DEPARTMENT OF ENERGY

10 CFR Part 430

[EERE–2020–BT–TP–0041]

RIN 1904–AE15

Energy Conservation Program: Test Procedure for Consumer Furnace Fans

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

ACTION: Notice of proposed rulemaking and request for comment.

SUMMARY: The U.S. Department of Energy (''DOE'') proposes to amend the test procedure for consumer furnace fans to: Clarify the scope of applicability; incorporate by reference the most recent version of industry test methods; establish a test method for furnace fans incapable of operating at the required external static pressure; clarify testing of certain products, including furnace fans with modulating controls, furnace fans and modular blowers tested with electric heat kits, certain two-stage furnaces that operate at reduced input only for a preset period of time, dual-fuel furnaces, and certain oil-fired furnaces; and make updates to improve test procedure repeatability and reproducibility. DOE is seeking comment from interested parties on the proposals.

DATES: DOE will accept comments, data, and information regarding this proposal no later than July 12, 2022. See section V, ''Public Participation,'' for details. DOE will hold a webinar on Thursday, May 19, 2022, from 1:00 p.m. to 3:00 p.m. See section V, ''Public Participation,'' for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

ADDRESSES: Interested persons are encouraged to submit comments using the Federal eRulemaking Portal at *www.regulations.gov.* Follow the instructions for submitting comments. Alternatively, interested persons may submit comments, identified by docket number EERE–2020–BT–TP–0041, by any of the following methods:

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

2. *Email:* to *FurnFans2020TP0041@ee.doe.gov.* Include docket number EERE–2020–BT–TP–0041 in the subject line of the message.

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

Although DOE has routinely accepted public comment submissions through a variety of mechanisms, including postal mail and hand delivery/courier, the Department has found it necessary to make temporary modifications to the comment submission process in light of the ongoing coronavirus 2019 (''COVID–19'') pandemic. DOE is currently suspending receipt of public comments via postal mail and hand delivery/courier. If a commenter finds that this change poses an undue hardship, please contact Appliance Standards Program staff at (202) 586–1445 to discuss the need for alternative arrangements. Once the COVID–19 pandemic health emergency is resolved, DOE anticipates resuming all of its regular options for public comment submission, including postal mail and hand delivery/courier.

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

The docket web page can be found at *www.regulations.gov/docket/EERE-2020-BT-TP-0041.* 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:

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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 maintains a previously approved incorporation by reference (ASHRAE 41.1–1986 (Reapproved (''RA'') 2006)), and proposes to incorporate by reference the following industry standards into 10 CFR part 430:

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

ANSI/ASHRAE Standard 37–2009 (RA 2019) (including Errata Sheets issued October 3, 2016 and April 25, 2019) (''ASHRAE 37–2009 (RA 2019)''), *Methods of Testing for Rating Electrically Driven Unitary Air-Conditioning and Heat Pump Equipment,* approved 2019.

ANSI/ASHRAE Standard 41.2–1987 (RA 92), (''ASHRAE 41.2–1987 (RA 1992)''), *Standard Methods for Laboratory Airflow Measurement,* approved 1992.

ANSI/ASHRAE 103–2017 (''ASHRAE 103–2017''), *Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers,* approved 2017.

Copies of AMCA 210–2007 can be obtained from Air Movement and Control Association International, Inc. (AMCA), 30 West University Drive, Arlington Heights, IL 60004, (847) 394–0150, or by going to *http://www.amca.org/store/item.aspx?ItemId=81.*

Copies of ANSI/ASHRAE 37–2009 (RA 2019), ASHRAE 41.2–1987 (RA 1992), and ASHRAE 103–2017, can be obtained from the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Publication Sales, 1791 Tullie Circle NE, Atlanta, GA 30329, 800–527–4723 or (404) 636–8400, or go to *www.ashrae.org.*

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

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I. Authority and Background

The Energy Policy and Conservation Act, as amended (''EPCA''),[1] authorizes DOE to establish and amend energy conservation standards and test procedures for consumer furnace fans. (42 U.S.C. 6295(f)(4)(D)) DOE's energy conservation standards and test procedures for consumer furnace fans are currently prescribed at title 10 of the Code of Federal Regulations (''CFR''), part 430 section 32(y); and 10 CFR part 430 subpart B appendix AA, *Uniform Test Method for Measuring the Energy Consumption of Furnace Fans* (''appendix AA''), respectively. The following sections discuss DOE's authority to establish test procedures for consumer furnace fans and relevant background information regarding DOE's consideration of test procedures for this product.

A. Authority

EPCA authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. (42 U.S.C. 6291–6317) Title III, Part B[2] of EPCA established the Energy Conservation Program for Consumer Products Other Than Automobiles, which sets forth a variety of provisions designed to improve energy efficiency. These products include consumer furnace fans, the subject of this document. (42 U.S.C. 6295(f)(4)(D))

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

The Federal testing requirements consist of test procedures that manufacturers of covered products must use as the basis for: (1) Certifying to DOE that their products comply with the applicable energy conservation standards adopted pursuant to EPCA (42 U.S.C. 6295(s)), and (2) making other representations about the efficiency of those consumer products (42 U.S.C. 6293(c)). Similarly, DOE must use these test procedures to determine whether the products comply with relevant standards promulgated under EPCA. (42 U.S.C. 6295(s))

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

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

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

If the Secretary determines, on her own behalf or in response to a petition by any interested person, that a test procedure should be prescribed or amended, the Secretary shall promptly publish in the **Federal Register** proposed test procedures and afford interested persons an opportunity to present oral and written data, views, and arguments with respect to such procedures. The comment period on a proposed rule to amend a test procedure shall be at least 60 days and may not exceed 270 days. In prescribing or amending a test procedure, the Secretary shall take into account such information as the Secretary determines relevant to such procedure, including technological developments relating to energy use or energy efficiency of the type (or class) of covered products involved. (42 U.S.C. 6293(b)(2)) If DOE determines that test procedure revisions are not appropriate, DOE must publish its determination not to amend the test procedures.

In addition, EPCA requires that DOE amend its test procedures for all covered products to integrate measures of standby mode and off mode energy consumption. (42 U.S.C. 6295(gg)(2)(A)) Standby mode and off mode energy consumption must be incorporated into the overall energy efficiency, energy consumption, or other energy descriptor for each covered product unless the

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

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

current test procedures already account for and incorporate standby and off mode energy consumption or such integration is technically infeasible. If an integrated test procedure is technically infeasible, DOE must prescribe a separate standby mode and off mode energy use test procedure for the covered product, if technically feasible. (42 U.S.C. 6295(gg)(2)(A)(ii)) Any such amendment must consider the most current versions of the International Electrotechnical Commission (IEC) Standard 62301 [3] and IEC Standard 62087 [4] as applicable. (42 U.S.C. 6295(gg)(2)(A))

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

B. Background

As discussed, DOE's existing test procedures for consumer furnace fans appear at appendix AA. Appendix AA provides procedures and calculations to determine the fan energy rating (''FER''), expressed as watts per 1,000 cubic feet per minute of airflow (''W/1000 cfm'').

DOE established the test procedure for consumer furnace fans at appendix AA in a final rule published on January 3, 2014 (''January 2014 Final Rule''). 79 FR 499. The test procedure is applicable to furnace fans used by weatherized and non-weatherized gas furnaces, oil furnaces, electric furnaces, and modular blowers.[5] Section 1, appendix AA. For each of these categories, the test procedure covers both mobile home and non-mobile home models. The test procedure is not applicable to non-ducted products, such as whole-house ventilation systems without ductwork, central air-conditioning (''CAC'') condensing unit fans, room fans, and furnace draft inducer fans, since a ''furnace fan'' is defined as ''an electrically-powered device used in a consumer product for the purpose of circulating air through ductwork.'' 10 CFR 430.2.

As established in the January 2014 Final Rule, appendix AA incorporates by reference the definitions, test setup and equipment, and procedures for measuring steady-state combustion efficiency from the 2007 version of American National Standards Institute (''ANSI'')/American Society of Heating, Refrigerating and Air Conditioning Engineers (''ASHRAE'') Standard 103, *Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers* (''ASHRAE 103–2007''). In addition to these provisions, appendix AA includes provisions for apparatuses and procedures for measuring temperature rise, external static pressure (''ESP''), and furnace fan electrical input power. Appendix AA also incorporates by reference provisions for measuring temperature and ESP from ANSI/ASHRAE 37–2009, *Methods of Testing for Rating Electrically Driven Unitary Air-Conditioning and Heat Pump Equipment* (''ASHRAE 37–2009'') including its reference in Section 5.1 to ASHRAE 41.1–1986 (RA 2006), *Standard Method for Temperature Measurement.*

In the January 2014 Final Rule, DOE determined that there is no need to address standby and off mode energy use in the test procedure for consumer furnace fans, as the standby mode and off mode energy use associated with furnace fans is measured by test procedures for the products in which furnace fans are used (*i.e.,* consumer furnaces and consumer central air conditioners and heat pumps). 79 FR 499, 504.

On July 7, 2021, DOE published in the **Federal Register** a request for information (''July 2021 RFI'') seeking comments on the existing DOE test procedure for consumer furnace fans to determine whether amendments are warranted for the test procedure for consumer furnace fans. 86 FR 35660. More specifically, DOE requested comments, information, and data about a number of issues, mainly concerning: Test settings (including selection of airflow control settings and ESP requirement for airflow settings other than the maximum setting); incorporation by reference of the most recent industry test method; clarifications for testing of certain products, including furnace fans with modulating controls, furnace fans and modular blowers tested with electric heat kits, certain two-stage furnaces that operate at reduced input only for a preset period of time, dual-fuel furnaces, and certain oil-fired furnaces; and issues related to test procedure repeatability and reproducibility. *Id.*

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

TABLE I.1—LIST OF COMMENTERS WITH WRITTEN SUBMISSIONS IN RESPONSE TO THE JULY 2021 RFI

Commenter(s)	Reference in this NOPR	Commenter type
Carrier Corporation	Carrier	Manufacturer.
Air Conditioning, Heating & Refrigeration Institute	AHRI	Trade Association.
Pacific Gas and Electric Company, Southern California Edison, San Diego Gas & Electric Company; collectively, the California Investor-Owned Utilities.	CA IOUs	Utilities.
Northwest Energy Efficiency Alliance	NEEA	Efficiency Organization.

A parenthetical reference at the end of a comment quotation or paraphrase provides the location of the item in the public record.[6]

C. Deviation From Appendix A

In accordance with section 3(a) of 10 CFR part 430, subpart C, appendix A (''appendix A''), DOE notes that it is deviating from the provision in appendix A regarding the pre-NOPR process for test procedure rulemakings. Section 8(b) of appendix A states if DOE determines that it is appropriate to continue the test procedure rulemaking after the early assessment process, it

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

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

[5] DOE defines the term ''modular blower'' in section 2.9 of appendix AA as a product which only uses single-phase electric current, and which: (a) Is designed to be the principal air circulation source for the living space of a residence; (b) Is not contained within the same cabinet as a furnace or central air conditioner; and (c) Is designed to be paired with HVAC products that have a heat input rate of less than 225,000 Btu per hour and cooling capacity less than 65,000 Btu per hour.

[6] The parenthetical reference provides a reference for information located in the docket of DOE's rulemaking to develop test procedures for consumer furnace fans. (Docket No. EERE–2020–BT–STD–0041, which is maintained at *www.regulations.gov*). The references are arranged as follows: (commenter name, comment docket ID number, page of that document).

will provide further opportunities for early public input through **Federal Register** documents, including notices of data availability and/or requests for information. DOE is opting to deviate from this provision due to the substantial feedback and information supplied by commenters in response to the July 2021 RFI. As discussed previously, DOE requested comment on a number of specific topics in the July 2021 RFI, and comments received in response to the July 2021 RFI informed the proposals included in this NOPR, as addressed in the following sections.

II. Synopsis of the Notice of Proposed Rulemaking

In this NOPR, DOE proposes to update appendix AA of 10 CFR part 430, *Uniform Test Method for Measuring the Energy Consumption of Furnace Fans* as follows:

(1) Specify testing instructions for furnace fans incapable of operating at the required ESP.

(2) Incorporate by reference the most recent versions of industry standards, ASHRAE 103–2017 and ASHRAE 37–2009 (RA 2019), in 10 CFR 430.3.

(3) Define dual-fuel furnace fans and exclude them from the scope of appendix AA.

(4) Change the term ''default airflow-control settings'' to ''specified airflow-control settings''.

(5) Add provisions to directly measure airflow.

(6) Revise the ambient temperature conditions allowed during testing to between 65 degreees Fahrenheit (''°F'') and 85 °F for all units (both condensing and non-condensing).

(7) Assign an allowable range of relative humidity during testing to be between 20 percent and 80 percent.

DOE's proposed actions are summarized in Table II.1 compared to the current test procedure as well as the reason for the proposed change.

TABLE II.1—SUMMARY OF CHANGES IN PROPOSED TEST PROCEDURE RELATIVE TO CURRENT TEST PROCEDURE

Current DOE test procedure	Proposed test procedure	Attribution
Does not specify instructions for testing furnace fans that are incapable of operating at the specified ESP.	Specifies testing instructions for furnace fans incapable of operating at the specified ESP.	Response to granted waiver from the test procedure.
Incorporates by reference ASHRAE 103–2007 and ASHRAE 37–2009.	Incorporates by reference ASHRAE 103–2017 and ASHRAE 37–2009 (RA 2019).	Incorporate the most recent industry test procedure.
Does not address dual-fuel furnace fans	Defines dual-fuel furnace fans in appendix AA and explicitly excludes them from the scope of the test method.	Clarify scope of coverage of the test procedure.
Defines ''default airflow-control settings''	Defines ''specified airflow-control settings'' to differentiate the settings used in testing from the as-shipped settings.	Clarifying selection of airflow control settings during testing.
Calculates airflow using ESP and temperature rise measurements.	Requires measuring airflow directly	Improve repeatability and reproducibility of test results.
Ambient temperature must remain between 65 °F and 100 °F for non-condensing furnaces and between 65 °F and 85 °F for condensing furnaces.	Ambient temperature must remain between 65 °F and 85 °F for all furnaces.	Improve repeatability and reproducibility of test results.
Does not specify an allowable range of relative humidity.	Requires ambient relative humidity to be maintained between 20% and 80% for all furnaces.	Improve repeatability and reproducibility of test results.

DOE has tentatively determined that the proposed amendments described in section III of this NOPR would not alter the measured efficiency of consumer furnace fans, or require retesting or recertification solely as a result of DOE's adoption of the proposed amendments to the test procedures, if made final. Discussion of DOE's proposed actions are addressed in detail in section III of this NOPR.

III. Discussion

A. Scope and Definitions

As discussed, a ''furnace fan'' is ''an electrically-powered device used in a consumer product for the purpose of circulating air through ductwork.'' 10 CFR 430.2. As stated, DOE's test procedure is applicable to furnace fans used in weatherized and non-weatherized gas furnaces, oil furnaces, electric furnaces, and modular blowers. Section 1, appendix AA. The test procedure is not applicable to non-ducted products, such as whole-house ventilation systems without ductwork, CAC condensing unit fans, room fans, and furnace draft inducer fans, since a ''furnace fan'' is defined as ''an electrically-powered device used in a consumer product for the purpose of circulating air through ductwork.'' 10 CFR 430.2.

In the July 2021 RFI, DOE sought comment on whether any changes are warranted to the scope of applicable products currently covered by the test procedure in appendix AA and if so, how the scope should be revised. 86 FR 35660, 35662.

1. CACs, HPs, and SDHVs

In response to DOE's questions about the scope of products covered by appendix AA, AHRI recommended that the exclusion of fans in CACs, heat pumps (''HPs''), small-duct high-velocity (''SDHV'') modular blowers, SDHV electric furnaces, and ductless products from the test procedure at appendix AA be maintained. AHRI commented that the fan efficiency for CAC and HP products is adequately addressed through DOE's test procedure at appendix M1.[7] (AHRI, No. 5 at p. 2)

NEEA suggested that the language of 42 U.S.C. 6295(f)(4)(D),[8] as discussed by DOE in the January 2014 Final Rule, could support the inclusion of furnace fans distributing air through ductwork for CACs, air source HPs, and hydronic systems, and encouraged DOE to specify that these are within the scope of the test procedures in appendix AA. NEEA commented that the explicit inclusion of CAC and air source HP units within the test procedure could result in significant energy savings. (NEEA, No. 3 at p. 4)

[7] Use of appendix M1 is required on or after January 1, 2023, for any representations, including compliance certifications, made with respect to the energy use, power, or efficiency of CACs and CAC heat pumps.

[8] 42 U.S.C. 6295(f)(4)(D) specifies the following: Notwithstanding any other provision of this chapter, if the requirements of subsection (o) are met, not later than December 31, 2013, the Secretary shall consider and prescribe energy conservation standards or energy use standards for electricity used for purposes of circulating air through duct work.

Carrier commented that the FER requirement for single packaged air conditioners with gas heat is no longer needed because the fan efficiency will be adequately measured when these products transition to the appendix M1 test procedure on January 1, 2023. Carrier commented that should DOE choose not to remove single packaged air conditioners from the scope, the test procedure should be updated to account for units with two stages of cooling operation and to credit these units for the lower fan power during low-stage cooling operation. (Carrier, No. 2 at pp. 1–2)

AHRI commented that modular blowers without supplementary heating sources are currently included in the scope of the furnace fan test procedure, but suggested that DOE should exempt these products from the scope of the test procedure. AHRI stated that fans that are connected to duct work but that are unable to be tested as shipped (*e.g.,* without an electric heat resistance kit) should be excluded from the regulation and not be considered furnace fans. (AHRI, No. 5 at p. 3)

DOE is directed by EPCA to ''consider and prescribe energy conservation standards or energy use standards for electricity used for purposes of circulating air through ductwork.'' (42 U.S.C. 6295(f)(4)(D)) As DOE described in the January 2014 Final Rule, such language could be interpreted as encompassing electrically-powered devices used in any residential heating, ventilation, and air-conditioning (''HVAC'') product to circulate air through duct work, not just furnaces. 79 FR 499, 504. However, DOE established test procedures only for those fans that are used in residential furnaces and modular blowers. DOE did not address fans in other types of HVAC products (such as CACs, HPs, and SDHV modular blowers) in that rule. *Id.*

Regarding the suggestion by AHRI to exclude modular blowers from the scope of the test procedure, DOE notes that modular blower fans are included within the scope of appendix AA and are subject to standards prescribed at 10 CFR 430.32(y). DOE must maintain the test method for modular blowers to assure that such products meet the required minimum level of energy efficiency specified in the standard. (42 U.S.C. 6295(r)) DOE has not received any waiver requests regarding modular blowers and is not aware of any modular blowers that are not designed to be paired with supplementary heating sources. However, to the extent that a specific basic model of modular blower is unable to be tested according to the prescribed test procedure in appendix AA, DOE provides the test procedure waiver process at 10 CFR 430.27.

In response to Carrier's suggestion to remove single packaged air conditioners from the scope of appendix AA, DOE notes the ''anti-backsliding'' provision of EPCA prevents the Secretary from prescribing any amended standard that either increases the maximum allowable energy use or decreases the minimum required energy efficiency of a covered product. (42 U.S.C. 6295(o)(1)) DOE would be unable to separate the furnace fan's energy consumption from that of other system components that affect SEER2 and HSPF2 ratings, and thus could not ensure that the energy consumption of covered furnace fans in such a product could not decrease under this metric. Therefore, DOE is not proposing to remove single packaged air conditioners from the scope of appendix AA.

In response to Carrier's suggestion to credit units with two stages of cooling operation to account for the lower fan power during low-stage cooling operation, DOE lacks adequate data to evaluate this proposal at this time.

Issue 1: DOE requests information and data regarding the electrical energy consumption of multi-stage furnace fans during low-stage cooling operation, specifically in relation to single-stage furnace fans in cooling mode.

Furthermore, DOE is not proposing to include fans used in other types of HVAC products, such as CACs, HPs, and SDHV modular blowers within the scope of appendix AA at this time. Similar to single packaged air conditioners, DOE tentatively agrees with commenters that the electrical energy consumption of furnace fans used in the aforementioned types of HVAC products will be accounted for by the seasonal energy efficiency ratio 2 (''SEER2'') and heating seasonal performance factor 2 (''HSPF2'') metrics measured by appendix M1. Although the applicable statutory provision (specifically, 42 U.S.C. 6295(f)(4)(D) directs DOE to ''consider and prescribe energy conservation standards or energy use standards for electricity used for purposes of circulating air through duct work''), could be interpreted as encompassing electrically-powered devices used in any residential HVAC product to circulate air through duct work, DOE has tentatively concluded that it is not necessary to expand the scope of coverage of appendix AA at this time.

2. Dual-Fuel Heating Products

Some consumer heating products include an electric heat pump and gas burner and are often referred to as dual-fuel or hybrid heating units. These products are designed to provide space heating with the heat pump and/or gas burner, depending on the operating conditions (*e.g.,* outdoor air temperature and heating demand). The annual operating characteristics of a dual-fuel product may differ significantly from a typical furnace, because the inclusion of a heat pump may change the operating time necessary to meet the heating load demand when compared with a gas burner alone, resulting in changes to the operating hours of the furnace fan. Therefore, the estimated national annual operating values provided in Table IV.2 of appendix AA may not be representative of an average use cycle for furnaces installed in dual-fuel applications. In addition, the current DOE test procedure does not specify provisions to set up or operate furnace fans for dual-fuel heating units.

In the July 2021 RFI, DOE requested comment on the typical operating characteristics of dual-fuel systems and whether and how the user has control over which heating source is used in a dual-fuel system. 86 FR 35660, 35666.

In response, AHRI commented that a dual-fuel-enabled thermostat determines if the heat pump or gas burner provides heat, and that the two cannot work at the same time. (AHRI, No. 5 at p. 10) AHRI stated that lower ambient temperatures will make the thermostat switch from the heat pump to the gas burner, but some controls can allow the consumer to lock out one or the other method of heating at a specified outdoor ambient temperature. (*Id.* at pp. 10–11) AHRI also described more complicated settings that the installer or consumer may implement, such as setting the thermostat to identify when a set point cannot be maintained and triggering the furnace (specifically, DOE understands the reference to ''furnace'' in this instance refers only to the burner portion of the dual-fuel furnace), choosing an outdoor temperature above which the furnace should not operate, and choosing an outdoor air temperature at which only the furnace will operate. (*Id.* at p. 11)

NEEA commented that dual-fuel HVAC system operating conditions should be included in testing procedures because of the expected increase in their prevalence in the market due to trends in electrification of space heating. (NEEA, No. 3 at pp. 4–6) NEEA encouraged DOE to investigate common balance points and other factors that might influence the temperature at which the heat source is changed in dual-fuel HVAC systems and encouraged DOE to contact researchers from Bonneville Power Administration

for information on their recently completed study pertaining to air source HPs. (*Id.* at p. 5)

Carrier urged for the removal of FER requirements for packaged dual-fuel units. Carrier stated that the electrical efficiency of the indoor blower in these units is accounted for in the DOE test procedure for heat pumps at appendix M, which Carrier asserted measures the primary mode of operation of such units. Carrier stated that requiring the indoor blower to meet the FER requirements is an additional regulatory requirement that adds rulemaking, certification, and enforcement effort to DOE and the regulated community with no additional benefit to consumers. (Carrier, No. 2 at p. 1)

Dual-fuel units are subject to the separate applicable standards for both heat pumps (*i.e.,* in terms of seasonal energy efficiency ratio (''SEER'') and heating seasonal performance factor (''HSPF'') or SEER2 and HSPF2) and furnaces (*i.e.,* in terms of AFUE). As discussed in this section, DOE tentatively concludes that the fan energy use of these products is already accounted for by the SEER and HSPF metrics measured by appendix M (*i.e.,* the currently applicable test procedure for these products) and will continue to be captured in the SEER2 and HSPF2 metrics when use of appendix M1 is required. The SEER2 and HSPF2 metrics measure the fan energy in its cooling and heating modes, respectively, covering the two major functions of furnace fans. Dual-fuel models were not subject to appendix AA prior to this notice and, therefore, were not part of the previous standards analysis. Consequently, DOE proposes to define dual-fuel units as a consumer product that includes both a heat pump and a burner in a single cabinet and to explicitly exclude them from the scope of appendix AA.

Issue 2: DOE requests comment on its proposed definition for dual-fuel units. DOE further requests comment on its proposal to explicitly exclude these units from the scope of appendix AA.

B. Updates to Industry Standards

As discussed previously, the current DOE test procedure for furnace fans incorporates by reference ASHRAE 103–2007. ASHRAE 103–2007 provides test procedures for determining the annual fuel utilization efficiency (''AFUE'') of residential furnaces and boilers. DOE's test procedure for furnace fans in appendix AA adopts certain sections of ASHRAE 103–2007 applicable to testing furnace fans, including requirements for instrumentation and test apparatus setup and test methodology.

In July 2017, ASHRAE published an update to ASHRAE 103, *i.e.,* ASHRAE 103–2017. The 2017 version made several editorial changes to the 2007 version, including use of mandatory language and use of the International System of units, in addition to other revisions such as an extension of the minimum length of the inlet duct from 12 inches to 18 inches. In the July 2021 RFI, DOE requested comment on whether to update the referenced version of ASHRAE 103 to the 2017 version. 86 FR 35660, 35665.

In response, AHRI commented that it agrees with DOE's description of updates in the 2017 version and suggested that the changes would only minimally impact FER. (AHRI, No. 5 at pp. 8, 9) Specifically, AHRI stated that increasing the minimum inlet duct length from 12 inches to 18 inches will not significantly impact the performance rating. (*Id.* at p. 9.) Further, AHRI commented that it does not object to the use of the 2017 version in the DOE test procedure. (*Id.* at pp. 8, 9)

DOE has tentatively determined that updating the DOE test procedure to reference the 2017 version of ASHRAE 103–2017 would not significantly impact the FER ratings as compared to the current test procedure. As noted, one substantive change between the versions of ASHRAE 103 is the length of the inlet duct. DOE does not expect the increase in length from 12 to 18 inches to impact the measured FER because the external static pressure and airflow will not change with this alteration, which is consistent with the comments from AHRI. Given that ASHRAE 103–2017 is the most recent version of the industry standard, and given DOE's tentative determination that its use as a reference standard would not significantly impact FER ratings or require retesting, DOE proposes to incorporate by reference ASHRAE 103–2017 in its test procedure for furnace fans. This proposed change, if adopted, would ensure that the test procedure references the most up-to-date language and stays consistent with the latest industry testing practices.

The current DOE test procedure for furnace fans also incorporates by reference ASHRAE 37–2009. ASHRAE 37–2009 provides methods of testing for unitary air conditioning and heat pump equipment. DOE's test procedure for furnace fans at appendix AA adopts certain Sections of ASHRAE 37–2009 regarding specifications for the required temperature measuring instruments and the ESP apparatus. Since the publication of the January 2014 Final Rule, two addenda for ASHRAE 37–2009 were published on October 3, 2016 and April 25, 2019 (''ASHRAE 37–2009 (RA 2019)''). These addenda include errata that corrected the total heating capacity equations for the outdoor liquid coil method in section 7.6.5.1 of the test standard and corrected the coefficient used to calculate the specific heat of air in sections 7.3.3.1, 7.3.3.2, and 7.7.4.1 of the test standard. In reviewing these changes, DOE has tentatively concluded that they would not significantly impact FER ratings or require retesting, as these changes were made to sections not used in appendix AA. Thus, DOE proposes to incorporate by reference ASHRAE 37–2009 (RA 2019) and update all references of ASHRAE 37–2009 to ASHRAE 37–2009 (RA 2019).

Finally, DOE currently incorporates by reference ASHRAE 41.1–1986 (RA 2006). ASHRAE 41.1–1986 (RA 2006) is referenced in Section 5.1 of ASHRAE 37–2009. ASHRAE 41.1–1986 (RA 2006) provides practices for temperature measurements for heating, refrigerating, and air-conditioning equipment. Despite the most recent version of ASHRAE 41.1 being ASHRAE 41.1–2020, the proposed version of ASHRAE 37 to be incorporated by reference (ASHRAE 37–2009 (RA 2019)) references ASHRAE 41.1–1986 (RA 2006). Thus, DOE proposes to maintain by reference ASHRAE 41.1–1986 (RA 2006).

Issue 3: DOE requests comment on its proposal to incorporate by reference ASHRAE 103–2017, ASHRAE 37–2009 (RA 2019), and maintain by reference ASHRAE 41.1–1986 (RA 2006).

C. Furnace Fans That Operate at Low External Static Pressures

On February 20, 2019, DOE received a petition for waiver and an application for interim waiver from ECR International, Inc. (''ECR'') for certain basic models of furnace fans that ECR described as belt-driven, single-speed furnace fans designed for heating-only applications in oil-fired warm air furnaces.[9] ECR asserted that the furnace fan basic models specified in the petition have design characteristics that prevent testing of the basic model according to the test procedure prescribed in appendix AA. Specifically, ECR claimed that the specified products are not designed to operate within the range of ESP required in appendix AA and that testing such furnace fans at the required ESP reduces airflow and increases temperature rise to the point where the units shut off during testing due to high temperature limits, making it impossible to reach

[9] *See: www.regulations.gov/document?D=EERE-2019-BT-WAV-0004-0001.*

steady state for testing at the required conditions. On March 9, 2021, DOE published a Decision and Order (''2021 Decision and Order'') granting ECR a test procedure waiver specifying an alternate test procedure that must be used to test and rate the specified basic models.[10] 86 FR 13530, 13534–13535. Specifically, the 2021 Decision and Order specified adjustments to the ESP test conditions specified in section 8.6.1.2 of appendix AA. Basic models subject to the 2021 Decision and Order must be tested at the specified ESP. *Id.* The alternate test procedure in the 2021 Decision and Order further specifies that if the unit under test shuts down prior to completion of the test, the ESP range is incrementally reduced by 0.05 inches of water column (''″ w.c.''), and the test is to be re-run. *Id.* This process is repeated until a range is reached at which the test can be conducted to its conclusion, with a minimum allowable ESP range of 0.30–0.35″ w.c., which corresponds to the first range at which shut-off could be avoided in the ECR data. *Id.* at 86 FR 13532 and 13534–13535.

In the July 2021 RFI, DOE requested feedback on whether the approach in the test procedure waiver would be appropriate for testing all basic models of furnace fans designed for heating-only applications. 86 FR 35660, 35667.

In response, AHRI commented that it is not opposed to the test procedure waiver approach being applied to all basic models of furnace fans designed for heating-only applications. (AHRI, No. 5 at p. 12) In contrast, the CA IOUs asserted that the alternate test procedure specified in the Decision and Order—by requiring testing at the highest ESP (and accordingly the highest discharge temperature) that does not trip the furnace's thermal safety limits—is likely to produce temperature rises that would exceed the manufacturer recommended maximum temperature rise specified in installation instructions. (CA IOUs, No. 4 at pp. 1–2) The CA IOUs additionally presented an analysis of the relationship between ESP and fan power consumption, from which the CA IOUs asserted that for a forward-curved fan operating at a given speed, FER improves (decreases) as ESP increases. (*Id.* at pp. 2–3) The CA IOUs asserted based on this analysis that testing at the highest ESP that the unit can accommodate before thermal cutoff may result in an artificially low (*i.e.,* more favorable) FER rating, and therefore the methodology provided in the 2021 Decision and Order may not accomplish the goal of increasing the representativeness of heating-only furnace fan ratings. (*Id.*) The CA IOUs recommended using a lower ESP to test heating-only furnaces and additionally providing a method to correct for how the fan would perform at the current ESP. The CA IOUs stated that this would ensure that heating-only units are not unfairly advantaged and would avoid DOE having to conduct a separate analysis of heating-only units in energy conservation standards rulemakings. (*Id.* at p. 3) The CA IOUs also commented that, should a separate test procedure be established for heating-only products, then the procedure should be designed such that it is analogous to that in appendix AA to produce an FER rating appropriately representative of heating-only furnace fan energy use in the field and should include an ESP value that reasonably represents values that heating-only equipment encounter in the field. (*Id.* at pp. 1, 4) Further, the CA IOUs recommended required labeling for ''heating-only'' units to explicitly indicate that they are not to be installed with air-conditioning cooling coils or air conditioners. (*Id.* at p. 4)

NEEA stated that the approach in the waiver granted to ECR is inappropriate for representative furnace fan testing and recommended that DOE use a consistent test procedure for all products, including heating-only applications. (NEEA, No. 3 at pp. 1–3) NEEA asserted that the basic models subject to the waiver are intended for use with cooling, and that the waiver allows separate testing procedures for less efficient furnace fans that may overstate real-world efficiency. (*Id.* at p. 2) NEEA referenced concerns that the CA IOUs had previously expressed to DOE regarding the end use applications for the basic models subject to the waiver. (*Id.*) NEEA cited DOE's decision in the January 2014 Final Rule not to create separate testing procedures for heating-only installation types and asserted that DOE's justification was that doing so would create multiple conditions for testing the same equipment and lead to non-representative energy use information. (*Id.*) NEEA further raised concerns that since energy consumption is a function of ESP, the waiver approach may produce lower (*i.e.,* more favorable) FER values that are not comparable to other furnace fans also used for cooling applications, and that this approach could create an unfair advantage for heating-only products. (*Id.*) NEEA asserted that the test conditions specified under the waiver are not representative of field conditions for these units if the oil furnace is eventually paired with an air conditioner. (*Id.*) To support its position, NEEA presented an analysis of FER ratings from DOE's Compliance Certification Database, which indicated that the majority of oil furnace fans have an FER greater than 450 W/1000 cfm; whereas, among the basic models subject to the waiver, the highest FER is 443 and the average value is 409. NEEA noted that while these lower FER values are achievable by other furnace fans not subject to the waiver, the FER ratings of the basic models subject to the waiver are not comparable since they are tested at different ESP conditions. (*Id.* at p. 3) In summary, NEEA recommended that DOE not establish separate testing provisions for heating-only furnace fans. (*Id.* at p. 1–3)

As discussed in section I.A of this document, DOE is required by EPCA to ensure that its test procedures are reasonably designed to produce test results which measure energy efficiency, energy use or estimated annual operating cost of a covered product during a representative average use cycle or period of use and not be unduly burdensome to conduct. (42 U.S.C. 6293(b)(3)) In the notices leading up to the January 2014 Final Rule, DOE considered creating a ''heating-only'' product designation for products that would have different reference system ESP installation considerations than other products. However, as discussed in an SNOPR published on April 2, 2013 (''April 2013 SNOPR''), DOE did not create a heating-only product designation because it was not aware of any heating-only products at the time other than hydronic air handlers, but those were outside the scope of applicability of the test procedure. 78 FR 19606, 19619.

As indicated by the waiver request submitted by ECR, certain furnace fans may not be able to operate at the ESP conditions specified by the current DOE test procedure (*i.e.,* cannot be tested at the currently required conditions). For such furnace fans, the current test procedure is unable to produce test results which measure energy efficiency during a representative average use cycle or period of use. Therefore, DOE is proposing to amend the test procedure in order to ensure that such furnace fans will be able to complete a valid test under conditions corresponding to representative average use. Specifically, DOE is proposing to add provisions to require that all furnace fans be initially tested at the applicable ESP range specified in Table 1 of appendix AA. If the unit under test is unable to complete the testing (*i.e.,*

[10] *See: www.regulations.gov/document/EERE-2019-BT-WAV-0004-0015.*

the unit shuts down), the ESP range would be incrementally reduced by 0.05″ w.c. (*e.g.,* for units designed to be paired with an evaporator coil but without one installed, first from 0.65″–0.70″ to 0.60″–0.65″ w.c.). This process would be repeated until an ESP range is reached at which the test can be conducted to its conclusion.

DOE found in the January 2014 Final Rule that generally the ESP values in appendix AA are representative of national average ductwork system characteristics. 79 FR 499, 502. DOE now recognizes that certain furnace fans are designed for operation at ESP conditions lower than those specified in the test procedure and that such units are incapable of operating at the specified ESP conditions. DOE has tentatively determined that requiring all furnace fans to begin tests at the ESP levels specified in Table 1 and allowing furnace fans that are unable to complete tests at those ESPs to test at their maximum possible ESP, would provide results representative of the average use of that unit under test. A method of testing in which products are subject to ESP values at which they are incapable of operating would yield results that are unrepresentative of their typical performance when installed. The proposed modifications will address products designed for all operating ESPs to be tested according to the same proposed test procedure.

Furnaces that cannot operate at the ESP conditions outlined in Table 1 of appendix AA will be tested according to the highest achievable ESP for the unit. DOE notes that, as suggested by the CA IOUs, testing these furnace fans at the highest achievable ESP could result in lower-than-usual airflows, which in turn could lead to higher temperature rises than expected for that unit. However, the proposed test method ensures that all units would be tested at or as close as possible to the ESP levels that represent the national average ductwork system, and therefore the operation mode closest to this representative scenario.

Additionally, as noted in the 2021 Decision and Order, DOE is not aware of any conversion equation that has been validated to accurately predict the change in FER as ESP varies at a given fan setting. Validating an equation for extrapolating to FER at an ESP that is higher than that at which the unit can operate may be difficult or even not possible (as the unit cannot operate at that point). 86 FR 13530, 13533. As a result of these considerations regarding the accuracy and representativeness of an adjustment factor, DOE is not proposing an adjustment factor to the test procedure for furnace fans that are unable to complete testing at the ESPs specified in Table 1 of this document.

DOE has also tentatively concluded the proposed test procedure amendment, if adopted, would not create an advantage for furnace fans incapable of operating at the applicable ESP values specified in Table 1 of appendix AA. Because a ''low-ESP'' furnace fan would be unable to operate at the ESP values specified by Table 1, such a unit would not be manufactured for the same application as furnace fans that are able to operate at the ESP values specified by Table 1 of this document.

Furthermore, because DOE has not received any applications for waiver besides the waiver submitted by ECR in 2020, and these provisions would result in the same test conditions for the furnace fans that were subject to ECR's waiver, DOE believes these proposed provisions would not affect the ratings or require the retesting of any fans currently on the market. Therefore, DOE tentatively determines that this change would allow all products, including those subject to ECR's waiver, to be able to use appendix AA as written, while having no impact on test burden.

DOE is not proposing labeling requirements for furnace fans that test at ESPs other than those in Table 1. Manufacturers of those fans would already be incentivized to specify in their product literature that such models are not suitable for use in systems with higher ESPs. Otherwise, it would be expected that there would be issues with consumer satisfaction if a furnace fan were installed in an environment in which it was incapable of operating. As previously noted, DOE is currently only aware of one manufacturer (ECR) that produces furnace fans that are incapable of operating at the ESPs currently in Table 1 of appendix A because DOE has not received any applications for waiver from any other manufacturers, which indicates that all other furnace fans currently available on the market are able to complete a valid test according to the test procedure currently prescribed in appendix AA. The current product literature from ECR specifies the intended applications and operating conditions of the furnace fans which are not intended for operation at higher ESPs.

This proposed amendment is consistent with the test procedure waiver provision at 10 CFR 430.27(l) that provides that, as soon as practicable after the granting of any waiver, DOE will publish in the **Federal Register** a NOPR to amend its regulations so as to eliminate any need for the continuation of such waiver. 10 CFR 430.27(l). As soon thereafter as practicable, DOE will publish in the **Federal Register** a final rule to that effect. *Id.* With regard to whether separate product classes may be warranted for ''low-ESP'' furnace fans, DOE would undertake such consideration in a separate furnace fans standards rulemaking. *See* 86 FR 66465, 66467–66468.

Issue 4: DOE requests comment on the proposed test instructions for furnace fans unable to complete testing at the ESP values currently specified in appendix AA.

D. Test Procedure Repeatability and Reproducibility

In the July 2021 RFI, DOE requested comment on whether stakeholders have encountered difficulty obtaining repeatable and reproducible FER results using appendix AA, and sought information on whether fluctuations in ESP and ambient conditions (within the boundaries allowed by appendix AA) impact FER ratings. 86 FR 35660, 35666. Additionally, to further understand the repeatability and reproducibility of the FER test procedure, DOE had confidential interviews conducted with several furnace fan manufacturers. The manufacturers similarly responded that there is generally a high level of uncertainty in FER results. Based on the collected feedback, DOE understands that there are several key areas of possible improvement to the current furnace fan test procedure that could improve repeatability and reproducibility including limiting the allowable range of ambient conditions, updating the method of airflow determination, and making clarifications to the current test procedure language.

In response to DOE's questions in the July 2021 RFI, AHRI stated that it had conducted an assessment to identify causes of variability in FER. (AHRI, No. 5 at p. 12) AHRI found that FER results are affected by natural gas input rate and relative humidity, which it said is problematic because testing is not conducted in a controlled environment. (*Id.*) AHRI stated that its assessment indicates that there is an 11-percent error in FER due solely to the tolerances of the inputs to the FER equation. (*Id.*)

DOE agrees with AHRI's comment that the natural gas input rate could impact FER, but notes that DOE previously considered tightening the tolerance on firing rate (from ±2 percent) in its test procedure for the residential furnaces and boilers. In a NOPR published on March 11, 2015, DOE determined that it could not change the tolerance on firing rate without increasing manufacturer burden because

of variations in gas valve performance. 80 FR 12875, 12886–12887. ASHRAE 103–2017, which is referenced in the current furnace fan test procedure, also includes a requirement that the burner input rate be within ±2 percent of the hourly British thermal unit (''Btu'') nameplate input rating. Because DOE is not aware of any data suggesting it would now be possible to tighten this tolerance, DOE is not proposing to change the tolerance on fuel input rating at this time.

Issue 5: DOE requests comment on its tentative decision not to tighten the tolerance on fuel input ratings beyond what is required in ASHRAE 103–2017.

1. Ambient Conditions

DOE also acknowledges that FER results can be affected by several other inputs, including the measurement accuracy of measured variables feeding into the FER calculation as well as allowable variation in these variables. Specifically, through communications with manufacturers and comments received in response to the July 2021 RFI, DOE understands that the FER results are also affected by ambient air temperature and humidity. As discussed in more detail in the following subsections, DOE is proposing additional restrictions on these test conditions.

a. Temperature

To help improve the repeatability and reproducibility of test results, DOE proposes to tighten the range of allowable ambient conditions during testing. The current range of ambient temperature is prescribed in section 7 of appendix AA, which references Section 8.5.2 of ASHRAE 103–2007. Section 8.5.2 of ASHRAE 103–2007 specifies that the ambient temperature must be maintained between 65 °F and 100 °F for non-condensing furnaces or between 65 °F and 85 °F for condensing furnaces. DOE proposes to modify the ambient temperature range such that for all tests and all furnaces (*i.e.,* both condensing and non-condensing), ambient air temperature must be maintained between 65 °F and 85 °F. Based on an analysis of the impact of ambient temperature on the test result and feedback received during communications with manufacturers, DOE tentatively concludes that the tightening of ambient temperature ranges will reduce FER variability. DOE reasons that furnace fan manufacturers produce both non-condensing and condensing furnace products and, therefore, manufacturers and third-party testing laboratories already have the capability to maintain the test room at a temperature between 65 °F and 85 °F to be able to test condensing furnaces. Further, DOE expects that most testing is conducted in at least semi-conditioned spaces and are unlikely to experience temperatures above 85 °F even if the outdoor conditions occasionally exceed that threshold. Because manufacturers and third-party test laboratories likely already have the capability to test furnaces while maintaining ambient air temperatures between 65 °F and 85 °F, DOE tentatively determines that this change would improve reproducibility by limiting extreme temperatures during testing, while having no impact on test burden. Additionally, this change would maintain the representativeness of the test procedure because it would ensure that air temperature in the test room is in line with the temperatures that furnace fans are likely to experience in residential applications.

Issue 6: DOE requests comment on its proposal to modify the allowable ambient temperature range in appendix AA such that for all tests and all furnaces (*i.e.,* both condensing and non-condensing), ambient air temperature must be maintained between 65 °F and 85 °F. DOE also requests comment regarding any potential burden associated with the change in allowable ambient temperature. Additionally, DOE requests data of the typical ambient temperatures of testing facilities throughout the year as well as any data on the relationship between ambient temperature and FER.

b. Humidity

As noted previously, AHRI commented that relative humidity (''RH'') can impact FER ratings. (AHRI, No. 5 at p. 12) Currently, there is no humidity requirement currently applicable to DOE's test procedure for furnace fans. However, there is a humidity tolerance in the test procedure applicable to consumer furnaces and boilers. Specifically, ASHRAE Standard 103–1993, which is referenced in the DOE test procedure for consumer furnaces and boilers, specifies that the relative humidity of the air in the test room at no time exceed 80 percent when measuring the condensate of condensing furnaces and boilers (*see* Sections 9.2 and 9.8.1 of ASHRAE 103–1993).

DOE proposes to specify the RH conditions for all tests of FER and all furnaces (*i.e.,* both condensing and non-condensing) to require that ambient air RH must be maintained at or below 80 percent. DOE reasons that most furnace fan manufacturers produce both non-condensing and condensing furnace products and, therefore, DOE expects that most manufacturers and third-party testing laboratories already have the capability to maintain the test room at an RH below 80 percent to be able to measure condensate for condensing furnaces. Because manufacturers and third-party test laboratories likely already have the capability to maintain the test room RH below 80 percent, DOE tentatively determines that this change would improve reproducibility by limiting extreme humidity conditions during testing, while having no impact on test burden.

DOE is also proposing to specify a limit on the lower range of allowable RH values during testing, specifically to require that for all tests and all furnaces, ambient air RH must be maintained at or above 20 percent. Similar to its proposal to add a maximum RH, DOE expects that imposing a minimum limit on the allowable RH values during testing would improve reproducibility but have no impact on test burdens because it is very unlikely that any test laboratories would be unable to meet a requirement excluding only the driest conditions.

The optimal RH values in conditioned living space are typically considered to range from 30 percent to 50 percent.[11] Therefore, imposing a requirement on RH during testing to maintain the RH of the room air between 20 percent and 80 percent will improve the representativeness of the FER test method compared to allowing RH to range from 0 percent to 100 percent, as the proposed range is closer to the optimal RH range for residences. However, the proposed range is not so tight that it would be expected to add burden for manufacturers.

Issue 7: DOE requests comment on its proposal to require maintaining the room air RH between 20 percent and 80 percent during FER testing, and on its tentative determination that this proposal would decrease variability between tests. DOE also requests comment on its tentative determination that the requirement of room air RH to be maintained between 20 percent and 80 percent would not add burden for manufacturers or test laboratories. DOE

[11] See, for example:

(1) U.S. Consumer Product Safety Commission. The Inside Story: A Guide to Indoor Air Quality. Available at: *www.cpsc.gov/safety-education/safety-guides/home/inside-story-guide-indoor-air-quality.* Last accessed February 1, 2022; or

(2) U.S. Environmental Production Agency. Dehumidifier Basics. *www.energystar.gov/products/appliances/dehumidifiers/dehumidifier_basics#:~:text=Relative%20Humidity%20(RH)%20and%20Humidistats&text=The%20optimum%20RH%20level%20for,RH%20to%20prevent%20window%20condensation.* Last accessed February 2, 2022.

requests comment on whether a tighter range for RH during testing (for example, 30 percent to 50 percent RH, which could further improve representativeness and further increase repeatability beyond the proposed range) would be possible to maintain without being unduly burdensome. DOE seeks data on ambient RH values at test facilities throughout the year and any data on the relationship between RH and FER variability.

2. Airflow Determination

In the January 2014 Final Rule, DOE adopted in appendix AA a method of calculating airflow based on temperature rise. Specifically, the equation for airflow in airflow control setting ''*i*'' (''Q_i'') compares the input heat energy to the heat picked up by the air based on temperature rise and the specific conditions of the inlet air (*see* section 10.1 of appendix AA). 79 FR 499, 508–510.

In response to the April 2013 SNOPR, Goodman recommended that DOE consider allowing an alternate method of directly measuring airflow using a code tester [12] and ASHRAE 37 ductwork.[13] 79 FR 499, 509. In response to this comment, DOE stated in the January 2014 Final Rule that a test setup that includes a code tester is not typical when testing a furnace, and that DOE tried to harmonize, where possible, the test set up for furnaces and furnace fans. Additionally, DOE stated that an alternative test method using a code tester and ASHRAE 37 ductwork could provide similar results as the test procedure established in the January 2014 Final Rule, but that the test procedure would differ significantly. Thus, DOE concluded at the time that adding a code tester to the furnace fan test procedure would add substantial burden. *Id.*

As previously noted, in response to the July 2021 RFI, AHRI commented that it had conducted an uncertainty analysis and found that there is an 11-percent error in FER due solely to the tolerances of the inputs to the FER equation. (AHRI, No. 5 at p. 12) Additionally, AHRI commented that it had commissioned an assessment of the FER metric, including the variability therein. (*Id.*) AHRI stated that this report showed that the natural gas input rate and relative humidity affect FER ratings and stated that this finding was also supported by reports from AHRI members. AHRI asserted that these sources of variability are problematic because testing is not conducted in a controlled environment. (*Id.*)

After considering these comments and given DOE's understanding based on discussions with manufacturers that some of the challenges associated with repeatability may stem from the current method of calculating airflow indirectly based on measurements of other parameters, DOE has reconsidered the previous suggestion to allow airflow to be measured directly.

Each parameter involved in the calculation of the airflow at the maximum airflow-control setting (''Q_{max}'') and FER has its own inherent variability. Measuring airflow directly would avoid the dependence on measured temperature rise (which is the difference between the measured outlet and inlet air temperatures), fuel input rate, and fan power consumption (and avoid the uncertainty associated with each of these measurements), which could therefore reduce the overall variation inherent to the final FER value. Using the allowable accuracies specified in Sections 5.3 and 6.1.2 of ASHRAE 37–2009 (RA 2019), DOE understands that an airflow-measuring device would have an accuracy of about 2–3 percent. This 2–3-percent range is significantly smaller than the percentage variation in airflow as calculated based on measurements of other test conditions that each have a degree of variability.

DOE acknowledges that requiring the use of an airflow-measuring device for furnace fans could introduce a one-time cost for manufacturers that either do not utilize such devices for their current testing programs (presumably of other products) or do not have enough of such devices available to test furnace fans in addition to other HVAC products that use airflow-measuring devices. The estimated cost of an airflow-measuring device is up to $50,000. DOE discusses test procedure costs and impacts further in section III.I.1 of this document.

Having considered the potential benefits and burdens associated with measuring airflow directly using an airflow-measuring device, DOE has tentatively determined that the benefits would outweigh the burdens, and that requiring directly measuring airflow would not be unduly burdensome. DOE therefore proposes to require that airflow be measured directly during each test. Specifically, DOE is proposing that this measurement be done using the procedures and methods for measuring airflow specified in ASHRAE 37–2009 (RA 2019), similar to how it is done for central air conditioners and heat pumps. As part of this proposal, DOE proposes to incorporate by reference Figure 12 of ANSI/Air Movement and Control Association International, Inc. (''AMCA'') 210–07, ANSI/ASHRAE 51–07 (''AMCA 210–2007''), *Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating* and Figure 14 of ANSI/ASHRAE Standard 41.2–1987 (RA 92), (''ASHRAE 41.2–1987 (RA 1992)''), *Standard Methods for Laboratory Airflow Measurement.* However, DOE is also aware of several other ~~additional~~ methods of directly measuring the airflow, such as methods outlined in AMCA 210 (*e.g.,* the pitot traverse method),[14] duct-mounted airflow measurement devices, and anemometers. DOE has tentatively determined that the proposed approach to measure airflow as specified by ASHRAE 37–2009 offers the most accurate and repeatable option for direct measurement of airflow and is not unduly burdensome but seeks comment on the proposed approach as well as any potential alternative approaches. Specifically, DOE requests comment on alternative methods of direct airflow measurement, including on the level of measurement accuracy associated with each approach and any associated test burden.

Issue 8: DOE requests comment on its tentative conclusion that measuring airflow directly would be more accurate and result in less variability than the current method of calculating airflow based on temperature rise. Additionally, DOE requests comment on its estimated cost for an apparatus to measure airflow directly using the procedures and methods for measuring airflow specified in ASHRAE 37–2009 (RA 2019) (up to $50,000). DOE also requests comment on whether test laboratories would need to purchase additional equipment for testing, if DOE adopts this proposal to measure airflow directly, or if test laboratories generally already have this equipment available.

Issue 9: DOE requests comment on whether it is necessary to reference AMCA 210–2007 and ASHRAE 41.2–1987 (RA 1992) in the test procedure instructions for constructing an airflow measuring apparatus.

Issue 10: DOE requests comment on alternative methods of direct airflow measurement, other than using the procedures and methods for measuring airflow specified in ASHRAE 37–2009 (RA 2019). For these alternatives, DOE requests comment on the expected

[12] A ''code tester'' is an instrument used to measure airflow. Such instruments determine airflow by measuring the pressure drop across one or more nozzles as air passes between two chambers.

[13] See: *www.regulations.gov/comment/EERE-2010-BT-TP-0010-0037.*

[14] *See: https://www.amca.org/assets/resources/public/pdf/Education%20Modules/AMCA%20210-16.pdf.* (Last accessed April 7, 2022.)

measurement accuracy, the cost of associated instrumentation, and appropriate associated setup and operation procedures.

3. Location of External Static Pressure Measurements

Currently, section 6.4 of appendix AA specifies that for all test configurations, external static pressure taps shall be placed 18 inches from the outlet. Additionally, although section 6.4 of appendix AA references Section 6.4 of ASHRAE 37–2009 for a description of the apparatus for measuring external static pressure, section 6.4 of appendix AA includes explicit instructions to not follow the specifications in Section 6.4 of ASHRAE 37–2009 regarding the minimum length of the ducting and minimum distance between the external static pressure taps and product inlet and outlet. The external static pressure measurement location in Section 6.4 of ASHRAE 37–2009 varies depending on the dimensions of the duct outlet. DOE adopted the requirement to measure external static pressure at 18 inches from the outlet in the January 2014 Final Rule in response to comments from manufacturers concerning practical constraints of the test setup. 79 FR 500, 511. Specifically, DOE previously determined that a fixed dimension requirement of measuring external static pressure 18 inches from the outlet (as opposed to the requirements in ASHRAE 37–2009, which depend on the dimensions of the outlet duct) would allow larger products to be tested in existing furnace testing facilities and would improve consistency with the test setup for consumer furnace testing. *Id.* However, in light of the concerns about the repeatability of the current furnace fan test procedure, DOE is reconsidering the appropriate location for measuring external static pressure. ASHRAE 37–2009 was developed through a consensus process and would generally be expected to represent the current best practices for measuring external static pressure. DOE is concerned that measuring at a fixed location of 18 inches from the outlet could lead to a less accurate and less repeatable measurement than the approach provided in ASHRAE 37–2009 because the airflow profile may not be fully developed. Therefore, although DOE is not proposing a change to the measurement location in this NOPR, DOE is seeking more information to determine whether a change would improve the repeatability of the FER test. If DOE determines that changing the location of the pressure taps could improve repeatability, DOE may do so in a future final rule.

Issue 11: DOE requests comment on whether requiring that the external static pressure be measured at the location specified in Section 6.4 of ASHRAE 37–2009, as opposed to specifying that external static pressure taps always be placed 18 inches from the outlet, could improve test repeatability. DOE also requests comment on whether manufacturer facilities and other test laboratories would be able to accommodate the added duct length during testing. Further, if test facilities would not be able to accommodate the added duct length during testing, DOE requests comment on whether a different length requirement could improve test repeatability while not preventing any existing test facilities from completing a valid test for furnace fans.

4. Language Updates

In the July 2021 RFI, DOE sought comment on whether any definitions in the test procedure require revision and if so, how the definitions should be revised. 86 FR 35660, 35662. DOE received a number of comments in response suggesting revisions to the language in appendix AA that could reduce confusion about the test procedure.

a. Definitions

For furnace fans used in furnaces or modular blowers with single-stage heating, the three airflow-control settings required to be tested are: The maximum setting, the default constant-circulation setting, and the default setting when operated using the maximum heat input rate.[15] For furnace fans used in furnaces or modular blowers with multi-stage heating or modulating heating, the airflow-control settings to be tested are: The maximum setting; the default constant-circulation setting; and the default setting when operated using the reduced heat input rate. *See* sections 8.6.1, 8.6.2 and 8.6.3 of appendix AA. For both single-stage and two-stage or modulating units, if a default constant-circulation setting is not specified, the lowest airflow-control setting is used to represent constant circulation for testing. *See* section 8.6.2, appendix AA.

In addition, if the manufacturer specifies multiple heating airflow-control settings, the highest heating airflow-control setting specified for the given function (*i.e.,* at the maximum or reduced input, as applicable) is used. *See* section 8.6.3, appendix AA.

Inquiries sent to DOE since the publication of the January 2014 Final Rule indicate that there are differing interpretations regarding the appropriate airflow-control settings for testing, with some manufacturers interpreting the DOE test procedure as requiring testing only the ''as-shipped'' airflow-control settings. However, the definition for ''default airflow-control setting'' specifically states that ''[i]n instances where a manufacturer specifies multiple airflow-control settings for a given function to account for varying installation scenarios, the highest airflow-control setting specified for the given function shall be used for the procedures specified in this appendix.'' Section 2.6, appendix AA. Further, the default airflow-control settings are defined as airflow-control settings specified for installed-use by the manufacturer. That section in turn clarifies that the ''manufacturer specifications for installed use'' are those specifications provided for typical consumer installations in the product literature shipped with the product in which the furnace fan is installed.

The ''default airflow-control setting'' should not be conflated with the as-shipped airflow-control settings. For example, a furnace may be shipped with the low-speed airflow-control setting configured for the heating function (*i.e.,* the as-shipped airflow-control setting), but the installation manual shipped with the furnace fan specifies the medium speed airflow-control setting for the heating function for certain installations, which is the highest airflow-control setting specified for the heating function. In this scenario, the DOE definition for ''default airflow-control setting'' requires the medium airflow-control setting to be used during the heating-mode test, rather than the as-shipped setting (*i.e.,* the low setting) because there are multiple airflow-control settings for the heating function, and the medium setting is the highest setting specified.

Additionally, inquiries sent to DOE indicate that some manufacturers may be interpreting the test procedure to require testing according to installation instructions printed on the control board. However, DOE notes that the same control board may be used across multiple products to reduce manufacturing complexity and costs, and as a result, instructions provided on a control board may not be applicable to every unit in which a control board is

[15] For furnace fans where the maximum airflow control setting is a heating setting, the maximum airflow control setting test and the default heating airflow control setting test would be identical, such that only two tests are required: Maximum airflow (which is the same as the default heating setting) and constant circulation.

used and could contradict the specifications in product literature. For this reason, DOE specifies in the definition of default airflow-control setting that the manufacturer specifications for installed-use are those specifications provided for typical consumer installations in the product literature shipped with the product in which the furnace fan is installed. Section 2.6, appendix AA.

In the July 2021 RFI, DOE requested comment on whether further instruction was necessary for determining the appropriate airflow controls used for testing. 86 FR 35660, 35663.

AHRI recommended that DOE change the term ''default airflow-control settings,'' which AHRI stated implies as-shipped settings or factory settings, to ''specified airflow-control settings'' or ''multiple airflow-control settings'' to ensure the correct settings are used for testing. (AHRI, No. 5 at pp. 3–4) AHRI also commented that there is a conflict between the directions in section 8.6.2 and section 2.6 of appendix AA, with section 8.6.2 directing the testing laboratory to use the lowest available airflow-control setting if none is provided, and section 2.6 specifying to use the highest. (*Id.* at pp. 4–5) AHRI recommended providing a flow chart to outline the hierarchy of instructions to guide the selection of airflow-control settings for each mode. (*Id.* at p. 4)

To provide further clarity regarding the correct airflow control setting to be used for each test, DOE proposes to change the defined term at section 2.6 in appendix AA from ''default airflow-control settings'' to ''specified airflow-control settings.'' This revised definition would avoid potential misinterpretation of the term ''default,'' which is not intended to limit testing to the as-shipped airflow-control settings. Additionally, DOE agrees with AHRI's comment that the conflicting direction from sections 8.6.2 and 2.6 of appendix AA could cause confusion when selecting airflow-control settings for testing. The intended hierarchy of these sections is for the airflow control setting to be selected according to section 2.6, unless section 8.6.2 applies, in which case section 8.6.2 should be used to select airflow control settings. To clarify this hierarchy, in addition to changing the term ''default airflow-control settings'' to ''specified airflow-control settings,'' DOE proposes to add the phrase ''unless otherwise specified within the test procedure'' to the end the definition of ''specified airflow-control settings.''

These proposed changes would clarify the appropriate airflow control settings to use for testing. Because these changes are meant to improve clarity but not change the current test methodology, DOE does not expect that these proposals would cause any changes to current testing or ratings. Additionally, DOE expects that these proposals will alleviate confusion about the appropriate airflow control settings to use for testing, and therefore DOE does not also propose to add a flowchart into appendix AA to further clarify which airflow control settings are appropriate.

Issue 12: DOE seeks comment on its proposal to change the term ''default airflow-control settings'' to ''specified airflow-control settings'' and to add the phrase ''unless otherwise specified within the test procedure'' to the end of the revised term's definition.

Additionally, the CA IOUs recommended that DOE further investigate the effect of control features on fan performance to ensure that fan energy use in the test procedure is representative of use in the field for all available furnace capabilities, including for modulating furnaces with very low heating outputs. The commenter stated that modulating controls increase both the frequency of fan speed variation and the number of hours spent in heating mode at reduced speeds. (CA IOUs, No. 4 at p. 4)

In a NOPR published in the **Federal Register** on May 15, 2012 (''the May 2012 NOPR''), DOE tentatively concluded that a metric based on measurements in multiple airflow-control settings would be appropriate to account for furnace fan energy consumption across its entire operating range. 77 FR 28673, 28687. DOE recognized that furnace fans are used not just for circulating air through duct work during heating operation, but also for circulating air during cooling and constant-circulation operation. *Id.* DOE also stated that it understands that higher airflow-control settings are factory set for cooling operation, and that the electrical energy consumption of a furnace fan is generally higher while performing the cooling function. *Id.* Additionally, DOE compared ratings that use measurements in two, three, and five airflow-control settings and found that a metric that uses measurements in three of the available airflow-control settings appropriately captures the efficiency advantages of using more-efficient technologies while minimizing burden on manufacturers. *Id.* In the absence of data or examples indicating otherwise for modulating units, DOE tentatively concludes that including maximum airflow, cooling, and constant circulation tests fully encompass the fan control features and are therefore representative of field use. Accordingly, DOE is not proposing any changes to how modulating units are tested under appendix AA.

Additionally, in the July 2021 RFI, DOE requested comment on the appropriate hierarchy to follow in the event of conflicting airflow-control settings in the manufacturer's product literature. 86 FR 35660, 35663. In response, AHRI recommended DOE clarify that the order of priority should be the AHRI Database followed by the manufacturer's installation guide. Additionally, AHRI stated that operating furnaces intended for high-static pressure applications at the highest airflow-control setting may lead to excessive airflow that will result in the furnace operating outside the nameplate-specified temperature rise range. AHRI stated that furnace safety certification requires furnace airflow settings in heating mode to be limited by the labeled rise range and recommended that heating mode airflow control settings should be limited by the requirements of the labeled rise range. (AHRI, No. 5 at p. 5)

As discussed previously, DOE tentatively concludes that with the proposed changes to the airflow-control settings definitions, the instructions for selecting the appropriate airflow-control setting for testing are sufficiently clear. Regarding AHRI's concern that certain furnaces may operate with excessive airflow that would cause the furnace to operate outside the nameplate-specified rise range, DOE notes that the test method requires testing of the maximum heating airflow mode as specified by the manufacturer. DOE expects that if a fan setting is identified for heating mode operation that the fan would be capable operating in that mode at the ESP specified in appendix AA (which is representative of a typical ESP that would be encountered in the field) and at the specified temperature rise range.

Issue 13: DOE requests further comment on this issue of whether it is necessary to specify that the maximum heating airflow-control setting used during testing be one that also allows for operation within the manufacturer-specified temperature rise range during testing. DOE is also interested in information regarding how often furnace fans operate outside of the manufacturer-specified temperature rise range during FER testing under the current requirements.

In response to DOE's question about whether any definitions in the furnace fan test procedure require revision, AHRI commented that the phrase ''manufacturer specifications . . . in product literature . . . shipped with products'' should be clarified to include

values used in testing that may be located on the label, printed literature, or online. AHRI stated that manufacturers understand the FER test procedure is intended to limit furnace fan operation to within the manufacturer's intended range of use, which it interprets as the manufacturer-specified temperature rise range, static pressure range for the given operation mode, and airflow range for the function being evaluated. AHRI further commented that it understands these limits may be provided on the label, in printed literature, or through a web address provided with the product. (AHRI, No. 5 at pp. 3–4)

Currently, DOE refers to ''manufacturer specifications for installed-use'' in sections 2.2 and 2.6 of appendix AA. DOE agrees with AHRI that the current instructions could benefit from additional clarity. As discussed in section III.E.3.a of this document, DOE is proposing to replace the definition of ''default airflow settings'' with ''manufacturer-specified airflow settings.'' DOE is also creating a new definition of dual fuel units, as discuss in section III.A.2 of this document.

b. External Static Pressure

Sections 8.6.2 and 8.6.3 of appendix AA provide the test requirements for taking measurements in airflow-control settings other than the maximum airflow-control setting. Both sections state that their respective required operating settings be maintained until steady-state conditions are attained as specified in sections 8.3, 8.4, and 8.5 of appendix AA. Regarding ESP, sections 8.3, 8.4, and 8.5 state that stabilization is ''indicated by an external static pressure within the range shown in Table 1.'' The ESP values in Table 1, as indicated by the table's title, apply only to the maximum airflow-control setting (section 8.6.1), and therefore are not applicable to sections 8.6.2 and 8.6.3 of appendix AA. In an accompanying statement immediately below Table 1, appendix AA directs that ''once the specified ESP has been achieved, the same outlet duct restrictions shall be used for the remainder of the furnace fan test.'' As such, the test procedure specifies the ESP conditions in terms of the ductwork geometry when testing at airflow-control settings other than the maximum airflow-control setting.

In the July 2021 RFI, DOE requested comment on how manufacturers are currently implementing sections 8.6.2 and 8.6.3 of appendix AA with respect to ESP. DOE requested further comment regarding whether additional direction is needed as to the ESP requirement provided in the statement accompanying Table 1, including whether additional criteria are necessary to limit variability in ESP readings for steady-state operation during the tests for airflow-control settings other than the maximum airflow setting, and if so, what that direction should be. 86 FR 35660, 35664.

AHRI asserted that to implement sections 8.6.2 and 8.6.3 of appendix AA with respect to ESP, manufacturers first set the supply duct restrictions, then adjust the ESP according to section 8.6.1.1 or section 8.6.1.2, then record the electrical power. AHRI stated that the airflow control setting is next adjusted according to section 8.6.2, without adjusting the ESP, and then electrical power is recorded again. AHRI stated the airflow control setting is then adjusted according to section 8.6.3, again without adjusting the ESP unless the temperature rise is not within the rise range, in which case the ESP is adjusted until the temperature rise is within the rise range. (AHRI, No. 5 at p. 7)

AHRI also commented that the asterisk located in the ESP table column heading for Table 1 was intended to precede a clarifying comment, but this asterisk was left out and should be reintroduced and linked to the statement reading ''once the specified ESP has been achieved, the same outlet duct restrictions shall be used for the remainder of the furnace fan test'' that follows Table 1 of appendix AA. (AHRI, No. 5 at p. 7)

Based on AHRI's description of how testing is typically performed, DOE tentatively concludes that the current test procedure generally provides sufficient instruction (*i.e.,* the test is being performed as intended). DOE agrees that the asterisk was omitted in appendix AA, and proposes to add an asterisk prior to the statement ''once the specified ESP has been achieved, the same outlet duct restrictions shall be used for the remainder of the furnace fan test'' in section 8.6.1.2 of appendix AA to link this statement to the ESP column of Table 1. This proposed change would clarify the appropriate duct restrictions for testing and not make any substantive changes.

c. Power Measurements

Sections 8.6.1.1, 8.6.1.2, 8.6.2, and 8.6.3 of appendix AA require the following parameters to be measured once steady-state operation is achieved: The furnace fan electrical input power, fuel or electric resistance heat kit input energy, external static pressure, steady-state efficiency, outlet air temperature, and/or temperature rise. DOE believes that some test facilities take a single reading for each of these parameters after achieving the steady state criteria. In DOE testing where these parameters were measured in one second intervals throughout the steady-state period, data showed that the values fluctuate sometimes significantly between readings, even while steady-state conditions are maintained. These fluctuations could contribute to repeatability issues in FER testing if a value from a single point in time is used for each test due to the potential for significant differences from one reading to the next. In particular, DOE has seen that the standard deviation of furnace fan power measurements over a 30 minute period (at steady state operation) can be up to 16 percent of the average, although for most units the standard deviation is less than 1 percent of the average power consumption. Therefore, DOE is considering whether further clarifications are necessary for appendix AA to clarify how manufacturers should take power measurements. Specifically, DOE believes that increasing the number of discrete measurements taken (*i.e.,* increasing the sample size) and averaging them to determine each furnace fan power consumption measurement may yield a result that is more representative and repeatable than using single point measurements of the furnace fan power. For example, DOE could require that power measurements should be based on the average value over a one-minute interval beginning immediately after steady-state operation has been achieved, during which the power is measured at least once per second. Alternatively, DOE could require furnace fan power measurements to be based on the average of measurements taken over the entire steady-state period at certain specified intervals (*e.g.,* every minute or every 5 minutes). If DOE determines that adding instructions to appendix AA to clarify how to measure furnace fan power consumption could improve the repeatability of FER tests, DOE may do so in the final rule.

Issue 14: DOE requests data and information on the methods and granularity with which test facilities currently measure the aforementioned variables, particularly furnace fan power (EMax, ECirc, and EHeat). DOE also requests comment on the intervals at which test facilities are currently capable of recording these measurements with their current instrumentation. Finally, DOE also requests information on whether there are variables besides the fan power

consumption variables for which there are significant fluctuations in measurements that DOE should also consider requiring be determined as an average of multiple measurements.

Issue 15: DOE requests comment on the number of samples that should be taken and the length of time over which data should be collected in order for a representative average to be achieved. DOE also requests comment on the associated costs, if any, to upgrade measurement instruments or software to be able to collect furnace fan power consumption measurements at frequencies of once per second, once per minute, once per 5 minutes, and/or other recommended sampling frequencies.

d. Other Language Clarifications

The title of section 8.3 of appendix AA is *Steady-State Conditions for Gas and Oil Furnaces,* the title of section 8.4 is *Steady-State Conditions for Electric Furnaces and Modular Blowers,* and the title of section 8.5 of appendix AA is *Steady-State Conditions for Cold Flow Tests.* The former two sections (8.3 and 8.4) describe the steady-state conditions for ''hot flow'' tests where the burner or heating element is on, while the latter section (8.5) describes the steady-state conditions for ''cold flow'' tests when the burner or heating element is off. To provide better consistency between the section titles and to provide clarity for the intended use of sections 8.3 and 8.4 of appendix AA, DOE proposes to amend the section titles to include the terminology ''for Hot Flow Tests'' in the titles.

Section 10.1 of appendix AA specifies that in calculating FER, the furnace fan electrical consumption in the maximum airflow-control setting (E_{max}) is multiplied by the cooling hours (CH). However, if the maximum airflow-control setting is a not a cooling setting (*e.g.,* if it is only a heating setting), E_{max} would not necessarily be measured during operation in a cooling airflow-control setting. Therefore, DOE proposes to change the description of the operating mode hours to be ''maximum airflow hours'' and to designate it with the variable ''MH'' in the nomenclature and associated equations. DOE tentatively concludes that this proposed change would provide consistency with the description of the operational mode and E_{max} measurement and avoid the implication that the maximum airflow-control setting will always be a cooling mode.

E. Nomenclature and Equations

In response to the July 2021 RFI, AHRI submitted several comments regarding the nomenclature and equations in appendix AA. In the current test procedure for furnace fans, the equation for FER includes a dependence on the term Q_{max}, which represents the airflow at the maximum airflow-control setting. For products for which the maximum airflow-control setting is the specified heat setting, Q_{max} will equal the airflow measured at the heating mode control setting (''Q_{heat}''). Otherwise, a separate equation in section 10.1 of appendix AA is used to adjust Q_{heat} to determine the expected Q_{max}. Q_{heat} is first determined using the equation for Q_i (the airflow in airflow-control setting *i*), when *i* indicates heating mode.

AHRI stated that the use of subscript ''i'' is confusing. Specifically, AHRI stated that the subscript ''i'' has two different meanings within the equation for Q_{max}: The airflow control setting, and the heat input setting. AHRI recommended that the subscript ''k'' be used to indicate the heat setting, thereby creating measured input at heat setting *k* ($Q_{IN,k}$), steady-state efficiency at heat input setting *k* ($Effy_{SS,k}$), and furnace fan electrical consumption at heat setting *k* (E_k). Further, AHRI recommended replacing Q_i with $Q_{heat.k}$ as opposed to implying that Q_{heat} is equal to Q_i. (AHRI, No. 5 at p. 4)

DOE agrees that the current use of subscripts could lead to confusion. However, as discussed in section III.D.2 of this document, DOE is proposing to measure airflow directly. As a result, the equations to calculate airflow would no longer be needed if this proposal were adopted. However, if DOE does not ultimately adopt its proposal to measure airflow directly, it would consider using the subscripts ''i'' and ''k'' to distinguish between airflow control settings and heat input settings.

Additionally, AHRI submitted a revised equation for Q_{max}. Specifically, AHRI submitted a derivation of the Q_{max} equation based on the fan laws from the 2016 ASHRAE Handbook suggesting that the average outlet air temperatures in the heating and maximum airflow modes ($T_{Heat,\ Out}$ and $T_{Max,Out}$, respectively) of the adjustment factor for Q_{heat} should be inverted. (AHRI, No. 5 at pp. 4, 24–26) In response to AHRI's suggestion that the Q_{max} calculation should be corrected, DOE notes that the derivation of the Q_{max} equation was discussed in the April 2013 SNOPR. 78 FR 19606, 19614–19616. Further, DOE notes that the fan laws are not an appropriate starting point for AHRI's derivation of the Q_{max} equation. Residential furnaces are almost exclusively designed such that air is not heated until after it has passed through the furnace fan (*i.e.,* the furnace fan pushes rather than pulls air through the heat exchanger) so the inlet air, which is what is experienced by the fan, will remain at approximately the same (ambient) conditions throughout the course of the test, independent of the furnace fan's operating mode. As a result, the air temperature and density experienced by the fan will not change when testing a furnace fan in different operating modes. In contrast, DOE's derivation was based on differences in the temperatures of the air passing through the outlet ductwork but is not derived from the fan laws.

In addition, AHRI recommended several clarifications for the calculation of the airflow equation to determine Q_i. AHRI's suggestions included defining the previously undefined variables in the Q_i equation. Specifically, it suggested a definition for jacket loss (''L_J''), using the definition and default value of 1 percent based on the January 2014 Final Rule. (AHRI, No. 5 at p. 17) Next, AHRI suggested a definition for the steady-state efficiency in airflow setting *i* (''$Effy_{ss}$,'') to incorporate comments from the January 2014 Final Rule. (*Id.*) AHRI also suggested adding a specific definition for the electrical energy to the furnace fan motor in the airflow control setting *i* (''E_i'') for clarity. (*Id.* at p. 18) Further, AHRI commented that several constants in the Q_i equation should be explicitly defined and/or corrected. It recommended defining 60 as the conversion factor from hours to minutes (''min/h''), 0.24 as the approximate specific heat capacity of dry air, and 0.444 as the approximate specific heat capacity of saturated water vapor. AHRI stated that each of these definitions would provide additional clarity when calculating Q_i. (*Id.*) AHRI also recommended revising the included factor for converting watts to Btu per hour (''(Btu/h)/W'') from 3,413 to 3.413 to correct the misplaced the decimal point. (*Id.*) AHRI noted that DOE currently uses the variable ''W'' to represent both relative humidity in section 8.6.1 of appendix AA and humidity ratio in section 9 of appendix AA. AHRI recommends clarifying that humidity ratio is denoted using the variable ''W,'' while the relative humidity is represented by the variable ''φ'' to align with the ASHRAE handbook. (*Id.*) Finally, AHRI suggested changing the definition of the specific volume of air ($v_{air,i}$), which is currently defined in the test procedure as the ''specific volume of dry air'' in units of lb/ft^3, to the ''specific volume of moist air mixture in the airflow-control setting i'' in units of ft^3/lb_{da}. (*Id.* at p. 19) *Id.*

Were DOE to adopt in a final rule its proposal to measure airflow directly rather than to calculate airflow (as discussed in section III.D.2 of this document), the terms reference system descriptor (''kref''), air throughput temperature rise in setting i (''ΔT_i''), inlet air temperature at time of the electrical power measurement in airflow-control setting i (''$T_{i,In}$''), $Effy_{ss}$, L_J, the airflow variable (''Q_i''), and a specific volume of dry air (''v_{air}'') would no longer be used and as a result, their definitions would be removed from the test procedure in appendix AA. The humidity ratio, W, and average outlet air temperature at time of the electrical power measurements in airflow-control setting i (''$T_{i,out}$'') would remain in appendix AA even though they would not be used directly in any calculations because they would be necessary for measurement of airflow. Should, however, DOE determine to maintain the indirect calculation of airflow based on measurement of temperature rise, as required by the current test procedure, DOE would consider adopting several of the nomenclature revisions recommended by AHRI, including those for variables $Effy_{SS}$, v_{air}, L_J, Q_i, 60, 0.24, and 0.44. In addition, the variables for ΔT_i, $T_{i,In}$, $T_{i,Out}$ were not mentioned by AHRI but would be updated for consistency with the clarifications of the indices. The nomenclature definition for variable $Q_{IN,i}$ is relevant regardless of whether DOE ultimately adopts its proposal to directly measure airflow; therefore, DOE proposes to revise it within the test procedure for furnace fans at appendix AA as discussed in the paragraphs below.

In reviewing the suggested changes, DOE agrees with AHRI's recommended definitions for steady-state efficiency in airflow-control setting *i* ($Effy_{ss,i}$), jacket loss (L_J), clarification of the meaning of the indices for airflow(Q_i), humidity ratio (W), conversion from hours to minutes, the approximate specific heat capacity of dry air in Btu per pound per °F (''Btu/lb-°F''), the approximate specific heat capacity of saturated water vapor in Btu/lb-°F, and the correction of the units for the specific volume of air (v_{air}) in the nomenclature from lb/ft^3 to ft^3/lb. All other variables that would include the modified indices would also be updated in the nomenclature section of appendix AA including $\Delta T_{i,k}$, $T_{i,k,\ In}$, $T_{i,k,\ Out}$, and $Q_{IN,k}$. Should DOE not adopt the proposal to measure airflow directly, DOE tentatively concludes that providing a specific definition for each of these variables and constants would allow for increased clarity when calculating airflow. Therefore, should DOE not adopt the proposal to measure airflow directly, DOE would propose to include the following new definitions in section 9 of appendix AA:

- 60 = conversion factor from hours to minutes, (min/h)
- 0.24 = approximate specific heat capacity of dry, (Btu/lb-°F)
- 0.44 = approximate specific heat capacity of saturated water vapor, (Btu/lb-°F)
- $Effy_{ss,i}$ = Steady-State Efficiency in airflow-control setting i. For gas and oil furnaces, $Effy_{ss,i}$ as specified in Sections 11.2.7 (Non-Condensing and Non modulating), 11.3.7.3 (Condensing and Non modulating), 11.4.8.8 (Non-Condensing and Modulating), or 11.5 (Condensing and Modulating) of ASHRAE 103–2017, in %. For electric furnaces or modular blowers, $Eff_{yss,i}$ equals 100, in %.
- L_J = jacket loss as determined as specified in Section 8.6 of ASHRAE 103–2017 or a default value of 1% if the jacket loss test is not performed, in %
- $T_{i,k,\ In}$ = inlet air temperature at time of the electrical power measurement, in °F, in airflow-control setting *i* and heat setting *k,* where *i* can be ''Circ'' to represent constant-circulation (or minimum airflow) mode, ''Heat'' to represent heating mode, or ''Max'' to represent maximum airflow (typically designated for cooling) mode. If *i* = Heat, *k* can be ''H'' to represent the high heat setting or ''R'' to represent the reduced heat setting. If *i* = Max or Circ, *k* is not needed.
- $T_{i,k,\ Out}$ = average outlet air temperature as measured by the outlet thermocouple grid at time of the electrical power measurement, in °F, in airflow-control setting *i* and heat setting *k,* where *i* can be ''Circ'' to represent constant-circulation (or minimum airflow) mode, ''Heat'' to represent heating mode, or ''Max'' to represent maximum airflow (typically designated for cooling) mode. If *i* = Heat, *k* can be ''H'' to represent the high heat setting or ''R'' to represent the reduced heat setting. If *i* = Max or Circ, *k* is not needed.
- $\Delta T_{i,k}$ = $T_{i,k,\ Out}$ minus $T_{i,k,\ In}$, which is the air throughput temperature rise in setting *i* and heat setting *k,* in °F
- $Q_{i,k}$ = airflow in airflow-control setting *i* and heat setting *k,* in cubic feet per minute (CFM)
- $Q_{IN,k}$ = measured fuel energy input rate, in Btu/h, at specified operating conditions *k* based on the fuel's high heating value (HHV) determined as required in Section 8.2.1.3 or 8.2.2.3 of ASHRAE 103–2017, where *k* can be ''H'' for the maximum heat setting or ''R'' for the reduced heat setting.
- v_{air} = specific volume of dry air at specified operating conditions per the equations in the psychrometric chapter in 2001 ASHRAE Handbook—Fundamentals in ft^3/lb

DOE also agrees with AHRI's comment regarding the conversion factor from watts to Btu/h. Currently, the conversion factor multiplies watts by 3,413, and therefore converts the value to thousand Btu per hour per watt (''(kBtu/h)/W''). However, the measured fuel energy input rate, $Q_{IN,k}$, is expressed in Btu/h. Therefore, to stay consistent throughout the equation, the appropriate conversion factor is 3.413, which would convert watts to Btu/h. Although DOE is proposing to directly measure the maximum airflow for determining Q_{max} which obviates the need for the Q_i equation used to calculate Q_{max}, if DOE were to ultimately not adopt that proposal, DOE would propose the following equation for airflow in airflow-control setting *i* and heat setting *k* in section 10.1 of appendix AA:

$$Q_{i,k} = \frac{\left(Effy_{ss,k} - L_J\right) \times Q_{IN,k} + (3.413 \times E_k)}{60 \times (0.24 + 0.44 \times W) \times \left(\frac{1}{v_{air,k}}\right) \times \Delta T_{i,k}}$$

Finally, DOE agrees that there should be different variables assigned to represent relative humidity and the humidity ratio. To provide clarity regarding these variables, DOE proposes to redesignate the variable for relative humidity from ''W'' to ''φ.''

Issue 16: DOE requests comment on its proposals to add definitions to certain variables and constants in the airflow equation and change the conversion factor from (kBtu/h)/W to (Btu/h)/W in the event that DOE were to

decide not to adopt the proposal to directly measure airflow in the final rule. DOE seeks further comment regarding its proposal to redesignate the variable for relative humidity from ''W'' to ''φ.''

AHRI further commented that the hours used in the equation to calculate FER are assigned arbitrarily that do not represent the performance in either the north or the south. (AHRI, No. 5 at p. 12) DOE notes that these hours were estimated to be the national average for each function, and therefore represent the mean usage across the country, as opposed to the performance in any particular part of the country. DOE originally proposed these hours in the May 2012 NOPR. 77 FR 28673, 28683. AHRI responded in a comment to the May 2012 NOPR that DOE should calculate FER using the annual operating hours that DOE proposed.[16] 78 FR 19606, 19613. Therefore, DOE does not propose any deviation from the operating hours as outlined in Table IV.2 of appendix AA.

F. Thermocouple Accuracy

Section 5.1 of appendix AA, which references Section 5.1 of ASHRAE 37–2009, requires that temperature measuring instruments must be accurate to within 0.75 °F. Section 6 of appendix AA references Section 7 of ASHRAE 103–2007 for the test apparatus setup. Section 7.6 of ASHRAE 103–2007 includes instructions to take temperature measurements with thermocouple grids constructed of either 5, 9, or 17 thermocouples, depending on the stack diameter. The measurement accuracy of a thermocouple grid depends on the type and number of thermocouples used, as well as the magnitude of the air temperature being measured.

In the July 2021 RFI, DOE requested information regarding the number and types of thermocouples, or other temperature measurement devices, that laboratories use to measure the stack temperatures of oil-fired furnaces. DOE also sought feedback on whether the stack temperatures of gas-fired furnaces are likely to exceed 450 °F, and the accuracy of instruments used to test furnaces (gas- or oil-fired) with stack temperatures exceeding 450 °F. 86 FR 35660, 35665.

AHRI commented that stack temperatures of gas furnaces probably would not exceed 450 °F and recommended using five thermocouples in the stack to measure temperature. (AHRI, No. 5 at p. 10) AHRI commented that required thermocouple accuracy should be adjusted because thermocouples are only accurate to 1–2 degrees Celsius (''°C'') depending on the class of the product, while ASHRAE 37 (and by extension the DOE test method at appendix AA) require measurement devices to be accurate within ±0.75 °F. (*Id.*) AHRI recommended reviewing and updating the measurement tolerances to address this issue. (*Id.*) DOE did not receive any further comments on these topics.

As discussed in the July 2021 RFI, using the types of thermocouples commonly used in test facilities (including ''T-type'' and ''K-type''), DOE determined that the measurement accuracy required in appendix AA (0.75 °F) is achievable with a minimum of five thermocouples at temperatures up to approximately 450 °F. 89 FR 35660, 35665. This measurement accuracy requirement was calculated using the thermocouple characteristics found in Table 1 of ANSI/ASTM E230/E230M–17 [17] and assuming that the overall measurement accuracy is equal to the measurement tolerance of individual thermocouples of that type divided by the square root of the number of thermocouples. Assuming that the stack temperatures of gas furnaces would not likely exceed 450 °F as indicated by AHRI, DOE tentatively concludes that current instrumentation is adequate to measure the stack temperature of furnaces on the market and does not propose any changes to accuracy of temperature measuring instruments in appendix AA.

G. Burner Selection

In the July 2021 RFI, DOE requested comment on the potential impact (if any) of burner selection on furnace fan performance. DOE also requested comment on the potential approaches for specifying burner(s) for testing. 86 FR 35660, 35666. In response, AHRI asked for clarification regarding DOE's question, and indicated that it was unable to provide meaningful comment. (AHRI, No. 5 at p. 11)

DOE notes that there are oil-fired furnaces that are shipped without a burner, but for which the manufacturer instead provides several burner options in the accompanying product literature. These burners may have different steady-state heating efficiencies and/or different airflow resistance characteristics, that could result in differences in furnace fan operation and efficiency. Therefore, if different burner options are used in tests for a given oil furnace and if burner selection impacts FER, test repeatability issues could arise.

Because DOE did not receive any additional information about burner selection, DOE is not proposing to add any requirements related to burner selection into appendix AA at this time.

H. Reporting Requirements

NEEA and the CA IOUs encouraged DOE to require mandatory reporting of fan performance results for maximum/cooling, heating, and air circulation individually. (NEEA, No. 3 at p. 6; CA IOUs, No. 4 at p. 4) The CA IOUs suggested that this method of reporting would allow consumers and utility incentive program designers to better understand fan performance in each mode, which they assert is particularly important in regions where operation time in each mode differs from the FER weighting factors. (CA IOUs, No. 4 at p. 4) Similarly, NEEA commented that reporting the specific energy consumption values in each mode would provide information for planners for the adoption of efficient fan equipment suitable for their region. (NEEA, No. 3, at pp. 6–7) NEEA asserted that this additional reporting is reasonable, considering manufacturers already test for each consumption value separately. (*Id.* at p. 7)

Manufacturers, including importers, must use product-specific certification templates to certify compliance to DOE. For consumer furnace fans, the certification template reflects the general certification requirements specified at 10 CFR 429.12 and the product-specific requirements specified at 10 CFR 429.58. DOE is not proposing to amend the product-specific certification requirements for these products. Were DOE to finalize the proposals as amended, DOE would consider as part of a separate rulemaking whether amendments to the certification requirements and reporting for furnace fans would be warranted.

I. Test Procedure Costs and Harmonization

1. Test Procedure Costs and Impact

In this NOPR, DOE proposes to amend the existing test procedure for consumer furnace fans by specifying a test method for furnace fans that operate at low ESPs, incorporating by reference the most recent industry test procedures, clarifying the scope of the definition of ''furnace fans,'' directly measuring airflow, tightening ambient conditions, and clarifying language for airflow-

[16] For AHRI's comment see: *www.regulations.gov/comment/EERE-2010-BT-TP-0010-0016.*

[17] ANSI/ASTM E230/E230M–17, *Standard Specification For Temperature-Electromotive Force (Emf) Tables For Standardized Thermocouples.* Available at: *webstore.ansi.org/standards/astm/astme230e230m17.*

control settings. DOE has tentatively determined that only the proposed amendment requiring directly measuring air flow would impact testing costs as discussed in the following paragraphs.

a. Airflow Determination

DOE proposes to require that airflow be measured directly in appendix AA in accordance with procedures specified in ASHRAE 37–2009 (RA 2019). This would impose additional cost if a manufacturer or test laboratory does not already have an airflow-measuring device for testing other HVAC equipment, or if they would need to purchase one to specifically dedicate to testing furnace fans. DOE estimates a purchase price of approximately $50,000 for an airflow-measuring device that meets the requirements of ASHRAE 37–2009 (RA 2019). DOE recognizes that laboratories may have multiple test rigs, and that each test rig could require its own additional equipment. As an example, for a laboratory with two furnace fan test rigs, the cost associated with new test equipment resulting from this proposed requirement would be $100,000. However, DOE expects that not all manufacturers and test laboratories would need to purchase new equipment, since direct airflow measurement is performed for testing of other HVAC equipment and the necessary equipment could also be used for furnace fan testing, depending on the testing capacity at that site. As such, DOE is unable to estimate the total expected cost to industry that would be incurred as a result of this proposal. Further, this proposed change is intended to increase the accuracy of FER ratings and consistency of test results but would not be expected to change the actual performance of any units. Additionally, DOE is not proposing to require units that are currently certified to retest according to the updated test procedure.

Issue 17: DOE requests comment, specifically from manufacturers and third-party test laboratories, on whether costs would be incurred as a result of the proposals in this NOPR to require measuring airflow directly; and if so, the total incurred cost expected for each test facility.

DOE has initially determined that the proposed amendments would not impact the representations of consumer furnace fan energy efficiency. Based on the initial determination, manufacturers would be able to rely on data generated under the current test procedure should the proposed amendments be finalized. As such, retesting of consumer furnace fans would not be required solely as a result of DOE's adoption of the proposed amendments to the test procedure.

Issue 18: DOE requests comment on the impact and associated costs of the proposed amendments.

b. Additional Amendments

DOE does not anticipate that the remainder of the amendments proposed in this NOPR would impact test costs.

In response to petition for waiver and an application for interim waiver for heating-only furnace fans, DOE granted a waiver requiring use of an alternate test procedure that specifies alternate ESP test conditions for furnace fans that operate at low ESPs. Any such furnace fan models currently on the market have already been granted a test procedure waiver from DOE, which specifies use of the alternate test procedure. As such, DOE's proposal to incorporate a similar methodology as the waiver methodology into the test procedure for furnace fans that operate at low ESPs will not result in any additional costs for manufacturers.

DOE's proposal to incorporate by reference the most recent versions of ASHRAE 103, ASHRAE 37, and maintain by reference ASHRAE 41.1–1986 (RA 2006), would update references to the most recent versions of ASHRAE 103 and ASHRAE 37. As discussed previously, DOE's review of these standards indicates that reference to the latest versions of them would not impact FER ratings and would not require that manufacturers recertify their units. Therefore, manufacturers would not incur any additional costs.

DOE's proposal to define and explicitly exclude dual-fuel furnace fans from the scope of appendix AA would make clear that such products are not subject to testing under appendix AA, and would not impose any additional burden.

DOE's proposal to tighten ambient conditions would limit the permissible ambient temperature range to between 65 °F and 85 °F and the ambient humidity range to between 20 percent and 80 percent for both condensing and non-condensing furnaces. As discussed, appendix AA currently already limits ambient temperatures to between 65 °F and 85 °F, as well as humidity to below 80 percent for condensing furnaces, and DOE understands that testing laboratories are generally able to meet these criteria in their testing laboratories without the use of a specialized test chamber. Additionally, DOE tentatively concludes that it is unlikely that test laboratories would be unable to meet a minimum requirement of 20 percent, because that limit would exclude only the driest conditions. Therefore, DOE expects that test laboratories would not incur additional cost in applying these same temperature tolerances to testing of non-condensing furnaces as well. Similar to the proposal to directly measure the airflow in section III.J.1.a of this document, the ambient condition requirements proposed in this NOPR are intended to increase the accuracy of FER ratings and the consistency of test results but should not change the actual performance of any units. Additionally, DOE is not proposing to require units that are currently certified to retest according to the updated test procedure.

DOE's remaining proposals to clarify nomenclature and fix typographic errors would not result in any changes to the test conduct and therefore would not affect the cost of testing.

DOE has tentatively determined that manufacturers would be able to rely on data generated under the current test procedure, should any of these additional proposed amendments be finalized.

2. Harmonization With Industry Standards

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

The test procedure for consumer furnace fans at appendix AA incorporates by reference ASHRAE 103–2017, ASHRAE 37–2009, and ASHRAE 41.1–1986 (RA 2006), which provide test conditions, testing equipment, and methods for measuring the energy use of furnace fans.

In the July 2021 RFI, DOE sought comment on the availability of consensus-based test procedures for measuring the energy use of furnace fans that could be adopted without modification and more accurately or fully comply with the requirement that the test procedure produces results that measure energy use during a representative average use cycle for the product, and not be unduly burdensome to conduct. 86 FR 35660, 35665.

In response, AHRI commented that the industry test standard Canadian

Standards Organization (''CSA'') Standard C823:11 (R2021) ''Performance of air handlers in residential space conditioning systems'' specifies requirements for measuring both the air delivery and the electrical energy consumption of air handlers in residential space conditioning systems over a range of static pressures and speed control settings. (AHRI, No. 5 at p. 9) AHRI stated that while performance ratings can be developed for each of the air handler operating controls settings, manufacturers find this procedure to be unduly burdensome for regulatory purposes, where multiple test samples are required to establish ratings. (*Id.*) Upon review of the standard, DOE tentatively concludes that harmonizing DOE's test method with this test procedure could impose unnecessary burden on the testing facility and does not propose to reference or incorporate this procedure in its test procedure for consumer furnace fans.

AHRI also commented that it is beginning work on an industry rating procedure, AHRI 630 *Performance Rating of Annual Fuel Utilization Efficiency 2 (AFUE2) for Residential Furnaces,* the purpose of which is to establish for residential furnaces the following: Definitions; test requirements; rating requirements; minimum data requirements for published ratings; marking and nameplate data; and conformance conditions. (AHRI, No. 5 at p. 9) The scope is limited to products that are either a gas-fired or oil-fired central furnace, use single-phase electric current, and have a heat input rates of less than 225,000 Btu/h. (*Id.*) AHRI further stated that this standard will combine the three metrics used to rate residential furnaces—AFUE, as determined by DOE's test procedures for furnaces at appendix N; standby mode electrical consumption, as determined by appendix N; and the electric efficiency of furnace fans, as determined by appendix AA—into a single performance rating, ''AFUE2.'' AHRI asserted that AFUE2 will reduce consumer confusion and increase the opportunity for innovation through a streamlined performance rating. (*Id.*)

On October 12, 2018, DOE received a petition from AHRI (''AHRI Petition'') asking DOE to initiate notice-and-comment rulemaking to develop a new test procedure for residential furnaces and furnace fans which would replace the two currently required performance metrics for furnaces (*i.e.,* AFUE and $P_{W,SB}/P_{W,OFF}$) and the one performance metric for furnace fans (*i.e.,* FER) with a single new metric (*i.e.,* AFUE2). On November 14, 2018, DOE published a Notice of Petition for Rulemaking announcing the receipt of the AHRI Petition and inviting interested parties to submit comments. 83 FR 56746. After considering the AFUE2 metric and comments from interested parties, DOE published a final denial of petition for rulemaking on September 21, 2021. 86 FR 52422. In denying the petition, DOE determined that a combined test procedure and energy conservation standard for consumer furnaces and furnace fans would enable an increase in the maximum allowable energy use and/or minimum required efficiency of furnaces and furnace fans, which is impermissible under the ''anti-backsliding'' provision EPCA.[18] 86 FR 52422, 52423. DOE also determined that a unified metric for consumer furnaces and furnace fans (using the proposed combined metric AFUE2) would be contrary to DOE's prior determination that it is technologically infeasible to integrate active mode and standby or off mode energy use for furnaces. *Id.* DOE maintains its conclusions presented in the denial of the AHRI petition and for these reasons, did not further consider the AFUE2 test method.

The industry standards that DOE proposes to incorporate by reference via amendments described in this proposed rule are discussed in further detail in section IV.M of this document.

Issue 19: DOE requests comment on the benefits and burdens of the proposed updates and additions to industry standards referenced in the test procedure for consumer furnace fans.

J. Compliance Date and Waivers

EPCA prescribes that, if DOE amends a test procedure, all representations of energy efficiency and energy use, including those made on marketing materials and product labels, must be made in accordance with that amended test procedure, beginning 180 days after publication of such a test procedure final rule in the **Federal Register**. (42 U.S.C. 6293(c)(2)).

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

Upon the compliance date of test procedure provisions of an amended test procedure, should DOE issue a such an amendment, any waivers that had been previously issued and are in effect that pertain to issues addressed by such provisions are terminated. 10 CFR 430.27(h)(3). Recipients of any such waivers would be required to test the products subject to the waiver according to the amended test procedure as of the compliance date of the amended test procedure. The amendments proposed in this document pertain to issues addressed by waivers granted to ECR International, Inc. (Case number 2019–001). 86 FR 13530.

IV. Procedural Issues and Regulatory Review

A. Review Under Executive Order 12866 and 13563

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

[18] The ''anti-backsliding'' provision prevents the Secretary from prescribing any amended standard that either increases the maximum allowable energy use or decreases the minimum required energy efficiency of a covered product. (42 U.S.C. 6295(o)(1))

that such techniques may include identifying changing future compliance costs that might result from technological innovation or anticipated behavioral changes. For the reasons stated in the preamble, this proposed regulatory action is consistent with these principles.

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

B. Review Under the Regulatory Flexibility Act

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

1. Description of Reasons Why Action Is Being Considered

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

DOE is proposing amendments to the test procedures for consumer furnace fans in satisfaction of its statutory obligations under EPCA.

2. Objectives of, and Legal Basis for, Rule

DOE is required to review existing DOE test procedures for all covered products every 7 years to determine if an amended test procedure would more accurately or fully comply with the requirement that a test procedure be reasonably designed to measure energy efficiency during a representative average use cycle and not be unduly burdensome to conduct. (42 U.S.C. 6293(b)(1)(A))

3. Description and Estimate of Small Entities Regulated

For manufacturers of consumer furnace fans, the U.S. Small Business Administration (''SBA'') has set a size threshold, which defines those entities classified as ''small businesses'' for the purposes of the statute. DOE used the SBA's small business size standards to determine whether any small entities would be subject to the requirements of the rule. (*See* 13 CFR part 121.) The size standards are listed by North American Industry Classification System (''NAICS'') code and industry description and are available at *www.sba.gov/document/support--table-size-standards.* Manufacturing of consumer furnace fans is classified under NAICS 333415, ''Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing.'' The SBA sets a threshold of 1,250 employees or fewer for an entity to be considered as a small business for this category.

DOE reviewed this proposed rule under the provisions of the Regulatory Flexibility Act and the procedures and policies published on February 19, 2003. 68 FR 7990.

DOE conducted a market survey using available public information to identify manufacturers of the products covered by this rulemaking. DOE's research involved its Compliance Certification Database (''CCD''),[19] California Energy Commission's Modernized Appliance Efficiency Database System (''MAEDbS''),[20] individual company websites, and consumer furnace fan energy conservation standards rulemakings[21] to create a list of companies that manufacture or sell consumer furnace fans in the United States. DOE then consulted other publicly available data, such as manufacturer specifications and product literature, U.S. import and export data (*e.g.,* Panjiva[22]) and basic model numbers, to identify original equipment manufacturers (''OEMs'') of the products covered by this proposed rulemaking. DOE further relied on public sources and subscription-based market research tools (*e.g.,* Dun & Bradstreet reports[23]) to determine company location, headcount, and annual revenue. DOE screened out companies that do not offer products covered by this proposed rulemaking, do not meet the SBA's definition of a ''small business,'' or are foreign-owned and operated.

DOE initially identified 25 OEMs offering consumer furnace fans for the domestic market. Of the 25 OEMs identified, DOE estimates that eight companies qualify as small businesses and are not foreign-owned and operated.

4. Description and Estimate of Compliance Requirements

In this NOPR, DOE proposes to amend the existing test procedure for consumer furnace fans by (1) specifying testing instructions for furnace fans incapable of operating at the required external static pressure (''ESP''); (2) incorporating by reference the most recent versions of industry standards, ASHRAE 103–2017 and ASHRAE 37–2009 (RA 2019), in 10 CFR 430.3; (3) defining dual-fuel furnace fans and excluding them from the scope of appendix AA; (4) changing the term ''default airflow-control settings'' to ''specified airflow-control settings''; (5) adding provisions to directly measure airflow; (6) revising the ambient temperature condition allowed during testing; and (7) assigning an allowable range of relative humidity during testing.

DOE has tentatively determined that only the proposed amendment requiring directly measuring air flow would impact testing costs. This amendment would impose additional testing costs if a manufacturer or test laboratory does not already have an airflow-measuring device for testing other HVAC equipment, or if they would need to purchase one to specifically dedicate to testing furnace fans. DOE estimates a

[19] DOE's Compliance Certification Database, *www.regulations.doe.gov/certification-data/* (last accessed February 2, 2022).

[20] California Energy Commission's Modernized Appliance Efficiency Database System, *cacertappliances.energy.ca.gov/Pages/Search/AdvancedSearch.aspx* (last accessed February 2, 2022).

[21] DOE relied on written comments submitted by AHRI in response to the consumer furnace fan energy conservation standards RFI published in the **Federal Register** on November 23, 2021. 86 FR 66465. (AHRI, No. 11, p. 7).

[22] Panjiva: S&P Global. Available at: *panjiva.com/import-export/United-States* (Last access February 25, 2022).

[23] The Dun & Bradstreet Hoovers subscription login is accessible online at *app.dnbhoovers.com/* (last accessed February 25, 2022).

purchase price of approximately $50,000 for an airflow-measuring device that meets the requirements of ASHRAE 37–2009 (RA 2019). DOE estimates that domestic small businesses would incur this one-time cost associated with the proposed change to measure airflow directly, if they do not already have the necessary apparatus to directly measure airflow. This cost is not re-occurring, and DOE does not expect that any of the proposed changes would increase the cost of performing testing on an ongoing basis. Furthermore, DOE is not proposing to require units that are currently certified to retest according to the updated test procedure.

DOE identified eight small, domestic OEMs that manufacture the products covered by this rulemaking. DOE does not have a method for determining which manufacturers have an existing airflow-measuring device that meets the requirements of ASHRAE 37–2009 (RA 2019). For the cost analysis, DOE assumed all small manufacturers identified would purchase the additional equipment. DOE estimates that the annual revenue of these small companies range from $4.8 million to $187.4 million, with an average annual revenue of $61.8 million.[24] Using the $50,000 one-time cost estimate, DOE expects that the additional costs associated with this NOPR would account for one percent or less of annual revenue for each small business.

Issue 20: DOE requests comment on the number of small consumer furnace fan manufacturers. DOE also seeks comment on DOE's estimates of potential costs these small manufacturers may incur.

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

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

6. A Description of Significant Alternatives to the Rule

DOE considered alternative test methods and modifications to the test procedure for consumer furnace fans, and the Department has initially determined that there are no better alternatives than the modifications and test procedures proposed in this Notice, in terms of both meeting the agency's objectives and reducing burden. Specifically, DOE is aware of and did consider several other methods of directly measuring the airflow, such as methods outlined in AMCA 210 (*e.g.,* the pitot traverse method),[25] duct-mounted airflow measurement devices, and anemometers. However, DOE has tentatively determined that the proposed approach to measure airflow as specified by ASHRAE 37–2009 offers the most accurate and repeatable option for direct measurement of airflow and is not unduly burdensome.

DOE is requesting comment on methods of direct airflow measurement that would be appropriate alternatives to the proposal in this document, including requesting comment on the expected measurement accuracy and the cost of associated instrumentation.

DOE also examined relevant industry test standards, and the Department incorporated these standards in the proposed test procedures whenever appropriate. Specifically, this NOPR incorporates by reference the most recent versions of industry standards, ASHRAE 103–2017 and ASHRAE 37–2009 (RA 2019), in 10 CFR 430.3.

Additionally, manufacturers subject to DOE's energy efficiency standards may apply to DOE's Office of Hearings and Appeals for exception relief under certain circumstances. 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 furnace fans 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 all covered consumer products and commercial equipment, including consumer furnace fans. (*See generally* 10 CFR part 429.) The collection-of-information requirement for the certification and recordkeeping is subject to review and approval by OMB under the Paperwork Reduction Act (''PRA''). This requirement has been approved by OMB under OMB control number 1910–1400. Public reporting burden for the certification is estimated to average 35 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

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

E. Review Under Executive Order 13132

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

[24] DOE relied on information from Dun & Bradstreet to estimate the annual revenues of the eight small businesses identified. The Dun & Bradstreet subscription login is accessible at: *app.dnbhoovers.com/* (Last accessed February 25, 2022).

[25] *See: https://www.amca.org/assets/resources/public/pdf/Education%20Modules/AMCA%20210-16.pdf.* (Last accessed 4/7/2022.)

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

F. Review Under Executive Order 12988

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

G. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (''UMRA'') requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Public Law 104–4, sec. 201 (codified at 2 U.S.C. 1531). For a proposed regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed ''significant intergovernmental mandate,'' and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect small governments. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820; also available at *energy.gov/gc/office-general-counsel.*

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 consumer furnace fans is not a significant regulatory action under Executive Order 12866. Moreover, it would not have a significant adverse effect on the supply, distribution, or use of energy, nor has it been designated as a significant energy action by the Administrator of OIRA. Therefore, it is not a significant energy action, and, accordingly, DOE has not prepared a Statement of Energy Effects.

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

Under section 301 of the Department of Energy Organization Act (Pub. L. 95–91; 42 U.S.C. 7101), DOE must comply with section 32 of the Federal Energy Administration Act of 1974, as amended by the Federal Energy Administration Authorization Act of 1977. (15 U.S.C.

788; ''FEAA'') Section 32 essentially provides in relevant part that, where a proposed rule authorizes or requires use of commercial standards, the notice of proposed rulemaking must inform the public of the use and background of such standards. In addition, section 32(c) requires DOE to consult with the Attorney General and the Chairman of the Federal Trade Commission (''FTC'') concerning the impact of the commercial or industry standards on competition.

The proposed modifications to the test procedure for consumer furnace fans would incorporate testing methods contained in certain sections of the following commercial standards: ASHRAE 103–2017, ASHRAE 37–2009 (RA 2019), and ASHRAE 41.1–1986 (RA 2006). DOE has evaluated these standards and is unable to conclude whether they fully comply with the requirements of section 32(b) of the FEAA (*i.e.,* whether it was developed in a manner that fully provides for public participation, comment, and review.) DOE will consult with both the Attorney General and the Chairman of the FTC concerning the impact of these test procedures on competition, prior to prescribing a final rule.

M. Description of Materials Incorporated by Reference

In this NOPR, DOE proposes to incorporate by reference the following test standards:

(1) The test standard published by ANSI/ASHRAE, titled *Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers,* ASHRAE 103–2017. ASHRAE 103–2017 is an industry-accepted test procedure for measuring the performance of consumer furnaces and boilers. Copies of ASHRAE 103–2017 may be purchased from ANSI at 1899 L Street NW, 11th Floor, Washington, DC 20036, or by going to *webstore.ansi.org/standards/ashrae/ansiashrae1032017.*

(2) The test standard published by ASHRAE, titled *Methods of Testing for Rating Electrically Driven Unitary Air-Conditioning and Heat Pump Equipment,* ANSI/ASHRAE Standard 37–2009 (RA 2019). ANSI/ASHRAE Standard 37–2009 (R 2109) is an industry-accepted test procedure that provides a method of test for many categories of air conditioning and heating equipment. ANSI/ASHRAE Standard 37–2009 (RA 2019) is available on ANSI's website at *webstore.ansi.org/RecordDetail.aspx?sku=ANSI%2FASHRAE+Standard+37-2009.*

(3) The test standard published by AMCA, titled *Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating,* ANSI/AMCA 210–07. ANSI/AMCA 210–07 is an industry-accepted standard that prescribes methods of testing fans and other air moving devices. ANSI/AMCA 210–07 is available on ANSI's website at *webstore.ansi.org/standards/amca/ansiamca21007.*

(4) The test standard published by ASHRAE, titled *Standard Methods for Laboratory Airflow Measurement,* ASHRAE 41.2–1987 (RA 1992). ASHRAE 41.2–1987 (RA 1992) is an industry-accepted standard that prescribes pressure measurement for the calculation of airflow under laboratory conditions. ASHRAE 41.2–1987 (RA 1992) is available on ANSI's website at *webstore.ansi.org/standards/ashrae/ansiashrae411987ra92.*

The Director of the Federal Register previously approved ASHRAE 41.1–1986 (RA 2006) for incorporation by reference in the locations in which it appears in this proposed rule's regulatory text for 10 CFR part 430.

V. Public Participation

A. Participation in the Webinar

The time and date of the webinar meeting are listed in the **DATES** section at the beginning of this document. Webinar registration information, participant instructions, and information about the 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 proposed rule, 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.

DOE requests persons selected to make an oral presentation to submit an advance copy of their statements at least two weeks before the webinar. At its discretion, DOE may permit persons who cannot supply an advance copy of their statement to participate, if those persons have made advance alternative arrangements with the Building Technologies Office. As necessary, requests to give an oral presentation should ask for such alternative arrangements.

C. Conduct of the Webinar

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

The webinar will be conducted in an informal, conference style. DOE will present a general overview of the topics addressed in this proposed rulemaking, allow time for prepared general statements by participants, and encourage all interested parties to share their views on issues affecting this 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 proposed rulemaking. The official conducting the webinar will accept additional comments or questions from those attending, as time permits. The presiding official will announce any further procedural rules or modification of the above procedures that may be needed for the proper conduct of the webinar.

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 no later than the date provided in the **DATES** section at the beginning of this proposed rule.[26] 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 or in any documents attached to your comment. Any information that you do not want to be publicly viewable should not be included in your comment, nor in any document attached to your comment. Persons viewing comments will see only first and last names, organization names, correspondence containing comments, and any documents submitted with the comments.

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

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

Submitting comments via email. Comments and documents submitted via email 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. No faxes will be accepted.

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

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

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

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

E. Issues on Which DOE Seeks Comment

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

Issue 1: DOE requests information and data regarding the electrical energy consumption of multi-stage furnace fans during low-stage cooling operation, specifically in relation to single-stage furnace fans in cooling mode.

Issue 2: DOE requests comment on its proposed definition for dual-fuel units. DOE further requests comment on its proposal to explicitly exclude these units from the scope of appendix AA.

Issue 3: DOE requests comment on its proposal to incorporate by reference ASHRAE 103–2017, ASHRAE 37–2009 (RA 2019), and maintain by reference ASHRAE 41.1–1986 (RA 2006).

Issue 4: DOE requests comment on the proposed test instructions for furnace fans unable to complete testing at the ESP values currently specified in appendix AA.

Issue 5: DOE requests comment on its tentative decision not to tighten the tolerance on fuel input ratings beyond what is required in ASHRAE 103–2017.

Issue 6: DOE requests comment on its proposal to modify the allowable ambient temperature range in appendix AA such that for all tests and all furnaces (*i.e.,* both condensing and non-condensing), ambient air temperature must be maintained between 65 °F and 85 °F. DOE also requests comment regarding any potential burden associated with the change in allowable ambient temperature. Additionally, DOE requests data of the typical ambient temperatures of testing facilities throughout the year as well as any data on the relationship between ambient temperature and FER.

[26] 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.

Issue 7: DOE requests comment on its proposal to require maintaining the room air RH between 20 percent and 80 percent during FER testing, and on its tentative determination that this proposal would decrease variability between tests. DOE also requests comment on its tentative determination that the requirement of room air RH to be maintained between 20 percent and 80 percent would not add burden for manufacturers or test laboratories. DOE requests comment on whether a tighter range for RH during testing (for example, 30 percent to 50 percent RH, which could further improve representativeness and further increase repeatability beyond the proposed range) would be possible to maintain without being unduly burdensome. DOE seeks data on ambient RH values at test facilities throughout the year and any data on the relationship between RH and FER variability.

Issue 8: DOE requests comment on its tentative conclusion that measuring airflow directly would be more accurate and result in less variability than the current method of calculating airflow based on temperature rise. Additionally, DOE requests comment on its estimated cost for an apparatus to measure airflow directly (up to $50,000). DOE also requests comment on whether test laboratories would need to purchase additional equipment for testing, if DOE adopts this proposal to measure4 airflow directly, or if test laboratories generally already have this equipment available.

Issue 9: DOE requests comment on whether it is necessary to reference AMCA 210–2007 and ASHRAE 41.2–1987 (RA 1992) in the test procedure instructions for constructing an airflow measuring apparatus.

Issue 10: DOE requests comment on alternative methods of direct airflow measurement, other than using the procedures and methods for measuring airflow specified in ASHRAE 37–2009 (RA 2019). For these alternatives, DOE requests comment on the expected measurement accuracy, the cost of associated instrumentation, and appropriate associated setup and operation procedures.

Issue 11: DOE requests comment on whether requiring that the external static pressure be measured at the location specified in Section 6.4 of ASHRAE 37–2009, as opposed to specifying that external static pressure taps always be placed 18 inches from the outlet, could improve test repeatability. DOE also requests comment on whether manufacturer facilities and other test laboratories would be able to accommodate the added duct length during testing. Further, if test facilities would not be able to accommodate the added duct length during testing, DOE requests comment on whether a different length requirement could improve test repeatability while not preventing any existing test facilities from completing a valid test for furnace fans.

Issue 12: DOE seeks comment on its proposal to change the term ''default airflow-control settings'' to ''specified airflow-control settings'' and to add the phrase ''unless otherwise specified within the test procedure'' to the end of the revised term's definition.

Issue 13: DOE requests further comment on this issue of whether it is necessary to specify that the maximum heating airflow-control setting used during testing be one that also allows for operation within the manufacturer-specified temperature rise range during testing. DOE is also interested in information regarding how often furnace fans operate outside of the manufacturer-specified temperature rise range during FER testing under the current requirements.

Issue 14: DOE requests data and information on the methods and granularity with which test facilities currently measure the aforementioned variables, particularly furnace fan power (E_{Max}, E_{Circ}, and E_{Heat}). DOE also requests comment on the intervals at which test facilities are currently capable of recording these measurements with their current instrumentation. Finally, DOE also requests information on whether there are variables besides the fan power consumption variables for which there are significant fluctuations in measurements that DOE should also consider requiring be determined as an average of multiple measurements.

Issue 15: DOE requests comment on the number of samples that should be taken and the length of time over which data should be collected in order for a representative average to be achieved. DOE also requests comment on the associated costs, if any, to upgrade measurement instruments or software to be able to collect furnace fan power consumption measurements at frequencies of once per second, once per minute, once per 5 minutes, and/or other recommended sampling frequencies.

Issue 16: DOE requests comment on its proposals to add definitions to certain variables and constants in the airflow equation and change the conversion factor from (kBtu/h)/W to (Btu/h)/W in the event that DOE were to decide not to adopt the proposal to directly measure airflow in the final rule. DOE seeks further comment regarding its proposal to redesignate the variable for relative humidity from ''W'' to ''φ.''

Issue 17: DOE requests comment, specifically from manufacturers and third-party test laboratories, on whether costs would be incurred as a result of the proposals in this NOPR to require measuring airflow directly; and if so, the total incurred cost expected for each test facility.

Issue 18: DOE requests comment on the impact and associated costs of the proposed amendments.

Issue 19: DOE requests comment on the benefits and burdens of the proposed updates and additions to industry standards referenced in the test procedure for consumer furnace fans.

Issue 20: DOE requests comment on the number of small consumer furnace fan manufacturers. DOE also seeks comment on DOE's estimates of potential costs these small manufacturers may incur.

VI. Approval of the Office of the Secretary

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

List of Subjects in 10 CFR Part 430

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

Signing Authority

This document of the Department of Energy was signed on May 2, 2022, by Kelly J. Speakes-Backman, Principal Deputy Assistant Secretary for Energy Efficiency and Renewable Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the **Federal Register**.

Signed in Washington, DC, on May 3, 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

part 430 of Chapter II of Title 10, Code of Federal Regulations as set forth below:

PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS

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

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

■ 2. Section 430.3 is amended by:
■ a. Redesignating paragraphs (b)(3) and (4) as paragraphs (b)(4) and (5);
■ b. Adding new paragraph (b)(3);
■ c. Redesignating paragraphs (g)(17) and (18) as (g)(19) and (20) and paragraphs (g)(5) through (16) as paragraphs (g)(6) through (17), respectively;
■ d. Adding new paragraph (g)(5);
■ e. In newly redesignated paragraph (g)(6), removing the text ''(Reaffirmed 2006)'' and adding, in its place, the text ''(Reaffirmed 2006) (''ASHRAE 41.1–1986 (RA 2006)'')'';
■ f. In newly redesignated paragraph (g)(9), removing the text ''appendix F'' and adding in its place, the text ''appendices F and AA'';
■ g. In newly redesignated paragraph (g)(17), removing the text ''appendices O and AA'' and adding in its place, the text ''appendix O''; and
■ h. Adding new paragraph (g)(18).

The revisions and additions read as follows:

§ 430.3 Materials incorporated by reference.

* * * * *

(b) * * *

(3) ANSI/AMCA 210–07, ANSI/ASHRAE 51–07 (''AMCA 210–2007''), Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating, ANSI-approved August 17, 2007, IBR approved for appendix AA to subpart B.

* * * * *

(g) * * *

(5) ANSI/ASHRAE Standard 37–2009 (RA 2019), (''ASHRAE 37–2009 (RA 2019)''), Methods of Testing for Rating Electrically Driven Unitary Air-Conditioning and Heat Pump Equipment (including Errata Sheets issued October 3, 2016 and April 25, 2019, ANSI-approved June 21; 2019, IBR approved for appendix AA to subpart B.

* * * * *

(18) ANSI/ASHRAE Standard 103–2017, (''ASHRAE 103–2017''), Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers; ANSI-approved July 3, 2017, IBR approved for appendices AA to subpart B.

* * * * *

■ 3. Appendix AA to subpart B of part 430 is revised to read as follows:

Appendix AA to Subpart B of Part 430—Uniform Test Method for Measuring the Energy Consumption of Furnace Fans

0. Incorporation by Reference

DOE incorporated by reference in § 430.3, the entire standard for ASHRAE 103–2017, ASHRAE 37–2009 (RA 2019), ASHRAE 41.1–1986 (RA 2006), AMCA 210–07, and ASHRAE 41.2–1987 (RA 1992). In cases where there is a conflict, the language of the test procedure in this appendix takes precedence over the incorporated standards. Only enumerated provisions of AMCA 210–07 and ASHRAE 41.2–1987 (RA 1992) are applicable to this appendix, as follows:

0.1 AMCA 210–07

(i) Figure 12—Outlet Chamber Setup—Multiple Nozzles in Chamber

0.2 ASHRAE 41.2–1987 (RA 1992)

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

(ii) Figure 14—Outlet Chamber Setup for Multiple Nozzles in Chamber

1. *Scope.* This appendix covers the test requirements used to measure the energy consumption of fans used in weatherized and non-weatherized gas furnaces, oil furnaces, electric furnaces, and modular blowers. This appendix does not apply to furnace fans used in dual-fuel units.

2. *Definitions.* Definitions include the definitions as specified in Section 3 of ASHRAE 103–2017 and the following additional definitions, some of which supersede definitions found in ASHRAE 103–2017:

2.1. *Active mode* means the condition in which the product in which the furnace fan is integrated is connected to a power source and circulating air through ductwork.

2.2. *Airflow-control settings* are programmed or wired control system configurations that control a fan to achieve discrete, differing ranges of airflow—often designated for performing a specific function (*e.g.,* cooling, heating, or constant circulation)—without manual adjustment other than interaction with a user-operable control such as a thermostat that meets the manufacturer specifications for installed-use. For the purposes of this appendix, manufacturer specifications for installed-use shall be found in the product literature shipped with the unit.

2.3. *Dual-fuel unit* means a consumer product that includes both a heat pump and a burner in a single cabinet.

2.4. *External static pressure* (ESP) means the difference between static pressures measured in the outlet duct and return air opening (or return air duct when used for testing) of the product in which the furnace fan is integrated.

2.5. *Furnace fan* means an electrically-powered device used in a consumer product for the purpose of circulating air through ductwork.

2.6. *Modular blower* means a product which only uses single-phase electric current, and which:

(a) Is designed to be the principal air circulation source for the living space of a residence;

(b) Is not contained within the same cabinet as a furnace or central air conditioner; and

(c) Is designed to be paired with HVAC products that have a heat input rate of less than 225,000 Btu per hour and cooling capacity less than 65,000 Btu per hour.

2.7. *Off mode* means the condition in which the product in which the furnace fan is integrated either is not connected to the power source or is connected to the power source but not energized.

2.8. *Seasonal off switch* means a switch on the product in which the furnace fan is integrated that, when activated, results in a measurable change in energy consumption between the standby and off modes.

2.9. *Specified airflow-control settings* are the airflow-control settings specified for installed-use by the manufacturer. For the purposes of this appendix, manufacturer specifications for installed-use are those specifications provided for typical consumer installations in the product literature shipped with the product in which the furnace fan is installed. In instances where a manufacturer specifies multiple airflow-control settings for a given function to account for varying installation scenarios, the highest airflow-control setting specified for the given function shall be used for the procedures specified in this appendix, unless otherwise specified within this test procedure.

2.10. *Standby mode* means the condition in which the product in which the furnace fan is integrated is connected to the power source and energized, but the furnace fan is not circulating air.

2.11. *Thermal stack damper* means a type of stack damper that opens only during the direct conversion of thermal energy of the stack gases.

3. *Classifications.* Classifications are as specified in Section 4 of ASHRAE 103–2017.

4. *Requirements.* Requirements are as specified in Section 5 of ASHRAE 103–2017. In addition, Fan Energy Rating (FER) of furnace fans shall be determined using test data and estimated national average operating hours pursuant to section 10.1 of this appendix.

5. *Instruments.* Instruments must be as specified in section 6, not including Section 6.2, of ASHRAE 103–2017; and as specified in section 5.1 and 5.2 of this appendix.

5.1. *Temperature.* Temperature measuring instruments shall meet the provisions specified in Section 5.1 of ASHRAE 37–2009 (RA 2019), including the references to ASHRAE 41.1–1986 (RA 2006), and shall be accurate to within 0.75 degrees Fahrenheit (within 0.4 degrees Celsius).

5.1.1. *Outlet Air Temperature Thermocouple Grid.* Outlet air temperature shall be measured as described in Section 8.2.1.5.5 of ASHRAE 103–2017 and illustrated in Figure 2 of ASHRAE 103–2017. Thermocouples shall be placed downstream

of pressure taps used for external static pressure measurement.

5.2. *Humidity.* Air humidity shall be measured with a relative humidity sensor that is accurate to within 5% relative humidity. Air humidity shall be measured as close as possible to the inlet of the product in which the furnace fan is installed.

6. *Apparatus.* The apparatus used in conjunction with the furnace during the testing shall be as specified in Section 7 of ASHRAE 103–2017 except for section 7.1, the second paragraph of sections 7.2.2.2, 7.2.2.5, and 7.7, and as specified in sections 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, and 6.7 of this appendix.

6.1. *General.* The product in which the furnace fan is integrated shall be installed in the test room in accordance with the product manufacturer's written instructions that are shipped with the product unless required otherwise by a specific provision of this appendix. The apparatus described in this section is used in conjunction with the product in which the furnace fan is integrated. Each piece of the apparatus shall conform to material and construction specifications and the reference standard cited. Test rooms containing equipment shall have suitable facilities for providing the utilities necessary for performance of the test and be able to maintain conditions within the limits specified.

6.2. *Downflow furnaces.* Install the internal section of vent pipe the same size as the flue collar for connecting the flue collar to the top of the unit, if not supplied by the manufacturer. Do not insulate the internal vent pipe during steady-state test described in Section 9.1 of ASHRAE 103–2017. Do not insulate the internal vent pipe before the cool-down and heat-up tests described in Sections 9.5 and 9.6, respectively, of ASHRAE 103–2017. If the vent pipe is surrounded by a metal jacket, do not insulate the metal jacket. Install a 5-ft test stack of the same cross sectional area or perimeter as the vent pipe above the top of the furnace. Tape or seal around the junction connecting the vent pipe and the 5-ft test stack. Insulate the 5-ft test stack with insulation having a minimum R-value of 7 and an outer layer of aluminum foil. (*See* Figure 3–E of ASHRAE 103–2017.)

6.3. *Modular Blowers.* A modular blower shall be equipped with the electric heat resistance kit that is likely to have the largest volume of retail sales with that particular basic model of modular blower.

6.4. *Ducts and Plenums.* Ducts and plenums shall be built to the geometrical specifications in Section 7 of ASHRAE 103–2017 and section 6.7 of this appendix. An apparatus for measuring external static pressure shall be integrated in the plenum and test duct as specified in Sections 6.4 of ASHRAE 37–2009 (RA 2019), excluding specifications regarding the minimum length of the ducting and minimum distance between the external static pressure taps and product inlet and outlet, and Section 6.5 of ASHRAE 37–2009 (RA 2019). External static pressure measuring instruments shall be placed between the furnace openings and any restrictions or elbows in the test plenums or ducts. For all test configurations, external static pressure taps shall be placed 18 inches from the outlet.

6.4.1. *For tests conducted using a return air duct.* Additional external static pressure taps shall be placed 12 inches from the product inlet. Pressure shall be directly measured as a differential pressure as depicted in Figure 8 of ASHRAE 37–2009 (RA 2019) rather than determined by separately measuring inlet and outlet static pressure and subtracting the results.

6.4.2. *For tests conducted without a return air duct.* External static pressure shall be directly measured as the differential pressure between the outlet duct static pressure and the ambient static pressure as depicted in Figure 7a of ASHRAE 37–2009 (RA 2019).

6.5. *Air Filters.* Air filters shall be removed.

6.6. *Electrical Measurement.* Only electrical input power to the furnace fan (and electric resistance heat kit for electric furnaces and modular blowers) shall be measured for the purposes of this appendix. Electrical input power to the furnace fan and electric resistance hate kit shall be sub-metered separately. Electrical input power to all other electricity-consuming components of the product in which the furnace fan is integrated shall not be included in the electrical input power measurements used in the FER calculation. If the procedures of this appendix are being conducted at the same time as another test that requires metering of components other than the furnace fan and electric resistance heat kit, the electrical input power to the furnace fan and electric resistance heat kit shall be sub-metered separately from one another and separately from other electrical input power measurements.

6.7. *Airflow Measuring Apparatus.*

6.7.1. Fabricate and operate an airflow measuring apparatus as specified in Sections 6.2 and 6.3 of ASHRAE 37–2009 (RA 2019). Place the static pressure taps and position the diffusion baffle (settling means) relative to the chamber inlet as indicated in Figure 12 of AMCA 210–07 and/or Figure 14 of ASHRAE 41.2–1987 (RA 1992). When measuring the static pressure difference across nozzles and/or velocity pressure at nozzle throats using electronic pressure transducers and a data acquisition system, if high frequency fluctuations cause measurement variations to exceed the test tolerance limits specified in Section 9.2 and Table 2 of ASHRAE 37–2009 (RA 2019), dampen the measurement system such that the time constant associated with response to a step change in measurement (time for the response to change 63% of the way from the initial output to the final output) is no longer than five seconds.

6.7.2. Connect the airflow measuring apparatus to the outlet duct of the unit at a distance of at least $0.5 \times (A \times B)^{1/2}$ (where A and B are the duct dimensions) downstream of the outlet pressure taps (specified in section 6.4 of this appendix).

7. *Test Conditions.* The testing conditions shall be as specified in Section 8, not including Sections 8.5.2 and 8.6.1.1 of ASHRAE 103–2017; and as specified in sections 7.1 and 7.2 of this appendix.

7.1. *Ambient Temperature and Humidity Conditions.* During the time required to perform all tests, maintain the room temperature within ±5 °F (2.8 °C) of the air temperature value measured at the end of the steady-state performance test (T_{RA}). For condensing furnaces and boilers, maintain the relative humidity within ±5% of the relative humidity measured at the end of the steady-state performance test. During all tests, the room temperature shall not fall below 65 °F (18.3 °C) or exceed 85 °F (29.4 °C) and the relative humidity shall not fall below 20% or exceed 80%.

7.2. *Measurement of Jacket Surface Temperature (optional).* The jacket of the furnace or boiler shall be subdivided into 6-inch squares when practical, and otherwise into 36-square-inch regions comprising 4 in. x 9 in. or 3 in. x 12 in. sections, and the surface temperature at the center of each square or section shall be determined with a surface thermocouple. The 36-square-inch areas shall be recorded in groups where the temperature differential of the 36-square-inch area is less than 10 °F for temperature up to 100 °F above room temperature and less than 20 °F for temperature more than 100 °F above room temperature. For forced air central furnaces, the circulating air blower compartment is considered as part of the duct system and no surface temperature measurement of the blower compartment needs to be recorded for the purpose of this test. For downflow furnaces, measure all cabinet surface temperatures of the heat exchanger and combustion section, including the bottom around the outlet duct, and the burner door, using the 36 square-inch thermocouple grid. The cabinet surface temperatures around the blower section do not need to be measured (*see* Figure 3–E of ASHRAE 103–2017.)

8. *Test Procedure.* Testing and measurements shall be as specified in Section 9 of ASHRAE 103–2017 except for Sections 9.1.2.1, 9.3, 9.5.1.1, 9.5.1.2.1, 9.5.1.2.2, 9.5.2.1, and Section 9.7.1; and as specified in sections 8.1 through 8.6 of this appendix.

8.1. *Direct Measurement of Off-Cycle Losses Testing Method.* [Reserved]

8.2. *Measurement of Electrical Standby and Off Mode Power.* [Reserved]

8.3. *Steady-State Conditions for Hot Flow Tests for Gas and Oil Furnaces.* Steady-state conditions are indicated by an external static pressure within the range shown in Table 1 of this appendix and a temperature variation in three successive readings, taken 15 minutes apart, of not more than any of the following:

(a) 3 °F in the stack gas temperature for furnaces equipped with draft diverters;

(b) 5 °F in the stack gas temperature for furnaces equipped with either draft hoods, direct exhaust, or direct vent systems; and

(c) 1 °F in the flue gas temperature for condensing furnaces.

8.4. *Steady-state Conditions for Hot Flow Tests for Electric Furnaces and Modular Blowers.* Steady-state conditions are indicated by an external static pressure within the range shown in Table 1 of this appendix and a temperature variation of not more than 5 °F in the outlet air temperature in four successive temperature readings taken 15 minutes apart.

8.5. *Steady-State Conditions for Cold Flow Tests.* For tests during which the burner or

electric heating elements are turned off (*i.e.,* cold flow tests), steady-state conditions are indicated by an external static pressure within the range shown in Table 1 of this appendix and a variation in the difference between outlet temperature and ambient temperature of not more than 3 °F in three successive temperature readings taken 15 minutes apart.

8.6. *Fan Energy Rating (FER) Test.*

8.6.1. *Initial FER test conditions and maximum airflow-control setting measurements.* Measure the relative humidity (φ) and dry bulb temperature (T_{db}) of the test room.

8.6.1.1. *Furnace fans for which the maximum airflow-control setting is not a specified heating airflow-control setting.* The main burner or electric heating elements shall be turned off. Adjust the external static pressure to within the range shown in table 1 of this appendix. Maintain these settings until steady-state conditions are attained as specified in section 8.3, 8.4, and 8.5 of this appendix. Measure furnace fan electrical input power (E_{Max}), and airflow (Q_{Max}).

8.6.1.2. *Furnace fans for which the maximum airflow-control setting is a specified heating airflow-control setting.* Adjust the main burner or electric heating element controls to the default heat setting designated for the maximum airflow-control setting. Burner adjustments shall be made as specified by Section 8.4.1 of ASHRAE 103–2017. Adjust the furnace fan controls to the maximum airflow-control setting. Adjust the external static to within the range shown in table 1 of this appendix. Maintain these settings until steady-state conditions are attained as specified in section 8.3, 8.4, and 8.5 of this appendix and the temperature rise (ΔT_{Max}) is at least 18 °F. Measure furnace fan electrical input power (E_{Max}) and airflow (Q_{Max}).

TABLE 1—REQUIRED MINIMUM EXTERNAL STATIC PRESSURE IN THE MAXIMUM AIRFLOW-CONTROL SETTING BY INSTALLATION TYPE

Installation type	ESP (in. wc.)*
Units with an internal, factory-installed evaporator coil	0.50–0.55
Units designed to be paired with an evaporator coil, but without one installed	0.65–0.70
Mobile home	0.30–0.35

*Once the specified ESP has been achieved, the same outlet duct restrictions shall be used for the remainder of the furnace fan test. If the unit under test is unable to complete the testing (*i.e.,* the unit shuts down before completing a test), reduce the target ESP range by 0.05″ w.c. and restart the test. Repeat this process until the test can be completed.

8.6.2. *Constant circulation airflow-control setting measurements.* The main burner or electric heating elements shall be turned off. The furnace fan controls shall be adjusted to the specified constant circulation airflow-control setting. If the manufacturer does not specify a constant circulation airflow-control setting in the installation and operations manual supplied with the unit, the lowest airflow-control setting shall be used. Maintain these settings until steady-state conditions are attained as specified in sections 8.3, 8.4, and 8.5 of this appendix.

8.6.3. *Heating airflow-control setting measurements.* For single-stage gas and oil furnaces, the burner shall be fired at the maximum heat input rate. For single-stage electric furnaces, the electric heating elements shall be energized at the maximum heat input rate. For multi-stage and modulating furnaces the reduced heat input rate settings shall be used. Burner adjustments shall be made as specified by Section 8.4.1 of ASHRAE 103–2017. After the burner is activated and adjusted or the electric heating elements are energized, the furnace fan controls shall be adjusted to operate the fan in the default heat airflow-control setting. In instances where a manufacturer specifies multiple airflow-control settings for a given function to account for varying installation scenarios, the highest airflow-control setting specified for the given function shall be used. High heat and reduced heat shall be considered different functions for multi-stage heating units. Maintain these settings until steady-state conditions are attained as specified in section 8.3, 8.4, and 8.5 of this appendix and the temperature rise (ΔT_{Heat}) is at least 18 °F. Measure furnace fan electrical input power (E_{Heat}), airflow (Q_{Heat}), external static pressure (ESP_{Heat}), steady-state efficiency for this setting ($Effy_{SS}$) as specified in Sections 11.2 and 11.3 of ASHRAE 103–2017, outlet air temperature ($T_{Heat,\ Out}$) and temperature rise (ΔT_{Heat}).

9. *Nomenclature.* Nomenclature shall include the nomenclature specified in Section 10 of ASHRAE 103–2017 and the following additional variables:

CCH = annual furnace fan constant-circulation hours

E_{Circ} = furnace fan electrical consumption at the specified constant-circulation airflow-control setting (or minimum airflow-control setting operating point if a default constant-circulation airflow-control setting is not specified), in watts

E_{Heat} = furnace fan electrical consumption in the specified heat airflow-control setting for single-stage heating products or the specified low-heat setting for multi-stage heating products, in watts

E_{Max} = furnace fan electrical consumption in the maximum airflow-control setting, in watts

FER = fan energy rating, in watts/1000 cfm

HH = annual furnace fan heating operating hours

HCR = heating capacity ratio (nameplate reduced heat input capacity divided by nameplate maximum input heat capacity)

MH = annual furnace fan maximum airflow hours

$Q_{IN,,k}$ = nameplate fuel energy input rate, in Btu/h, at specified operating conditions *k,* where *k* can be ''H'' for the maximum heat setting or ''R'' for the reduced heat setting.

Q_{Max} = airflow at the maximum airflow-control setting, in cfm

10. *Calculation of derived results from test measurements for a single unit.* Calculations shall be as specified in Section 11 of ASHRAE 103–2017, except for appendices B and C; and as specified in sections 10.1 through 10.10 and Figure 1 of this appendix.

10.1. *Fan Energy Rating (FER)*

$$FER = \frac{(MH \times E_{Max}) + (HH \times E_{Heat}) + (CCH \times E_{circ})}{(CH + 830 + CCH) \times Q_{Max}} \times 1000$$

The estimated national average operating hours presented in table 2 to this appendix shall be used to calculate FER.

TABLE 2—ESTIMATED NATIONAL AVERAGE OPERATING HOUR VALUES FOR CALCULATING FER

Operating mode	Variable	Single-stage (hours)	Multi-stage or modulating (hours)
Heating	HH	830	830/HCR
Maximum Airflow	MH	640	640
Constant Circulation	CCH	400	400

Where:

$$HCR = \frac{Q_{IN,R\ (nameplate)}}{Q_{IN,H\ (nameplate)}}$$

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