ''fan outlet area'', which is a more commonly used term. In addition, the AMCA committee is considering adding diagrams to further clarify how the fan outlet area should be determined for housed ACFHs.

In this NOPR, DOE is proposing a definition for fan outlet area specific to air circulating fans as (*i.e.*, ''air circulating fan outlet area''): (1) for unhoused ACHFs, the area of a circle having a diameter equal to the blade tip diameter; (2) for housed ACFHs, the inside area perpendicular to the airstream, measured at the plane of the opening through which the air exits the fan.

For fans and blowers other than air circulating fans, DOE notes that Annex H of AMCA 210–16 includes requirements for determining where the fan outlet area is measured for different fan categories and also references AMCA 99–16, which includes further diagrams to aid in the determination of the outlet area. DOE has tentatively determined that for fans and blowers other than air circulating fans, the current definition in AMCA 214–21 and the existing requirements in Annex H of AMCA 210–16 are sufficient to determine the outlet area and is not proposing edits. Should DOE receive comments that additional specifications are required, DOE may consider revising the definition of outlet area for fans and blowers other than air circulating fans.

DOE requests comment on its proposed definition of air circulating fan outlet area. DOE additionally requests comment on whether the definition of outlet area for fans and blowers other than air circulating fans should be revised and, if so, how.

C. Industry Standards

DOE's established practice is to adopt industry standards as DOE test procedures, unless such methodology would be unduly burdensome to conduct or would not produce test results that reflect the energy efficiency, energy use, water use (as specified in EPCA) or estimated operating costs of that product during a representative average use cycle. 10 CFR 431.4; 10 CFR part 430 subpart C appendix A section 8(c).

The Working Group recommended that the test procedure for commercial and industrial fans:

(1) For standalone (non-embedded) fans, be based on a physical test performed in accordance with the latest version of AMCA 210 (*i.e.,* available at the time of publication of any test procedure final rule) (Docket No. EERE–2013–BT–STD–0006, No. 179, Recommendation #7, at p. 5); [55]

(2) Establish methods to determine the ''FEP'' either by: the direct measurement of the electrical input power to the fan, or by the measurement of the mechanical input power to the fan (*i.e.,* a fan shaft power test, which captures the performance of the bare-shaft fan) and by applying default values (*i.e.,* calculation algorithms) to reflect the additional motor, transmission, or motor controller energy use (Docket No. EERE–2013–BT–STD–0006, No. 179, Recommendation #9, at pp. 5–6); and [56]

(3) Allow the use of equations (''fan laws'') to determine the performance of a bare-shaft fan at a non-tested speed, based on the results of a test conducted at a different speed. (Docket No. EERE–2013–BT–STD–0006, No. 179, Recommendation #17, at p. 10)

The Working Group also recommended specific test set-up and minimal testable configurations to use for each fan category.[57] (Docket No. EERE–2013–BT–STD–0006, No. 179, Recommendation #7, at p. 5)

The Working Group further made recommendations on calculation algorithms and reference values to use to represent the motor, transmission, and motor controller energy efficiency when testing a fan based on a fan shaft power test. (Docket No. EERE–2013–BT–STD–0006, No. 179, Recommendations #10 through #15, at pp. 6–9) Additionally, the Working Group recommended that embedded fans be tested in a standalone fan configuration (*i.e.,* outside of the piece of equipment in which they are embedded). Because some components of embedded fans may not be removable without causing irreversible damage to the equipment, the Working Group recommended non-impeller components of the fan that are geometrically similar to the ones used by the fan as embedded in the larger piece of equipment be used to complete the fan testable configuration. (Docket No. EERE–2013–BT–STD–0006, No. 179, Recommendation #8, at pp. 5–6) The Working Group also recommended calculating FEP as the ratio of the electrical input power of a reference fan (in this case, a fan that is exactly compliant with any future fan energy conservation standards) to the electrical input power of the actual fan for which the FEP is calculated, both established at the same duty point.[58] In addition, the Working Group recommended using either static or total pressure [59] to characterize the duty point of a fan and to calculate the associated reference FEP, depending on the fan category and the test set-up used.[60] (Docket No. EERE–2013–BT–STD–0006, No. 179, Recommendations #18, #19, at pp. 10–11) Finally, the Working Group recommended equations and default values to use when calculating the reference FEP of a fan at a given duty point. (Docket No. EERE–2013–BT–STD–0006, No. 179, Recommendations #18 through #21, at pp. 10–12)

Since the publication of the term sheet, AMCA has revised and developed test standards consistent with the recommendations of the Working Group:

• In September 2016, AMCA published AMCA 210–16, which updated ANSI/AMCA 210–2007, ''Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating'', to include a wire-to-air test method, which captures the performance of any motor, transmission, or motor controller present in the fan, in addition to the performance of the bare-shaft fan (*i.e.,* a measurement of the FEP in kW), in addition to the previously existing methods for conducting laboratory tests to determine fan shaft power in hp, airflow in cubic feet per minute (''cfm''), pressure in inches of water gauge (''in. wg.''), and at a given speed of rotation in ''RPM''.

• In April 2017, AMCA published ANSI/AMCA Standard 207–2017 ''Fan System Efficiency and Fan System Input Power''. This publication provides calculation algorithms representing the performance of reference motors, transmissions, and motor controllers. These calculations can be directly applied to the results of a fan shaft power test in accordance with AMCA 210–16 to obtain the FEP of a fan at a given duty point.

• In January 2018, AMCA published ''AMCA 208–18''. This publication defines FEI as the ratio of the electrical input power of a reference fan to the electrical input power of the actual fan for which FEI is calculated, both established at the same duty point. It provides equations to calculate the FEP of a fan of as a function of airflow and pressure (either static or total depending on the fan category considered).

Building on these test standards, AMCA developed a new AMCA 214–21 test method which was approved by ANSI on March 1, 2021. AMCA 214–21 combines provisions of AMCA 210–16, AMCA 207–17, and AMCA 208–18, as well as portions of AMCA 211–13 (R2018), ''Certified Ratings Program Product Rating Manual for Fan Air Performance'' (''AMCA 211–13''), into a single standard.[61] Consistent with the recommendations of the Working Group, AMCA 214–21 provides methods to establish the FEP either by: (1) the measurement of the electrical input power to the fan (*i.e.,* a ''wire-to-air'' test); or by (2) the measurement of the fan shaft power and the application

[55] Currently the latest version of AMCA 210 is AMCA 210–16.

[56] A bare-shaft fan is a fan without a motor or any other drive.

[57] AMCA 214–21 references AMCA 210–2016 as the physical test method to use for fans and blowers (except ACFHs). AMCA 210–16 describes four fan test set-ups (or ''installation categories'') designated by a letter, depending on the ducting at the inlet and outlet of the fan. ''A'': free inlet, free outlet; ''B'': free inlet, ducted outlet; ''C'': ducted inlet, free outlet; and ''D'': ducted inlet, ducted outlet.

[58] A duty point is characterized by a given airflow and pressure and has a corresponding operating speed.

[59] Fan total pressure is the air pressure that exists by virtue of the state of the air and the rate of motion of the air. It is the sum of velocity pressure and static pressure at a point. If air is at rest, its total pressure will equal the static pressure.

[60] Depending on the fan category, the fan performance is represented using a test set-up with a ducted outlet (*i.e.,* using total pressure) or a free outlet (*i.e.,* using static pressure) to reflect typical usage conditions. Fans with ducts attached to the fan's outlet are typically selected based on their performance at a given airflow and total pressure, because both the static pressure and fan velocity pressure are available to overcome system resistance. However, fans with a free outlet are typically selected based on their performance at a given airflow and static pressure, because the velocity pressure cannot be used to overcome system resistance. The Working Group recommended using total pressure for some categories of fans (*i.e.,* axial cylindrical housed fans, centrifugal housed fans, inline and mixed flow fans, and radial housed fans) and static pressure for others (*i.e.,* panel fans, centrifugal unhoused fans, and PRVs).

[61] AMCA 211–13 provides instructions on how to apply fan laws and on how to perform a test when establishing an AMCA-certified rating. Some of these instructions were revised and integrated in AMCA 214.

of calculation algorithms to reflect additional motor, transmission, or control energy use. In each case, the fan power measurements are performed in accordance with AMCA 210–16 or ISO 5801:2017, which is referenced in AMCA 214–21 as an equivalent test procedure to AMCA 210–16. AMCA 214–21 also references laboratory test methods for additional categories of fans such as jet fans, circulating fans, and induced flow fans.[62] Specifically, AMCA 214–21 references AMCA 230–15 [63] as the industry test procedure to follow when conducting performance measurements on air circulating fans. In addition, AMCA 214–21 adds specific test instructions to ensure test repeatability and reproducibility. Specifically, AMCA 214–21 defines a single set of test set-ups that must be used when conducting a test to ensure comparability of results (*See* Table III–9). Further, AMCA 214–21 specifies how to select the speed(s) and duty points at which to conduct the test, as well as which accessories to include in the test (*See* Table III–10).

Section 6.3.1 of AMCA 214–21 provides specific equations to be used for bare-shaft fans that can only accommodate a direct-drive transmission (*i.e.,* fans that are directly coupled to the drive). (See DOE's request for comment at the end of this section requesting information on the physical features that could be identified to differentiate bare-shaft fans that can accommodate only a direct-drive transmission from other bare-shaft fans).

AMCA 214–21 establishes the FEP metric, measured in kW, and the FEI metric.[64] FEI is calculated as the ratio of the electrical input power of a reference fan (in this case, a fan with electrical input power calculated using the equations provided in Section 5 of AMCA 214–21) to the electrical input power of the actual fan for which the FEI is calculated, both established at the same duty point. AMCA 214–21 specifies different measurement methods to obtain the FEP and FEI of a fan depending on whether the fan includes a motor (polyphase regulated [65] or not), transmission, or motor controller. (*See* Table III–10). The methods included in AMCA 214–21 are designed to provide flexibility and reduce test burden. Specifically, AMCA 214–21 includes methods to reduce the number of speeds at which the manufacturer performs a test:

• Annex G of AMCA 214–21 allows manufacturers to reduce the number of speeds selected for testing by applying an interpolation method that uses the results obtained at two tested speeds to calculate the FEP of a fan at a speed between the two tested speeds; and

• When establishing the FEP using a fan shaft power test and the calculations described in Sections 6.3, 6.4, and 6.5 of AMCA 214–21, Annex E of AMCA 214–21 allows a reduction in the number of tests needed by allowing either: (1) an interpolation of test results between tested speeds (similar to what was previously described); or (2) use of fan laws [66] to calculate the fan shaft power and corresponding airflow and pressure of a fan at a non-tested speed based on the results (*e.g.,* fan shaft power at a given duty point) at a different speed.

AMCA 214–21 also provides a number of provisions that may reduce the amount of required testing. Specifically, AMCA 214–21 provides:

• The same fan shaft power test can be used for combinations of the same bare-shaft fan and different motor, transmission, or motor controller. (See Section 6.3 of AMCA 214–21).

• A separate fan shaft power and motor test (with or without a motor controller) [67] may be conducted. Methods for combining the results for both tests to calculate the FEP at a given duty point are provided (See Section 6.5 of AMCA 214–21).

• Annex E of AMCA 214–21 uses fan laws to calculate the fan shaft power of a non-tested fan using results from a fan shaft power test of a fan with a smaller impeller diameter.

• Annex E of AMCA 214–21 also provides interpolation methods to calculate the fan shaft power based on two fan tests in which a single geometric feature (*i.e.,* dimension) is varied. Examples include changes in axial fan blade pitch, or centrifugal fan blade width, as well as the distance from an impeller to a separating panel on fans for fan arrays. The interpolation method is applied between two fan tests at the same tested fan speed. The dimension for the calculated fan must be between the dimensions for the two tested fans.

TABLE III–9—AMCA 214–21 TEST CONFIGURATIONS FOR PROPOSED IN-SCOPE FANS AND BLOWERS USING AMCA 210–16 AND AMCA 230–15

[Table 7.1 of AMCA 214–21]

Fan configuration	Test standard	Required		Optional	
		Test configuration *	FEI pressure basis **	Test configuration	FEI pressure basis
Centrifugal housed	AMCA 210–16	B or D	Total	A or C	Static.
Radial housed	AMCA 210–16	B or D	Total	A or C	Static.
Centrifugal inline	AMCA 210–16	B or D	Total	A or C	Static.
Centrifugal unhoused	AMCA 210–16	A	Static	N/A	N/A.
Centrifugal PRV exhaust.	AMCA 210–16	A or C	Static	N/A	N/A.
Centrifugal PRV supply.	AMCA 210–16	B	Total	A	Static.

[62] AMCA 230–15, AMCA 250–12, ''Laboratory Methods of Testing Jet Tunnel Fans for Performance'', and AMCA 260–20, ''Laboratory Methods of Testing Induced Flow Fans for Rating'' for testing circulating fans, jet fans, and laboratory exhaust fans with induced flow.

[63] AMCA 230–15 provides methods for conducting laboratory tests to determine the performance characteristics of circulating fans including the FEP in W, speed in RPM, pressure in inches of mercury, airflow in cfm, thrust in pound force (lbf), efficacy in cfm/W, and overall efficiency in lbf/W.

[64] As discussed, the FEI of a fan at a given operating point is a dimensionless index defined as the FEP (kW) of a theoretical reference fan divided by the FEP (kW) of the fan at the same operating point.

[65] AMCA 214–21 uses the term ''polyphase regulated motor'' to designate a three-phase motor regulated under 10 CFR 431.25.

[66] When applying the fan laws, the results of a tested fan are used to calculate the fan shaft power of a non-tested fan at a higher speed or with a larger diameter than the tested fan. The fan laws are described in section E.1 of Annex E of AMCA 214–21.

[67] AMCA 214–21 references additional industry test methods for motors (with or without a motor controller): Canada Standards Association (''CSA'') C747–09 (R2019), ''Energy efficiency test methods for small motors''; CSA C838–13 (R2018), ''Energy efficiency test methods for three-phase variable frequency drive systems;'' and Institute of Electrical and Electronics Engineers (''IEEE'') 112–2017, ''IEEE Standard Test Procedure for Polyphase Induction Motors and Generators.'' See annex F of AMCA 214–21.

TABLE III–9—AMCA 214–21 TEST CONFIGURATIONS FOR PROPOSED IN-SCOPE FANS AND BLOWERS USING AMCA 210–16 AND AMCA 230–15—Continued

[Table 7.1 of AMCA 214–21]

Fan configuration	Test standard	Required		Optional	
		Test configuration *	FEI pressure basis **	Test configuration	FEI pressure basis
Axial inline	AMCA 210–16	D	Total	C	Static.
Axial panel	AMCA 210–16	A	Static	N/A	N/A.
Axial PRV	AMCA 210–16	A or C	Static	N/A	N/A.
Circulating Fans	AMCA 230–15	E	Total	N/A	N/A.

* Each letter corresponds to a test set-up described in Section 7.1 of AMCA 214–21. A: free inlet, free outlet; B: free inlet, ducted outlet; C: ducted inlet, free outlet; D: ducted inlet, ducted outlet.
** This indicates that reference FEP used in the FEI calculation is established using either static or total pressure as indicated in this table and as determined by the required test configuration.

TABLE III–10—AMCA 214–21 TEST OPTIONS

Test description (section 6 of AMCA 214–21)	Driver configuration	Motor controller configuration	Transmission configuration	Test speed(s)	FEP determination method
Wire to air test at all speeds.	Motor	With or without a motor controller.	With or without transmission.	All speeds **	Section 6.1 of AMCA 214–21.
Wire to air test at selected speeds.	Motor	With or without a motor controller.	With or without transmission.	At least two speeds	Section 6.2 of AMCA 214–21.
Fan shaft power test for fans without a motor *.	None	With or without a motor controller.	Without transmission	At least one speed	Section 6.3 of AMCA 214–21.
Fan shaft power test for fans with a regulated motor *.	Electric motors subject to standards at 10 CFR 431.25.	With a variable frequency drive in accordance with section 6.4.1.4 of AMCA 214–21 or without a motor controller.	Direct drive, V-belt drive, flexible coupling, or synchronous belt drive.	At least one speed	Section 6.4 of AMCA 214–21.
Fan shaft power test and motor/motor and controls test *.	Motor	With or without a motor controller.	Direct drive, V-belt drive, flexible coupling, or synchronous belt drive.	At least one speed	Section 6.5 of AMCA 214–21.

* With or without the use of interpolation or fan laws as provided in Annex E.
** All speeds for which FEP values are generated.

The Petitioners suggested reliance on the FEP and FEI metrics and recommended that both metrics be derived using AMCA 214 (Docket No. EERE–2020–BT–PET–0003, The Petitioners, No. 1.3 at pp. 5–7).

In response to the April 2020 Notice of Petition for Rulemaking, AHRI, CTI, Daikin, and Lennox questioned the appropriateness of the AMCA 214 test standard, which was still under review with ANSI at the time the April 2020 Notice of Petition for Rulemaking was published (Docket No. EERE–2020–BT–PET–0003, AHRI, No. 14 at pp. 1–2; CTI, No. 11 at p. 3; Daikin, No. 8 at p. 1; Lennox, No. 5 at p. 3). AHRI requested that DOE delay the establishment of a test procedure until after AMCA 214 was final and published, stating that AHRI was working with AMCA to seek resolution on several technical issues. (Docket No. EERE–2020–BT–PET–0003, AHRI, No. 14 at p. 2). As discussed, AMCA 214 was approved by ANSI on March 1, 2021. DOE reviewed the final version of AMCA 214–21 in the preparation of the October 2021 RFI.

Daikin commented that the draft AMCA 214 test procedure was appropriate for fans distributed in commerce as standalone fans, but is not useful for fans embedded in equipment. (Docket No. EERE–2020–BT–PET–0003, Daikin, No. 8 at p. 1).

NEEA and NWPCC commented in support of establishing a test procedure for commercial and industrial fans and stated that the industry and efficiency advocates have collaboratively participated in developing AMCA 214. (Docket No. EERE–2020–BT–PET–0003, NEEA and NWPCC, No. 12 at p. 2). ASAP, ACEEE, and NRDC commented in support of establishing a test procedure for commercial and industrial fans and commented that AMCA incorporated input from a broad range of stakeholders in developing AMCA 214 (Docket No. EERE–2020–BT–PET–0003, ASAP, ACEEE, NRDC, No. 7 at p. 1).

Greenheck commented that a DOE test procedure based on AMCA 214 would: accelerate the use of the FEI over Fan Efficiency Grade (''FEG'') [68] in state and municipal energy codes and reduce manufacturer burden; reduce burden on consumers, designers, code officials, and manufacturers by preempting costly patchwork state and local fan test procedure regulations; help U.S. manufacturers compete internationally by minimizing the potentially disruptive and inconsistent regulations in Europe (EU ecodesign regulation for industrial fans No 327/2011); provide manufacturers with a more immediate return on investment through national demand for fans with a good FEI rating

[68] FEG is a numerical rating that classifies fans by their aerodynamic ability to convert mechanical shaft power, or impeller power in the case of a direct driven fan, to air power. FEG applies to the efficiency of the fan only and not to the motor and drives. More efficient fan models have a higher FEG rating. See AMCA whitepaper available at *www.amca.org/assets/resources/public/userfiles/file/Nospreads_FanEfficGrades.pdf.*

rather than limited and sporadic demand from individual states and municipalities; and be consistent with the fan FEI requirements in ASHRAE 90.1–2019. In addition, Greenheck stated that this would align with the process used by DOE to regulate other equipment in ASHRAE 90.1–2019 Tables 6.8.1–1 through 6.8.1–20 and would be useful to support future incentive programs based on FEI. Greenheck additionally commented that NEEA was developing an incentive program based on FEI. (Docket No. EERE–2020–BT–PET–0003, Greenheck, No. 6.1 at pp. 1–2).

Several interested parties also commented that a DOE test procedure based on AMCA 214 would provide a basis to assist customers and designers in making purchasing decisions and save energy by informing design decisions. (Docket No. EERE–2020–BT–PET–0003, NEEA and NWPCC, No. 12 at p. 1; ASAP, ACEEE, NRDC, No. 7 at p. 1; Johnson Controls, No. 10 at p. 1). (*See* section III.F III.E for further discussion of these comments).

In response to the October 20221 RFI, AMCA commented in support of the use of AMCA 214–21 and AMCA 230–15 as the basis for the test procedure with the caveat that AMCA 230–15 is entering a revision cycle and that DOE should refer to the latest version of AMCA 230. (AMCA, No. 6 at p. 7) AMCA also stated that an erratum to AMCA 230–15 was published on the AMCA website[69] in May 2021 and a copy was provided to DOE. AMCA also stated that references to ANSI/AMCA Standard 230–15 generally mean ''ANSI/AMCA Standard 230–15 with errata.'' (AMCA, No. 6 at p. 2) AMCA further commented that AMCA 230–15 will undergo a regularly scheduled periodic review and update in 2022 to maintain ANSI approval. AMCA commented that although AMCA is not expecting the physical test method to change in the next revision, the 2021 erratum will be integrated with the standard and improvements will be made to definitions as part of the standards revision process. AMCA recommended that DOE allow the ANSI/AMCA Standard 230 revision committee to complete its work so the new edition of the standard can be referenced in a DOE rulemaking involving ACFH. (AMCA, No. 6 at p. 2) AMCA stated that the majority of the market is single-speed, and recommended that, for regulatory purposes, only ''high speed'' should be required for compliance and check-testing. AMCA asserted that this approach would be more repeatable and reduce regulatory burden. AMCA stated that it generally understood that fans having two or more speeds are run at high speed in commercial and industrial environments, although AMCA did not have data to support its understanding. (AMCA, No. 6 at p. 8)

NEEA recommended that DOE consider AMCA 214–21 to determine the efficiency of fans and blowers and AMCA 230–15 as the test procedure for ACFHs. NEEA commented that these procedures incorporate decisions made during the 2015 ASRAC working group, and thus have consensus from industry, advocacy and governmental organizations as procedures that reflect energy efficiency during a representative average use cycle and are not unduly burdensome to conduct. NEEA commented that they have supported the development of these test procedures and asserted there is momentum in the market for these procedures. NEEA further asserted that these test procedures represent the current best practice for defining and calculating the efficiencies of fans. NEEA stated that AMCA 230 will be in revision soon, and recommended that the new version of the standard be the basis for DOE's regulation once the standard is published. (NEEA, No. 11 at pp. 1–2)

AHRI commented that ACFHs are standalone fans, with performance testing established appropriately using AMCA 230–15 and a FEI metric calculated using AMCA 214–21. (AHRI, No. 10 at p. 2)

The CA IOUs recommended that DOE use the FEI metric from AMCA 214–21 for ACFHs. (CA IOUs, No. 9 at p. 2)

DOE is proposing to incorporate by reference AMCA 214–21 as the prescribed test method for evaluating the energy use of fans and blowers, with modifications discussed in section III.D of this document. AMCA 214–21 references AMCA 210–16 and AMCA 230–15 (with errata) as the physical test method, and further provides provisions for calculating the FEI. This industry-based test procedure, which is already used by industry and referenced by ASHRAE 90.1, can be applied to the range of fans and blowers proposed in scope, including air circulating fans. DOE also proposes to incorporate by reference AMCA 210–16, ISO 5801:2017, and AMCA 230–15 (with errata) (or latest version available at the time of the any final rule),[70] which are the physical test methods referenced in AMCA 214–21 for fans and blowers and air circulating fans. DOE has tentatively determined that AMCA 214–21 provides a representative measurement of energy use or energy efficiency during a representative average use cycle for all fans and blowers in the proposed scope. The proposal to use AMCA 214–21 is consistent with the comments received from stakeholder and with the Working Group recommendations. Although NEEA commented in support of using AMCA 230–15 (with errata), DOE notes that AMCA 214–21 requires testing air circulating fans in accordance with AMCA 230–15.

DOE is also aware that the AMCA 230 committee is currently reviewing AMCA 230–15 (with errata), to determine if any revisions are necessary. DOE understands that should the AMCA 230 committee make any changes to AMCA 230–15 (with errata), AMCA would publish a revised standard, potentially numbered as AMCA 230–22 (or AMCA 230–23, based on the publication year). DOE is participating in the AMCA 230 committee meetings to review and revise AMCA 230–15 (with errata). While this NOPR proposes to reference the requirements from AMCA 230–15 (with errata), it also discusses the revisions being considered by the AMCA 230 committee. DOE requests comment on these revisions as well as any additional revisions under consideration by the AMCA 230 committee that are not discussed in this document. Should the revised version of AMCA 230–15 (with errata), publish prior to the publication of any DOE test procedure final rule, DOE intends, after considering stakeholder feedback received in response to the proposals in this document, to incorporate by reference the latest version of AMCA 230, provided the updates in the final published standard are consistent with the provisions DOE is proposing in this NOPR, or the updates are related to topics that DOE has discussed and solicited comments on in this NOPR. The subsequent sections of this NOPR discuss each substantive change in AMCA 230–15 (with errata), that DOE proposes to incorporate into appendix B, as well as the updates being considered by the AMCA 230 committee.

Estimated costs for the proposed test procedure are discussed in section III.L of this document. DOE seeks information on whether, in general, AMCA 214–21, AMCA 210–16, and AMCA 230–15 (with errata) provide measurements which reflect energy efficiency or energy use during a representative average use cycle of the

[69] See *www.amca.org/LDCF.*

[70] DOE is aware that AMCA 230–15 is currently undergoing periodic review and may be revised in the future. Should a new version become available at the time of any final rule, DOE would incorporate by reference the latest available version of AMCA 230.

fans and blowers (including air circulating fans) proposed to be in scope. If these standards would not provide such measurements, DOE seeks input on how it should be amended and why, and on any other industry test standard that would be more appropriate.

DOE requests comment and supporting data on whether AMCA 214–21 and ISO 5801:2017 produce equivalent test results.

DOE seeks information and data to assist in evaluating the repeatability and reproducibility of AMCA 214–21, AMCA 210–16, and AMCA 230–15 (with errata). DOE seeks input on whether any changes to these standards are needed to increase its repeatability and reproducibility.

DOE seeks information on whether changes to AMCA 214–21, AMCA 210–16, and AMCA 230–15 (with errata) are needed to allow for the determination of more representative energy efficiency ratings, and any cost associated with a suggested change.

DOE requests comment on the physical features that could be identified to differentiate bare-shaft fans that can accommodate only a direct-drive transmission from other bare-shaft fans.

DOE requests comment on any additional revisions under consideration by the AMCA 230 committee that are not discussed in this document.

D. Proposed Adoption of the Test Procedure in AMCA 214–21 and Modifications to the Test Procedure

As discussed previously, DOE is proposing to adopt through reference certain provisions of AMCA 214–21 as the prescribed test method for measuring the energy use and energy efficiency of fans and blowers.

Specifically, for fans and blowers that are not air circulating fans, DOE proposes that testing be performed in accordance with the following sections of AMCA 214–21:

- Section 2 ''References'',
- Section 3 ''Definitions'',
- Section 4 ''Calculation of the FEI for a single duty point'',
- Section 5 ''Reference Fan Electrical Power (FEP_{ref})'',
- Section 6.1 ''Wire-to-Air Testing at the Required Duty Point'',
- Section 6.2 ''Calculated Ratings Based on Wire to Air Testing'',
- Section 6.3 ''Bare Shaft Fans'',
- Section 6.4.1.1 ''Requirements for the fan'',
- Section 6.4.1.2 ''Requirements for the transmission'',
- Section 6.4.1.3 ''Requirements for the motor,
- Section 6.4.2 Calculation of FEP_{act}'',
- Section 6.4.2.1 ''Calculation of transmission efficiency ($\eta_{trans,act}$)'',
- Section 6.4.2.2 ''Calculation of actual motor output power'',
- Section 6.4.2.3 ''Motor efficiency if no VFD is included'',
- Section 7 ''Testing'',
- Section 8.1 ''Laboratory Measurement Only'',
- Section 8.2.1 ''Fan laws and other calculation methods for shaft-to-air testing'',
- Section 8.2.3 '' Calculation to other speeds and densities for wire-to-air testing '',
- Annex D ''Motor Performance Constants (Normative)'',
- Annex E ''Calculation Methods for Fans Tested Shaft-to-Air'',
- Annex G ''Wire-to-Air Measurement—Calculation to Other Speeds and Densities (Normative)'',
- Annex J ''Other data and calculations to be retained'', and
- Annex K ''Proportionality and Dimensional Requirements (Normative)''.

For air circulating fans, DOE proposes that testing be performed in accordance with the following sections of AMCA 214–21:

- Section 2 ''References'',
- Section 3 ''Definitions'',
- Section 4 ''Calculation of the FEI for a single duty point'',
- Section 5 ''Reference Fan Electrical Power (FEP_{ref})'',
- Section 6.1 ''Wire-to-Air Testing at the Required Duty Point'',
- Table 7.1 of Section 7 ''Testing'',
- Section 7.1. ''Test Configurations''
- Section 7.2 ''Setup Selection''
- Section 7.4 ''Run-in requirements''; and
- Annex J ''Other data and calculations to be retained''

As proposed, the test procedure would provide methods to calculate the FEI and FEP of a fan at each of its duty points based on: (1) the fan electrical input measured by a wire-to-air test or, (2) the fan shaft input power measured by a shaft-to-air test (conducted in accordance with AMCA 210–16 or AMCA 230–15 (with errata), and the modifications proposed in this section), and the application of calculation algorithms to represents the performance of the motor. The test procedure would also provide methods to calculate the FEP or fan shaft input power at untested duty points, based on the performance of test duty points and interpolation methods, including the fan laws. The following sections discuss key elements of the proposed test procedure and proposed modification to AMCA 214–21.

1. Motor Efficiency Calculation

For bare shaft fans and fans with an electric motor subject to energy conservation standards at 10 CFR 431.25 (''polyphase regulated motor''), Section 6.3 and 6.4 of AMCA 214–21 specify testing these fans using a shaft-to-air test (*i.e.,* a test that does not include the motor performance). When conducting a shaft-to-air test, the mechanical fan shaft input power is measured and the FEP is then calculated by using a mathematical model to represent the performance of the motor (*i.e.,* its part-load efficiency). The FEP is then used to calculate the FEI of the fan.

AMCA 214–21 provides two different methods to estimate the part-load efficiency of a polyphase regulated motor. A single equation presented in Section 5.3 and section 6.3.3 of AMCA 214 are used to calculate the FEP of the reference fan (''FEP_{ref}'') and the actual FEP of bare-shaft fans (''FEP_{act}''), while a more complex model based on several equations described in Section 6.4.2.3 of AMCA 214 is used to calculate the actual FEP of fans sold with polyphase regulated motors without a variable frequency drive (''VFD''). In support of a final rule published January 25, 2016, for the commercial and industrial pump test procedure, DOE developed a model to estimate the electric motor part-load performance of polyphase regulated motors. 81 FR 4086, 4124–4125. As noted in the commercial and industrial pumps test procedure notice of proposed rulemaking published on April 1, 2015, DOE has designed the calculation-based approach used in the pump test procedure to be conservative (*i.e.,* the model represents a conservative estimate of part-load motor losses and efficiency) [71] 80 FR 17585, 17628 (''Pumps April 2015 TP NOPR'') DOE notes that such approach minimizes the possibility that testing the pump without the motor and using the model to estimate motor performance would result in better energy efficiency ratings than testing the pump inclusive of the motor.

Pumps and fans are powered by the same categories of motors, and DOE compared the motor part-load efficiency resulting from applying the two AMCA 214–21 motor equations with the motor part-load efficiency obtained when using the equation from the DOE pump test procedure. DOE found that the AMCA models resulted in efficiency values that were, on average, one percent higher (when using Sections 5.3 and 6.3.3) and two percent higher (when

[71] The efficiency (Eff) of a motor at a given load (x) relates to the motor horsepower (hp) and losses (L) as follows: Eff = (x. hp)/(x.hp + L)

using Section 6.4.2.3) than the values determined using the equation from the DOE pump test procedure.[72] When using these equations to calculate the FEI of a large sample of fans, DOE found that the impact on FEI was, on average, 1 percent higher than the FEI obtained using the model from the DOE pump test procedure.

Based on this review, DOE tentatively concludes that the impact on the FEI is not significant enough to justify deviating from the established industry test procedure. Therefore, DOE proposes to maintain the equations as provided in Sections 5.3 and 6.4.2.3 of AMCA 214–21 to estimate the part-load motor efficiency when calculating FEP_{ref}, FEP_{act}, and the FEP_{act} of fans sold with electric motors regulated at 10 CFR 431.25 (and without VFDs). Should additional information become available indicating that the FEI ratings resulting from the equations in AMCA 214–21 diverged to a greater extent from the FEI ratings resulting from testing the fan wire-to-air, DOE would consider the use of alternate equations, such as the equations from the DOE pump test procedure.

DOE requests comment on the equations provided in Sections 5.3 and 6.4.2.3 of AMCA 214–21. Specifically, DOE requests comment on whether applying the method outlined in Section 6.4 of AMCA 214–21 and the equations provided in Section 6.4.2.3 of AMCA 214–21 could result in a higher value of FEI than the FEI resulting from a wire-to-air test in accordance with Section 6.1 of AMCA 214–21.

2. Combined Motor and Controller Efficiency Calculation

For fans with a polyphase regulated motor and a controller, AMCA 214–21 allows testing these fans using a shaft-to-air test (*i.e.,* a test that does not include the motor and controller performance). When conducting a shaft-to-air test, the mechanical fan shaft input power is measured and the FEP is then calculated by using a mathematical model to represent the performance of the combined motor and controller (*i.e.,* its part-load efficiency). The FEP is then used to calculate the FEI of the fan.

Section 6.4.2.4 of AMCA 214–21, which relies on Annex B ''Motor Constants if Used With VFD (Normative)'' and Annex C ''VFD Performance Constants (Normative)'', provides a method to estimate the combined motor and controller part-load efficiency for certain electric motors and controller combinations that meet the requirements in Sections 6.4.1.3 and 6.4.1.4 of AMCA 214–21, which specify that the motor must be an electric motor subject to energy conservation standards at 10 CFR 431.25.

Previously, DOE developed a similar model to estimate the combined motors and controller part-load performance in support of the commercial and industrial pump rulemaking, in the case where the motor is polyphase regulated motor. 81 FR 4086, 4128–4130 (January 25, 2016). As noted in the Pumps April 2015 TP NOPR, the model used in the pump test procedure represents a conservative estimate of part-load motor losses (and efficiency).[73] 80 FR 17585, 17628 This minimizes the possibility that using the calculation approach to estimate the motor and controller performance would result in better energy efficiency ratings than when testing the equipment inclusive of the motor and controller.

Pumps and fans are powered by the same categories of motors and controllers and DOE compared the motor part-load efficiency resulting from applying the AMCA 214–21 motor and controller equations with the combined motor and controller part-load efficiency obtained when using the equation from the DOE pump test procedure and found that the AMCA model resulted in combined motor and controller part-load efficiency values that were, on average, four percent higher than when using the DOE model.[74] In addition, DOE reviewed motor and VFD efficiency data from the AHRI certified product database [75] and found existing motor and VFD combinations that performed at a lower efficiency than predicted by the AMCA 214 model. DOE also reviewed the reference motor and controller (''power drive system'') efficiency provided in IEC 61800–9–2:2017 ''Adjustable speed electrical power drive systems—Part 9–2: Ecodesign for power drive systems, motor starters, power electronics and their driven applications—Energy efficiency indicators for power drive systems and motor starters'', which also provides equations to represent the performance of a motor and controller used with fans, and found that the IEC model predicted values of efficiency that were significantly lower (more than 10 percent on average) than the model included in AMCA 214–21.

Based on this analysis, DOE has concerns that the equations described in Section 6.4.2.4 of AMCA 214–21 may not be appropriately representative, resulting in fan FEI ratings that would be higher than FEI ratings obtained using the wire-to-air test method described in Section 6.1 of AMCA 214–21. Therefore, DOE does not propose to allow the use of Section 6.4.2.4 of AMCA 214–21. Instead, DOE proposes that fans with motor and controller be tested in accordance with Section 6.1 of AMCA 214–21. Manufacturers would still be able to rely on a mathematical model (including the same model as described in Section 6.4.2.4 of AMCA 214–21, as long as the model meets the AEDM requirements discussed in section III.J of this document) in lieu of testing to determine the FEI of a fan with a motor and controller, subject to the proposed AEDM discussed in section III.J of this document.

3. Annex A of AMCA 214–21

Annex A provides the reference nominal full-load efficiency values to use for polyphase motors subject to energy conservation standards at 10 CFR 431.25 when calculating the motor part load efficiency in accordance with Section 6.4.2.3 of AMCA 214–21. DOE proposes to replace Annex A of AMCA 214–21 by a reference to Table 5 of 10 CFR 431.25. The values in Annex A and Table 5 of 10 CFR 431.25 are identical, however, referencing the Code of Federal Regulations would ensure that the values of polyphase regulated motor efficiencies remain up to date with any potential future updates established by DOE.

4. Annex E of AMCA 214–21

As previously discussed, Annex E of AMCA 214–21 allows a reduction in the number of tests potentially required by allowing the use of fan laws to calculate the fan shaft power of a non-tested fan using results from a fan shaft power test of a fan with a smaller impeller diameter. Since the publication of AMCA 214–21, AMCA 211–22 ''Certified Ratings Program Product Rating Manual for Fan Air Performance'' was published. Annex I of AMCA 211–

[72] On average, across operating motor loads (25 to 100 percent load) and across all motor horsepowers between 1 and 250 hp, the motor part-load efficiency values obtained using the equations in AMCA 214 were one and two percent higher than the motor part-load efficiency values obtained using the equations from the DOE pump test procedure.

[73] The efficiency (Eff) of a motor at a given load (x) relates to the motor horsepower (hp) and losses (L) as follows: Eff = (x. hp)/(x.hp + L).

[74] On average the combined motor and controller part-load efficiency values obtained using the equation in AMCA 214–21 were 5 percent higher across operating motor loads (25 to 100 percent load) and across all motor horsepowers between 1 and 250 hp, when compared to the combined motor and controller part-load efficiency values obtained using the equations from the DOE pump test procedure.

[75] AHRI Standard 1210, ''Standard for Performance Rating of Variable Frequency Drives,'' certified data from 2016, 2020, and 202. See: *https://www.ahridirectory.org/NewSearch?programId=71&searchTypeId=3.*

22 allows the use of fan laws to additionally interpolate the fan shaft power of a non-tested fan using results from a fan shaft power test of two fans with a smaller and larger impeller diameter (*i.e.,* interpolation between two tested sizes). DOE is considering adding a reference to section I.6 of Annex I of AMCA 211–22 and allowing manufacturer to additionally interpolate the fan shaft power of a non-tested fan between two tested fans sizes. Alternatively, DOE may consider referencing Annex I of AMCA 211–22 in place of Annex E of AMCA 214–21.

DOE requests comments on whether it should add a reference to Section I.6 of AMCA 211–22 or replace Annex E of AMCA 214–21 by Annex I of AMCA 211–22.

5. Section 6.5 of AMCA 214–21 and Annex F

Section 6.5 and Annex F of AMCA 214–21 provide methods to determine the FEP of the actual fan by conducting separate tests for the bare shaft fan and the motor or the combined motor and controller. Annex F specifies the industry test methods [76] to use when testing the motor or the combined motor and controller. As provided in Annex F, the motor and controller, if included, must be tested at the range of speeds and loads over which the fan is to be rated. The measurements result in a map of the input power (kW) versus speed and load and intermediate values can be determined through interpolation (linear interpolation or a polynomial curve fit). The methods in Section 6.5 and Annex F of AMCA 214–21 are applicable to any electric motor (including non-DOE regulated motors that meet the definition of electric motor at 10 CFR 431.12) as long as it can be tested per the industry test procedures included in Annex F.

The test procedure for combined motor and controller in AMCA 214–21 deviates from the methods proposed in the January 2021 electric motors test procedure NOPR. 86 FR 71710, 71743 (December 17, 2021) While Annex F of AMCA 214–21 specifies that testing that combined motor and controllers can be performed using either ANSI/ASHRAE Standard 222, ''Standard Method of Test for Electrical Power Drive Systems'', CSA C838, ''Energy efficiency test methods for three-phase variable frequency drive systems'', or CSA C747, ''Energy efficiency test methods for small motors'', DOE proposed, in the January 2021 electric motors test procedure NOPR, that combined motors and controllers be tested using IEC 61800–9–2:2017, ''Adjustable speed electrical power drive systems—Part 9–2: Ecodesign for power drive systems, motor starters, power electronics and their driven applications—Energy efficiency indicators for power drive systems and motor starters''. 86 FR 71710, 71743 For fans combined with regulated motors, the methods described in Section 6.5 and Annex F of AMCA 214–21 would be less burdensome than multiple wire-to-air tests; however, it would likely be significantly more burdensome than applying the calculation methods described in Section 6.3 of AMCA 24–21, since it would require physical tests of all motors with which the bare shaft fan could be paired. In addition, with the option to allow for an AEDM as discussed in section III.J. of this document, a manufacturer would be able to integrate the methods of Section 6.5 and Annex F of AMCA 214–21 into a mathematical model as long as the proposed AEDM requirements were met.

Therefore, DOE is not proposing to include Section 6.5 and annex F of AMCA 214–21 in the proposed DOE test procedure. Manufacturers would still be able to rely on a mathematical model (including potentially the same model as described in Section 6.5 of AMCA 214–21, as long as the models meet the AEDM requirements discussed in section III.J of this document) in lieu of testing to determine the FEI of a fan with a motor or a motor and controller, provided that the mathematical model meets all the AEDM requirements proposed in section III.J. of this document.

6. Annex H and Annex I of AMCA 214–21

Annex H ''Required Reported Values (Normative)'' of AMCA 214–21 provides reporting requirements. DOE is not proposing to adopt Annex H. DOE may consider proposals to establish reporting requirements for fans and blowers under a separate rulemaking.

Annex I ''Minimum Data Requirements for Published Ratings (Informative)'' provides guidance on what performance information to publish. DOE is not proposing to adopt Annex I. DOE is proposing requirements regarding represented values in section III.K of this document.

7. Section 8.3 of AMCA 214–21

Section 8.3 ''Appurtenances'' provides guidance on how to characterize fan performance in the case of a fan with additional appurtenances beyond what is required by the test procedure. DOE is not proposing to adopt this section as DOE does not propose to establish fan performance with additional appurtenances beyond what is specified by the test procedure in Section 7.3 of AMCA 214–21, which DOE proposes to adopt through reference.

8. Measurement of PRV Performance

As described in Table III–9, AMCA 214–21 requires different test configurations for PRVs that supply air to a building and PRVs that exhaust air from a building. Some PRVs can operate both as supply and exhaust fans. DOE proposes that PRVs that can operate both as supply and exhaust fans be tested in both configurations.

DOE seeks feedback on its proposal that PRVs that can operate both as supply and exhaust fans be tested in both configurations as described in Table III–9 of this document.

9. Exclusively Embedded Fans

As discussed in section III.A.3 of this document, DOE proposes to exclude fans that are exclusively embedded in equipment as listed in Table III–8 of this document. Other exclusively embedded fans would be included in the scope of the test procedure to the extent that they meet the proposed test procedure scope criteria presented in section III.A.1 of this document and do not fall under the proposed exclusions discussed in section III.A.2. of this document.

The Working Group recommended that embedded fans be tested in a standalone fan configuration (*i.e.,* outside of the piece of equipment in which they are embedded). (Docket No. EERE–2013–BT–STD–0006; No. 179, Recommendation #8 at p. 5) DOE interprets this recommendation to apply to exclusively embedded fans because standalone fans that are purchased by an OEM for incorporation into equipment can be tested prior to being embedded. Because exclusively embedded fans included in larger equipment may share structural or functional parts with that equipment, the fan would not be removable without causing irreversible damage to the equipment. To address such embedded fans, the Working Group recommended testing exclusively embedded fans using additional fan components, except for the fan impeller, that are geometrically identical to that of the embedded fan

[76] CSA C747–09 (R2014), ''Energy efficiency test methods for small motors;'' CSA C838–13 (R2018), ''Energy efficiency test methods for three-phase variable frequency drive systems;'' IEEE 112–2017, ''IEEE Standard Test Procedure for Polyphase Induction Motors and Generators'' and ANSI/ASHRAE Standard 222–2018, ''Standard Method of Test for Electrical Power Drive Systems''.

inside the larger piece of equipment. (Docket No. EERE–2013–BT–STD–0006; No. 179, Recommendation #8 at p. 5) In addition, the Working Group recommended that embedded fans be certified over their standalone operating range. (Docket No. EERE–2013–BT–STD–0006; No. 179, Recommendation #4 at p. 4)

DOE collected fan performance information from OEM and fan manufacturer websites, indicating that OEMs currently test and collect information on embedded fan performance and that OEMs understand a fan's typical operating range in terms of flow and pressure.[77] As previously discussed, the AMCA 214–21 foreword states that, ''AMCA Standard 214 primarily is for fans that are tested alone or with motors and drives; it does not apply to fans tested embedded inside of other equipment.'' To test exclusively embedded fans, DOE therefore proposes, consistent with the Working Group recommendation, that these fans be tested as standalone fans, outside of the equipment in which they are incorporated. In addition, DOE proposes that if any fan components are not removable without causing irreversible damage to the equipment into which the fan is embedded, the manufacturer must use additional fan components, except for the fan impeller, that are geometrically identical to that of the fan embedded inside the larger piece of equipment for testing. This would result in a range of FEI ratings at every operating point at which the fan is capable of operating, including at the flow and pressure point experienced by the fan when embedded inside the equipment.

DOE seeks comment on its proposal to test exclusively embedded fans in a standalone configuration outside of the equipment that incorporates the fan.

10. Wire-to-Air Testing for Air Circulating Fans

Air circulating fans incorporate and are sold with a motor. Accordingly, AMCA 230–15, which is the physical test method referenced in AMCA 214–21 for air circulating fans, only provides a wire-to-air test method. DOE proposes a test procedure for testing air circulating fans based on the methods in Sections 6.1 and 6.2 of AMCA 214–21.

In response to the February 2022 ECS RFI, the CA IOUs commented that ACFs sold without a motor should be included in the DOE test procedure. (Docket No. EERE–2022–BT–STD–0002, CA IOUs, No. 7 at p. 6) In addition, the CA IOUs stated that ACFs with multiple motor options should be tested using a motor capable of running the fan at the fan's maximum allowable speed. They added that doing so will prevent manufacturers from avoiding energy conservation standards by selling incomplete fans. The CA IOUs also suggested that optional motor fans be tested with the least efficient motor and allow for an optional representation of higher-efficiency motors. *Id.*

DOE did not find any circulating fans that were distributed in commerce without an electric motor. However, if an air circulating fan is sold without a motor, it would still meet the definition of an air circulating fan and would be included in the scope of the test procedure. DOE proposes that air circulating fans distributed in commerce without an electric motor be tested using an electric motor as recommended in the manufacturer's catalogs or distributed in commerce with the air circulating fan. If more than one motor is available in manufacturer's catalogs or distributed in commerce with the air circulating fan, DOE proposes requiring that it be tested using the least efficient motor capable of running the fan at the fan's maximum allowable speed.

DOE requests comment on its proposed approach for testing air circulating fans that are distributed in commerce without an electric motor.

11. Total Pressure Calculation for Air Circulating Fans

AMCA 214–21 specifies that air circulating fans must rely on a FEI based on total pressure (sum of the static pressure and velocity pressure) (See Table III–9 of this document). However, AMCA 230–15 does not specify the measurement or calculation of fan total pressure, which is a required input to the FEI calculation.

DOE proposes to add provisions to specify how to calculate fan total pressure and to apply the equations in Section A.2 of AMCA 208–18 when calculating the fan total pressure at a given airflow for fans tested per AMCA 230–15.

DOE requests comment on its proposal to add provisions for calculating the total pressure of air circulating fans based on the equations in Section A.2 of AMCA 208–18.

12. Appurtenances

Section 7.3 of AMCA 214–21 provides instructions on which appurtenances to include as part of the tested fan. It distinguishes between appurtenances that improve or reduce performance. For appurtenances that improve fan performance (including but not limited to inlet bells, diffusers, stators, or guide vanes), AMCA 214–21 specifies that these appurtenances should be included if always supplied with the fan when distributed in commerce. For appurtenances that reduce fan performance, which include, but are not limited to, safety guards, dampers, filters, or weather hoods, AMCA 214–21 states that if the appurtenance is always supplied with the fan when distributed in commerce, then it shall be tested with the fan. If the appurtenance is not always supplied with the fan when distributed in commerce, it shall not be tested with the fan.

For circulating fans, the AMCA 230 committee is considering adding the following provisions as part of the revised version of AMCA 230: any appurtenances sold with the fan shall be included in the minimum testable configuration.

DOE reviewed the provisions related to accessories in AMCA 214–21 and as considered by the AMCA 230 committee and has tentatively determined that testing using the provisions discussed by the AMCA 230 committee would provide results that are more representative of field conditions because consumers are likely to use the fan with the appurtenances they purchase. Therefore, DOE proposes to specify for fans and blowers, including air circulating fans, that any appurtenances sold with the fan must be included during the test.

In addition, for air circulating fans, the AMCA 230 committee is considering additional provisions to include in the next version of AMCA 230 to describe what should be considered as part of the test (*i.e.,* the ''minimum testable configuration''). The committee is considering the following: (1) If sold with the fan, an on/off switch or speed control device would be included in the minimum testable configuration. The power consumption of the on/off switch or speed control device would be included in the active and standby mode power measurements. (2) If multiple control devices are sold with the fan, only the standard fan control device would be used for testing. (3) Optional product features not related to generating air movement would not be energized for the purpose of testing. Optional product features not related to generating air movement include, but are not limited to: misting kits, external sensors not required to operate the fan, and communication devices not required to operate the fan.

For air circulating fans, DOE has tentatively determined that it is unlikely

[77] See for example: *www.trane.com/Commercial/Uploads/Pdf/1020/clchprc003_en_mseriescatalog_1205.pdf; content.greenheck.com/public/DAMProd/Original/10001/AllProducts_catalog.pdf.*

that additional features not related to air movement would remain in the on-position unless intended by the consumer. As such, requiring testing in their ''as-shipped'' configuration would not provide a more representative measure of energy use for air circulating fans. DOE proposes to add clarification that additional features not related to air movement be installed, but either powered off or set at the lowest energy-consuming mode during testing. Further, to avoid confusion as to which controller is used for testing in the case where multiple advanced controllers are offered, DOE proposes to add additional clarification to its specifications for appurtenances. Specifically, DOE proposes to clarify that if the air circulating fan is offered with a default controller, testing would be conducted using the default controller. If the air circulating fan is offered with multiple controllers, testing would be conducted using the minimally functional controller (*i.e.* ''standard controller''). Testing using the minimally functional controller is consistent with the direction to test with additional features not energized during the power consumption measurement. Controller functions other than the minimal functions (*i.e.,* the functions necessary to operate the air circulating fan blades) are akin to additional features that do not relate to the air circulating fan's ability to create airflow. This proposed addition clarifies which controller to select. These proposals are in line with the additional provisions considered by the AMCA 230 committee.

DOE is aware that the revisions considered by the AMCA 230 committee are subject to change and could further be revised in the next version of AMCA 230. Should the revised version of AMCA 230 publish prior to the publication of any DOE test procedure final rule, DOE intends, after considering stakeholder feedback received in response to the proposals in this document, to revise the provisions related to appurtenances in line with the latest AMCA 230 standard, provided the updates in this standard are consistent with the provisions DOE is proposing in this NOPR, or the updates are related to topics that DOE has discussed and for which DOE has solicited comments to in this NOPR.

DOE requests comment on the proposed provisions related to the consideration of appurtenances when testing fans and blowers, including air circulating fans.

DOE requests comment on whether it should consider specifying additional provisions to describe which components should be included in the test.

13. Voltage, Phase and Frequency

Fans and blowers can be rated to operate at 50 or 60 Hz, be supplied by single-phase or multi-phase electricity, and can operate at a single rated voltage (*e.g.* 115 V) or within one or more rated voltage ranges, or a combination of both (*e.g.* 115/208–230V).

Section 7.8 of AMCA 214–21 specifies that for fan electrical power measurement (when conducting a wire-to-air test), the fan must be operated using 60 Hz supply unless that frequency conflicts with nameplate values. The voltage during the test shall match the highest allowable value that corresponds with the relevant nameplate.

In the Unites States, 60 Hz frequency is the most representative, and DOE has tentatively determined that fans rated for operation with only 60Hz power supply would be tested with 60 Hz electricity and that fans capable of operating with 50Hz and 60Hz electricity would also be tested with 60Hz electricity. DOE has tentatively determined that it does not need to consider air circulating fans rated for operation with only 50 Hz power, since these fans are not relevant in the U.S. market.

Regarding the phase and voltage to select for testing, at this time, DOE is proposing to clarify which phase and voltage to use during the test as follows.

DOE proposes to specify to test fans and blowers, including circulating fans, rated for operation with only a single- or multi-phase power supply with single- or multi-phase electricity, respectively. Fans and blowers, including circulating fans, capable of operating with single- and multi-phase electricity, DOE proposes that fans capable of operating with single- and multi-phase electricity must be tested using multi-phase power supply, which is the most common power supply for industrial and commercial equipment. DOE would allow manufacturers of fans and blowers, including circulating fans, capable of operating with single- and multi-phase electricity to test such fans with single-phase power and make representations of efficiency associated with both single and multi-phase electricity if a manufacturer desires to do so.

For fans and blowers other than air circulating fans, DOE does not have any information to evaluate which configuration would be the most representative of an average energy use cycle and DOE proposes to retain the provisions in Section 7.8 of AMCA 214–21 to specify testing at the highest rated voltage and align with existing industry standards. Alternatively, DOE may consider other options such as specifying a voltage for test similar to that proposed below for air circulating fans.

For air circulating fans, DOE does not have any information to evaluate which configuration would be the most representative of an average energy use cycle. Instead, DOE reviewed the provisions related to the supply voltage in the ceiling fan test procedure, which are also tested based on AMCA 230–15 (with errata). Sections 3.43 and 3.4.4 of 10 CFR part 430 appendix U. DOE proposes the same provisions for air circulating fans that it uses for ceiling fan, with additional language to distinguish how to select the supply voltage for fans tested using single-phase and multi-phase electricity.

Specifically, DOE proposes that the supply voltage must be: (1) for air circulating fans tested with single-phase electricity, the supply voltage would be (a) 120 V if the air circulating fan's minimum rated voltage is 120 V or the lowest rated voltage range contains 120 V, (b) 240 V if the air circulating fan's minimum rated voltage is 240 V or the lowest rated voltage range contains 240 V, or (c) the air circulating fan's minimum rated voltage (if a voltage range is not given) or the mean of the lowest rated voltage range, in all other cases; (2) for air circulating fans tested with multi-phase electricity, the supply voltage would be (a) 240 V if the air circulating fan's minimum rated voltage is 240 V or the lowest rated voltage range contains 240 V, or (b) the air circulating fan's minimum rated voltage (if a voltage range is not given) or the mean of the lowest rated voltage range, in all other cases.

DOE is aware that the revisions considered by the AMCA 230 committee are subject to change and could further be revised in the next version of AMCA 230. Should the revised version of AMCA 230 publish prior to the publication of any DOE test procedure final rule, DOE intends, after considering stakeholder feedback received in response to the proposals in this document, to revise the provisions related to frequency, phase, and voltage in line with the latest AMCA 230 standard, provided the updates in this standard are consistent with the provisions DOE is proposing in this NOPR, or the updates are related to topics that DOE has discussed and solicited comments to in this NOPR.

DOE requests comment on the proposed provisions related to specifying which frequency, phase, and voltage to use during a test.

DOE additionally requests comment on whether the supply voltage requirements proposed for testing air circulating fans and fans and blowers other than air circulating fans would appropriately represent an average use cycle.

14. Test Speeds for Air Circulating Fans

Section 8.2.4 of AMCA 230–15 (with errata) specifies that for air circulating fans with variable speed, performance data is captured and reported at five speeds (20, 40, 60, 80 and 100 percent of maximum speed) evenly spaced throughout the speed range. If there are less than five speeds available, the performance of all speeds is measured. AMCA 230–15 does not explicitly indicate how to test fans with multiple discrete speed settings.

AMCA recommended that DOE require testing only at ''high speed'' for compliance and check-testing asserting that the majority of the market is single-speed. AMCA commented that this would be more repeatable -and reduce regulatory burden. While AMCA provided no supporting data, AMCA commented that fans having two or more speeds generally are run at high speed in commercial and industrial environments. (AMCA, No. 6 at p. 8)

The AMCA 230 committee is considering revising the test speed requirements in AMCA 230–15 (with errata) to indicate that all air circulating fans must be tested at their highest (*i.e.,* maximum) speed and that additional speeds may be captured and reported to more fully define the shape of the fan flow vs. speed curve (for example—additional measurements at 20, 40, 60, and 80 percent of maximum speed).

For single speed air circulating fans, DOE proposes to require that testing be conducted at the single available speed. For multi-speed fans with discrete operating speeds, and for variable-speed fans with continuously adjustable speeds, while DOE believes it is preferable to align the DOE test procedure with the accepted industry test procedures—in this case AMCA 230—as much as possible, DOE does not have data to determine the typical field operating speed(s) of air circulating fan [78] (AMCA did not provide any data to support their claims that air circulating fans are mainly used at high speed) and DOE has tentatively determined that testing at each discrete speed (for multi-speed fans) or at each of the five speeds currently specified in AMCA 230–15 (with errata), rather than only requiring testing at the maximum speed may provide a more holistic representation of an air circulating fan's performance over a range of service levels, which may in turn facilitate easier comparisons for consumers. It would also capture any changes in the efficiency of the motor and associated variable speed control device at part-load conditions. In addition, DOE proposes to clarify that variable-speed air circulating fans with a minimum speed that is greater than 20 percent of the maximum speed, the performance data would be captured and reported in five speeds evenly spaced throughout the speed range, including at minimum and maximum speeds.[79]

DOE is considering several alternative options for specifying the test speeds at which fans with multiple or variable speeds should be tested including testing a high speed only, or testing in accordance with the speed requirements for large diameter ceiling fans in section 3.5 of 10 CFR part 430, appendix U, which specifies that testing must be conducted at maximum speed and at 40 percent speed or the nearest speed that is not less than 40 percent speed. DOE notes that regardless of the proposed tested speeds, performance data at additional speeds may be captured and reported to better define the shape of the fan performance curve (for example, additional measurements at 20, 60, and 80 percent of maximum speed).

DOE is aware that the AMCA 230 committee is considering revisions to how test speeds are specified for air circulating fans and that the options considered by the AMCA 230 committee are subject to change and could further be revised in the next version of AMCA 230. Should the revised version of AMCA 230 publish prior to the publication of any DOE test procedure final rule, DOE intends, after considering stakeholder feedback received in response to the proposals in this document, to revise the provisions related to speed selection in line with the latest AMCA 230 standard, provided the updates in this standard are consistent with the provisions DOE is proposing in this NOPR, or the updates are related to topics that DOE has discussed and solicited comments on in this NOPR.

Finally, DOE notes that AMCA 214–21 has provisions to calculate performance data at non-tested speeds based on wire-to-air test results at different speeds. See Section 6.2 ''Calculated Ratings Based on Wire to Air Testing'' of AMCA 214–21, which references Section 8.2.3 ''Calculation to other speeds and densities for wire-to-air testing'', and Annex G ''Wire-to-Air Measurement—Calculation to Other Speeds and Densities (Normative)''. For air circulating fans, DOE has tentatively determined that these sections do not apply because air circulating fans have a more limited range of operating speeds and DOE is proposing to test at each speed where performance data is required. AMCA 214–21 also includes an annex that only applies to shaft-to-air tests and allows interpolating performance between tested speeds (Annex E of AMCA 214–21). For air circulating fans, DOE has tentatively determined that these sections do not apply because air circulating fans are tested wire-to-air.

DOE seeks feedback on the options presented for specifying the testing speed(s) for air circulating fans and its proposal to test single speed fans at the single available speed, multi-speed fans at each available speed, and variable speed fans at 20, 40, 60, and 80 percent of maximum speed. DOE further requests feedback on its proposal to clarify that if the fan minimum speed is greater than 20 percent of the maximum speed, the performance data would be captured and reported in five speeds evenly spaced throughout the speed range, including at minimum and maximum speeds.

DOE requests data to characterize typical air circulating fan operating speed(s) and time spent at each operating speed.

DOE requests feedback on whether Section 6.2 and Annex E of AMCA 214–21 should be applied to air circulating fans.

15. Determination of Equilibrium

Section 6.1.2 of AMCA 210–16 states that ''statistically stable conditions shall be established before each [test] determination. To test for a stable condition, trial observations shall be made until steady readings are obtained. The range of airflow over which stable condition[s] cannot be established shall be recorded and reported.'' Similarly, Section 8.1.1 of AMCA 230–15 (with errata) specifies that equilibrium conditions must be established before each measurement, with equilibrium achieved once steady readings are

[78] In agricultural applications, DOE has found some data indicating ventilation requirements vary by a factor of 12 depending on the season (cold weather vs. hot weather). However it's unclear if the different ventilation requirements would typically be met by cycling fans on/off at maximum speed or by varying speeds, or through other speed settings. *https://extension.umn.edu/swine-facilities/change-season-ventilation.*

[79] If the fan's maximum speed is 1000 RPM and the fan's minimum speed is 400 RPM, then the following speeds should be reported: 400, 550, 700, 850, and 1000 where each speed is equally spaced of 150 RPM or (1000–400)/4

obtained. DOE notes that while both AMCA 210–16 and AMCA 230–15 require that steady readings must be obtained prior to the start of test, neither test standard provides specific variables with associated tolerances within which equilibrium can be quantified. In order to ensure repeatable and reproducible results from a test method, it is necessary to specify consistent requirements for determining when a fan is and is not at equilibrium before the commencement of testing. It is also necessary to specify a time period over which equilibrium must be established.

(a) Air Circulating Fans

For circulating fans, the AMCA 230 committee is considering selecting three or four values from the options listed in Table III–12 for determining equilibrium prior to testing, namely: fan speed, system input power, barometric pressure, and load differential. To verify that equilibrium has been achieved, readings would need to meet the tolerances specified in Table III–12, after running the fan for at least 5 minutes, with measurements taken at least every 5 seconds.

TABLE III–12—EQUILIBRIUM OPTIONS CONSIDERED BY THE AMCA 230 COMMITTEE WORKING GROUP

Variable	Equilibrium tolerance
Ambient barometric pressure.	±3 percent of mean.
Extraneous airflow before test.	≤50 fpm.
System input voltage *	±2 percent of mean.
System input power **	±2 percent of mean or 1 Watt.
Fan speed	±1 percent of mean or 1 rpm.
Load	±1 percent of mean.
Load differential	±1 percent of mean.

* AMCA 230–15 (with errata) uses the terms system input voltage, electrical input voltage, and voltage interchangeably.

** AMCA 230–15 (with errata) uses the terms systems input power, electrical input power, and power interchangeably to designate the real power (see Section 6.3 of AMCA 230–15 (with errata).

DOE has tentatively determined that ambient air density, extraneous airflow (*i.e.,* test room ventilation), system input voltage, system input current, system input power, fan speed, load, and load differential will impact test results. Therefore, DOE is proposing that measurements of these values would need to fall within the tolerance window listed in Table III–13 prior to initiating the test for fans and blowers, including air circulating fans. As the examples above illustrate, equilibrium must be determined from multiple data points taken over a specified period of time. DOE is proposing that measurements for the variables listed in Table III–13 would be taken at least every 5 seconds over a minimum of 5 minutes. This timeframe provides a minimum of 60 data points from which equilibrium can be verified.

TABLE III–13—PROPOSED TEST VARIABLES AND TOLERANCES FOR DETERMINING EQUILIBRIUM OF AIR CIRCULATING FANS PRIOR TO EACH FAN TEST

Variable	Equilibrium tolerance
Calculated air density	±1 percent of mean.
System input voltage	±2 percent of mean.
System input current	±2 percent of mean.
System input power	±2 percent of mean or 1 W, whichever is greater.
Fan speed	±1 percent of mean or 1 rpm, whichever is greater.
Load	±1 percent of mean.
Load differential	±1 percent of mean.

Fan pressure and horsepower, and therefore fan efficiency, will vary with air density at the fan inlet. Therefore, DOE is proposing that air density, as determined from dry bulb temperature, dew point, and barometric pressure measured over at least 5 minutes, would remain within one percent of the mean air density in order to establish equilibrium prior to fan testing.

DOE's proposed system input voltage, system input current, system input power, load, and load differential tolerances for evaluating equilibrium are two times the equipment accuracy tolerances specified in AMCA 230–15. Doubling equipment accuracy is a typical approach for determining reasonable measurement tolerances. DOE notes that its proposed tolerances for input voltage, input current, load, and load differential are identical to those discussed by the AMCA 230 committee working group, as are the measurement interval and measurement time frame. However, DOE is proposing that system input power would also include a lower limit on wattage (*i.e.,* ±2 percent of mean wattage or 1 W). Additionally, DOE is proposing that fan speed would be within ±1 percent of the mean rpm or 1 rpm, whichever is highest over at least a 5-minute time period in order to establish equilibrium prior to testing. DOE recognizes that measurements at low airflow tend to be variable and this approach provides additional tolerance for fans tested at lower speeds.

DOE recognizes that demonstrating equilibrium for each of the variables listed in Table III–13 of this document may not be realistic for all fans. DOE may consider prioritizing the variables listed in Table III–13 of this document, such that equilibrium must always be demonstrated for a specific number of the highest priority variables. For instance, DOE may require that equilibrium must be demonstrated for more variables at high speed than at low speed. Alternately, DOE may consider specifying a subset of the variables proposed in Table III–13 of this document, similar to what has been discussed by the AMCA 230 committee.

Section 8.1.2 of AMCA 230–15 specifies that the extraneous airflow before, during, and after test should not exceed 50 fpm and that measurements should be taken immediately before and after the test to verify that this condition is met. DOE agrees that extraneous airflow in the test chamber may impact test results and should be recorded prior to and after the test; however, DOE notes that it is unrealistic to conduct extraneous airflow measurement during testing. Therefore, in addition to the maximum extraneous airflow requirement of 50 feet per minute specified in Section 8.1.2 of AMCA 230–15, DOE is proposing to measure and record extraneous airflow for at least one minute prior to establishing equilibrium and for at least one minute at the conclusion of the test, with measurements recorded at a maximum of 5 second intervals. A test would be considered to be concluded at the instant the blades are no longer spinning.

DOE is aware that the revisions considered by the AMCA 230 committee are subject to change and could further be revised in the next version of AMCA 230. Should the revised version of AMCA 230 publish prior to the publication of any DOE test procedure final rule, DOE intends, after considering stakeholder feedback received in response to the proposals in this document, to revise the provisions related to appurtenances in line with the latest AMCA 230 standard, provided the updates in this standard are consistent with the provisions DOE is proposing in this NOPR, or the updates are related to topics that DOE has discussed and for which DOE has solicited comments to in this NOPR.

DOE requests comment on its proposal for determining if an air circulating fan has reached equilibrium prior to initiating testing. Specifically, DOE is soliciting comment on the test variables and related tolerances that it is proposing to incorporate in its equilibrium determination. Additionally, DOE seeks comment on the minimum duration and maximum interval over which equilibrium would need to be verified. DOE also seeks comment on which variables proposed in Table III–13 that, if not stable prior to test, would have the greatest impact on measured fan performance. Finally, DOE requests comment on its proposal to specify the time and frequency over which extraneous airflow measurements would be recorded.

(b) Fans and Blowers Other Than Air Circulating Fans

Similar to the evaluation described previously for air circulating fans, DOE reviewed the test chamber and test equipment accuracy requirements listed in Section 6 of AMCA 210–16. DOE has tentatively determined that ambient air density, input power (as measured by a reaction dynamometer, torque meter, calibrated motor, or electrical meter) will impact test results. Additionally, ascertaining that fan speed is at steady state prior to testing is critical for ensuring repeatable and reproducible fan performance results. Therefore, DOE is proposing that measurements of these values would need to fall within the tolerance window listed in Table III–14 prior to initiating the test. Equilibrium on input power would be required on a single input power device. Equivalent to the proposal for air circulating fans, DOE is proposing that fan system equilibrium would need to be verified over at least 5 minutes, with measurements recorded on each variable at a maximum of 5 seconds.

TABLE III–14: PROPOSED TEST VARIABLES AND TOLERANCES FOR DETERMINING EQUILIBRIUM OF FANS AND BLOWER OTHER THAN AIR CIRCULATING FANS PRIOR TO EACH FAN TEST

Variable	Equilibrium tolerance
Ambient air density	±1 percent of mean.
Input power by reaction dynamometer.	±4 percent of mean.
Input power by torque meter.	±4 percent of mean.
Input power by calibrated motor.	±4 percent of mean.
Input power by electrical meter.	±2 percent of mean or 1 W, whichever is greater.
Fan speed	±1 percent of mean or 1 rpm, whichever is greater.

For fans other than circulating fans, DOE notes that Section 7.3 of the 2007 edition of ISO 5801 specified that before taking measurements, the fan must be run until it reaches steady operation, which was described as speed fluctuation being no more than ±0.5 percent of the average speed. While this provision is more stringent than DOE's proposal of ±1 percent of the average speed measured over at least 5 minutes, DOE is proposing tolerances on variables in addition to fan speed (as listed in Table III–14) to verify that equilibrium has been achieved.

DOE recognizes that demonstrating equilibrium for each of the variables listed in Table III–14 may not be realistic for all fans. DOE may consider prioritizing the variables listed in Table III–14, such that equilibrium must always be demonstrated for a specific number of the highest priority variables. For instance, DOE may require that equilibrium must be demonstrated for more variables at high speed than at low speed. Alternately, DOE may consider specifying a subset of the variables proposed in Table III–14, similar to what has been discussed in the AMCA 230 committee working group.

DOE requests comment on its proposal for determining if a fan that is not an air circulating fan has reached equilibrium prior to initiating testing. Specifically, DOE is soliciting comment on the test variables and related tolerances that it is proposing to incorporate in its equilibrium determination. Additionally, DOE seeks comment on the minimum duration and maximum interval over which equilibrium would need to be verified. Finally, DOE seeks comment on which variables proposed in Table III–14 that, if not stable prior to test, would have the greatest impact on measured fan performance.

16. Test Figures

AMCA 230–15 (with errata) describes the test set-up that can be used to test various categories of air circulating fans and specifies that air circulating fan heads and table fans, which correspond to unhoused ACFHs, must be tested according to test figures 2A, 2B1, and 2B2. AMCA 230–15 (with errata) also specifies that box fans and personnel coolers, which are both housed ACFHs, must be tested using test figures 3A and 3B. The AMCA 230 Committee reviewed the existing text figures and is considering revising the allowable test figures to reflect that housed air circulating fans could also be tested using test figures 2A, 2B1, and 2B2, and unhoused air circulating fans would be tested using figures 3A and 3B.

DOE has tentatively determined that test figures 2A, 2B1, 2B2, 3A and 3B are appropriate for all air circulating fans. As such, DOE is proposing to specify that any test figures that are specified in AMCA 230–15 (with errata) can be used for testing air circulating fans. Table III–14 of this document summarizes DOE's proposals for which test set-up would be used for each air circulating fan type.

TABLE III–14—TEST FIGURES IN AMCA 230–15

[With errata]

Test figure and description	Applicable air circulating fan category in AMCA 230–15	DOE's proposed applicable air circulating fan category
Test Figure 2A: Horizontal Airflow Setup with Counterweights Pivot Above Test Subject.	Air circulating fan heads and table fans	Any air circulating fan.
Test Figure 2B1: Horizontal Airflow Setup with Load Cell	Air circulating fan heads and table fans	Any air circulating fan.
Test Figure 2B2: Horizontal Airflow Setup with Load Cell Pivot Below Test Subject.	Air circulating fan heads and table fans	Any air circulating fan.
Test Figure 3A: Horizontal Airflow Setup with Load Cell	Box Fan and Personnel Cooler	Any air circulating fan.
Test Figure 3B: Horizontal Airflow Setup with Load Cell	Box Fan and Personnel Cooler	Any air circulating fan.

DOE is aware that the revisions being considered by the AMCA 230 committee are subject to change and could further be revised in the next version of AMCA 230. Should the revised version of AMCA 230 publish prior to the publication of any DOE test procedure final rule, DOE intends, after considering stakeholder feedback received in response to the proposals in this document, to revise the definitions in line with the latest AMCA 230 standard, provided the updates in this standard are consistent with the definitions DOE is proposing in this NOPR or the updates are related to topics that DOE has discussed and for which DOE has solicited comments in this NOPR.

DOE requests comment on the applicability of each test figure in AMCA 230–15 to air circulating fans.

17. Reference Fan Electrical Input Power Calculation

Section 5 of AMCA 214–21 provide the equations necessary to calculate the reference FEP at a given duty point. The reference FEP calculation relies on three equations:

- A reference fan shaft input power equation, used to calculate the reference fan shaft input power at a given duty point. This equation relies on a flow constant (Q_0, equal to 250) and a pressure constant (P_0, equal to 0.4), which represent how efficiency varies as a function of flow and pressure and an efficiency target, which was set to represent a market reference efficiency fan (equal to 0.66 total efficiency target or 0.6 static efficiency target, depending on the FEI pressure basis). *See* Section 5.1 of AMCA 214–21;
- A reference fan transmission efficiency equation, which calculates the reference fan transmission as a function of the reference shaft input power and represents a typical belt drive. *See* Section 5.2 of AMCA 214–21; and
- A reference motor equation as described in section III.D.1 of this document.

In response to the February 2022 ECS RFI, the CA IOUs encouraged DOE to use different flow and pressure constants for the FEI for ACFs than those that are used in either AMCA 214 or the Ceiling Fan Energy Index (''CFEI''). They stated the ACFs do not operate in ''high-pressure, low airflow'' conditions (for which the coefficients developed for the FEI metric in AMCA 214–21 are most applicable) nor do they operate in ''low-pressure, high airflow'' conditions (for which the CFEI metric is most applicable). CA IOUs provided data showing that the FEI from AMCA 214–21 favors larger diameter ACFs, while the CFEI favors smaller diameter, lower airflow ACFs. They further encouraged DOE to collaborate with industry stakeholders to develop new FEI coefficients specifically for ACFs. (Docket No. EERE–2022–BT–STD–0002, CA IOUs, No. 7 at p. 2–5)

DOE collected air circulating fan performance data from the BESS certification database[80] and performed the following analysis to determine the appropriate flow and pressure constants for air circulating fans: (1) DOE used the published fan impeller diameter (in) and flow (cfm) and the total pressure formula discussed in section III.D.10 of this document to calculate the total pressure[81] of each fan in the database; (2) DOE used the published efficacy (cfm/W) and airflow (cfm) data to calculate the FEP of each fan in the database (FEP_{act}); (3) DOE used the formulas in Section 5 of AMCA 214–21 to calculate the reference FEP (FEP_{ref}) of each fan in the database at its corresponding total pressure and flow point; and (4) DOE conducted a regression analysis using the method of least squares to identify the values of the flow constant, Q_0, pressure constant, P_0, and efficiency target, which minimize the sum of squared difference between FEP_{act} and $FEP_{ref.}$. DOE obtained the following results: Q_0 = 3,210 (rounded to the nearest 10); P_0 = 0; and an efficiency target of 0.43. Based on this analysis, DOE has tentatively determined that these constant values for flow and pressure constants are appropriate for air circulating fans and proposes to use the values of Q_0 = 3,210 and P_0 = 0 when calculating the FEI of air circulating fans as part of the test procedure. Should additional data become available to justify different constants, DOE may consider different values of Q_0 and P_0 for air circulating fans.

Figure III–1 through Figure III–3 show air circulating fan performance data from the BESS database as well as the corresponding reference fan performance data calculated using Q_0 = 3,210, P_0=0, and an efficiency target of 0.43. Figure III–3 and Figure III–4 also shows the cfm/w index calculated as the cfm/w value of the fan divided by the average cfm/w value of all fans of the same diameter present in the database.

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[80] Data collected on March 22, 2022, included 507 models of air circulating fans with the following information: Manufacturer, Power Supply, Model Number, Style (*i.e.* basket, box, panel, or tube), Size (in) (*i.e.,* impeller diameter), Guard configuration, Airflow (cfm), Efficacy (cfm/w), Thrust (lbf), Input power (kW), Thrust Efficiency ratio (lbf/kW), 5D Centerline Velocity (fpm). *See bess.illinois.edu.*

[81] DOE notes that for housed air centrifugal fans, DOE relied on the impeller diameter as a proxy for the diameter of the orifice of the housing.

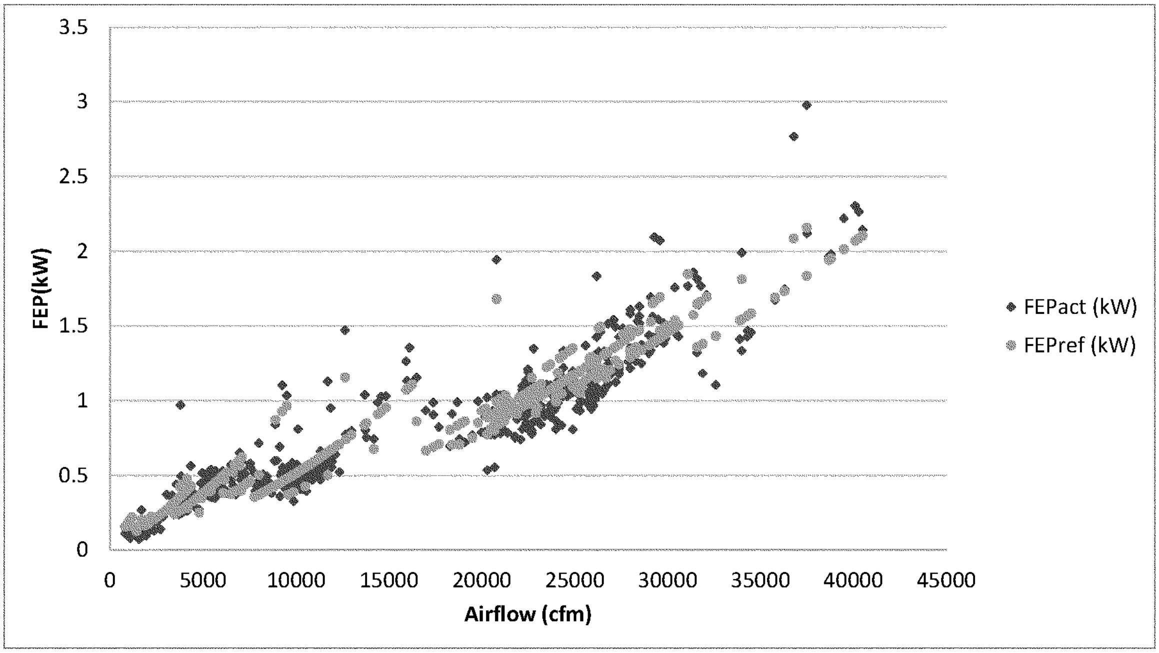

Figure III-1: Fan Electrical Input Power as a Function of Airflow (Q_0=3,210; P_0=0; Efficiency target = 0.43)

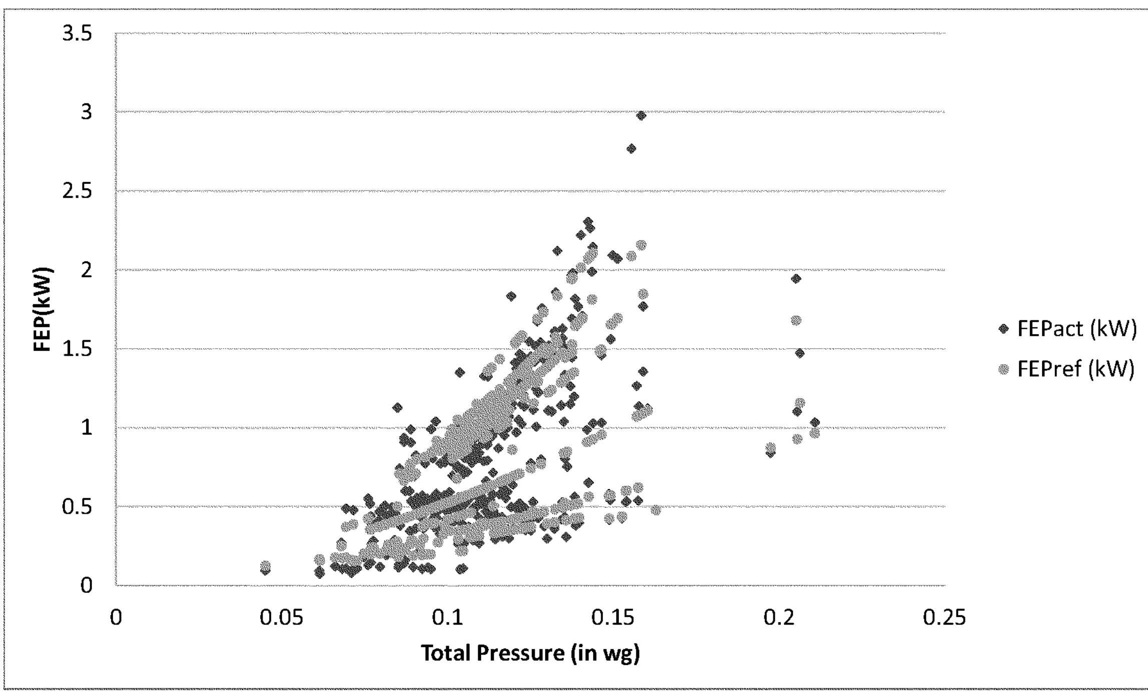

Figure III-2: Fan Electrical Input Power as a Function of Total Pressure (Q_0=3,210; P_0=0; Efficiency target = 0.43)

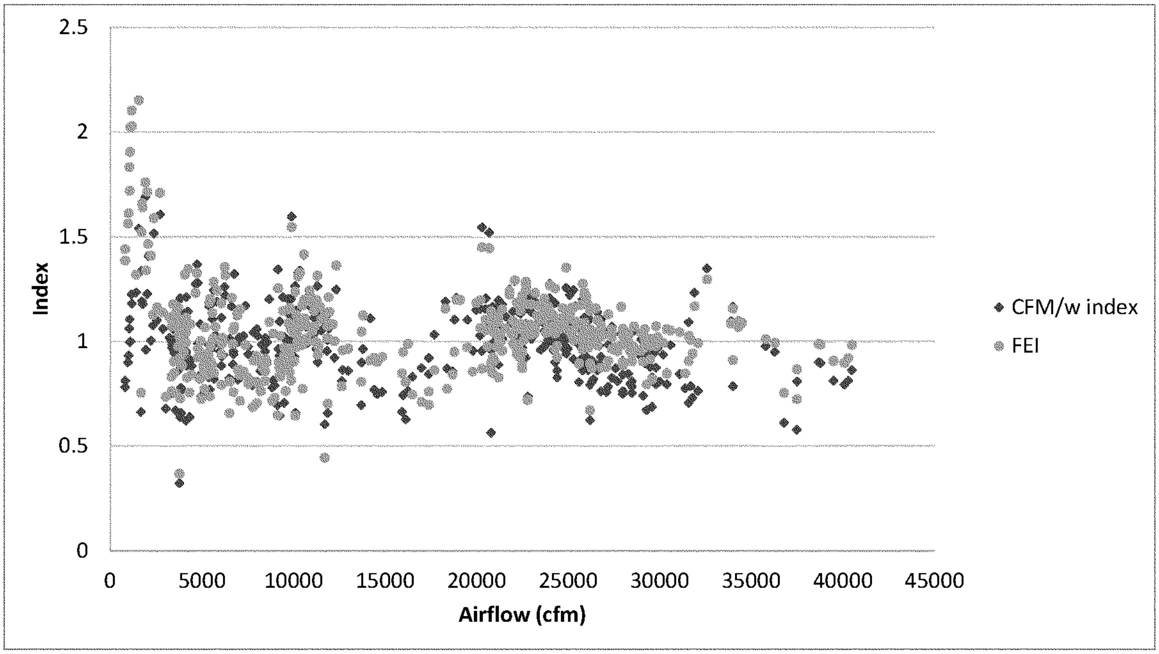

Figure III-3: FEI and cfm/w index as a Function of Airflow (Q_0=3,210; P_0=0; Efficiency target = 0.43)

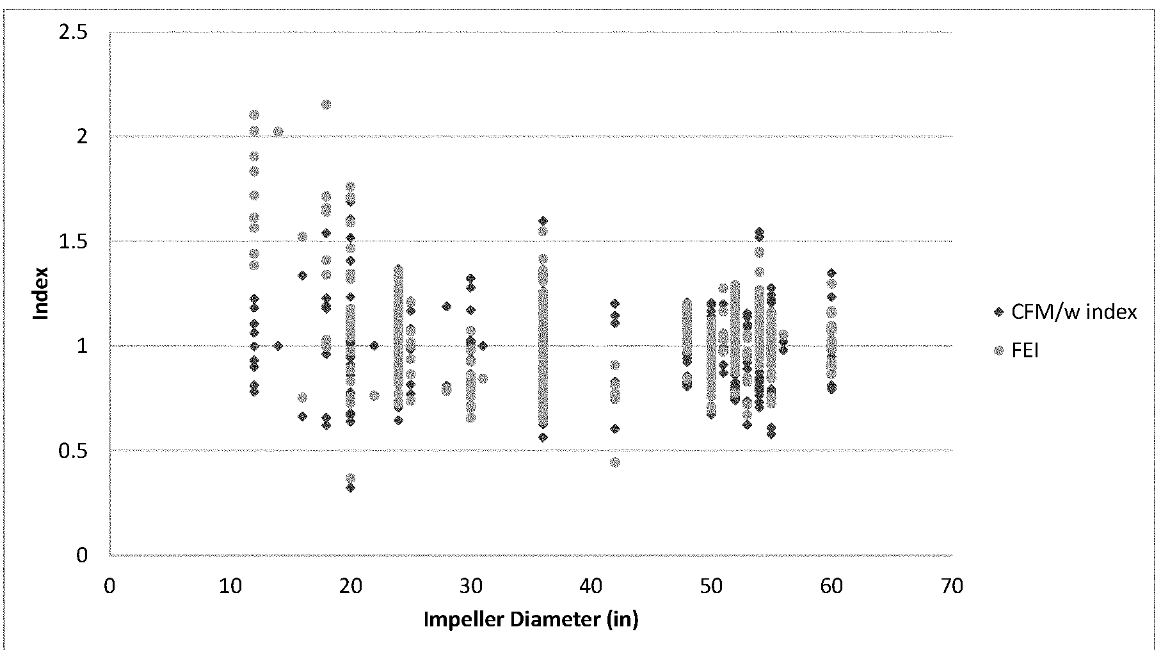

Figure III-4: FEI and cfm/w index as a Function of Impeller Diameter (Q_0=3,210; P_0=0; Efficiency target = 0.43)

Using an efficiency target of 0.43 results in a reference fan that performs better than approximately 50 percent of the market.[82] For general fans and blowers, the current efficiency target of 0.66 is estimated to correspond to a fan that performs better than approximately 20 percent of the market.[83] In line with this approach, DOE has tentatively determined that the efficiency target for air circulating fans that would correspond to a reference fan which performs better than 20 percent of the market is 0.38. Therefore, DOE proposes to use an efficiency target of 0.38 in its calculations for determining air circulating fan FEI. DOE notes that if additional data become available to

[82] This is a direct result of the analysis which looks at minimizing the distance (*i.e.,* the square of the difference) between FEP_{ref} and FEP_{act}.

[83] An efficiency target of 0.66 corresponds to the efficiency level 3 (''EL3'') as analyzed in the November 2016 Notice of Data Availability. Based on the analysis conducted in support of this NODA DOE estimated that 80 percent of fans perform at or above EL3 based on information published in the life-cycle cost spreadsheet, ''LCC Sample'' worksheet. (Docket No. EERE–2013–BT–STD–0006, LCC Spreadsheet, No. 190, at p. 4, cell AD51–AD58)

justify a different efficiency target, DOE may consider a different efficiency target for air circulating fans. Figure III–5 illustrates the impact of changing the efficiency target on the calculated reference fan wire-to-air efficiency, (''Wire-to-air Efficiency ref'') in comparison to the wire-to-air efficiency of actual fans (''Wire-to-air Efficiency act'').

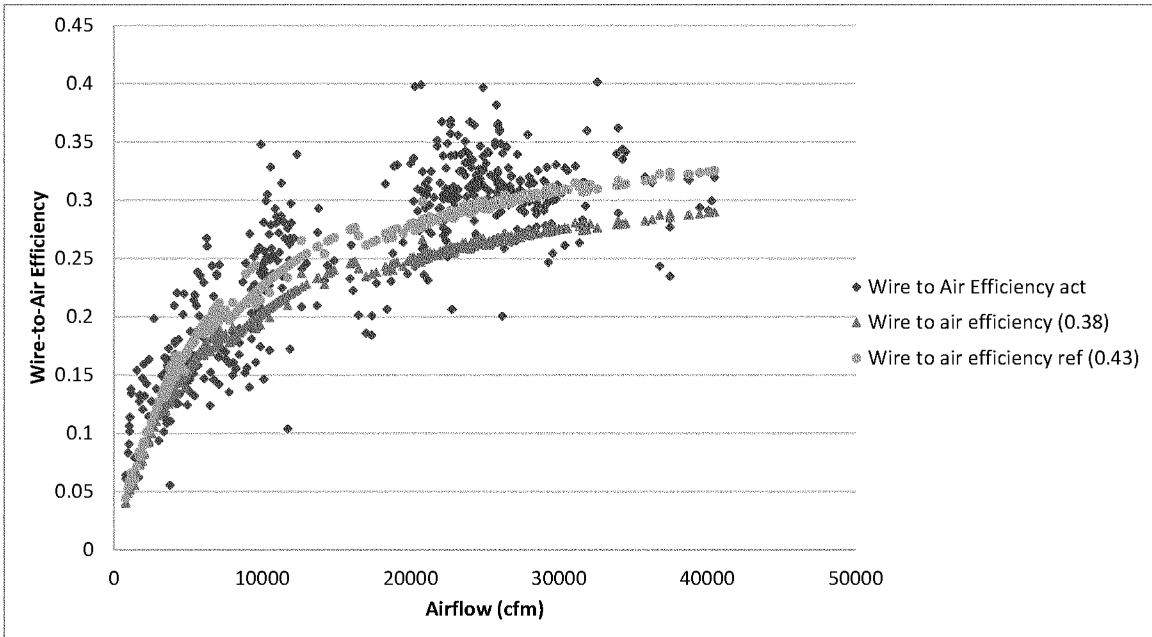

Figure III-5: Wire-to-air Efficiency as Function of Airflow (Q_0=3,210; P_0=0; Efficiency target = 0.43 and 0.38)

Figure III–5 shows the reference fan cfm/w compared against the cfm/w of the actual fans included in the BESS database. Below impeller diameters of 20 inches, DOE notes that most fans in the database have a FEI value greater than 1 (as illustrated by having higher cfm/w values compared to the reference fan, this can also be seen on Figure III–4 where smaller fan impellers tend to have higher FEIs). DOE believes this is because most fans with impeller diameters at or below 20 inches are direct driven, while the reference fan always includes belt losses. DOE may consider calculating the FEP_{ref} value s using the same transmission configuration as the actual fan being evaluated (*i.e.,* include transmission losses in the FEP_{ref} calculation only for fans distributed in commerce with a belt transmission). However, DOE has tentatively determined that using the same reference fan for all fan configurations results in a FEI that can be compared across transmission configurations and that different FEI calculations depending on the transmission configuration may be confusing to the consumer. Therefore, at this time, DOE proposes to calculate FEP_{ref} inclusive of the belt losses.

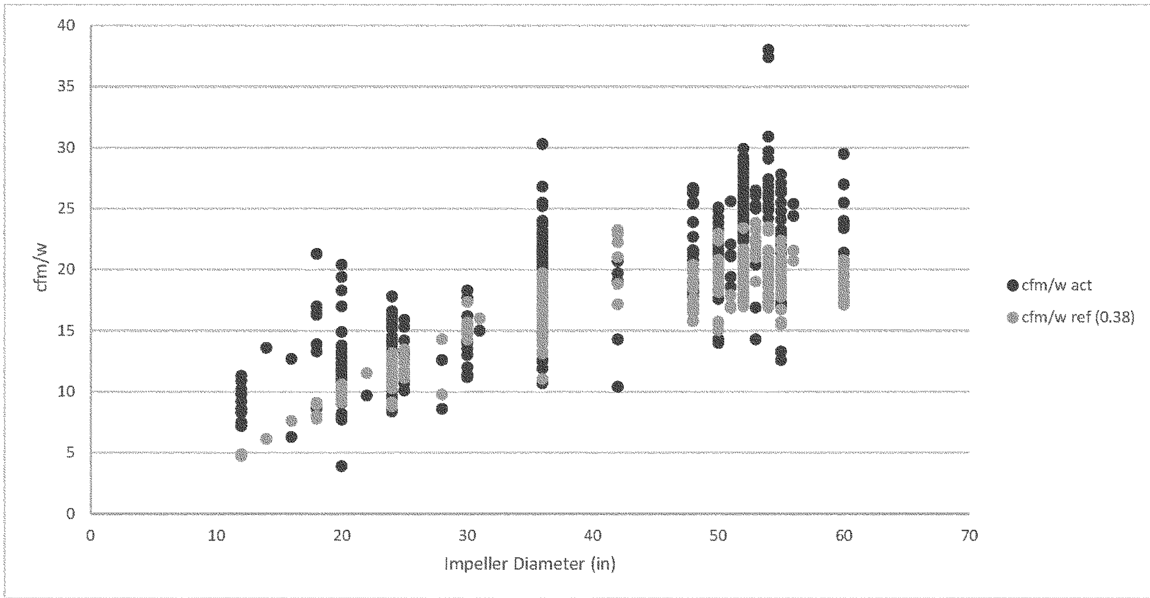

Figure III-5: Comparison of cfm/w Metric for Actual Fans vs. cfm/w Metric for Reference Fans at the Same Duty Point (Q_0=3,210; P_0=0; Efficiency target = 0.38)

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DOE requests comment on the proposed FEI calculation for air circulating fans.

18. Rounding

As discussed in section III.K, DOE presents a sampling plan for determining representative values of FEI, FEP, and BHP. As discussed, AMCA 214–21 provides a method for calculating fan performance using the FEI metric. However, AMCA 214–21 does not provide normative rounding requirements for FEI.

DOE notes that the FEI requirement is specified to the hundredths place in Section 6.5.3.1.3 of ASHRAE 90.1–2019 (Fan Efficiency). Additionally, the DOE energy conservation standard for large diameter ceiling fans is the Ceiling Fan Energy Index (''CFEI''), where the CFEI metric is calculated according to AMCA 208–18, is specified to the hundredths place (*i.e.,* CFEI must be greater than or equal to 1.00 at high speed and 1.31 at 40 percent speed, or the nearest speed that is not less than 40 percent speed). 10 CFR 430.32. Additionally, Annex I of AMCA 214–21 (informative) specifies rounding the FEI to the hundredth place.

DOE notes that FEI is the ratio of the electric input power of a reference fan to the electric input power of the actual fan and agrees that rounding FEI to two decimal places seems reasonable. Therefore, DOE is proposing that represented values of FEI would be rounded to the hundredths place. For consistency, DOE is also proposing that represented values for FEP would be rounded to the hundredths place.

Rounding of the inputs to the calculation of FEI can impact the represented FEI (or FEP value). DOE reviewed the provisions related to rounding in the ceiling fan test procedure, which state that all measurements should be recorded at the resolution of the test instrumentation and that calculations shall be rounded to the number of significant digits present at the resolution of the test instrumentation. Section 3.1.1 of 10 CFR part 430 appendix U.

DOE has tentatively concluded that the rounding provisions in section 3.1.1 of 10 CFR part 430 appendix U are reasonable and that recording measurements at the resolution of the test instrumentation would provide sufficient significant digits for accurately calculating representative values of FEI and FEP. Therefore, DOE is proposing that all measurements would be recorded at the resolution of the test instrumentation and that calculations would be rounded to the number of significant digits present at the resolution of the test instrumentation.

DOE is aware that the AMCA 230 committee is considering adding rounding requirements in the revised version of AMCA 230. Should the revised version of AMCA 230 publish prior to the publication of any DOE test procedure final rule, DOE intends, after considering stakeholder feedback received in response to the proposals in this document, to revise the provisions related to appurtenances in line with the latest AMCA 230 standard, provided the updates in this standard are consistent with the provisions DOE is proposing in this NOPR, or the updates are related to topics that DOE has discussed and for which DOE has solicited comments to in this NOPR.

DOE requests comment on its proposals for rounding represented values of FEI and FEP to the hundredths place. Additionally, DOE seeks comment on its proposal to specify rounding requirements for test values and calculations that are consistent with the resolution of the test instrumentation.

19. Location of Extraneous Airflow Measurement

Section 8.1.2 of AMCA 230–15 (with errata) specifies that the air velocity in the test room, not generated by the test air circulating fan, shall not exceed 0.25 m/s (50 fpm) prior to, during, and after the test. Velocity measurements shall be taken immediately before and immediately after the test to ensure that this condition is met. In addition, AMCA 230–15 (with errata) specifies the location of the extraneous airflow measurement shall be directly under the center of the fan at an elevation of 1701.8 mm (67 in.) above the floor. DOE notes that this provision is only applicable to fans tested according to Figure 1 of AMCA 230–15 (with errata) and that there is no location specified for extraneous airflow measurement for fans tested according to Figures 2A, 2B1, 2B2, 3A and 3B.

The AMCA committee is considering adding the following provisions to specify the location of the extraneous airflow measurement and to move these provisions from Section 8.1.2 of AMCA 230–15 (with errata) into each of the figures. For figure 1 of AMCA 230–15, the location of extraneous airflow measurement would be directly under the center of the fan at an elevation of 1.7m (67 in.) above the floor. For figures 2A, 2B1, 2B2, 3A and 3B, the location of extraneous airflow measurement should be at the center of the fan at a distance of 1.5m (5 ft) downstream of the fan impeller.

DOE agrees that these additional specifications are necessary to ensure test procedure repeatability, and therefore proposes to add these additional provisions as considered by the AMCA 230 committee.

DOE requests comment on the proposed location of the extraneous airflow measurement for air circulating fans.

20. Run-In Requirements

Section 7.4 of AMCA 214–21 specifies that all fans shall be run-in for not less than fifteen minutes prior to the commencement of data collection. The AMCA 230 committee is considering adding similar requirements for air circulating fans. DOE proposes that the minimum run-in requirement of 15 minutes for fans and blowers be applied to air circulating fans.

DOE requests comment on the proposed run-in requirements.

21. Transducer Type Barometers

Section 6.5.2.1 of AMCA 230–15 (with errata) specifies that transducer type barometers shall be calibrated for each test. The AMCA 230 committee is considering removing this requirement from the revised version. DOE is also considering not including this requirement as it may be sufficient to require that the barometer be calibrated against a mercury column barometer with a calibration that is traceable to the National Institute of Standards and Technology (''NIST'') or other national physical measures recognized as equivalent by NIST, without having to repeat calibration before each test.

DOE requests comment on whether the requirement to calibrate transducer type barometers for each test is necessary or should be removed for air circulating fans.

E. Distinguishing Between Fans and Blower and Air Circulating Fans

In response to the February 2022 ECS RFI, ebm-papst supported the use of the thrust-test method described in AMCA 230 to test ACFs without a housing. They also stated that either AMCA 210 or AMCA 230 test methods could be used for ACFs with housing. (Docket No. EERE–2022–BT–STD–0002, ebm-papst, No. 8 at p. 1)

Some manufacturers offer the same fan model with different mounting configurations. Depending on the mounting configuration, the same fan could either meet the definition of a fan tested per AMCA 210–15 or meet the definition of an air circulating fan and be tested per AMCA 230–15. DOE identified that air circulating fans with housing (*i.e.,* axial panel air circulating fans and box fans) can also be distributed in commerce as with brackets for mounting through a wall, ceiling, or other structure that separates the fan's inlet for its outlet and marketed as ''exhaust fans''. In this case, DOE agrees with ebm-papst that these fans would be tested per AMCA 210–16 as they would meet the definition of an axial panel fan. Manufacturers who distribute these fans in commerce in both configurations and market the fans both for air circulation and exhaust applications typically test the fan using both AMCA 230–15 (with errata) and AMCA 210–16.

DOE is proposing that fan models that meet both the definition of an axial panel fan and the definition of an air circulating fan (*i.e.,* axial air circulating panel fan, box fan, or ACFH) depending on the presence or absence of brackets for mounting through a wall, ceiling, or other structure that separates the fan's inlet from its outlet be tested according to both the proposed test procedures for fans and blowers, excluding air circulating fans, and the proposed test procedure for air circulating fans.

DOE requests comment on its proposal that fans that meet the definition of both an axial panel fan and the definition of an air circulating fan because of the presence or absence of brackets for mounting through a structure that separates a fan's inlet from its outlet be tested both as a fan and blower and as an air circulating fan.

F. Metric

AMCA 214–21 provides uniform methods to determine the FEP and FEI of a fan at a given duty point.[84] As explained, FEP describes the electrical input power of a fan in kilowatts. AMCA 214–21 defines FEI as the ratio of the electrical input power of a reference fan to the electrical input power of the actual fan for which the FEI is calculated, both established at the same duty point. As stated, FEI is a dimensionless index for evaluating a fan's performance against a reference fan. Section 5 of AMCA 214–21 provides the equations to calculate the reference fan electrical input power as a function of airflow and pressure.

For fans other than circulating fans, the Working Group recommended using FEP as the primary fan metric and to allow using FEI for additional representation of energy use. The Working Group also recommended calculating FEI using the FEP of a fan that is exactly compliant with any future fan energy conservation standards. (Docket No. EERE–2013–BT–STD–0006, No. 179, Recommendation #6, at p. 5). The Working Group further recommended that the metric be evaluated at each operating point as specified by the manufacturer. (Docket No. EERE–2013–BT–STD–0006, No. 179, Recommendations #18, #27, at pp. 10–11, 13–14). Under this approach, for each basic model of fan, a manufacturer would have to determine the FEP of the fan at each operating point.

As discussed, FEG is another efficiency metric developed for fans other than air circulating fans. FEG is a numerical rating that represents the ratio of airpower produced by the fan divided by the fan shaft power, as a function of fan impeller diameter.[85] As stated by the petitioners, starting in 2012, FEG was used in model energy codes and standards[86] to establish fan efficiency requirements, which were subsequently adopted by at least 12 State energy codes.[87] (Docket No. EERE–2020–BT–PET–0003, The Petitioners, No. 1.3., at p. 2, 4) Following the recommendations of the Working Group, AMCA developed the metrics FEP and FEI as a replacement for FEG.

The Petitioners stated that, compared with FEG, FEI is a wire-to-air metric for fans. The Petitioners also commented that the FEI metric allows fan specifiers and purchasers to easily compare the power consumption of multiple fans, including motor and drive combinations. Petitioners stated that

[84] As previously described, a duty point is characterized by a given airflow and pressure and has a corresponding operating speed. The collection of all duty points associated with a given speed is referred to as a ''fan curve''. AMCA 214–21 provides methods to establish the FEP and FEI at any point within the operating range of the fan.

[85] See AMCA 205–2010, ''Energy Efficiency Classification for Fans''.

[86] International Green Construction Code (2012); ANSI/ASHRAE/IES 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings (2013); ANSI/ASHRAE/USGBC/IES 189.1, Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings (2014); International Energy Conservation Code (2015).

[87] Alabama, Florida, Hawaii, Idaho, Illinois, Maryland, Minnesota, New Jersey, New York, Oregon, Utah, Vermont, and Washington.

using FEI would facilitate simpler enforcement by code officials because FEI ratings are easy to compare to potential minimum code requirements. (Docket No. EERE–2020–BT–PET–0003, The Petitioners, No. 1.3 at p. 3)

In response to the April 2020 Notice of Petition, CTI commented that FEI is a new metric and questioned its longevity as a basis for Federal regulation. CTI commented that AMCA previously advocated for FEG in ASHRAE 90.1 and is now advocating for FEI. CTI commented that the use of FEI in ASHRAE 90.1–2019 will help assess the usability and application of this metric. (Docket No. EERE–2020–BT–PET–0003, CTI, No. 11 at p. 3)

NEEA and NWPCC commented in support of the FEI metric. NEEA and NWPCC stated that the FEI, which is established at any given duty point, can be used to compare the energy consumption of different fans operating at the same design conditions. NEEA and NWPCC commented that the FEI metric provides a straightforward way for designers to evaluate the relative power consumption of different fans and would drive the market to select more efficient fans through providing consistent, actionable information to designers. (Docket No. EERE–2020–BT–PET–0003, NEEA and NWPCC, No. 12 at p. 2)

ASAP, ACEEE, and NRDC and Greenheck commented that a DOE test procedure based on AMCA 214 would provide the basis to assist customers and designers in making purchasing decisions and save energy by informing design decisions. (Docket No. EERE–2020–BT–PET–0003, ASAP, ACEEE, NRDC, No. 7 at p. 1; Greenheck, No. 6.2. at p. 1). ASAP, ACEEE, and NRDC stated that AMCA 214 provides methods to establish FEI ratings across the entire operating range of a fan model, which can improve fan selection and deliver large energy and cost savings. ASAP, ACEEE, and NRDC commented that the FEI metric provides a simple way to evaluate the relative power consumption of potential fans at a customer's design point. (Docket No. EERE–2020–BT–PET–0003, ASAP, ACEEE, NRDC, No. 7 at p. 1)

Johnson Controls commented in support of a transition from FEG to FEI for fans in airside applications (*i.e.,* applications where the primary purpose of equipment is to deliver airflow to a space, and where the energy efficiency of the fan operation is the primary driver of performance). Johnson Controls commented that using FEI for the representation of fan efficiency in airside applications will help consumers better understand the energy performance of a fan based on the expected airflow and pressure at the point of design. (Docket No. EERE–2020–BT–PET–0003, Johnson Controls, No. 10 at p. 1)

In the October 2021 RFI, DOE requested feedback on the metrics used in AMCA 230–15 and AMCA 214–21, particularly in the context of air circulating fans, including ACFHs. 86 FR 54412, 54415.

AHRI commented that ACFHs are standalone fans, with performance testing established appropriately using AMCA 230–15 and a FEI metric calculated using AMCA 214–21. (AHRI, No. 10 at p. 2)

AMCA reiterated its support for the use of FEI as the regulatory metric over FEP and as the metric for representation for fans and blowers, including air circulating fans. AMCA commented that FEI is preferred over FEP because FEI is a comprehensive ratio that already has duty-point dependent reference power embedded. FEI lends itself as a practical efficiency metric for setting a fan energy standard. FEP, is variable, depending on flow and other parameters. FEI, therefore, would be a more stable compliance metric. AMCA added that FEI has become the norm for AMCA certification and industry practice and has been adopted into model energy codes and standards and is used in state energy codes.[88] AMCA added that FEI is also being used as the metric for utility incentive programs presently offered or under development. (AMCA, No. 6 at p. 9) AMCA also recommended that DOE allow representation of intermediate data used to determine FEI, if those values were calculated using data from physical tests in accordance with the DOE test procedure, *i.e.,* FEP, W; Airflow, cfm; Efficacy, cfm/W; and Thrust efficiency ratio, lbf/kW. (AMCA, No. 6 at p. 9)

ASAP, ACEEE, NRDC support using FEI as the efficiency metric for air circulating fans. ASAP, ACEEE, NRDC commented that the FEI is both representative of energy usage and straightforward for purchasers to interpret. ASAP, ACEEE, NRDC commented that FEI accounts for inherent efficiency differences between fans of the same diameter that deliver different airflows. ASAP, ACEEE, NRDC also stated that using FEI for air circulating fans would also provide consistency with other commercial and industrial fan types subject to any future DOE standards. Moreover, ASAP, ACEEE, NRDC commented that FEI is intuitive and easy to understand for informing purchase decisions and provided the example that a FEI of 1.1 represents 10% energy savings over a FEI of 1. ASAP, ACEEE, NRDC also stated that FEI is similar to the Pump Energy Index for pumps. (ASAP, ACEEE, NRDC, No. 7 at p. 2)

NEEA agreed with AMCA in preferring the use of FEI over FEP for Federal efficiency standards. NEEA commented that FEI is a metric the market is already beginning to align to, and an additional efficiency metric could confuse the market. NEEA commented that the industry has begun to transition away from Fan Efficiency Grade (FEG) to FEI, encouraged by the inclusion of FEI in model energy codes (including ASHRAE 90.1–2019 and the 2021 Oregon Energy Efficiency Specialty Code). NEEA stated that consistency in the metric used to calculate efficiency will expedite adoption of efficient equipment and make opportunities for incentive programs more readily available to the market. NEEA is not opposed to the use of FEP as an intermediary metric to determine FEI, but recommends that DOE align with the market's momentum toward FEI to create industry alignment around the definition of fan efficiency. (NEEA, No. 11 at p. 3)

The CA IOUs recommended that DOE use the FEI metric from AMCA 214–21 for ACFHs. The CA IOUs commented that FEP is not an efficiency metric, but rather a measurement of the fan's input power, taking motor, motor controller, and transmission losses into account. The CA IOUs asserted that FEI, which is a ratio of the product's FEP to the electrical input power of a reference fan, is a more appropriate metric for these products. The CA IOUs stated that FEI also accounts for the air velocity generated by the fan, which is an important consideration for ACFHs since one of the primary requirements of an ACFH is to deliver a focused airstream at a moderate to high velocity. Additionally, the CA IOUs commented that FEI has become the default metric for fans in building codes and incentive programs. The CA IOUs stated that FEI is the efficiency metric used in ASHRAE 90.1, IECC, and the California Energy Code. The CA IOUs added that since FEP and ACFH airflow in cubic feet per minute is needed to calculate overall efficiency and efficacy per AMCA 230–

[88] AMCA listed the following in its comment: ANSI/ASHRAE/IES 90.1–2019, Energy Standard for Buildings Except Low-Rise Residential Buildings; ANSI/ASHRAE/ICC/USGBC/IES 189.1–2020, Standard for the Design of High-Performance; Green Buildings Except Low-Rise Residential Buildings; 2021 International Energy Conservation Code; 2021 International Green Construction Code; 2020 Florida Building Code: Energy Conservation; 2021 Oregon Energy Efficiency Specialty Code; 2022 California Building Energy Efficiency Standards (Title 24).

15, testing labs and manufacturers can still report those metrics in their product literature without additional burden. (CA IOUs, No. 9 at p. 2)

In response to the February 2022 ECS RFI, ebm papst suggested using a metric that distinguishes air circulating fans with exceptional air velocity from air circulating fans with exceptional wire-to-air efficiency because of the importance of air velocity when selecting an air circulating fans. (ebm-papst, No. 8 at p. 3)

In its proposed regulation, the CEC is proposing to use the FEI metric for fans and blowers.[89] Since the publication of the term sheet and of AMCA 214–21, a number of incentive programs and model energy codes and standards used in state energy codes rely on the FEI metric.[90]

As noted, FEG is a numerical rating that represents the ratio of airpower produced by the fan divided by the fan shaft power and is defined as a function of fan impeller diameter. FEG ratings are defined in discrete ''bands'' (*e.g.,* FEG 85, FEG 80, FEG 75, etc.) and are established in accordance with AMCA 205–12, ''Energy Efficiency Classification for Fans''.[91] To determine FEG, a fan is tested to measure its maximum bare-shaft fan efficiency (*i.e.,* peak efficiency). The FEG rating is determined by plotting the measured peak efficiency versus the fan impeller diameter, then reading the associated FEG band in which this point falls.

Fans can operate over a wide range of speed, pressure, and airflow, and the fan bare-shaft efficiency can vary greatly over this range. As defined in AMCA 205–12, the FEG rating is representative of only the maximum efficiency of the fan. As a result, depending on the actual operating conditions, a fan with a higher peak efficiency and FEG rating could consume more energy in a particular application than a fan with a lower peak efficiency and FEG rating. In addition, the FEG metric does not capture the performance of the motor, transmission, or motor controllers and does not differentiate among fans with motors, transmissions, and motor controllers with differing efficiency levels.

AMCA 230–15 provides methods to determine FEP of air circulating fans as well as efficacy (*i.e.,* amount of flow per unit of electrical input power produced in cfm/W) and overall efficiency (*i.e.,* amount of thrust per unit of electrical input power produced in lbf/W). While AMCA 230–15 provides methods to determine several metrics associated to air circulating fan performance, AMCA 214–21 relies on the FEP and FEI metrics (''wire-to-air metrics) for air circulating fans. In addition, FEI accounts for air velocity[92] as it relies on the calculation of the reference fan FEP (FEP_{ref}) as a function of flow and total pressure (which is equal to velocity pressure for air circulating fans) and allows comparing the wire-to-air performance of fans at different air velocities.

Based on the discussion in the preceding paragraphs, DOE proposes to apply FEI as the efficiency metric for fans and blowers. As discussed, FEI would provide for evaluation of the efficiency of a fan or blower across a range of operating conditions, would capture the performances of the motor, transmission, or motor controllers (if any), and would allow for the differentiation of fans with motors, transmissions, and motor controllers with differing efficiency levels. Also as discussed, use of FEI would align with the industry test standard (AMCA 214–21) and drive better fan selections. In addition, DOE proposes to establish the FEI differently for fans and blowers other than air circulating fans, and for air circulating fans as described in section III.F.1 and section III.F.2 of this document.

1. FEI Determination for Fans and Blowers Other Than Air Circulating Fans

For fans and blowers that are not air circulating fans, considering their wide range of application, DOE proposes that fan FEI would be evaluated in accordance with the DOE proposed test procedure at each of the fan's operating points within the range of airpower and shaft input power proposed in scope (*i.e.,* at each duty point, as specified by the manufacturer within the range of airpower and shaft input power proposed in scope). This approach is consistent with the term sheet recommendations and would require the determination of the FEI at each duty point as specified by the manufacturer. With this approach, the test procedure would not prescribe particular operating conditions at which the FEI is to be evaluated in order to calculate the FEI metric, instead, the FEI is determined at each duty point. Further, if DOE were to establish any potential energy conservation standards, compliance with that standard would be required at each duty point specified by the manufacturer within the range of airpower and shaft input power proposed in scope (*i.e.,* operating range or ''bubble''), and for which the manufacturer publishes performance data. See discussion in section III.L. of this document.

DOE notes several stakeholders (AMCA, AHRI, NEEA, and the CA IOUs) submitted comments related to this approach as part of the CEC proposed rulemaking docket.[93] AMCA, AHRI, NEEA, and the CA IOUs recommended that manufacturers be able to publish performance data for duty points where the FEI is non-compliant (*i.e.,* FEI < 1 in the case of the CEC proposed regulation) and explained that performance data across the entire fan operating range is needed for designing or troubleshooting fan system problem.[94] The CA IOUs suggested that manufacturers be allowed to publish fan performance data in marketing or catalogs materials, but clearly indicate inefficient values that are outside the FEI ≥1.0 bubble.[95] AMCA, AHRI and NEEA jointly commented that a regulation should not prohibit, but rather distinguish duty points that meet the California Standards and duty points that don't.[96]

In view of these comments, DOE is considering to require calculating a weighted-average FEI (''WFEI'') based on the FEI at a limited number of

[89] See Proposed regulatory language for Commercial and Industrial Fans and Blowers available in the following Docket: 22–AAER–01 at: *efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=22-AAER-01.*

[90] ANSI/ASHRAE/IES 90.1–2019, Energy Standard for Buildings Except Low-Rise Residential Buildings; ANSI/ASHRAE/ICC/USGBC/IES 189.1–2020, Standard for the Design of High-Performance; Green Buildings Except Low-Rise Residential Buildings; 2021 International Energy Conservation Code; 2021 International Green Construction Code; 2020 Florida Building Code: Energy Conservation; 2021 Oregon Energy Efficiency Specialty Code; 2022 California Building Energy Efficiency Standards (Title 24); incentive programs presently offered or under development by Seattle City Light, ComEd, and Xcel Energy. See AMCA FEI Advocacy Brief available at: *www.amca.org/assets/resources/public/assets/uploads/0621-FEI_Advocacy_Brief_V3-20210715.pdf.*

[91] *See* AMCA whitepaper available at *www.amca.org/assets/resources/public/userfiles/file/Nospreads_FanEfficGrades.pdf.*

[92] Average velocity of air emerging from an outlet measured in the plane of the outlet.

[93] All documents related to this rulemaking can be found in the rulemaking Docket 22–AAER–01 accessible at: *www.energy.ca.gov/rules-and-regulations/appliance-efficiency-regulations-title-20/appliance-efficiency-proceedings-11.* See Joint AMCA, AHRI and NEEA comments at *https://efiling.energy.ca.gov/GetDocument.aspx?tn=242893&DocumentContentId=76471* (p. 20) and CA IOUs comments at: *https://efiling.energy.ca.gov/GetDocument.aspx?tn=242904&DocumentContentId=76485 (p.7).*

[94] See Joint AMCA, AHRI and NEEA comments at *https://efiling.energy.ca.gov/GetDocument.aspx?tn=242893&DocumentContentId=76471 (p. 20).*

[95] See CA IOUs comments at: *https://efiling.energy.ca.gov/GetDocument.aspx?tn=242904&DocumentContentId=76485* (p.7).

[96] See Joint AMCA, AHRI and NEEA comments at *https://efiling.energy.ca.gov/GetDocument.aspx?tn=242893&DocumentContentId=76471 (p. 20).*

representative duty points instead of having the FEI metric evaluated at each duty point as proposed. With such approach, if DOE were to establish energy conservation standards, compliance would be based on the weighted-average FEI of a given basic model, and manufacturers would be allowed to publish performance information at all duty points. DOE has tentatively determined that while some fans can operate at different speeds, the FEI generally increases (*i.e.,* performs better) as the speed of the fan decreases. Therefore, DOE is considering requiring manufacturers calculate a weighted-average FEI based on operating points at maximum speed. This would ensure that the fan will perform with an FEI that is equal to or greater than the FEI at maximum speed. In addition, end-users have been encouraged to select and operate the fan near a fan's best efficiency point (BEP),[97] therefore, DOE is considering using the BEP at maximum speed as a reference duty point and to require calculating the weighted average FEI using the duty points specified as described in the remainder of this section, depending on the fan's speed capability and motor configuration. In the absence of fan field operating data, DOE is considering equally weighting these duty points.

For fans without motors or controls: DOE is considering requiring that the weighted-average FEI be calculated at maximum speed and using the following duty points: 100 percent of BEP flow, 75 percent of BEP flow, and 50 percent of BEP flow. All flow points would be on the same fan curve [98] at the fan's maximum operating speed.

For single-speed fans (*i.e.,* fans with a single-speed motor), DOE is considering to require that the weighted-average FEI be calculated at the single available speed and using the following operating points: 100 percent of BEP flow, 75 percent of BEP flow, and 50 percent of BEP flow. All flow points would be on the same fan curve at the same single available operating speed.

For variable-speed fans that can continuously adjust their operating speeds (*i.e.,* fans with a variable-speed motor), DOE is considering to require that the weighted-average FEI be calculated at the following points: 100 percent of BEP flow at maximum speed, 75 percent of BEP flow, and 50 percent of BEP flow. However, in this case the reduced BEP flow points would be achieved by reducing the fan's operating speed and following a quadratic system curve, rather than following the fan curve at maximum speed to achieve the desired flow point. The system curve represents the system's resistance (pressure) at various flows and is often represented by a curve where the pressure varies as the square of the flow ratios.[99]

For multi-speed fans (*i.e.,* fans with a multi-speed motor capable of operating at different discrete speeds): DOE is also considering requiring that the weighted-average FEI be calculated at the following points: 100 percent of BEP flow at maximum speed, 75 percent of BEP flow, and 50 percent of BEP flow. In this case, similar to variable speed fans, the reduced BEP flow points would be achieved by reducing the fan's operating speed (For multi-speed fans, the speed options are limited). Therefore, in this case the manufacturer would not be able to continuously reduce speed until the required flow is achieved. Instead, DOE is considering an approach where the manufacturer would be required to achieve the reduced BEP flow points by reducing speed and increasing pressure (*i.e.,* moving along the fan curve at reduced speeds). In addition, DOE is considering requiring that the pressure at the reduced BEP flow point be greater than the pressure on the reference system curve.

In addition, DOE notes that for fans tested wire-to-air, it is not possible to determine the BEP as a ratio of air power to shaft input power as the fan shaft input power is not measured directly. Therefore, when applying a wire-to-air test method, DOE is considering establishing the BEP as the point that maximizes the fan's wire-to-air efficiency.

DOE requests comment on the appropriate metric to use for fans and blowers other than air circulating fans.

DOE requests comment on the proposed FEI metric determined in accordance with the proposed test procedure, and on whether any changes are necessary to provide for more representative energy efficiency ratings. If changes are suggested, DOE seeks input on how the proposed FEI metric should be amended and why, and on any other metrics that would be more appropriate. If changes or alternate metrics are suggested, DOE requests information on the impact to testing cost as compared to the proposed use of FEI.

DOE requests comments on the alternative approach considered to establish a weighted average FEI metric for fans and blowers other than air circulating fans. DOE requests comments on the appropriate reference system curve to use in the case of variable-speed fans to standardize the calculation of the reduced BEP flow operating points.

2. FEI Determination for Air Circulating Fans

For air circulating fans, to account for variations in fan speeds, DOE proposes the following, depending on the air circulating fan's speed capability: for single speed fans, DOE proposes that the FEI be evaluated at the single available speed and corresponding duty point. For multi-speed fans and variable speed fans, in the absence of data to characterize typical operating speeds, DOE proposes to calculate the FEI based on the weighted average FEI at each of the tested fan speeds, and that each speed be apportioned an equal weight. (*e.g.,* if the FEI is calculated at five speeds, each speed is given 20 percent in the calculation of the weighted average FEI). DOE has tentatively determined that while DOE has not found data to characterize the field operating speeds of air circulating fans, a more representative FEI can be calculated by using a weighted-average across multiple speeds and weighting all those speeds equally (when compared to calculating the efficiency at only high speed). DOE notes that it would still allow manufacturers to make representations of performance using cfm/w if a manufacturer desires to do so. In addition, to differentiate the proposed FEI for air circulating fans (*i.e.,* based on Q_0=3,210 and P_0=0, and an efficiency target of 0.38—See section III.D.17 of this document) from the FEI as it applies to fans and blowers that are not air circulating fans (*i.e.,* based on Q_0= 250 and P_0=0.4, and an efficiency target of 0.66 for fans with a total pressure basis—See section III.D.17 of this document) and from the CFEI as it applies to ceiling fans, DOE is considering using the term ''Air Circulating Fan FEI'' or ''ACFEI''.

DOE is aware that the AMCA 230 committee may consider specifying

[97] The BEP represents the flow and pressure values at which the fan total efficiency (ratio of total airpower to fan shaft input power) is maximized when operating a given speed. Prior to the use of FEI, energy codes required selecting a fan with an efficiency within 10–15 percentage points of the BEP efficiency. See International Green Construction Code (2012); ANSI/ASHRAE/IES 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings (2013); ANSI/ASHRAE/USGBC/IES 189.1, Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings (2014); International Energy Conservation Code (2015).

[98] A fan curve represents the flow and pressure duty points of a fan at a given speed.

[99] See section 6.3 of AMCA 201–02: AMCA. (2002). *Fans and systems.* AMCA Publication 201. Arlington Heights, IL: Air Movement and Control Association International. Available at *www.amca.org/assets/resources/public/pdf/Education%20Modules/AMCA%20201-02%20(R2011).pdf.*

which metric to use in AMCA 230–22 when evaluating the energy performance of air circulating fans. While this NOPR proposes to rely on FEI, DOE is considering alternative metrics such as cfm/w including weighted average cfm/w for multi- and variable-speed fans), as well as alternative weights for multi- and variable-speed fans.

DOE requests comment on the appropriate metric to use for air circulating fans.

DOE requests comment on the proposed FEI metric determined in accordance with the proposed test procedure, and on whether any changes are necessary to provide for more representative energy efficiency ratings. If changes are suggested, DOE seeks input on how the proposed FEI metric should be amended and why, and on any other metrics that would be more appropriate. Specifically, for air circulating fans, DOE requests comment on the proposed use of the FEI metric determined in accordance with the test procedure as proposed and if DOE should consider other performance metrics as measured by AMCA 230–15, or different weights. If changes or alternate metrics are suggested, DOE requests information on the impact to testing cost as compared to the proposed use of FEI.

DOE requests comments on whether to use a different acronym to designate the FEI of air circulating fans (''ACFEI'').

G. Efficiency Considerations for Certain Unducted Fans

As proposed, depending on the fan category, the reference FEP would be calculated based on total pressure as opposed to static pressure. See Table III–9 of this document. As discussed, the reference FEP would be used to calculate the FEI value.

An individual commenter opposed the use of the FEI metric, stating that the FEI disadvantages non-ducted fans, in particular, wall fans and PRVs, which are tested in AMCA 214 based on static pressure. Graves stated that such fans are penalized unfairly by excluding the velocity pressure component in the calculation of FEI. Graves asserted that wall fans and PRVs would have a higher measured efficiency if total pressure rather than static pressure was used in the calculation of FEI. (Docket No. EERE–2020–BT–PET–0003, Graves, No. 4 at p. 1)

Graves stated that for certain non-ducted fans, the outlet velocity pressure is a useful fan output, citing the following examples: poultry houses, which require a minimum of 600 feet per minute of air velocity; dairy installations, in which air movement contributes to greater milk production; paint shops, which use PRVs to filter the exhausted air from the paint booth; and restaurant PRVs, which extract heat from the kitchen and filter the supply air. (Docket No. EERE–2020–BT–PET–0003, Graves, No. 4 at p. 1). Graves recommended testing agricultural fans [100] with the metric relied on by the BESS Lab at the University of Illinois, which uses a cubic feet per minute per watt (''cfm/watt'') metric. (Docket No. EERE–2020–BT–PET–0003, Graves, No. 4 at p. 3).

To reflect typical usage conditions, AMCA 214–21 specifies whether testing is required to be conducted with a ducted outlet (*i.e.,* measuring total pressure) or a free outlet (*i.e.,* measuring static pressure) for each defined fan category (See Table III–9). For certain categories required to be tested with a ducted outlet, AMCA 214–21 defines an optional test that can be performed with a free outlet. For axial panel fans (*i.e.,* ''wall fans'') and axial PRV fans, AMCA 214–21 requires testing with a free outlet (*i.e.,* measuring static pressure), but does not define an optional test with a ducted outlet.

AMCA commented that the FEI calculations submitted by Graves were based on an older methodology. (Docket No. EERE–2020–BT–PET–0003, AMCA, No. 13 at p. 1). AMCA commented that the velocity pressure at the fan's outlet is not the same as the velocity pressure created by the air moving inside the building, and that the two are only tangentially related. AMCA described an example illustrating that two different rooftop fans—one larger fan with an outlet velocity of 500 FPM and an airflow of 1,000 cfm, and one smaller fan with an outlet velocity of 750 FPM and the same airflow of 1,000 cfm—would both result in the same air velocity inside the building; however, the smaller fan's efficiency would be lower, and it would consume more energy than the larger fan with lower outlet velocity. (Docket No. EERE–2020–BT–PET–0003, AMCA, No. 13 at pp. 1–2).

AMCA stated that FEI is calculated using a lower reference fan efficiency for unducted fans than for ducted fans (0.60 vs. 0.66, respectively), which it described as providing a 6 percent efficiency ''grace'' for unducted fans. (Docket No. EERE–2020–BT–PET–0003, AMCA, No. 13 at p. 2).

AMCA also commented that BESS Lab uses static pressure as a basis for the cfm/watt metric and that manufacturers of agricultural fans include performance data in catalogs using static pressure. AMCA further commented that the cfm/watt metric is similar to the FEI metric, and that the results of the BESS Lab test could be used to calculate FEI.[101] According to AMCA, all the agricultural exhaust fans listed on the BESS Lab website have an FEI of at least 1.00. (Docket No. EERE–2020–BT–PET–0003, AMCA, No. 13 at pp. 2–3).

AMCA further commented that the metric of cfm/watt is a simple metric that was appropriate for agricultural exhaust fans because these fans are almost always applied at the same pressure (0.10 in. wg. of static pressure). However, AMCA stated that PRVs, which have similar applications to agricultural exhaust fans, can be applied at much higher pressures in other applications. Accordingly, a metric of cfm/watt evaluated at a single pressure and airflow can no longer be used for evaluation because the cfm/watt of a fan applied at a higher pressure would be much less than the cfm/watt at a lower pressure. (Docket No. EERE–2020–BT–PET–0003, AMCA, No. 13 at pp. 2–3).

AMCA commented that the choice to calculate FEI using either static or total pressure depending on fan category was recommended by the Working Group, which included a mix of stakeholders, including manufacturers of unducted fans. (Docket No. EERE–2020–BT–PET–0003, AMCA, No. 13 at p. 2).

In response to the October 2021 RFI, Morrison commented that air circulating fan heads (''ACFHs'') are different from other fans intended to be hooked up to ducts and should be evaluated differently. Morrison commented that an efficacy metric, such as that used by the BESS Lab (cfm/watt), would be appropriate. (Morrison, No. 8 at p. 1)

DOE reviewed the metric used by BESS Lab for reporting test results for agricultural fans. Although BESS Lab relies on a cfm/watt metric, the measured values are the same as those measured by a wire-to-air test in

[100] DOE identified that fans used in agricultural applications (''agricultural fans'') include PRVs (tested per AMCA 214–21, referencing AMCA 210–16) axial panel fans (tested per AMCA 214–21, referencing AMCA 210–16) and air circulating fans (tested per AMCA 214–21, referencing AMCA 230–15). Grave's comment focuses on agricultural fans that are PRVs.

[101] BESS Lab publishes test results for agricultural fans and provides the values of cfm/watt at different duty points expressed in static pressure, speed, and airflow. Based on these results, the electrical input power of a fan in kilowatts (same metric as the FEP) can be converted to cfm/watt by dividing the airflow by 1000 at a given duty point. This is similar to the results of an AMCA 214–21 test which provides the FEP in kilowatts at a given airflow, static pressure, and speed (the ratio of the airflow and FEP, divided by 1000 would provide the cfm/watts metric). See for example: *https://bess.illinois.edu/pdf/00110.pdf.*

accordance with AMCA 214–21 (*i.e.,* airflow, static pressure, electrical input power) and DOE tentatively determined this metric is identical to the FEP metric measured at a unique pressure point (or limited number of pressure points). In addition, DOE notes that the BESS Lab relies on test methods that are based on AMCA 210–16 and AMCA 230–15.[102] Therefore, DOE is proposing to use the FEI (based on FEP) metric for all PRVs and air circulating fans, including agricultural fans.

DOE seeks feedback on the proposed use of the FEI metric for all PRVs and air circulating fans, including agricultural fans.

H. Control Credit Approach

The Working Group recommended that the FEP of a fan with dynamic continuous control[103] be calculated with an additional credit to offset the losses inherent to the control. (Docket No. EERE–2013–BT–STD–0006; No. 179, Recommendation #16, at p. 9)

ebm-papst, Inc. commented that fans with electronic VSDs for automatic load matching should be allowed a credit that does not disfavor their rating. However, voltage controls such as triac controls, series resistors, tapped motor windings, and autotransformers should not be allowed a credit because of their low efficiency at part-load. (Docket No. EERE–2013–BT–STD–0006, ebm-papst, No. 152 at pp. 1–2)

Greenheck, supported by Wade S. Smith Consulting, suggested applying a 10 percent credit to the FEP of fans equipped with variable speed controls (*e.g.,* for these fans the FEP would be decreased by a factor of 0.9). (Docket No. EERE–2013–BT–STD–0006; Greenheck, No. 221a at p. 13; Smith, No. 207 at p.3) Greenheck stated that a 10 percent credit is in line with the credit used in the current European regulations.[104] Greenheck commented that such credit would be sufficient to compensate for the losses inherent to the variable speed control, while being small enough to not provide enough incentive to make inefficient fans paired with controls attractive to customers. (Docket No. EERE–2013–BT–STD–0006; Greenheck, No. 221a at p. 13)

DOE analyzed the control credit in the European Commission Regulation No. EU 327/2011 and observed that the value of the credit is equivalent to about 5–10 percent of the fan electrical input power for a fan with controls with an electrical input power less than 5 kW, but that it decreases to 4 percent for fans at or above 5 kW. Since the term sheet publication, AMCA established the FEI calculation method in AMCA 214–21. DOE also reviewed the calculation of FEP for fans with variable speed controls in AMCA 214–21, which does not provide for any control credit. (See Section 6.4.2 of AMCA 214–21).

In its proposed rulemaking for commercial and industrial fans and blowers, the CEC did not propose a credit when establishing the FEI of fans with controllers and did not specify a different minimum FEI level when proposing energy conservation standards for fans with a controller.[105] Instead, the CEC highlighted that fans with a controller will have a larger FEI-compliant performance capability compared to fans that are single speed.[106]

Consistent with industry practice, DOE proposes to adopt the FEP and FEI calculation as specified in AMCA 214–21 and does not propose to develop a control credit for fans with a controller. As stated, EPCA requires the DOE test procedures be reasonably designed to produce test results, which reflect energy efficiency and energy use during a representative average use cycle and not be unduly burdensome to conduct. (42 U.S.C. 6314(a)(2)) To the extent use of a dynamic continuous control impacts the energy use characteristics of a fan or blower, appropriate consideration of any such impact would be part of the evaluation of potential energy conservation standards.

DOE requests comment on its proposal to not include a credit in the FEP and FEI calculation for fans with a motor controller.

I. Use of a Single Test Procedure Nationally

In response to the April 2020 Notice of Petition, ebm-papst requested that a DOE test procedure preempt potentially differing physical test methods and calculations associated with existing, pending, and future building energy codes and fan standards anywhere in the Nation. (Docket No. EERE–2020–BT–PET–0003, ebm-papst, No. 9 at p. 1)

As previously noted, Federal energy efficiency requirements for covered equipment established under EPCA generally supersede State laws and regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6316(a) and (b); 42 U.S.C. 6297) DOE may, however, grant waivers of Federal preemption for particular State laws or regulations, in accordance with the procedures and other provisions of EPCA. (42 U.S.C. 6316(b)(2)(D)) With respect to equipment covered by DOE under section 6311(1)(L), pre-emption of State or local standards for that equipment would begin on the date that an energy conservation standard is established, except where state or local standards have already been established. (42 U.S.C. 6316(a)(10)) Pre-emption of existing State regulations would begin on the date compliance is required with the Federal energy conservation standard, should such a standard be established. (*Id.*) As DOE established fans and blowers as a covered equipment under its authority in section 6311(1)(L), pre-emption of State or local standards will not apply until DOE establishes standards for this equipment (if the State or locality has not adopted their own standard) or until the DOE standard takes effect (if the State or locality has existing standards for the covered equipment in place).

J. Alternative Energy Determination Methods (AEDM)

For certain covered equipment, DOE permits the use of an AEDM subject to the requirements at 10 CFR 429.70. An AEDM is a mathematical model based on the covered equipment design, and mitigates the potential cost associated with having to physically test units. AEDMs are permitted in instances in which the model can reasonably predict the equipment's energy efficiency performance.

Although specific requirements vary by product or equipment, use of an AEDM entails development of a mathematical model that estimates energy efficiency or energy consumption characteristics of the basic model, as would be measured by the

[102] Comments from BESS Lab to the CEC process indicate that they Lab tests rely on AMCA 210–16 with modifications as noted in American Society of Agricultural and Biological Engineers (''ASABE'')/S565 Oct2005 Agricultural Ventilation Constant Speed Fan Test Standard or on AMCA 230–15. See *efiling.energy.ca.gov/GetDocument.aspx?tn=218197&DocumentContentId=26682* and *efiling.energy.ca.gov/GetDocument.aspx?tn=221228.*

[103] Variable speed controls or dynamic continuous controls: any device that adjusts the speed of the fan continuously over the fan's operating speed range in response to incremental changes in the required fan output airflow during its operation. (Docket No. EERE–2013–BT–STD–0006; No. 179 at p. 6)

[104] See European Commission Regulation No. EU 327/2011; *eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32011R0327&from=EN.*

[105] See Proposed regulatory language for Commercial and Industrial Fans and Blowers available in the following Docket: 22–AAER–01 at: *efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=22-AAER-01.*

[106] See Staff Report, p. 36–37 for Commercial and Industrial Fans and Blowers available in the following Docket: 22–AAER–01 at: *efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=22-AAER-01.*

applicable DOE test procedure. 10 CFR 429.70(c)(1)(i). The AEDM must be based on engineering or statistical analysis, computer simulation or modeling, or other analytic evaluation of performance data. 10 CFR 429.70(c)(1)(ii). A manufacturer must validate an AEDM by demonstrating that its predicted efficiency performance of the evaluated equipment agrees with the performance as measured by actual testing in accordance with the applicable DOE test procedure. 10 CFR 429.70(c)(1)(iii). The validation procedure and requirements, including the statistical tolerance, number of basic models, and number of units tested vary by product. 10 CFR 429.70(c)(2).

Once developed, an AEDM may be used for representations of the performance of untested basic models in lieu of physical testing. The manufacturer, by using an AEDM, bears the responsibility and risk of the validity of the ratings, including cases where the manufacturer receives and relies on performance data for certain components from a component manufacturer.

AEDMs, when properly developed, can provide a straight-forward and accurate means to predict the energy usage or efficiency characteristics of a basic model of a given covered product or equipment and reduce the burden and cost associated with testing. Where authorized by regulation, AEDMs enable manufacturers to rate and certify the compliance of their basic models by using the projected energy use or energy efficiency results derived from these simulation models in lieu of testing.

The Working Group recommended allowing the use of an AEDM to generate the represented values of FEP and FEI of a fan basic model. (Docket No. EERE–2013–BT–STD–0006, No. 179, Recommendations #23, #24, #25 at pp. 12–13)

DOE proposes to allow the use of an AEDM in lieu of testing to determine fan performance, which would mitigate the potential cost associated with having to physically test units.

1. Validation

Validation is the process by which a manufacturer demonstrates that an AEDM meets DOE's requirements for use as a certification tool by physically testing a certain number of basic models and comparing the test results to the output of the AEDM. Before using an AEDM, a manufacturer must validate the AEDM's accuracy and reliability as follows.

A manufacturer must select a minimum number of basic models from each validation class to which the AEDM applies. To validate an AEDM, the specified number of basic models from each validation class must be tested in accordance with the DOE test procedure and sampling plan in effect at the time those basic models used for validation are distributed in commerce. Testing may be conducted at a manufacturer's testing facility or a third-party testing facility. The resulting rating is directly compared to the result from the AEDM to determine the AEDM's validity. A manufacturer may develop multiple AEDMs per equipment category, and each AEDM may span multiple validation classes; however, the minimum number of basic models must be validated per equipment category for every AEDM that a manufacturer chooses to develop. An AEDM may be applied to any basic model within the applicable equipment category at the manufacturer's discretion. All documentation of testing, the AEDM results, and subsequent comparisons to the AEDM would be required to be maintained as part of both the test data underlying the certified rating and the AEDM validation package pursuant to 10 CFR 429.71.

The Working Group recommended that the AEDM be validated by the testing of at least two basic models, compliant with any potential energy conservation standards for each equipment class.[107] In addition, the Working Group recommended that if an AEDM was used to simulate a wire-to-air test method, then the basic models used to validate the AEDM had to be tested using the wire-to-air test method. (Docket No. EERE–2013–BT–STD–0006; No. 179, Recommendation #24, at p. 13).

DOE is proposing to include fan and blower validation classes at 10 CFR 429.70(k) and to require that two basic models per validation class be tested using the relevant proposed test procedure. This number of basic models is consistent with the number of basic models required for most DOE-regulated equipment that utilize AEDMs. In addition, at least one basic model selected for validation testing would be required to include a motor, or a motor and controller of each topology (*e.g.,* induction, permanent magnet, electronically commutated motor) included in the AEDM. In addition, DOE proposes that if the AEDM is intended to represent the wire-to-air test method, then the testing of the basic models used to validate the AEDM must be performed according to the wire-to-air test method. Similarly, if the AEDM is intended to represent the fan shaft power test method, DOE proposes that the testing of the basic models used to validate the AEDM be performed according to the fan shaft power test method.

DOE's proposed validation classes for fans and blowers are listed as follows: (1) Centrifugal housed; (2) Radial housed; (3) Centrifugal inline; (4) Centrifugal unhoused; (5) Centrifugal PRV exhaust; (6) ; Centrifugal PRV supply; (7) Axial inline; (8) Axial panel; (9) Axial PRV; (10) unhoused ACFH; (11) air circulating axial panel fan; (12) box fan; (13) cylindrical air circulating fan; and (14) housed centrifugal air circulating fan.

The Working Group recommended adding a tolerance of five percent to the results of the AEDM for the basic models used for validation of the AEDM. The Working Group recommended that the predicted FEP using the AEDM may not be more than five percent less than the FEP determined from the test according to the DOE test procedure for the basic models used to validate an AEDM. (Docket No. EERE–2013–BT–STD–0006; No. 179, Recommendation #25, at p. 13).

The Working Group recommendation would require that the FEP calculated by an AEDM must be greater than or equal to 95 percent of the FEP determined testing the basic models used to validate the AEDM. This is equivalent to requiring that the FEI determined using the FEP calculated by an AEDM must be less than or equal to 100/0.95 percent or approximately 105 percent of the FEI calculated using the FEP determined from testing the basic models used to validate the AEDM.[108]

DOE proposes to apply the 5 percent tolerance to the FEI because FEI is the proposed metric. DOE proposes that the FEI calculated by an AEDM must be less than or equal to 105 percent of the FEI determined from the test of the basic models used to validate the AEDM.

2. Additional AEDM Requirements

Consistent with provisions for other commercial and industrial equipment, DOE proposes to require that, if requested by DOE, a manufacturer must perform at least one of the following activities: (1) conduct a simulation

[107] DOE uses validation classes for AEDMs. While validation classes may not directly align with equipment classes, validation classes are consistent with equipment classes. DOE would propose equipment classes in a future energy conservation standards rulemaking for fans and blowers.

[108] The FEI is equal to the reference FEP (FEP–ref) divided by the FEP of the actual fan. Therefore, if the FEP calculated using the AEDM (FEP–AEDM) is greater than or equal to 95 percent of the FEP (FEP–test) determined through testing, the FEP–ref/FEP–AEDM is less than or equal to 1/0.95 * FEP–ref/FEP–test.

before a DOE representative to predict the performance of particular basic models of the equipment to which the AEDM was applied; (2) provide analysis of previous simulations conducted by the manufacturer; or (3) conduct certification testing of basic model(s) selected by DOE.

In addition, DOE proposes that when making representations of values other than FEI (*e.g.,* FEP, fan shaft power) for a basic model that relies on an AEDM, all other representations would be required to be based on the same AEDM results used to generate the represented value of FEI.

3. AEDM Verification Testing

Consistent with provisions for certain other commercial and industrial equipment, DOE proposes including in 10 CFR 429.70(k) provisions related to AEDM verification testing for fans and blowers, including: (1) selection of units from retail if available, or otherwise from a manufacturer, (2) independent, third-party testing if available, or otherwise at a manufacturer's facility, (3) testing performed without manufacturer representatives on-site, (4) testing in accordance with the DOE test procedure, any active test procedures, any guidance issued by DOE, and lab communication with the manufacturer only if DOE organizes it, (5) notification of manufacturer if a model tests worse than its certified rating by an amount exceeding a 5 percent tolerance with opportunity for the manufacturer to respond, (6) potential finding of the rating for the model to be invalid, and (7) specifications regarding when a manufacturer's use of an AEDM may be restricted due to prior invalid represented values and how a manufacturer could regain the privilege of using an AEDM for rating.

DOE requests feedback regarding all aspects of its proposal to permit use of an AEDM for fans and blowers, and any data or information comparing modeled performance with the results of physical testing. DOE specifically seeks comment on its proposed validation classes, and whether different number of basic models should be considered.

K. Sampling Plan

DOE provides sampling provisions for determining represented values of energy use or energy efficiency of a covered product or equipment. *See generally* 10 CFR part 429. These sampling provisions provide uniform statistical methods that require testing a sample of units that is large enough to account for reasonable manufacturing variability among individual units of a basic model, or variability in the test methodology, such that the test results for the overall sample will be reasonably representative of the efficiency of that basic model.

The general sampling requirement currently applicable to all covered products and equipment provides that a sample of sufficient size must be randomly selected and tested and that, unless otherwise specified, a minimum of two units must be tested to certify a basic model. 10 CFR 429.11. This minimum is implicit in the requirement to calculate a mean—an average—which requires at least two values. Manufacturers can increase their sample size to narrow the margin of error. The design of the sampling plan is intended to determine an accurate assessment of product or equipment performance, within specified confidence limits, without imposing an undue testing or economic burden on manufacturers. Different samples from the same population will generate different values for the sample average. An interval estimate quantifies this uncertainty in the sample estimate by computing lower and upper confidence limits (''LCL'' and ''UCL'') of an interval (centered on the average of the sample) which will, with a given level of confidence, contain the population average. Instead of a single estimate for the average of the population (*i.e.,* the average of the sample), a confidence interval generates a lower and upper limit for the average of the population. The interval estimate gives an indication of how much uncertainty there is in the estimate of the average of the population.[109] Confidence limits are expressed in terms of a confidence coefficient. For covered equipment and products, the confidence coefficient typically ranges from 90 to 99 percent.[110] The confidence coefficient, for example 97.5 percent means that if an infinite number of samples are collected, and the confidence interval computed, 97.5 percent of these intervals would contain the average of the population: *i.e.,* although the average of the entire population is not known, there is a high probability (97.5 percent confidence level) that it is greater than or equal to the LCL and less than or equal to the UCL.

To ensure that the represented value of efficiency is no greater than the population average, the sampling plans for determination of the represented value typically consist of testing a representative sample to insure that . . . (ii) Any represented value of energy efficiency[111] . . . shall be no greater than the lower of (A) the average of the sample ($\bar{x}$) or (B) the lower XX confidence limit of the true mean divided by K, where the values for XX and K vary with product or equipment type. XX, the confidence limit, typically ranges from 90 to 99 percent, while K, an adjustment factor, typically ranges from 0.9 to 0.99. The specific values for XX and K for a particular product or equipment are selected based on an expected level of variability in product performance and measurement uncertainty. 10 CFR 429.14 through 10 CFR 429.63. Requiring that the represented value be less than or equal to the LCL would ensure that the represented value of efficiency is no greater than the population average. DOE divides the LCL by K to provide additional tolerance to account for variability in product performance and measurement uncertainty.[112] The comparison with the average of the sample further ensures that if LCL divided by K is greater than $\bar{x}$, the represented value is established using the average of the sample. In addition, DOE relies on a one-sided confidence limit to provide the option for manufacturers to rate more conservatively.

The Working Group recommended that a represented value of a basic model be based on a minimum of one test, where the tested value must be less than the represented value. The Working Group did not provide recommendations to address a situation in which a manufacturer chooses to increase their test sample size. (Docket No. EERE–2013–BT–STD–0006, No. 179, Recommendation #23 at p. 12) The Petitioners also requested that manufacturers be allowed to establish FEP and FEI ratings of a fan basic model based on testing of a single unit. (Docket No. EERE–2020–BT–PET–0003, The Petitioners, No. 1.3 at p. 8)

In response to the October 2021 RFI, AMCA commented that they do not yet have a specific sampling recommendation it can support with data and analyses. AMCA would prefer to use the ratings and sampling methods embodied in AMCA Publication 211, ''Certified Ratings Program Product Rating Manual for Fan Air Performance'', which is the program's operating manual for certifying fans to

[109] *NIST/SEMATECH e-Handbook of Statistical Methods, https://www.itl.nist.gov/div898/handbook/eda/section3/eda352.htm.*

[110] 10 CFR part 429 outlines sampling plans for certification testing for product or equipment covered by EPCA.

[111] Or any other metric for which the consumer will favor a higher value, such as FEI.

[112] For example, if DOE expects that the variability for measured performance is within a margin of 3 percent, DOE will use a K value of 0.97. See for example 79 FR 32019, 32037 (June 3, 2014).

AMCA's certification programs. (AMCA, No. 6 at p. 10)

DOE proposes that a minimum sample size of two units would be used when making representations of FEP, FEI, and BHP, as applicable. This proposal is consistent with the statistical sampling requirements in place for other commercial and industrial equipment regulated by DOE.[113] In addition, DOE proposes that the FEI be rounded to the nearest hundredth. These requirements would be added to 10 CFR 429.66.

DOE seeks information on whether the statistical sampling plans used for other commercial and industrial equipment at 10 CFR part 429 would be appropriate for fans and blowers. If not, DOE requests information and data to explain why not, and what changes would be appropriate. DOE also requests comment on the proposed minimum sample size.

L. Enforcement Provisions

DOE proposes to add specific enforcement testing provisions for fans and blowers at 10 CFR 429.110 and proposes that DOE would use an initial sample size of not more than four units and would determine compliance based on the arithmetic mean of the sample. This is similar to existing enforcement testing provisions for pumps and HVACR equipment.

DOE proposes to add product-specific enforcement provisions for fans and blowers other than air circulating fans to specify that: (1) geometric similarity of two or more fans will be verified by requiring that the manufacturer provides all fan design dimensions as described in Annex K of AMCA 214–21; and (2) DOE will test each fan basic model according to the test method (specified by the manufacturer in any certification report (*i.e.,* based on Sections 6.1, 6.2, 6.3 or 6.4 of AMCA 214–21).

M. Test Procedure Costs and Impact

As previously discussed, DOE proposes to establish a test procedure for fans and blowers at 10 CFR part 431 subpart J and a newly proposed appendix A and appendix B as follows: (1) adopting through reference the test methods in AMCA 214–21, with certain modifications; (2) adopting through reference certain test procedure provisions in AMCA 210–16 and AMCA 230–15 with errata, as referenced by AMCA 214–21; and (3) specifying FEP and FEI as the relevant metrics, based on AMCA 214–21. Additionally, DOE is proposing to add section 66 to 10 CFR part 429, which adds fan and blower sampling requirements and provisions related to determining represented values, and to add section (k) to 10 CFR 429.70, which specifies alternative efficiency determination method requirements. DOE has tentatively determined that the proposed test procedure would impact testing costs as discussed in the following paragraphs.

By proposing to adopt industry standards, DOE has tentatively determined that the test procedure proposed in this NOPR would be reasonably designed to produce test results, which reflect energy efficiency and energy use of fans and blowers during a representative average use cycle and that would not be unduly burdensome for manufacturers to conduct. DOE is presenting the costs associated with performing testing according to the proposed test procedure at third-party testing facilities (*i.e.,* facilities that are not operated by the manufacturer whose product is being tested).

DOE recognizes that some manufacturers of fans and blowers may operate their own testing facilities or may establish in-house testing facilities suitable for obtaining representative efficiency values using the test procedure proposed in this NOPR. In order to establish a test laboratory capable of testing to the proposed test procedure, DOE expects that manufacturers could have substantial initial capital costs; however, DOE anticipates that the cost to perform a test would be less for in-house testing than for third-party testing. Therefore, it is expected that over the lifetime of a new test laboratory, the initial expense of the capital costs would be less than the total cost of third-party testing. For the purpose of estimating the costs in order to properly represent efficiency values for fans and blowers according to the test procedure proposed in this NOPR, DOE analyzed the case of testing at third-party laboratories.

1. Estimated Costs for Testing Fans and Blowers at a Third-Party Facility

In the case of testing at third-party testing facilities, DOE estimates a per-test cost of $3,000 for AMCA members and $6,000 for non-AMCA members. These estimates are based on statements made by AMCA during the ASRAC negotiations, where a member cost of $3,000 per test and a non-member cost of no more than double the member cost were stated. (Docket No. EERE–2013–BT–STD–0006, #82, p. 228) DOE estimates that approximately 60 percent of fan manufacturers are AMCA members and that the remaining 40 percent are not AMCA members. Utilizing these percentages and the respective costs per test for AMCA members and non-AMCA members, DOE estimates the aggregated average test cost would be $4,200 for third-party testing of both general fans and air circulating fans. As stated in section III.K, DOE proposes that basic model representations would be required to be based on testing a minimum of two units. Therefore, DOE estimates that it will cost $8,400 to test a basic model.

DOE requests feedback on its assumption that it would cost an average of $4,200 to test one fan for both general fans and air circulating fans. Additionally, DOE requests data on third-party laboratory testing costs (other than AMCA).

DOE requests feedback on the method described above for estimating manufacturer per-model testing costs of general fans and air circulating fans. Additionally, DOE requests feedback and data on the total testing costs per basic model for testing at third-party facilities.

2. Estimated Cost To Develop, Validate, and Implement an AEDM

As previously discussed, an AEDM is a mathematical model developed by a manufacturer that estimates the energy efficiency or energy consumption characteristics of a basic model as measured by the applicable DOE test procedure. Before using an AEDM, a manufacturer must validate the AEDM's accuracy and reliability by physically testing a certain number of basic models and comparing the test results to the output of the AEDM.

DOE assumes a mechanical engineer would develop and validate a new AEDM. Based on wage and salary data from the Bureau of Labor Statistics (''BLS''), DOE estimates the hourly fully burdened mechanical engineering wage to be approximately $66.[114] DOE also estimates that it would take 24 labor

[113] The general sampling requirement currently applicable to all covered products and equipment provides that a sample of sufficient size must be randomly selected and tested to ensure compliance and that, unless otherwise specified, a minimum of two units must be tested to certify a basic model as compliant. See 10 CFR 429.11.

[114] DOE estimated the hourly wage using data from BLS's ''Occupational Employment and Wages, May 2021'' publication. DOE used the ''Mechanical Engineers'' mean hourly wage of $46.64 to estimate the hourly wage rate (*www.bls.gov/oes/current/oes172141.htm*). DOE then used BLS's ''Employer Costs for Employee Compensation—December 2021'' to estimate that wages and salary account for approximately 70.5 percent of compensation for private industry workers (*www.bls.gov/news.release/archives/ecec_03182022.pdf*). Last accessed on April 2, 2022. Therefore, DOE estimated a fully burdened labor rate of $66.16 ($46.64 ÷ 0.705 = $66.16).

hours per validation class for an engineer to develop and validate an AEDM using existing simulation tools. Therefore, DOE estimated the cost of a fully burdened mechanical engineer as approximately $1,600 per validation class. As discussed in section III.J.1, testing of two basic models is required to validate an AEDM for a specific validation class. One unit must be tested per basic model in order to validate an AEDM. 10 CFR 429.70(c)(2)(i) Therefore, two physical tests on two different basic models are required for validation of a fans and blowers AEDM. As discussed in the previous section, DOE estimates the average cost per test to be $4,200. Therefore, the total estimated manufacturer cost to develop and validate an AEDM for a single validation class is estimated to be $10,000, which is the cost to perform one test on two basic models at a third-party lab ($8,400) plus the fully burdened cost of a mechanical engineer's time to develop and validate the AEDM ($1,600).

DOE assumes a mechanical technician would implement an AEDM once it is developed. Based on wage and salary data from the Bureau of Labor Statistics, DOE estimates the hourly fully burdened mechanical technician wage to be approximately $43.[115] DOE estimates that it would take a mechanical technician 1 hour to determine the representative values necessary to certify a basic model using an AEDM. Therefore, the estimated cost to implement an AEDM to develop certified ratings is $43 per basic model.

DOE requests comment on its assumption that manufacturers have existing simulation tools that a mechanical engineer could use to develop an AEDM. Additionally, DOE requests comment on its assumption that AEDMs would be developed by a mechanical engineer and later utilized by mechanical technicians to develop certified ratings for each basic model. Finally, DOE requests comment on its assumption that it would take a mechanical engineering approximately 24 working hours to develop an AEDM and that it would take a mechanical technician approximately 1 hour per basic model to develop certified ratings from an AEDM.

3. Voluntary Representations

If manufacturers voluntarily make representations regarding the energy consumption or cost of energy of the fans and blowers that are proposed to be in-scope for the proposed test procedure (listed in Section III.A of this document), they would be required to make representations based on testing according to the DOE test procedure. (42 U.S.C. 6314(d)(1)) DOE has initially determined that the implementation of the proposed test procedure, if finalized, would result in added costs to fan and blower manufacturers if manufacturers choose to make efficiency representations. These added costs pertain to manufacturers that would need to update current efficiency representations in marketing materials and those that would choose to add efficiency representations to marketing materials.

N. Compliance Date

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. 6314(d)(1)) To the extent the test procedure proposed in this document is required only for the evaluation and issuance of new efficiency standards, use of the proposed test procedure, if finalized, would not be required until the implementation date of new standards. 10 CFR 431.4; Section 8(e) of appendix A 10 CFR part 430 subpart C.

If DOE were to publish a new 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. 6314(d)(2)) 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.*)

IV. Procedural Issues and Regulatory Review

A. Review Under Executive Orders 12866 and 13563

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

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

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of an initial regulatory flexibility analysis (IRFA) for any rule that by law must be proposed for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As

[115] DOE estimated the hourly wage using data from BLS's ''Occupational Employment and Wages, May 2021'' publication. DOE used the ''Mechanical Engineering Technologists and Technicians'' mean hourly wage of $30.47 to estimate the hourly wage rate (*www.bls.gov/oes/current/oes173027.htm*). DOE then used BLS's ''Employer Costs for Employee Compensation—December 2021'' to estimate that wages and salary account for approximately 70.5 percent of compensation for private industry workers (*www.bls.gov/news.release/archives/ecec_03182022.pdf*). Last accessed on April 2, 2022. Therefore, DOE estimated a fully burdened labor rate of $43.22 ($30.47 ÷ 0.705 = $43.22).

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.*

The following sections detail DOE's IRFA for this test procedure rulemaking:

1. Descriptions of Reasons Why Action Is Being Considered

DOE is proposing to establish a test procedure for fans and blowers at subpart J of 10 CFR part 431. As discussed, EPCA provides that DOE may include a type of industrial equipment, including fans and blowers, as covered equipment if it determines that to do so is necessary to carry out the purposes of Part A–1. (42 U.S.C. 6311(2)(B)(ii) and (iii); 42 U.S.C. 6312(b)). The purpose of Part A–1 is to improve the efficiency of electric motors and pumps and certain other industrial equipment in order to conserve the energy resources of the Nation. (42 U.S.C. 6312(a)) As stated, on August 19, 2021, DOE published a final determination determining that fans and blowers meet the statutory criteria for classifying industrial equipment as covered, because fans and blowers are a type of industrial equipment (1) which in operation consume, or are designed to consume, energy; (2) are to a significant extent distributed in commerce for industrial or commercial use; and (3) are not covered under 42 U.S.C. 6291(a)(2). 86 FR 46579, 46586. DOE also determined that coverage of fans and blowers is necessary to carry out the purposes of Part A–1. 86 FR 46579, 46588.

This proposed rulemaking is in accordance with DOE's obligations under EPCA.

2. Objectives of, and Legal Basis for, Rule

The energy conservation program under EPCA consists essentially of four parts: (1) testing, (2) labeling, (3) Federal energy conservation standards, and (4) certification and enforcement procedures. Relevant provisions of EPCA include definitions (42 U.S.C. 6311), test procedures (42 U.S.C. 6314), labeling provisions (42 U.S.C. 6315), energy conservation standards (42 U.S.C. 6313), and the authority to require information and reports from manufacturers. (42 U.S.C. 6316; 42 U.S.C. 6296)

The Federal testing requirements consist of test procedures that manufacturers of covered equipment must use as the basis for: (1) certifying to DOE that their equipment complies with the applicable energy conservation standards adopted pursuant to EPCA (42 U.S.C. 6316(a); 42 U.S.C. 6295(s)), and (2) making other representations about the efficiency of that equipment. (42 U.S.C. 6314(d)) Similarly, DOE must use these test procedures to determine whether the equipment complies with relevant standards promulgated under EPCA. (42 U.S.C. 6316(a); 42 U.S.C. 6295(s)

3. Description and Estimate of Small Entities Regulated

DOE has recently conducted a focused inquiry into small business manufacturers of the equipment covered by this proposed rulemaking. DOE used the Small Business Administration (SBA) size standards to determine whether any small entities would be subject to the requirements of the proposed rule. The small business size standards are listed by North American Industry Classification System (''NAICS'') code as well as by industry description and are available at *www.sba.gov/document/support--table-size-standards.* Manufacturing commercial and industrial fans and blowers is classified under NAICS 333413, ''Industrial and Commercial Fan and Blower and Air Purification Equipment Manufacturing.'' The SBA sets a threshold of 500 employees or fewer for an entity to be considered as a small business for this category. DOE used a combination of publicly available information and a private stakeholder database to create a list of potential manufacturers. Once DOE created a list of potential manufacturers, DOE used market research tools to determine whether any met the SBA's definition of a small entity, based on the total number of employees for each company including parent, subsidiary, and sister entities.

4. Based on DOE's analysis, over 200 companies potentially selling commercial and industrial fans and blowers covered by this proposed test procedure were identified. DOE screened out companies that do not meet the small entity definition and additionally screened out companies that are largely or entirely foreign owned and operated. Of the identified companies, 51 were further identified as a potential small business manufacturing commercial and industrial fans and blowers.

5. Description and Estimate of Compliance Requirements

DOE estimates that this proposed test procedure would not require any manufacturer to incur any testing burden associated with the proposed test procedure. If finalized, DOE recognizes that commercial and industrial fans and blowers energy conservation standards may be proposed or promulgated in the future and manufacturers would then be required to test all covered equipment in accordance with the proposed test procedures. (*See* Docket No. EERE–2021–BT–TP–0021) Therefore, although such is not yet required, DOE is presenting the costs associated with testing equipment and procedure consistent with the requirements of the proposed test procedure, as would be required to comply with any future energy conservation standards for fans and blowers.

This proposed test procedure, if finalized, may result in manufacturers who choose to make voluntary representation incurring costs associated with re-testing their models to update efficiency representations in marketing materials based on testing according to the DOE test procedure. Estimated costs for testing fans and blowers is discussed in Section M of this notice.

(a) Establishment of a Test Procedure

Due to the lack of a model database and the large number of potential small businesses, DOE selected 20 of the small businesses to examine for model counts—which can be averaged across the full set of small businesses. DOE reviewed the websites and, where available, product catalogs of each of the sampled small businesses manufacturing equipment covered by the proposed test procedure. While detailed product information was not availiable for three of the sampled small businesses, DOE identified, maximally, 2,686 models of commercial and industrial fans and blowers that may be covered by the proposed test procedure across the remaining 17 small businesses. The number of models identified ranged from 7 to 636 across the applicable manufacturers, for an average of 158 and a median of 49 models per manufacturer. In the intesest of arriving at an upperbound cost estimate, DOE assumes that all small businesses will use third-party testing and not implement an AEDM. DOE previously estimated a total average certification testing cost of $8,400 per model—$6,000 for an AMCA member and $12,000 for a non-AMCA member—

which translates to an average cost for small business manufacturers of $1,327,200, assuming all models are tested. Accordingly, total costs for small businesses, assuming that the non-sampled small businesses have similar model counts would be approximately $67,687,200.

DOE was able to find annual revenue estimates for all of the 17 small businesses sampled. Testing costs as a pecentage of estimated annual revenue fluctuate widely—ranging from less than one percent to over 70 percent—for an average of approximately 15 percent and a median value of approximately four percent.

(b) Establishment of an AEDM

Establishing an AEDM for commercial and industrial fans and blowers is not expected to impose an additional cost on small business manufacturers. Manufacturers are not required to use the AEDM and using the AEDM to certify models is expected to result in an significantly lower cost relative to using the standard test procedure for all or most of the models a small business might produce.

6. 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 proposed rule being considered today.

7. Significant Alternatives to the Rule

The discussion in this section analyzes impacts on small businesses that would result from DOE's proposed test procedure, if finalized. In reviewing alternatives to the proposed test procedure, DOE examined not establishing a performance-based test procedure for commercial and industrial fans and blowers. While not establishing performance-based test procedures for commercial and industrial fans and blowers would reduce the burden on small businesses, DOE must use test procedures to determine whether the products comply with relevant standards promulgated under EPCA. (42 U.S.C. 6295(s))

DOE notes there currently are no energy conservation standards prescribed for commercial and industrial fans and blowers. Therefore, manufacturers would not be required to conduct the proposed test procedure, if made final, until such time as compliance is required with energy conservation standards, should DOE establish such standards, unless manufacturers voluntarily chose to make representations as to the energy use or energy efficiency of commercial and industrial fans and blowers.

DOE has tentatively determined that there are no better alternatives than the proposed amendments in terms of meeting the agency's objectives to measure energy efficiency more accurately and to reduce burden on manufacturers. Therefore, DOE is proposing in this NOPR to amend the existing DOE test procedure for fans and blowers.

Additional compliance flexibilities may be available through other means. Notably, 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 430, subpart E, and 10 CFR part 1003 for additional details.

C. Review Under the Paperwork Reduction Act of 1995

Manufacturers of covered equipment must certify to DOE that their products comply with any applicable energy conservation standards. To certify 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 certain covered consumer products and commercial equipment. (*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.

This proposed rule would not establish any certification or recordkeeping requirements on manufacturers of fans and blowers. Were DOE to establish energy conservation standards for fans and blowers, certification data would be required for fans and blowers subject to such standards; however, DOE is not proposing certification or reporting requirements for fans and blowers in this NOPR. Instead, DOE may consider proposals to establish certification requirements and reporting for fans and blowers under a separate rulemaking regarding appliance and equipment certification. 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 a new test procedure that it expects will be used to develop and implement future energy conservation standards for fans and blowers. DOE has determined that this rule falls into a class of actions that are categorically excluded from review under the National Environmental Policy Act of 1969 (42 U.S.C. 4321 *et seq.*) and DOE's implementing regulations at 10 CFR part 1021. Specifically, DOE has determined that adopting test procedures for measuring energy efficiency of consumer products and industrial equipment is consistent with activities identified in 10 CFR part 1021, appendix A to subpart D, A5 and A6. Accordingly, neither an environmental assessment nor an environmental impact statement is required.

E. Review Under Executive Order 13132

Executive Order 13132, ''Federalism,'' 64 FR 43255 (Aug. 4, 1999) imposes certain requirements on agencies formulating and implementing policies or regulations that preempt State law or that have federalism implications. The 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. Federal energy efficiency requirements for covered equipment established under EPCA supersede State laws and regulations concerning energy conservation testing, labeling, and standards beginning on the date on which a final rule establishing an energy conservation standard is issued by the Secretary, except that any State or local standard prescribed or enacted or the equipment before the date on which the final rule is issued shall not be preempted until the energy conservation standard established by the Secretary for the equipment takes effect. (42 U.S.C. 6316(a)(10); 42 U.S.C. 6297) DOE may, however, grant waivers of Federal preemption for particular State laws or regulations, in accordance with the procedures and other provisions of EPCA. (42 U.S.C. 6316(b)(2)(D)) 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 fans and blowers 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 test procedure for fans and blowers would incorporate testing methods contained in certain sections of the following commercial standards: AMCA 214–21, AMCA 210–16, AMCA 230–15, AMCA 240–15, AMCA 99–16, ISO 5801:2017, and ISO 80079–36:2016. DOE has evaluated these standards and is unable to conclude whether they fully complies 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 test standards published by AMCA, titled, ''ANSI/AMCA Standard 214–21, ''Test Procedure for Calculating Fan Energy Index for Commercial and Industrial Fans and Blowers.'' AMCA 214–21 is an industry-accepted test procedure that provides methods to determine fan electrical shaft power and/or electrical power, flow, and pressure and calculate the fan energy index (FEI) and is applicable to product sold in North America. AMCA 214–21 specifies testing conducted in accordance with other industry-accepted test procedures (also proposed for incorporation by reference). The test procedure proposed in this NOPR references various sections of AMCA 214–21 that address test setup, test conduct, and calculation of the FEI.

DOE also proposes to incorporate by reference the test standards published by AMCA, titled ''ANSI/AMCA Standard 210/ASHRAE 51–16 Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating;'' and ''ANSI/AMCA 230–15, ''Laboratory Methods of Testing Air Circulating Fans for Rating and Certification'' (with errata). AMCA 210–16 is an industry-accepted test procedure that provides methods of tests for fans and blowers that are not air circulating fans, and AMCA 230–15 is an industry-accepted test procedure that provides methods of tests for air circulating fans. These methods are referenced in AMCA 214–21.

DOE further proposes to incorporate by reference the test standards published by AMCA, titled ''ANSI/AMCA 240–15, Laboratory Methods of Testing Positive Pressure Ventilators for Aerodynamic Performance Rating'' (''AMCA 240–15''). AMCA 240–15 is an industry-accepted test procedure that provides definitions and methods of tests for positive pressure ventilator.

DOE further proposes to incorporate by reference the test standards published by AMCA, titled ''ANSI/AMCA 99–16 Standards Handbook'', (''AMCA 99–16''). AMCA 99–16 serves as a collection of technical information that is used in the development of other AMCA documents.

Copies of AMCA 214–21, AMCA 210–16, AMCA 230–15, AMCA 240–15, and AMCA 99–16 may be purchased from AMCA International at 30 West University Drive, Arlington Heights, IL 60004–1893, or by going to *www.amca.org.*

DOE also proposes to incorporate by reference the test standards published by the International Organization for Standardization, titled ''ISO 5801:2017, Fans—Performance testing using standardized airways'' (''ISO 5801:2017''). ISO 5801:2017 is the industry-accepted test procedure that provides methods of tests for fans and blowers that are not air circulating fans, internationally. In addition, DOE proposes to incorporate by reference ISO 80079–36:2016, which specifies the method and requirements for design, construction, testing and marking of non-electrical equipment intended for use in potentially explosive atmospheres.

Copies of ISO 5801:2017 and ISO 80079–36:2016 may be purchased from International Organization for Standardization, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, or by going to *www.iso.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: *www.energy.gov/eere/buildings/public-meetings-and-comment-deadlines.* Participants are responsible for ensuring their systems are compatible with the webinar software.

B. Procedure for Submitting Prepared General Statements for Distribution

Any person who has an interest in the topics addressed in this document, or who is representative of a group or class of persons that has an interest in these issues, may request an opportunity to make an oral presentation at the webinar. Such persons may submit to *ApplianceStandardsQuestions@ee.doe.gov.* Persons who wish to speak should include with their request a computer file in WordPerfect, Microsoft Word, PDF, or text (ASCII) file format that briefly describes the nature of their interest in this rulemaking and the topics they wish to discuss. Such persons should also provide a daytime telephone number where they can be reached.

C. Conduct of the Webinar

DOE will designate a DOE official to preside at the webinar/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 webinar/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 webinar/public meeting and until the end of the comment period, interested parties may submit further comments on the proceedings and any aspect of the rulemaking.

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

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

A transcript of the webinar will be included in the docket, which can be viewed as described in the *Docket* section at the beginning of this document. 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.[116] Interested parties may submit comments 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 contact information on a cover letter. Include your first and last names, email address, telephone number, and optional mailing address. The cover letter will not be publicly viewable as long as it does not include any comments.

Include contact information each time you submit comments, data, documents, and other information to DOE. If you submit via postal mail or hand delivery/courier, please provide all items on a CD, if feasible, in which case it is not necessary to submit printed copies. No 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, that are written in English and free of any defects or viruses. Documents should not contain special characters or any form of encryption and, if possible, they should carry the electronic signature of the author.

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

Confidential Business Information. Pursuant to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email two well-marked copies: one copy of the document marked confidential including all the information believed to be confidential, and one copy of the document marked non-confidential with the information believed to be confidential deleted. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

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

[116] 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.

E. Issues on Which DOE Seeks Comment

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

(1) DOE requests comment on the fans and blowers, other than air circulating fans, proposed for inclusion in the DOE test procedure.

(2) DOE requests comment on the proposed limits based on fan airpower, fan shaft input power and fan electrical input power for fans other than air circulating fans. Specifically, DOE requests comment on the proposed definitions of ''static airpower'' and ''total airpower'' used to characterize the upper 150 horsepower limit for fans other than air circulating fans.

(3) DOE requests comment on its proposed exclusions from the proposed scope of applicability of the test procedure, listed as follows: (1) radial housed unshrouded fans with a diameter less than 30 inches or a blade width of less than 3 inches; (2) safety fans; (3) induced flow fans; (4) jet fans; and (5) cross-flow fans. DOE seeks additional information to support exclusion from the scope of potential test procedures.

(4) DOE seeks comment and input on the applicability of AMCA 214–21 and AMCA 210–16 to fans that create a vacuum of 30 inches water gauge or greater. DOE requests comment on the 30 inches water gauge limit used by the CEC.

(5) DOE requests comment on the proposed exclusively embedded fan exclusions listed in Table III 8 of this document.

(6) DOE seeks information on whether it is common practice for standalone fan manufacturers that supply fans to HVACR equipment manufacturers to test these fans in accordance with AMCA 214–21 or AMCA 210–16 in a standalone configuration, and to provide fan performance data for these fans.

(7) DOE seeks information on whether it is common practice for manufacturers of HVACR equipment that manufacture and incorporate fans into their equipment to test these fans in accordance with AMCA 214–21 or AMCA 210–16 in a standalone configuration, and to provide fan performance data to their customers.

(8) DOE seeks comment on the estimates provided for the percentage of fans that are incorporated in HVACR equipment that are purchased by the HVACR equipment manufacturer vs. manufactured in-house.

(9) DOE seeks comment and input regarding any physical features that could be used to distinguish a fan that is exclusively designed for use in equipment listed in Table III 8 of this document.

(10) DOE seeks comment on the proposed definition of ''exclusively embedded fan''.

(11) DOE requests comments on the proposed scope of applicability of the test procedure for air circulating fans.

(12) DOE requests comment on excluding fans and blowers that are exclusively powered by internal combustion engines from the scope of this test procedure and associated energy conservation standards.

(13) DOE requests feedback and information on the physical features that would help distinguish fans and blowers that are exclusively powered by internal combustion engines from other fans and blowers.

(14) DOE requests comment on the definitions proposed for the following fan categories: (1) axial inline fan; (2) axial panel fan; (3) centrifugal housed fan; (4) centrifugal unhoused fan; (5) centrifugal inline fan; (6) radial-housed fan; and (7) PRVs, consistent with AMCA 214–21. If any of the definitions are not appropriate, DOE seeks input on how they should be amended and why.

(15) DOE seeks input and comments on the proposed definitions of (1) induced flow fan, (2) jet fan, and (3) cross-flow fan consistent with AMCA 214–21 and AMCA 208–18. If any of the definitions are not appropriate, DOE seeks input on how they should be amended and why.

(16) DOE requests comment on the proposed definition of basic model, with respect to fans and blowers.

(17) DOE requests comments on its proposed definition of safety fans. Specifically, DOE requests comments in whether item (4) of the CEC definition of safety fans is equivalent to ''laboratory exhaust fans'' as defined in Section 3.52 of AMCA 214–21.

(18) DOE requests comment on the proposed definitions for air circulating fan and related terms.

(19) DOE requests comment on the proposed definitions related to heat rejection equipment.

(20) DOE requests comment on its proposed definition of air circulating fan outlet area. DOE additionally requests comment on whether the definition of outlet area for fans and blowers other than air circulating fans should be revised and, if so, how.

(21) DOE seeks information on whether, in general, AMCA 214–21, AMCA 210–16, and AMCA 230–15 (with errata) provide measurements which reflect energy efficiency or energy use during a representative average use cycle of the fans and blowers (including air circulating fans) proposed to be in scope. If these standards would not provide such measurements, DOE seeks input on how it should be amended and why, and on any other industry test standard that would be more appropriate.

(22) DOE requests comment and supporting data on whether AMCA 214–21 and ISO 5801:2017 produce equivalent test results.

(23) DOE seeks information and data to assist in evaluating the repeatability and reproducibility of AMCA 214–21, AMCA 210–16, and AMCA 230–15 (with errata). DOE seeks input on whether any changes to these standards are needed to increase its repeatability and reproducibility.

(24) DOE seeks information on whether changes to AMCA 214–21, AMCA 210–16, and AMCA 230–15 (with errata) are needed to allow for the determination of more representative energy efficiency ratings, and any cost associated with a suggested change.

(25) DOE requests comment on the physical features that could be identified to differentiate bare-shaft fans that can accommodate only a direct-drive transmission from other bare-shaft fans.

(26) DOE requests comment on any additional revisions under consideration by the AMCA 230 committee that are not discussed in this document.

(27) DOE requests comment on the equations provided in Section 5.3 and section 6.4.2.3 of AMCA 214–21. Specifically, DOE requests comment on whether applying the method outlined in Section 6.4 of AMCA 214–21 and the equations provided in Section 6.4.2.3 of AMCA 214–21 could result in a higher value of FEI than the FEI resulting from a wire-to-air test in accordance with Section 6.1 of AMCA 214–21.

(28) DOE requests comments on whether it should add a reference to section I.6 of AMCA 211–22 or replace Annex E of AMCA 214–21 by Annex I of AMCA 211–22.

(29) DOE seeks feedback on its proposal that PRVs that can operate both as supply and exhaust fans be tested in both configurations as described in Table III 9.

(30) DOE seeks comment on its proposal to test exclusively embedded fans in a standalone configuration outside of the equipment that incorporates the fan.

(31) DOE requests comment on its proposed approach for testing air circulating fans that are distributed in commerce without an electric motor.

(32) DOE requests comment on its proposal to add provisions for calculating the total pressure of air circulating fans based on the equations in Section A.2 of AMCA 208–18.

(33) DOE requests comment on the proposed provisions related to the consideration of appurtenances when testing fans and blowers, including air circulating fans.

(34) DOE requests comment on whether it should consider specifying additional provisions to describe which components should be included in the test.

(35) DOE requests comment on the proposed provisions related to specifying which frequency, phase, and voltage to use during a test.

(36) DOE additionally requests comment on whether the supply voltage requirements proposed for testing air circulating fans and fans and blowers other than air circulating fans would appropriately represent an average use cycle.

(37) DOE seeks feedback on the options presented for specifying the testing speed(s) for air circulating fans and its proposal to test single speed fans at the single available speed, multi-speed fans at each available speed, and variable speed fans at 20, 40, 60, and 80 percent of maximum speed. DOE further requests feedback on its proposal to clarify that if the fan minimum speed is greater than 20 percent of the maximum speed, the performance data would be captured and reported in five speeds evenly spaced throughout the speed range, including at minimum and maximum speeds.

(38) DOE requests data to characterize typical air circulating fan operating speed(s) and time spent at each operating speed.

(39) DOE requests feedback on whether Section 6.2 and Annex E of AMCA 214–21 should be applied to air circulating fans.

(40) DOE requests comment on its proposal for determining if an air circulating fan has reached equilibrium prior to initiating testing. Specifically, DOE is soliciting comment on the test variables and related tolerances that it is proposing to incorporate in its equilibrium determination. Additionally, DOE seeks comment on the minimum duration and maximum interval over which equilibrium would need to be verified. DOE also seeks comment on which variables proposed in Table III–13 that, if not stable prior to test, would have the greatest impact on measured fan performance. Finally, DOE requests comment on its proposal to specify the time and frequency over which extraneous airflow measurements would be recorded.

(41) DOE requests comment on its proposal for determining if a fan that is not an air circulating fan has reached equilibrium prior to initiating testing. Specifically, DOE is soliciting comment on the test variables and related tolerances that it is proposing to incorporate in its equilibrium determination. Additionally, DOE seeks comment on the minimum duration and maximum interval over which equilibrium would need to be verified. Finally, DOE seeks comment on which variables proposed in Table III–14 that, if not stable prior to test, would have the greatest impact on measured fan performance.

(42) DOE requests comment on the applicability of each test figure in AMCA 230–15 to air circulating fans.

(43) DOE requests comment on the proposed FEI calculation for air circulating fans.

(44) DOE requests comment on its proposals for rounding represented values of FEI and FEP to the hundredths place. Additionally, DOE seeks comment on its proposal to specify rounding requirements for test values and calculations that are consistent with the resolution of the test instrumentation.

(45) DOE requests comment on the proposed location of the extraneous airflow measurement for air circulating fans.

(46) DOE requests comment on the proposed run-in requirements.

(47) DOE requests comment on whether the requirement to calibrate transducer type barometers for each test is necessary or should be removed for air circulating fans.

(48) DOE requests comment on its proposal that fans that meet the definition of both an axial panel fan and the definition of an air circulating fan because of the presence or absence of brackets for mounting through a structure that separates a fan's inlet from its outlet be tested both as a fan and blower and as an air circulating fan.

(49) DOE requests comment on the appropriate metric to use for fans and blowers other than air circulating fans.

(50) DOE requests comment on the proposed FEI metric determined in accordance with the proposed test procedure, and on whether any changes are necessary to provide for more representative energy efficiency ratings. If changes are suggested, DOE seeks input on how the proposed FEI metric should be amended and why, and on any other metrics that would be more appropriate. If changes or alternate metrics are suggested, DOE requests information on the impact to testing cost as compared to the proposed use of FEI.

(51) DOE requests comments on the alternative approach considered to establish a weighted average FEI metric for fans and blowers other than air circulating fans. DOE requests comments on the appropriate reference system curve to use in the case of variable-speed fans to standardize the calculation of the reduced BEP flow operating points.

(52) DOE requests comment on the appropriate metric to use for air circulating fans.

(53) DOE requests comment on the proposed FEI metric determined in accordance with the proposed test procedure, and on whether any changes are necessary to provide for more representative energy efficiency ratings. If changes are suggested, DOE seeks input on how the proposed FEI metric should be amended and why, and on any other metrics that would be more appropriate. Specifically, for air circulating fans, DOE requests comment on the proposed use of the FEI metric determined in accordance with the test procedure as proposed and if DOE should consider other performance metrics as measured by AMCA 230–15, or different weights. If changes or alternate metrics are suggested, DOE requests information on the impact to testing cost as compared to the proposed use of FEI.

(54) DOE requests comments on whether to use a different acronym to designate the FEI of air circulating fans (''ACFEI'').

(55) DOE seeks feedback on the proposed use of the FEI metric for all PRVs and air circulating fans, including agricultural fans.

(56) DOE requests comment on its proposal to not include a credit in the FEP and FEI calculation for fans with a motor controller.

(57) DOE requests feedback regarding all aspects of its proposal to permit use of an AEDM for fans and blowers, and any data or information comparing modeled performance with the results of physical testing. DOE specifically seeks comment on its proposed validation classes, and whether different number of basic models should be considered.

(58) DOE seeks information on whether the statistical sampling plans used for other commercial and industrial equipment at 10 CFR part 429 would be appropriate for fans and blowers. If not, DOE requests information and data to explain why not, and what changes would be appropriate. DOE also requests comment on the proposed minimum sample size.

(59) DOE requests feedback on its assumption that it would cost an average of $4,200 to test one fan for both general fans and air circulating fans. Additionally, DOE requests data on third-party laboratory testing costs (other than AMCA).

(60) DOE requests feedback on the method described above for estimating manufacturer per-model testing costs of general fans and air circulating fans. Additionally, DOE requests feedback and data on the total testing costs per basic model for testing at third-party facilities.

(61) DOE requests comment on its assumption that manufacturers have existing simulation tools that a mechanical engineer could use to develop an AEDM. Additionally, DOE requests comment on its assumption that AEDMs would be developed by a mechanical engineer and later utilized by mechanical technicians to develop certified ratings for each basic model. Finally, DOE requests comment on its assumption that it would take a mechanical engineering approximately 24 working hours to develop an AEDM and that it would take a mechanical technician approximately 1 hour per basic model to develop certified ratings from an AEDM.

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 request for comment, and announcement of public meeting.

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 431

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

Signing Authority

This document of the Department of Energy was signed on June 24, 2022, by Kelly J. Speakes-Backman, Principal Deputy Assistant Secretary for Energy Efficiency and Renewable Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the **Federal Register**.

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

Treena V. Garrett

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

For the reasons stated in the preamble, DOE is proposing to amend parts 429 and 431 of Chapter II of Title 10, Code of Federal Regulations as set forth below:

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

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

Authority: 42 U.S.C. 6291–6317; 28 U.S.C. 2461 note.

■ 2. Section 429.4 is amended by:
■ a. Revising paragraph (a);
■ b. Redesignating paragraphs (d), (e), and (f) as (e), (f) and (g); and
■ c. Adding new paragraph (d).

The revisions and addition read as follows:

§ 429.4 Materials incorporated by reference.

(a) Certain material is incorporated by reference into this part with the approval of the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. To enforce any edition other than that specified in this section, DOE must publish a document in the **Federal Register** and the material must be available to the public. All approved incorporation by reference (IBR) material is available for inspection at DOE, and at the National Archives and Records Administration (NARA). Contact DOE at: the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, Sixth Floor, 950 L'Enfant Plaza SW, Washington, DC 20024, (202) 586–9127, *Buildings@ee.doe.gov, https://www.energy.gov/eere/buildings/building-technologies-office.* For information on the availability of this material at NARA, email: *fr.inspection@nara.gov,* or go to: *www.archives.gov/federal-register/cfr/ibr-locations.html.* The material may be obtained from the following sources:

* * * * *

(d) *AMCA.* Air Movement and Control Association International, 30 West University Drive, Arlington Heights, IL 60004–1893, (847) 394–0150, *www.amca.org.*

(1) ANSI/AMCA Standard 214–21, (''AMCA 214–21''), ''Test Procedure for Calculating Fan Energy Index for Commercial and Industrial Fans and Blowers'', March 1, 2021; IBR approved for § 429.134.

(2) [Reserved]

* * * * *

§ 429.11 [Amended]

■ 3. Section 429.11 is amended in paragraph (a) by removing ''429.62'' and adding in its place ''429.66'', and in paragraph (b) by removing ''429.65'' and adding in its place ''429.66''.

■ 4. Add § 429.66 to subpart B to read as follows:

§ 429.66 Fans and blowers.

(a) *Determination of represented values.* A manufacturer must determine the represented values for each basic model, either by testing in conjunction with the applicable sampling provisions or by applying an AEDM as set forth in this section and in § 429.70(k). Manufacturers must update represented values to account for any change in the applicable motor standards in Table 5 of § 431.25 and certify amended values as of the next annual certification (as applicable).

(1) *Testing*—(i) *Units to be tested.* If the represented values for a given basic model are determined through testing, the requirements of § 429.11 apply.

(ii) Any represented value of fan electrical input power (''FEP''), fan shaft input power, or other measure of energy consumption of a basic model for which consumers would favor lower values shall be greater than or equal to the higher of:

(A) The mean of the sample, where

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

Where $\bar{x}$ is the sample mean; n is the number of samples, and x_i is the i^{th} sample. Or,

(B) The upper 95 percent confidence limit (UCL) of the true mean divided by 1.05, where:

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

and $\bar{x}$ is the sample mean; s is the sample standard deviation; n is the number of samples; and $t_{0.95}$ is the t statistic for a 95 percent one-tailed confidence interval with n–1 degrees of freedom (from appendix A of subpart B of part 429). Represented values must be rounded to the nearest hundredth.

(iii) Any represented value of the fan energy index (''FEI''), weighted-average FEI, or other measure of energy consumption of a basic model for which consumers would favor higher values shall be less than or equal to the lower of:

(A) The mean of the sample, where

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

Where $\bar{x}$ is the sample mean; n is the number of samples, and x_i is the i^{th} sample. Or,

(B) The lower 95 percent confidence limit (LCL) of the true mean divided by 0.95, where:

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

and $\bar{x}$ is the sample mean; s is the sample standard deviation; n is the number of samples; and $t_{0.95}$ is the t statistic for a 95 percent one-tailed confidence interval with n–1 degrees of freedom (from appendix A of subpart B of part 429). Represented values must be rounded to the nearest hundredth.

(2) *Alternative efficiency determination methods.* In lieu of testing, the represented values for a basic model of a fan or blower must be determined through the application of an AEDM pursuant to the requirements of § 429.70(j) and the provisions of this section, where: the represented values of any basic model used to validate an AEDM must be calculated under paragraph (b)(1) of this section.

■ 5. Section 429.70 is amended by:

■ a. In paragraph (a), removing ''429.62'' and adding its place ''429.66''; and

■ b. Adding paragraph (k).

The additions read as follows:

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

* * * * *

(k) *Alternative efficiency determination method (AEDM) for fans and blowers*— (1) *Criteria an AEDM must satisfy.* A manufacturer is not permitted to apply an AEDM to a basic model of fan or blower to determine represented values pursuant to this section unless:

(i) The AEDM is derived from a mathematical model that estimates the energy use characteristics of the basic model as measured by the applicable DOE test procedure and accurately represents the performance characteristics of that basic model;

(ii) The AEDM is based on engineering or statistical analysis, computer simulation or modeling, or other analytic evaluation of actual performance data; and

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

(2) *Validation of an AEDM.* Before using an AEDM, the manufacturer must validate the AEDM's accuracy and reliability by comparing the simulated FEI, or simulated weighted-average FEI, as applicable, to the tested FEI or tested weighted-average FEI, as applicable (determined by testing), as follows.

(i) *Select basic models.* For each fan or blower validation class listed as follows: centrifugal housed fan; radial housed fan; centrifugal inline fan; centrifugal unhoused fan; centrifugal power roof ventilator exhaust fan; centrifugal power roof ventilator supply fan; axial inline fan; axial panel fan; axial centrifugal power roof ventilator fan; unhoused ACFH; air circulating axial panel fan; box fan; cylindrical air circulating fan; and housed centrifugal air circulating fan to which the AEDM is applied, a manufacturer must select at least two basic models compliant with any energy conservation standards in subpart J of part 431. In addition, at least one basic model selected for validation testing should include a motor, or a motor and controller if the AEDM is applied to a basic model with a motor or to a basic model with a motor and controller.

(ii) *Apply the AEDM* to the selected basic models. Using the AEDM, calculate the simulated FEI, or weighted-average FEI, as applicable, for each of the selected basic models.

(iii) *Testing.* Test at least two units of each of the selected basic models in accordance with 10 CFR 431.174 of this chapter and determine the FEI or weighted-average FEI, as applicable, in accordance with § 429.66(a)(1).

(iv) *Compare.* The simulated FEI or simulated weighted-average FEI, as applicable, for each basic model must be less than or equal to 105 percent of the FEI or weighted-average FEI, as applicable, determined in paragraph (k)(2)(iii) of this section through testing.

(3) *Verification of an AEDM.* (i) *Periodic reviews.* Each manufacturer must periodically select basic models representative of those to which it has applied an AEDM. The manufacturer must select a sufficient number of basic models to ensure the AEDM maintains its accuracy and reliability. For each basic model selected for verification: subject at least one unit to testing in accordance with 10 CFR 431.174. The provisions in paragraph (k)(2)(iv) of this section must be met.

(ii) Each manufacturer that has used an AEDM under this section must have available for inspection by the Department of Energy records showing:

(A) The method or methods used to develop the AEDM;

(B) The mathematical model, the engineering or statistical analysis, computer simulation or modeling, and other analytic evaluation of performance data on which the AEDM is based;

(C) Complete test data, equipment information, and related information that the manufacturer has generated or acquired pursuant to paragraphs (k)(2) and (k)(3) of this section; and

(D) The calculations used to determine the simulated FEI or simulated weighted-average FEI, as applicable, of each basic model to which the AEDM was applied.

(iii) If requested by the Department, the manufacturer must:

(A) Conduct simulations to predict the performance of particular basic models of electric motors specified by the Department;

(B) Provide analyses of previous simulations conducted by the manufacturer; and/or

(C) Conduct testing of basic models selected by the Department.

■ 6. Amend § 429.110 by:

■ a. Redesignating paragraphs (e)(7), (8), and (9) as (e)(8), (9), and (10), respectively; and

■ b. Adding new paragraph (e)(7).

The addition reads as follows:

§ 429.110 Enforcement testing.

* * * * *

(e) * * *

(7) For fans and blowers, DOE will use an initial sample size of not more than four units and will determine compliance based on the arithmetic mean of the sample.

* * * * *

■ 7. Amend § 429.134 by adding paragraph (s) to read as follows:

§ 429.134 Product-specific enforcement provisions.

* * * * *

(s) *Fans and blowers*—(1) *Verification of geometric similarity.* For fans and blowers other than air circulating fans, geometric similarity of two or more fans or blowers will be verified by requiring that the manufacturer provides all fan design dimensions as described in Annex K of AMCA 214–21 (incorporated by reference, see § 429.4).

(2) For fans and blowers other than air circulating fans, DOE will test each fan or blower basic model according to the test method specified by the manufacturer (*i.e.,* based on Section 6.1, 6.2, 6.3 or 6.4 of AMCA 214–21).

PART 431—ENERGY EFFICIENCY PROGRAM FOR CERTAIN COMMERCIAL AND INDUSTRIAL EQUIPMENT

■ 8. The authority citation for part 431 continues to read as follows:

Authority: 42 U.S.C. 6291–6317; 28 U.S.C. 2461 note.

■ 9. Section 431.172 is revised to read as follows:

§ 431.172 Definitions.

Air circulating fan means a fan that has no provision for connection to ducting or separation of the fan inlet from its outlet using a pressure boundary, operates against zero external static pressure loss, and is not a jet fan.

Air circulating axial panel fan means an axial housed air circulating fan head without a cylindrical housing or box housing that is mounted on a panel, orifice plate or ring.

Air circulating fan outlet area means—

(1) For unhoused air circulating fan heads, the area of a circle having a diameter equal to the blade tip diameter; and

(2) For housed ACFHs, the inside area perpendicular to the airstream, measured at the plane of the opening through which the air exits the fan.

Air-cooled steam condenser means a device for rejecting heat to the atmosphere through the indirect condensing of steam inside air-cooled finned tubes.

Axial inline fan means a fan with an axial impeller and a cylindrical housing with or without turning vanes.

Axial panel fans means an axial fan, without cylindrical housing, that includes a panel, orifice plate, or ring with brackets for mounting through a wall, ceiling, or other structure that separates the fan's inlet from its outlet.

Basic model, with respect to fans and blowers, means all units of fans and blowers manufactured by one manufacturer, having the same primary energy source, and having essentially identical electrical, physical, and functional (*e.g.,* aerodynamic) characteristics that affect energy consumption. In addition:

(1) All variations of blade pitches of an adjustable-pitch axial fan may be considered a single basic model; and

(2) All variations of impeller widths and impeller diameters of a given full-width impeller and full-diameter impeller centrifugal fan may be considered a single basic model.

Box fan means an axial housed air circulating fan head without a cylindrical housing that is mounted on a panel, orifice plate or ring and is mounted in a box housing.

Centrifugal housed fan means a fan with a centrifugal or mixed flow impeller in which airflow exits into a housing that is generally scroll-shaped to direct the air through a single fan outlet. A centrifugal housed fan does not include a radial impeller.

Centrifugal inline fan means a fan with a centrifugal or mixed flow impeller in which airflow enters axially at the fan inlet and the housing redirects radial airflow from the impeller to exit the fan in an axial direction.

Centrifugal unhoused fan means a fan with a centrifugal or mixed flow impeller in which airflow enters through a panel and discharges into free space. Inlets and outlets are not ducted. This fan type also includes fans designed for use in fan arrays that have partition walls separating the fan from other fans in the array.

Cross-flow fan means a fan or blower with a housing that creates an airflow path through the impeller in a direction at right angles to its axis of rotation and with airflow both entering and exiting the impeller at its periphery. Inlets and outlets can optionally be ducted.

Cylindrical air circulating fan means an axial housed air circulating fan head with a cylindrical housing that is not a positive pressure ventilator as defined in ANSI/AMCA Standard 240–15, Laboratory Methods of Testing Positive Pressure Ventilators for Aerodynamic Performance Rating, (incorporated by reference, see § 431.173).

Evaporative field erected closed-circuit cooling tower means a structure which rejects heat to the atmosphere through the indirect cooling of a process fluid stream to a lower temperature by partial evaporation of an external recirculating water flow.

Evaporative field erected open-circuit cooling tower means a structure which rejects heat to the atmosphere through the direct cooling of a water stream to a lower temperature by partial evaporation.

Exclusively embedded fan means a fan or blower that is manufactured and incorporated into a product or equipment manufactured by the same manufacturer and that is exclusively distributed in commerce embedded in another product or equipment.

Fan or blower means a rotary bladed machine used to convert electrical or mechanical power to air power, with an energy output limited to 25 kilojoule (kJ)/kilogram (kg) of air. It consists of an impeller, a shaft and bearings and/or driver to support the impeller, as well as a structure or housing. A fan or blower may include a transmission, driver, and/or motor controller.

Fan static airpower means the static power delivered to air by the fan or blower; it is proportional to the product of the fan airflow rate, the fan static pressure and the compressibility coefficient and is calculated in accordance with Section 7.8.1 of AMCA 210–16, (incorporated by reference, see § 431.173), using static pressure instead of total pressure.

Fan total airpower means the total power delivered to air by the fan or blower; it is proportional to the product of the fan airflow rate, the fan total pressure and the compressibility coefficient and is calculated in accordance with Section 7.8.1 of AMCA 210–16 (incorporated by reference, see § 431.173).

Field erected air-cooled (dry) cooler means a structure which rejects heat to the atmosphere from a fluid, either liquid, gas or a mixture thereof, flowing through an air-cooled internal coil.

Field erected evaporative condenser means a structure which rejects heat to the atmosphere through the indirect condensing of a refrigerant in an internal coil by partial evaporation of an external recirculating water flow.

Full-width impeller means the maximum impeller width with which a given fan or blower basic model is distributed in commerce.

Full-diameter impeller means maximum impeller diameter with which a given fan or blower basic model is distributed in commerce.

Housed air circulating fan head means an air circulating fan with an axial or centrifugal impeller, and a housing.

Housed centrifugal air circulating fan means a housed air circulating fan head with a centrifugal or radial impeller in which airflow exits into a housing that is generally scroll shaped to direct the air through a single, narrow fan outlet.

Induced flow fan means a type of laboratory exhaust fan with a nozzle and windband; the fan's outlet airflow is greater than the inlet airflow due to induced airflow. All airflow entering the inlet exits through the nozzle. Airflow exiting the windband includes the nozzle airflow plus the induced airflow.

Jet fan means a fan designed and marketed specifically for producing a high velocity air jet in a space to increase its air momentum. Jet fans are rated using thrust. Inlets and outlets are not ducted but may include acoustic silencers.

Packaged air-cooled (dry) cooler means a device which rejects heat to the atmosphere from a fluid, either liquid, gas or a mixture thereof, flowing through an air-cooled internal coil.

Packaged evaporative closed-circuit cooling tower means a device which rejects heat to the atmosphere through the indirect cooling of a process fluid stream in an internal coil to a lower temperature by partial evaporation of an external recirculating water flow.

Packaged evaporative condenser means a device which rejects heat to the atmosphere through the indirect condensing of a refrigerant in an internal coil by partial evaporation of an external recirculating water flow.

Packaged evaporative open-circuit cooling tower means a device which rejects heat to the atmosphere through the direct cooling of a water stream to a lower temperature by partial evaporation.

Power roof ventilator means a fan with an internal driver and a housing to prevent precipitation from entering the building. It has a base designed to fit over a roof or wall opening, usually by means of a roof curb.

Radial-housed fan means a fan with a radial impeller in which airflow exits into a housing that is generally scroll-shaped to direct the air through a single fan outlet. Inlets and outlets can optionally be ducted.

Safety Fan means:

(1) A fan or blower that is designed and marketed to operate only at or above 482 degrees Fahrenheit (250 degrees Celsius);

(2) A reversible axial fan in cylindrical housing that is designed and marketed for use in ducted tunnel ventilation that will reverse operation under emergency ventilation conditions;

(3) A fan or blower bearing an Underwriter Laboratories or Electric Testing Laboratories listing for ‘‘Power Ventilators for Smoke Control Systems’’;

(4) An open discharge exhaust fan with integral discharge nozzles which develop or maintain a minimum discharge velocity of 3,000 FPM;

(5) A fan constructed in accordance with AMCA type A or B spark resistant construction as defined in ANSI/AMCA Standard 99–16 Standards Handbook, (incorporated by reference, see § 431.173);

(6) A fan or blower designed and marketed for use in explosive atmospheres and tested and marked according to ISO 80079–36:2016 Explosive atmospheres—Part 36: Non-electrical equipment for explosive atmospheres—Basic method and requirements, (incorporated by reference, see § 431.173); or

(7) An electric-motor-driven-Positive Pressure Ventilator as defined in ANSI/AMCA Standard 240–15, Laboratory Methods of Testing Positive Pressure Ventilators for Aerodynamic Performance Rating, (incorporated by reference, see § 431.173).

Unhoused Air circulating fan head means an air circulating fan without a housing, having an axial impeller with a ratio of fan-blade span (in inches) to maximum rate of rotation (in revolutions per minute) less than or equal to 0.06. The impeller may or may not be guarded.

■ 10. Section 431.173 is added to subpart J to read as follows:

§ 431.173 Materials incorporated by reference.

(a) Certain material is incorporated by reference into this subpart with the approval of the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. To enforce any edition other than that specified in this section, DOE must publish a document in the **Federal Register** and the material must be available to the public. All approved incorporation by reference (IBR) material is available for inspection at DOE, and at the National Archives and Records Administration (NARA). Contact DOE at: the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, Sixth Floor, 950 L'Enfant Plaza SW, Washington, DC 20024, (202) 586–9127, *Buildings@ee.doe.gov, https://www.energy.gov/eere/buildings/building-technologies-office*. For information on the availability of this material at NARA, email: *fr.inspection@nara.gov,* or go to: *www.archives.gov/federal-register/cfr/ibr-locations.html*. The material may be obtained from the sources in the following paragraphs:

(b) *AMCA.* Air Movement and Control Association International, Inc., 30 West University Drive, Arlington Heights, IL 60004–1893, (847) 394–0150, *www.amca.org*.

(1) ANSI/AMCA Standard 99–16 ‘‘Standards Handbook,’’ November 10, 2016, IBR approved for § 431.172.

(2) ANSI/AMCA Standard 210/ASHRAE 51–16, (‘‘AMCA 210–16’’), ‘‘Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating,’’ August 26, 2016, IBR approved for § 431.172 and appendix A to this subpart.

(3) ANSI/AMCA Standard 214–21, (‘‘AMCA 214–21’’), ‘‘Test Procedure for Calculating Fan Energy Index for Commercial and Industrial Fans and Blowers,’’ March 1, 2021; IBR approved for § 431.174, and appendices A and B to this subpart.

(4) ANSI/AMCA 230–15, (‘‘AMCA 230–15 (with errata)’’) ‘‘Laboratory Methods of Testing Air Circulating Fans for Rating and Certification,’’ October 16, 2015, with technical errata sheet for ANSI/AMCA standard 230–15 density corrections. IBR approved for appendix B to this subpart.

(5) ANSI/AMCA Standard 240–15, (‘‘AMCA 240–15’’) ‘‘Laboratory Methods of Testing Positive Pressure Ventilators for Aerodynamic Performance Rating,’’ September 5, 2015, IBR approved for § 431.172.

(c) *ISO.* International Organization for Standardization, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, *www.iso.org, email: customerservice@iso.org*.

(1) ISO 5801:2017, ‘‘Fans—Performance testing using standardized airways’’, approved 2017, IBR approved for appendix A to this subpart.

(2) ISO 80079–36 ‘‘Explosive atmospheres—Part 36: Non-electrical equipment for explosive atmospheres—Basic method and requirements’’, approved 2016, IBR approved for § 431.172.

■ 11. Section 431.174 is added to subpart J to read as follows:

§ 431.174 Test Procedure for fans or blowers.

(a) *Scope for fans and blowers other than air circulating fans.* A fan or blower, other than an air circulating fan is subject to the test procedure in this section if it meets the following criteria:

(1) Is a centrifugal housed fan; radial housed fan; centrifugal inline fan; centrifugal unhoused fan; centrifugal power roof ventilator exhaust fan; centrifugal power roof ventilator supply fan; axial inline fan; axial panel fan; or axial centrifugal power roof ventilator fan;

(2) Is not:

(i) A radial housed unshrouded fan with blade diameter at tip less than 30 inches or a blade width of less than 3 inches;

(ii) A safety fan;

(iii) An induced flow fan;

(iv) A jet fan;

(v) A cross-flow fan;

(vi) A fan manufactured exclusively to be powered by internal combustion engines; or

(viii) A fan and blower exclusively embedded in the equipment listed in paragraph (a)(3) of this section;

(3) Is not an exclusively embedded fan subject to the following exclusions:

(i) The test procedure in this section does not apply to fans or blowers that are exclusively embedded in:

(A) Single phase central air conditioners and heat pumps rated with a certified cooling capacity less than 65,000 British thermal units per hour (''Btu/h'') cooling capacity, that are subject to DOE's energy conservation standard at 10 CFR 430.32(c);

(B) Three phase, air-cooled, small commercial packaged air-conditioning and heating equipment rated with a certified cooling capacity less than 65,000 Btu/h cooling capacity, that are subject to DOE's energy conservation standard at § 431.97(b);

(C) Transport refrigeration (*i.e.,* Trailer refrigeration, Self-powered truck refrigeration, Vehicle-powered truck refrigeration, Marine/Rail container refrigerant);

(D) Vacuum cleaners;

(E) Heat Rejection Equipment: Packaged evaporative open-circuit cooling towers; Evaporative field-erected open-circuit cooling towers; Packaged evaporative closed-circuit cooling towers; Evaporative field-erected closed-circuit cooling towers; Packaged evaporative condensers; Field-erected evaporative condensers; Packaged air-cooled (dry) coolers; Field-erected air-cooled (dry) cooler; Air-cooled steam condensers; Hybrid (water saving) versions of all of the previously listed equipment that contain both evaporative and air-cooled heat exchange sections;

(F) Air curtains; and

(G) Direct expansion-dedicated outdoor air system that are subject to any DOE's test procedures in appendix B to subpart F of this part.

(ii) The test procedure in this section does not apply to supply or condenser fans or blowers that are exclusively embedded in:

(A) Air-cooled commercial package air conditioners and heat pumps (''CUAC'', ''CUHP'') with a certified cooling capacity between 5.5 ton (65,000 Btu/h) and 63.5 ton (760,000 Btu/h) that are subject to DOE's energy conservation standard at § 431.97(b);

(B) Water-cooled and evaporatively-cooled commercial air conditioners that are subject to DOE's energy conservation standard at § 431.97(b);

(C) Water-source heat pumps that are subject to DOE's energy conservation standard at § 431.97(b);

(D) Single package vertical air conditioners and heat pumps that are subject to DOE's energy conservation standard at § 431.97(d);

(E) Packaged terminal air conditioners (''PTAC'') and packaged terminal heat pumps (PTHP) that are subject to DOE's energy conservation standard at § 431.97(c);

(F) Computer room air conditioners that are subject to DOE's energy conservation standard at § 431.97(e); and

(G) Variable refrigerant flow multi-split air conditioners and heat pumps that are subject to DOE's energy conservation standard at § 431.97(f); and

(4) Is a fan or blower with duty points with the following characteristics, measured or calculated in accordance with the test procedure set forth in appendix A of this subpart:

(i)(A) fan shaft input power equal to or greater than 1 horsepower; or

(B) fan electrical input power equal to or greater than 0.89 kW; and

(ii)(A) fan static airpower equal to or less than 150 horsepower for fans using a static pressure basis fan energy index (''FEI'') in accordance with the required test configuration listed in Table 7.1 of AMCA 214–21; or

(B) fan total airpower equal to or less than 150 horsepower for fans using a total pressure basis FEI in accordance with the required test configuration listed in Table 7.1 of AMCA 214–21;

(b) *Scope for air circulating fans.* The test procedure in this section applies to all air circulating fans.

(c) *Testing and calculations for fans and blowers other than air-circulating fans.* Determine the FEI, the fan electrical input power (''FEP''), and fan shaft power (as applicable) at each duty point, as specified by the manufacturer, using the test procedure set forth in appendix A of this subpart.

(d) *Testing and calculations for air-circulating fan.* Determine the FEI and the fan electrical input power (''FEP'') or the weighted-average FEI and weighted-average FEP as applicable, using the test procedure set forth in appendix B of this subpart.

■ 12. Add appendix A to subpart J to part 431 to read as follows:

Appendix A to Subpart J of Part 431—Uniform Test Method for the Measurement of Energy Consumption of Fans and Blowers Other Than Air Circulating Fans

Note: After [date 180 days after date of publication of the final rule], any representations made with respect to energy use or efficiency of fans and blowers subject to testing pursuant to 10 CFR 431.174 must be made in accordance with this appendix.

0. Incorporation by reference.

In § 431.173, DOE incorporated by reference the entire standard for AMCA 214–21, AMCA 210–16, and ISO 5801:2017; however, only enumerated provisions of those documents are applicable as follows:

0.1. AMCA 214–21, ''Test Procedure for Calculating Fan Energy Index for Commercial and Industrial Fans and Blowers'':

0.1.1. Section 2 ''References,'' as referenced in section 2.2 of this appendix;

0.1.2. Section 3 ''Definitions'', as referenced in section 1 of this appendix;

0.1.3. Section 4 ''Calculation of the FEI for a single duty point'', as referenced in section 2.4 of this appendix;

0.1.4. Section 5 ''Reference Fan Electrical Power (FEP_{ref})'', as referenced in section 2.4 of this appendix;

0.1.5. Section 6.1 ''Wire-to-Air Testing at the Required Duty Point'', as referenced in section 2.2 of this appendix;

0.1.6. Section 6.2 ''Calculated Ratings Based on Wire-to-Air Testing'', as referenced in section 2.2 of this appendix;

0.1.7. Section 6.3 ''Bare Shaft Fans'', as referenced in section 2.2 of this appendix;

0.1.8. Section 6.4.1.1 ''Requirements for the fan'', as referenced in section 2.2 of this appendix;

0.1.9. Section 6.4.1.2 ''Requirements for the transmission'', as referenced in section 2.2 of this appendix;

0.1.10. Section 6.4.1.3 ''Requirements for the motor, as referenced in section 2.2 of this appendix;

0.1.11. Section 6.4.2 Calculation of FEP_{act}'', as referenced in section 2.2 of this appendix;

0.1.12. Section 6.4.2.1 ''Calculation of transmission efficiency ''$_{trans,act}$)'', as referenced in section 2.2 of this appendix;

0.1.13. Section 6.4.2.2 ''Calculation of actual motor output power'', as referenced in section 2.2 of this appendix;

0.1.14. Section 6.4.2.3 ''Motor efficiency if no VFD is included'', as referenced in section 2.2 of this appendix;

0.1.15. Section 7 ''Testing'', as referenced in section 2.2 of this appendix;

0.1.16. Section 8.1 ''Laboratory Measurement Only'', as referenced in section 2.2 of this appendix;

0.1.17. Section 8.2.1 ''Fan laws and other calculation methods for shaft-to-air testing'', as referenced in section 2.2 of this appendix;

0.1.18. Section 8.2.3 '' Calculation to other speeds and densities for wire-to-air testing'', as referenced in section 2.2 of this appendix;

0.1.19. Annex D ''Motor Performance Constants (Normative)'', as referenced in section 2.2 of this appendix;

0.1.20. Annex E ''Calculation Methods for Fans Tested Shaft-to-Air'', as referenced in section 2.2 of this appendix;

0.1.21. Annex G ''Wire-to-Air Measurement—Calculation to Other Speeds and Densities (Normative)'', as referenced in section 2.2 of this appendix;

0.1.22. Annex J ''Other data and calculations to be retained'' as referenced in section 2.2 of this appendix; and

0.1.23. Annex K ''Proportionality and Dimensional Requirements (Normative)'' as referenced in section 2.2 of this appendix.

0.2. AMCA 210–16, ''Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating'':

0.2.1. Section 3 ''Definitions/Units of Measure/Symbols'' as referenced in section 2.2 of this appendix;

0.2.2. Section 4 ''Instruments and Methods of Measurement'' as referenced in section 2.2 of this appendix;

0.2.3. Section 5 ''Test Setups and Equipment'' as referenced in section 2.2 of this appendix;

0.2.4. Section 6 ''Observation and Conduct of Test'' as referenced in section 2.2 of this appendix;

0.2.5. Section 7.1 ''Calibration Correction'' as referenced in section 2.2 of this appendix;

0.2.6. Section 7.2 ''Density and Viscosity of air'' as referenced in section 2.2 of this appendix;

0.2.7. Section 7.3 ''Fan Airflow Rate at Test Conditions'' as referenced in section 2.2 of this appendix

0.2.8. Section 7.4 ''Fan Velocity Pressure at Test Conditions'' as referenced in section 2.2 of this appendix

0.2.9. Section 7.5 ''Fan Total Pressure at Test Conditions'' as referenced in section 2.2 of this appendix;

0.2.10. Section 7.6 ''Fan Total Static Pressure at Test Conditions'' as referenced in section 2.2 of this appendix;

0.2.11. Section 7.7 ''Fan Input Power at Test Conditions'' as referenced in section 2.2 of this appendix; and

0.2.1.12. Section 7.8 ''Fan Efficiency'' as referenced in section 2.2 of this appendix.

0.3. ISO 5801:2017, ''Fans—Performance testing using standardized airways'':

0.3.1. Section 3 ''Terms and Definitions'' as referenced in section 2.2 of this appendix;

0.3.2. Section 4 ''Symbols, Abbreviated Terms and Subscripts'' as referenced in section 2.2 of this appendix;

0.3.3. Section 5 ''General'' as referenced in section 2.2 of this appendix;

0.3.4. Section 6 ''Teat Configurations'' as referenced in section 2.2 of this appendix;

0.3.5. Section 7 ''Test Configurations'' as referenced in section 2.2 of this appendix;

0.3.6. Section 8 '' Airways for Duct Configuration'' as referenced in section 2.2 of this appendix;

0.3.7. Section 9 ''Standardized Test Chambers'' as referenced in section 2.2 of this appendix;

0.3.8. Section 10 ''Various Components parts for a Laboratory Setup'' as referenced in section 2.2 of this appendix;

0.3.9. Section 11 ''Standard Test Configurations'' as referenced in section 2.2 of this appendix;

0.3.10. Section 12 ''Measurements'' as referenced in section 2.2 of this appendix;

0.3.11. Section 13 ''Reference Conditions'' as referenced in section 2.2 of this appendix;

0.3.12. Section 15 ''Calculations'' as referenced in section 2.2 of this appendix;

0.3.13. Section 16 ''fan Characteristic Curves'' as referenced in section 2.2 of this appendix; and

0.3.14. Section 17 ''Uncertainty Analysis'' as referenced in section 2.2 of this appendix.

In cases where there is a conflict, the language of this appendix takes precedence over those documents. Any subsequent amendment to a referenced document by the standard-setting organization will not affect the test procedure in this appendix, unless and until 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 material will be published in the **Federal Register**.

1. Definitions.

The definitions applicable to this appendix are defined in § 431.172 and in Section 3 ''Definitions'' of AMCA 214–21. In cases where there is a conflict, the definitions in § 431.172 take precedence over AMCA 214–21.

2. Test procedure for fans and blowers other than air circulating fans.

2.1. General.

This section describes the test procedure for fans and blowers other than air circulating fans. In cases where there is a conflict, the provisions in this appendix take precedence over AMCA 214–21. Where AMCA 214–21 refers to Annex A ''Polyphase Regulated Motor Efficiencies (Normative)''of AMCA 214–21, Table 5 of § 431.25 must be used instead. Centrifugal Power Roof Ventilators that are both supply and exhaust must be tested in both supply and exhaust configurations.

2.2. Testing.

2.2.1. General.

The fan electrical input power (FEP_{act}) in kilowatts must be determined at every duty point specified by the manufacturer in accordance with one of the test methods listed in Table 1, and the following sections of AMCA 214–21: Section 2 ''References'', Section 7 ''Testing'', included the referenced provisions to AMCA 210–16 and ISO 5801:2017 as listed in sections 2.2.2 and 2.2.3 of this appendix, Section 8.1 ''Laboratory Measurement Only'' (as applicable), and Annex J ''Other data and calculations to be retained''. Section 7 of AMCA 214–21 references AMCA 210–16 and ISO 5801:2017.

TABLE 1 TO APPENDIX A TO SUBPART J OF PART 431

Driver	Motor controller present?	Transmission configuration?	Test method	Applicable section(s) of AMCA 214–21
Electric motor	Yes or No	Any	Wire-to-air	6.1 ''Wire-to-Air Testing at the Required Duty Point''.
Electric motor	Yes or No	Any	Calculation based on Wire-to-air testing.	6.2 ''Calculated Ratings Based on Wire-to-Air Testing'' (references Section 8.2.3 ''Calculation to other speeds and densities for wire-to-air testing'' and Annex G ''Wire-to-Air Measurement—Calculation to Other Speeds and Densities (Normative)'').
Regulated polyphase motor	No	Direct drive, V-belt drive, flexible coupling or synchronous belt drive.	Shaft-to-air	6.4 ''Fans with Polyphase Regulated Motors ''(references Annex D ''Motor Performance Constants (Normative)'').*
None or non-electric	No	None	Shaft-to-air	Section 6.3 ''Bare Shaft Fans''.
Regulated polyphase motor	No	Direct drive, V-belt drive, flexible coupling or synchronous belt drive.	Calculation based on Shaft-to-air testing.	Section 8.2.1 ''Fan laws and other calculation methods for shaft-to-air testing''(references Annex D ''Motor Performance Constants (Normative)'', Annex E ''Calculation Methods for Fans Tested Shaft-to-Air'' and Annex K ''Proportionality and Dimensional Requirements (Normative)'').
None or non-electric	No	None	Calculation based on Shaft-to-air testing.	Section 8.2.1 ''Fan laws and other calculation methods for shaft-to-air testing'' (references Annex E ''Calculation Methods for Fans Tested Shaft-to-Air'' and Annex K ''Proportionality and Dimensional Requirements (Normative)'').

* Only the following section of 6.4 apply: Section 6.4.1.1 ''Requirements for the fan'', Section 6.4.1.2 ''Requirements for the transmission'', Section 6.4.1.3 ''Requirements for the motor, Section 6.4.2 Calculation of FEPact'', Section 6.4.2.1 ''Calculation of transmission efficiency (–trans,act)'', Section 6.4.2.2 ''Calculation of actual motor output power'', Section 6.4.2.3 ''Motor efficiency if no VFD is included''.

In addition, the following values must be determined in accordance with this appendix at each duty point specified by the manufacturer: fan airflow in cubic feet per minute; fan air density; fan total pressure in inches of water gauge for fans using a total pressure basis FEI in accordance with the required test configuration listed in Table 7.1 of AMCA 214–21; fan static pressure in inches of water gauge for fans using a static pressure basis FEI in accordance with the required test configuration listed in Table 7.1 of AMCA 214–21; fan speed in revolutions per minute; and fan shaft input power in horsepower for fans tested in accordance with Section 6.3, 6.4 or 6.5 of AMCA 214–21. All measurements must be recorded at the resolution of the test instrumentation and calculations must be rounded to the number of significant digits present at the resolution of the test instrumentation.

In cases where there is a conflict, the provisions in AMCA 214–21 take precedence over AMCA 210–16 and ISO 5801:2017. In addition, the provisions in this appendix apply.

2.2.2. AMCA 210–16, Applicable Sections.

The following sections of AMCA 210–16 are applicable: Section 3 ''Definitions/Units of Measure/Symbols'', Section 4 ''Instruments and Methods of Measurement''; Section 5 ''Test Setups and Equipment''; Section 6 ''Observation and Conduct of Test''; Section 7.1 ''Calibration Correction''; Section 7.2 ''Density and Viscosity of air''; Section 7.3 ''Fan Airflow Rate at Test Conditions; Section 7.4 ''Fan Velocity Pressure at Test Conditions''; Section 7.5 ''Fan Total Pressure at Test Conditions''; Section 7.6 ''Fan Total Static Pressure at Test Conditions''; Section 7.7 ''Fan Input Power at Test Conditions''; and Section 7.8 ''Fan Efficiency''.

2.2.3. ISO 5801:2017, Applicable Sections.

The following sections of ISO 5801:2017 are applicable: Section 3 ''Terms and Definitions''; Section 4 ''Symbols, Abbreviated Terms and Subscripts''; ''General''; Section 6 ''Teat Configurations''; Section 7 ''Test Configurations''; Section 8 '' Airways for Duct Configuration''; Section 9 ''Standardized Test Chambers''; Section 10 ''Various Components parts for a Laboratory Setup''; Section 11 ''Standard Test Configurations''; Section 12 ''Measurements''; Section 13 ''Reference Conditions''; Section 15 ''Calculations''; Section 16 ''fan Characteristic Curves''; and Section 17 ''Uncertainty Analysis''.

2.2.4. Appurtenances.

This section replaces the provisions in section 7.3 of AMCA 214–21 ''Appurtenances''. If present, any additional appurtenances sold with the fan must be included during the test.

2.2.5. Single-Phase and Multi-Phase.

Fans and blowers rated for operation for single- or multi-phase power supply must be tested with single- or multi-phase power electricity, respectively.

Fans and blowers, capable of operating with single- and multi-phase power supply, must be tested using multi-phase electricity.

2.3. Equilibrium Conditions.

The following provisions must be used to characterize steady operation (equilibrium) as required in section 6 of AMCA 210–16. Equilibrium is achieved if measurements are within the tolerances specified in the Table 2. Measurements need to be determined over at least 5 minutes, with measurements recorded on each variable at a maximum of 5-second intervals.

TABLE 2 TO APPENDIX A TO SUBPART J OF PART 431

Variable	Equilibrium tolerance
Ambient air density ...	± 1 percent of mean.
Input power by reaction dynamometer.	± 4 percent of mean.
Input power by torque meter.	± 4 percent of mean.
Input power by calibrated motor.	± 4 percent of mean.
Input power by electrical meter.	± 2 percent of mean or 1 W, whichever is greater.
Fan speed	± 1 percent of mean or 1 rpm, whichever is greater.

2.4. FEI Calculation.

The FEI must be determined at every duty point in accordance with Section 4 ''Calculation of the FEI for a single duty point'' and Section 5 ''Reference Fan Electrical Power (FEPref) of AMCA 214–21. In addition the FEI must be rounded to the nearest hundredths place.

■ 13. Add appendix B to subpart J to part 431 to read as follows:

Appendix B to Subpart J of Part 431—Uniform Test Method for the Measurement of Energy Consumption of Air Circulating Fans

Note: After [date 180 days after date of publication of the final rule], any representations made with respect to energy use or efficiency of fans and blowers subject to testing pursuant to § 431.174 must be made in accordance with this appendix.

0. Incorporation by reference.

In § 431.173, DOE incorporated by reference the entire standard for ANSI/AMCA Standard 214–21, and ANSI/AMCA 230–15 with errata; however, only enumerated provisions of those documents are applicable as follows:

0.1. AMCA 214–21, ''Test Procedure for Calculating Fan Energy Index for Commercial and Industrial Fans and Blowers'':

0.1.1. Section 2 ''References,'' as referenced in section 2.2 of this appendix;

0.1.2. Section 3 ''Definitions'', as referenced in section 1 of this appendix;

0.1.3. Section 4 ''Calculation of the FEI for a single duty point'', as referenced in section 2.10 of this appendix;

0.1.4. Section 5 ''Reference Fan Electrical Power (FEP_{ref})'', as referenced in section 2.10 of this appendix;

0.1.5. Section 6.1 ''Wire-to-Air Testing at the Required Duty Point'', as referenced in section 2.2 of this appendix;

0.1.6. Table 7.1 in Section 7. ''Testing'', as referenced in section 2.2 of this appendix;

0.1.7. Section 7.1 ''Test Configuration'', as referenced in section 2.2 of this appendix;

0.1.8. Section 7.2 ''Setup Selection'', as referenced in section 2.2 of this appendix;

0.1.9. Section 7.4 ''Run-in Requirements'' as referenced in section 2.2 of this appendix; and

0.1.10. Annex J ''Other data and calculations to be retained'' as referenced in section 2.2 of this appendix.

0.2. AMCA 230–15 (with errata), ''Laboratory Methods of Testing Air Circulating Fans for Rating and Certification'' (with errata)'':

0.2.1. Section 3 ''Units of Measurement'' as referenced in section 2.2 of this appendix;

0.2.2. Section 4 ''Symbols and Subscripts'' as referenced in section 2.2 of this appendix;

0.2.3. Section 5 ''Definitions'' as referenced in section 2.2 of this appendix;

0.2.4. Section 6 ''Instruments and Methods of Measurement'' as referenced in section 2.2 of this appendix;

0.2.5. Section 7 ''Instruments and Methods of Measurement'' as referenced in section 2.2 of this appendix;

0.2.6. Section 8 ''Observations and Conduct of Test'' as referenced in section 2.2 of this appendix;

0.2.7. Section 9 ''Calculations'' as referenced in section 2.2 of this appendix; and

0.2.8. Section 10 ''Report and Results of Test'' as referenced in section 2.2 of this appendix.

In cases where there is a conflict, the language of this appendix takes precedence over those documents. Any subsequent amendment to a referenced document by the standard-setting organization will not affect the test procedure in this appendix, unless and until 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 material will be published in the **Federal Register**.

1. Definitions.

The definitions applicable to this appendix are defined in § 431.172 and in Section 3 ''Definitions'' of AMCA 214–21. In cases where there is a conflict, the definitions in § 431.172 take precedence over AMCA 214–21.

2. Test procedure for air circulating fans.

2.1. General.

This section describes the test procedure for air circulating fans. In cases where there is a conflict, the provisions in this appendix take precedence over AMCA 214–21.

2.2. Testing.

2.2.1. General.

The fan electrical input power (FEPact) in kilowatts at each tested speed specified in section 2.6 of this appendix must be determined in accordance with the following sections of AMCA 214–21: Section 2 ''References'', Section 6.1 ''Wire-to-Air Testing at the Required Duty Point'', Table 7.1 in Section 7 ''Testing'', included the referenced provisions to AMCA 230–15 as listed in section 2.2.2 of this appendix (with errata), Section 7.1 ''Test Configuration'', Section 7.2 ''Setup Selection'', Section 7.4 ''Run-in Requirements'', and Annex J ''Other data and calculations to be retained''. Section 7 of AMCA 214–21 references AMCA 230–15 (with errata). In cases where there is a conflict, the provisions in AMCA 214–21 take precedence over AMCA 230–15 (with errata).

In addition, the following values must be determined in accordance with this appendix, at each tested speed as specified in section 2.6 of this appendix: fan energy index (''FEI'') in accordance with section 2.11 of this appendix, fan electrical input power (''FEP_{act}'') in kilowatts; fan airflow in cubic feet per minute; fan air density; fan total pressure in inches of water gauge; and fan speed in revolutions per minute. In addition, for multi- and variable-speed fans, the weighted-average FEI and FEP in accordance with sections 2.11 and 2.12 of this appendix must also be determined. All measurements must be recorded at the resolution of the test instrumentation and calculations must be rounded to the number of significant digits present at the resolution of the test instrumentation.

2.2.2. AMCA 230–15, Applicable Sections.

The following section of AMCA 230–15 are applicable: Section 3 ''Units of Measurement''; Section 4 ''Symbols and Subscripts''; Section 5 ''Definitions''; Section ''Instruments and Methods of Measurement''; Section 7 ''Instruments and Methods of Measurement''; Section 8 ''Observations and Conduct of Test''; Section 9 ''Calculations''; and Section 10 ''Report and Results of Test''. In addition, testing must be conducted in accordance with the provisions in section 2.3 through 2.12 of this appendix. Further, the terms ''electrical input power'' ''system input power'' and ''power'' shall be considered equivalent. The terms ''electrical input voltage'', ''system input voltage '', and ''voltage'' shall be considered equivalent.

2.3. Test Figures and Location of Extraneous airflow measurement.

The following test figures, described in AMCA 230–15 (with errata) must be used to test air circulating fans: 2A, 2B1, 2B2, 3A or 3B.

The location of extraneous airflow measurement shall be at the center of the fan at a distance of 1.5m (5 ft) downstream of the fan impeller.

2.4. Air circulating fans without motors.

Air circulating fans distributed in commerce without an electric motor must be tested using an electric motor as recommended in the manufacturer's catalogs or distributed in commerce with the air circulating fan. If more than one motor is available in manufacturer's catalogs or distributed in commerce with the air circulating fan, DOE proposes requiring testing using the least efficient motor capable of running the fan at the fan's maximum allowable speed.

2.5. Power Supply.

2.5.1. Frequency.

Air circulating fans rated for operation with only 60Hz power supply must be tested with 60 Hz electricity. Air circulating fans capable of operating with 50Hz and 60Hz electricity must be tested with 60Hz electricity.

2.5.2. Phase.

Air circulating fans rated for operation for single- or multi-phase power supply must be tested with single- or multi-phase power electricity, respectively.

Air circulating fans, capable of operating with single- and multi-phase power supply, must be tested using multi-phase electricity.

2.5.3. Voltage.

Select the supply voltage as follows:

(1) For air circulating fans tested with single-phase electricity, the supply voltage must be (a) 120 V if the air circulating fan's minimum rated voltage is 120 V or the lowest rated voltage range contains 120 V, (b) 240 V if the air circulating fan's minimum rated voltage is 240 V or the lowest rated voltage range contains 240 V, or (c) the air circulating fan's minimum rated voltage (if a voltage range is not given) or the mean of the lowest rated voltage range, in all other cases.

(2) For air circulating fans tested with multi-phase electricity, the supply voltage must be (a) 240 V if the air circulating fan's minimum rated voltage is 240 V or the lowest rated voltage range contains 240 V, or (b) the air circulating fan's minimum rated voltage (if a voltage range is not given) or the mean of the lowest rated voltage range, in all other cases.

2.6. Appurtenances.

If present, any additional appurtenances sold with the air circulating fan must be included during the test.

If present, any additional accessories or features sold with the air circulating fan that do not relate to the air circulating fan's ability to create airflow (for example, misting kits) is to be installed, but turned off during testing. If such an accessory or feature cannot be turned off, it shall be set to the lowest energy-consuming mode during testing. If the air circulating fan is offered with a default controller, test using the default controller. If multiple controllers are offered, test using the minimally functional controller.

2.7. Equilibrium Conditions.

The following provisions must be used to characterize equilibrium as required in Section 8 of AMCA 230–15 (with errata). Equilibrium is achieved if measurements are within the tolerances specified in the Table 1. Measurements need to be determined over at least 5 minutes, with measurements recorded on each variable at a maximum of 5 second intervals.

TABLE 1 TO APPENDIX B TO SUBPART J OF PART 431

Variable	Equilibrium tolerance
Calculated air density	±1 percent of mean.
System input voltage	±2 percent of mean.
System input current	±2 percent of mean.
System input power	±2 percent of mean or 1 W, whichever is greater.
Fan speed	±1 percent of mean or 1 rpm, whichever is greater.
Load	±1 percent of mean.
Load differential	±1 percent of mean.

2.8. Extraneous Airflow.

This section replaces Section 8.1.2 of AMCA 230–15 (with errata) ''Extraneous airflow.''

Air velocity in the test room not generated by the air circulating fan must not exceed 0.25 m/s (50 fpm) prior to, before and after the test. Velocity measurements must be taken to ensure that this condition is met as follows:

(1) At least one minute prior to establishing equilibrium; and

(2) For at least one minute at the conclusion of the test, with measurements recorded at a maximum of 5 second intervals. A test is considered to be concluded at the instant the blades are no longer spinning.

2.9. Test speed.

Select the test speed(s) as follows:

(1) For single speed fans, performance data shall be captured and reported for the single available speed;

(2) For multi-speed fans with discrete speeds, performance data shall be captured and reported at each available speeds;

(3) For variable-speed fans with continuously adjustable speeds, performance data shall be captured and reported at 20, 40, 60, 80 and 100 percent of the fan's maximum speed. If the fan's minimum speed is greater 20 percent of the maximum speed the performance data must be captured and reported at five speeds evenly spaced within the available speed range, including at the fan's minimum and maximum speed.

2.10. Total Pressure Calculations.

The fan total pressure at a given airflow must be calculated according to the following equation:

$$P_{t,i} = \rho \left(\frac{Q_i}{1097.8 \times A} \right)^2$$

Where:

A = air circulating fan outlet area (square feet),

$P_{t,i}$ = Fan total pressure at duty point i (inches of water gauge),

Q_i = Airflow at duty point i (cubic feet per minute),

ρ = Fan air density (Pound Mass Per Cubic Foot).

2.11. FEI and Weighted-average FEI Calculation.

The FEI must be determined at every test specified in section 2.6 of this appendix, in accordance with Section 4 ''Calculation of the FEI for a single duty point'' and Section 5 ''Reference Fan Electrical Power (FEPref)'' of AMCA 214–21. In addition, the values of Q_0, P_0, and η_0 in Section 5.1.1. of AMCA 214–21 must be replaced by the following values: Q_0 = 3,210, P_0 = 0, and η_0=0.38.

FEI values must be rounded to the nearest hundredths place.

For single speed fans, determine the FEI at the single available speed. For multi-speed and variable speed fans, calculate the weighted-average FEI as follows:

$$Weighted\ Average\ FEI = \frac{1}{n}\sum_{i=1}^{n} FEI_i$$

Where: *n* is the number of speeds as specified in section 2.6 of this appendix and FEI_i is the FEI at the i^th tested speed.

2.12. FEPact and Weighted-Average FEPact Calculation.

For single speed fans, determine the FEP_{act} at the single available speed.

For multi-speed and variable speed fans, calculate the weighted-average FEP_{act} (in kW) as follows:

$$Weighted\ Average\ FEPact = \frac{1}{n}\sum_{i=1}^{n} FEP_{act,i}$$

Where: *n* is the number of speeds as specified in section 2.6 of this appendix and is the $FEP_{act,i}$ is the FEP_{act} at the i^th tested speed.

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