This document, concerning ceiling fans is an action issued by the Department of Energy. Though it is not intended or expected, should any discrepancy occur between the document posted here and the document published in the Federal Register, the Federal Register publication controls. This document is being made available through the Internet solely as a means to facilitate the public's access to this document.

[6450-01-P]

DEPARTMENT OF ENERGY

10 CFR Parts 429 and 430

[Docket No. EERE-2013-BT-TP-0050]

RIN: 1904-AD10

Energy Conservation Program for Consumer Products: Test Procedure for Ceiling Fans

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

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

SUMMARY: The U.S. Department of Energy (DOE) proposes to reinterpret the statutory definition of a ceiling fan to include hugger ceiling fans and to amend its test procedure for ceiling fans established under the Energy Policy and Conservation Act. The proposed test procedure would establish an integrated efficiency metric for ceiling fans, based on the airflow and power consumption at low and high speed for low-volume ceiling fans, and at high speed for high-volume ceiling fans (where volume refers to airflow volume). The proposed efficiency metric would also account for power consumed in standby mode. The proposed test procedure amendments also include new test methods for high-volume ceiling fans, multi-mount ceiling fans, ceiling fans with multiple fan heads, and ceiling fans where the airflow is not directed vertically, as well as power consumption in standby mode. In addition, the proposed test procedure would: clarify that only high and low speeds are to be tested for low-volume ceiling fans;

eliminate the requirement to test with a test cylinder; add a false ceiling; clarify the distance between the ceiling fan blades and the air velocity sensors during testing; clarify the fan configuration during testing for low-volume ceiling fans; clarify the test method for ceiling fans with heaters; and revise the allowable tolerance for air velocity sensors. DOE is also announcing a public meeting to discuss and receive comments on issues presented in this test procedure rulemaking.

DATES: Meeting: DOE will hold a public meeting on Wednesday, November 19, from 9:00 a.m. to 4:00 p.m., in Washington, DC. The meeting will also be broadcast as a webinar. See section V, "Public Participation," for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

Comments: DOE will accept comments, data, and information regarding this notice of proposed rulemaking (NOPR) before and after the public meeting, but no later than **[INSERT DATE 75 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**. See section V, "Public Participation," for details.

ADDRESSES: The public meeting will be held at the U.S. Department of Energy, Forrestal Building, Room 6E-069, 1000 Independence Avenue, SW., Washington, DC 20585. To attend, please notify Ms. Brenda Edwards at (202) 586–2945. Please note that foreign nationals visiting DOE Headquarters are subject to advance security screening procedures. Any foreign national wishing to participate in the meeting should advise DOE as soon as possible by contacting Ms. Edwards to initiate the necessary procedures.

Please also note that any person wishing to bring a laptop into the Forrestal Building will be required to obtain a property pass. Visitors should avoid bringing laptops, or allow an extra 45 minutes. Persons may also attend the public meeting via webinar. For more information, refer to section V, "Public Participation," near the end of this notice.

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-2013-BT-TP-0050 and/or regulatory information number (RIN) number 1904-AD10, by any of the following methods:

1. E-mail: CF2013TP0050@ee.doe.gov Include the docket number EERE-2013-BT-TP-0050 and/or RIN 1904-AD10 in the subject line of the message. Submit electronic comments in WordPerfect, Microsoft Word, PDF, or ASCII file format, and avoid the use of special characters or any form of encryption.
2. Postal Mail: Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Office, Mailstop EE-5B, 1000 Independence Avenue, SW., Washington, DC, 20585-0121. If possible, please submit all items on a compact disc (CD), in which case it is not necessary to include printed copies.
3. Hand Delivery/Courier: Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Office, 950 L'Enfant Plaza, SW., Suite 600, Washington, DC, 20024. Telephone: (202) 586-2945. If possible, please submit all items on a CD, in which case it is not necessary to include printed copies.

Instructions: All submissions received must include the agency name and docket number and/or RIN for this rulemaking. No telefacsimilies (faxes) will be accepted. For detailed instructions on submitting comments and additional information on the rulemaking process, see section V of this document (Public Participation).

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

A link to the docket web page can be found at: http://www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx/ruleid/65. This webpage contains a link to the docket for this notice on the www.regulations.gov site. The www.regulations.gov webpage contains simple instructions on how to access all documents, including public comments, in the docket. See section V, "Public Participation," for information on how to submit comments through www.regulations.gov.

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

FOR FURTHER INFORMATION CONTACT: Ms. Lucy deButts, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Office, EE-2J, 1000 Independence Avenue, SW., Washington, DC 20585-0121. Telephone: (202) 287-1604. E-mail: ceiling_fans@ee.doe.gov.

Ms. Elizabeth Kohl, U.S. Department of Energy, Office of the General Counsel, GC-71, 1000 Independence Avenue, SW., Washington, DC, 20585-0121. Telephone: (202) 586-7796. Email: elizabeth.kohl@hq.doe.gov.

SUPPLEMENTARY INFORMATION:

Table of Contents

I. Authority and Background

Title III, Part B[1] of the Energy Policy and Conservation Act of 1975 ("EPCA" or "the Act"), Pub. L. 94-163 (42 U.S.C. 6291-6309, as codified) sets forth a variety of provisions designed to improve energy efficiency and established the Energy Conservation Program for Consumer Products Other Than Automobiles.[2] These include ceiling fans, the subject of this proposed rulemaking. (42 U.S.C. 6291(49), 6293(b)(16)(A)(i), and 6295(ff))

Under EPCA, this energy conservation program consists essentially of four parts: (1) testing; (2) labeling; (3) Federal energy conservation standards; and (4) certification and enforcement procedures. The testing requirements consist of test procedures that manufacturers of covered products must use as the basis for certifying to DOE that their products comply with the applicable energy conservation standards adopted pursuant to EPCA and for making other representations about the efficiency of those products. (42 U.S.C. 6293(c) and 6295(s)) Similarly, DOE must use these test requirements to

[1] For editorial reasons, upon codification in the U.S. Code, Part B was redesignated as Part A.
[2] All references to EPCA in this document refer to the statute as amended through the American Energy Manufacturing Technical Corrections Act (AEMTCA), Pub. L. 112-210 (Dec. 18, 2012).

determine whether the products comply with any relevant standards promulgated under EPCA. (42 U.S.C. 6295(s))

A. General Test Procedure Rulemaking Process

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

In addition, if DOE determines that a test procedure amendment is warranted, it must publish proposed test procedures and offer the public an opportunity to present oral and written comments on them. (42 U.S.C. 6293(b)(2)) Finally, in any rulemaking to amend a test procedure, DOE must determine to what extent, if any, the proposed test procedure would alter the measured energy efficiency of any covered product as determined under the existing test procedure. (42 U.S.C. 6293(e))

The Energy Policy Act of 2005 (EPACT 2005), Pub. L. 109-58, amended EPCA and established energy conservation standards for ceiling fans, as well as requirements for the ceiling fan test procedure. (42 U.S.C. 6295(ff) and 6293(b)(16)(A)(1)) Specifically, these amendments required that test procedures for ceiling fans be based on the "Energy Star Testing Facility Guidance Manual: Building a Testing Facility and

Performing the Solid State Test Method for ENERGY STAR Qualified Ceiling Fans, Version 1.1." Id. The current DOE ceiling fan test procedure, based on that source, was published in a 2006 final rule (71 FR 71341 (Dec. 8, 2006)), which codified the test procedure in DOE's regulations in the Code of Federal Regulations (CFR) at 10 CFR 430.23(w) and 10 CFR part 430, subpart B, appendix U, "Uniform Test Method for Measuring the Energy Consumption of Ceiling Fans."

The Energy Independence and Security Act of 2007 (EISA 2007), Pub. L. 110-140, amended EPCA to require that at least once every 7 years, DOE must conduct an evaluation of the test procedures for all covered products and either amend the test procedures (if the Secretary determines that amended test procedures would more accurately or fully comply with the requirements of 42 U.S.C. 6293(b)(3)) or publish a determination in the Federal Register not to amend them. (42 U.S.C. 6293(b)(1)(A)) Pursuant to this requirement, DOE must review the test procedures for ceiling fans not later than December 19, 2014 (*i.e.*, 7 years after the enactment of EISA 2007). Thus, the final rule resulting from this rulemaking will satisfy the requirement to review the test procedures for ceiling fans within 7 years of the enactment of EISA 2007.

In addition, for covered products with test procedures that do not fully account for standby-mode and off-mode energy consumption, EISA 2007 directs DOE to amend its test procedures to do so with such energy consumption integrated into the overall energy efficiency, energy consumption, or other energy descriptor, if technically feasible. (42 U.S.C. 6295(gg)(2)(A)) If an integrated test procedure is technically infeasible, DOE must prescribe a separate standby-mode and off-mode test procedure for the covered product, if technically feasible. Id. The current DOE ceiling fan test procedure, published in a 2006 final rule (71 FR 71341 (Dec. 8, 2006)), did not address standby mode or off mode. This test procedure rulemaking fulfills the statutory requirement to address standby-mode and off-mode power consumption.

B. Concurrent Standards Rulemaking

DOE is concurrently conducting an energy conservation standards rulemaking for ceiling fans. On March 15, 2013, DOE published in the Federal Register a Notice of Public Meeting and Availability of the Framework Document to initiate the energy conservation standard rulemaking for ceiling fans. (78 FR 16443 (Mar. 15, 2013)). DOE held the framework public meeting on March 22, 2013. DOE requested feedback in the framework document and received both written comments and comments at the public meeting from interested parties on many issues related to test methods for evaluating the airflow and electrical consumption performance of ceiling fans. Comments related to the test procedure for ceiling fans are addressed throughout this notice.

DOE invites comments on all aspects of the existing test procedures for ceiling fans.

II. Summary of the Notice of Proposed Rulemaking

In this NOPR, DOE proposes to reinterpret the statutory definition of a ceiling fan to include hugger ceiling fans and to amend the current test procedure for ceiling fans as follows:

(1) Specify an efficiency metric;

(2) Clarify that low-volume ceiling fans should be tested at low and high speeds;

(3) Eliminate the requirement to use a test cylinder;

(4) Add a false ceiling to the experimental setup for low-volume ceiling fans;

(5) Clarify the required distance between the ceiling fan blades and the air velocity sensors;

(6) Clarify the appropriate fan configuration during testing for low-volume ceiling fans;

(7) Clarify the test method for ceiling fans with heaters;

(8) Revise the allowable tolerance for air velocity sensors used during testing;

(9) Add a test method for high-volume ceiling fans;

(10) Add a test method for multi-mount ceiling fans;

(11) Add a test method for multi-headed ceiling fans;

(12) Add a test method for ceiling fans where the airflow is not directed vertically; and

(13) Add a test method for power consumption in standby mode.

The following paragraphs summarize these proposed changes, with further detail provided in section III (Discussion).

<u>Establishment of an efficiency metric</u>

In general, DOE proposes to establish the metric for <u>ceiling fan efficiency</u> based on measured air flow and energy consumption. For low-volume ceiling fans (where volume refers airflow volume), ceiling fan efficiency would be determined based on the weighted average of airflow and power consumption at high and low speeds. For high-volume ceiling fans, ceiling fan efficiency would be determined based on airflow and power consumption at high speed only. (See section III.A.2 for definitions of “low-volume ceiling fan” and “high-volume ceiling fan”.) The metric for ceiling fan efficiency would also include any power consumption in standby mode. Because DOE's research suggests that there is no off-mode power consumption for ceiling fans, DOE is not proposing to include off-mode power in the efficiency metric, or to require off-mode testing.

Clarification that low-volume ceiling fans are to be tested at high and low fan speeds

As noted in the previous paragraph, DOE proposes to clarify that testing is required at high and low speeds for low-volume ceiling fans. For high-volume ceiling fans, where the available fan speeds are often continuous instead of discrete, DOE proposes to test only at high speed.

Elimination of the requirement for a test cylinder to be used during testing

DOE proposes to eliminate the requirement to use a test cylinder while conducting airflow measurements. The positioning of the ceiling fan and the air velocity sensors would remain the same as in the current test procedure but without a test cylinder between them. The same effective area and number of sensors as in the current test procedure would be used to calculate the airflow of a low-volume ceiling fan.

Addition of a false ceiling to the experimental setup

For all low-volume ceiling fans, DOE proposes to add a test set-up requirement for a false ceiling directly above the ceiling fan during testing. This is intended to simulate real life usage conditions more accurately and provide an equitable basis of comparison across low-volume ceiling fans. The length and breadth of the false ceiling would be required to be at least 8 inches larger than the blade span of the ceiling fan being tested.

Clarification of the distance between the ceiling fan blades and the air velocity sensors

DOE proposes to modify its instructions for determining the appropriate vertical position of a low volume ceiling fan in relation to the air velocity sensors. More specifically, DOE proposes that such position be determined at the lowest point on the ceiling fan blades (i.e., the point on the ceiling fan blade that is farthest from the ceiling), rather than "the middle of the fan blade tips", as is currently required. DOE is proposing this change because it may be unclear how the "middle of blade tip" measurement should be made for ceiling fans having non-flat or unusually shaped blades.

Clarification of the appropriate fan configuration during testing for low-volume ceiling fans

DOE proposes to clarify that if more than one mounting option is included with a fan that would meet the definition of a standard low-volume ceiling fan, that ceiling fan should be tested in the configuration with the smallest distance between the ceiling and the lowest part of the fan blades. Similarly, if more than one mounting option is included with a fan that would meet the definition of a hugger low-volume ceiling fan, that ceiling fan should be tested in the configuration with the smallest distance between the ceiling and the lowest part of the fan blades. DOE seeks comment and data on how these fans are configured in the field.

Clarification of the test method for ceiling fans with heaters

DOE proposes to clarify that ceiling fans with heaters integrated into or sold packaged with the fan should be tested with the heater installed but turned off during testing.

Revision of the allowable tolerance for air velocity sensors used during testing

DOE proposes to revise the allowable accuracy tolerance for air velocity sensors used during testing of low-volume ceiling fans from ±1 percent to ±5 percent, based on testing results that indicate that the accuracy of the airflow measurement is not affected by this difference in tolerance.

Addition of a test method for high-volume ceiling fans

DOE proposes to base the test method for high-volume ceiling fans on ANSI/AMCA Standard 230-12, "Laboratory Methods of Testing Air Circulating Fans for Rating and Certification" (AMCA 230[3]), with some modifications to the specified room dimensions to allow for testing of ceiling fans up to 24 feet in diameter.

Addition of a test method for multi-mount ceiling fans

DOE proposes to test low-volume multi-mount ceiling fans in two configurations: 1) in the standard configuration that minimizes the distance between the ceiling and the lowest part of the fan blades, and 2) in the hugger configuration that minimizes the distance between the ceiling and the lowest part of the fan blades.

---

[3] Air Movement and Control Association International, Inc. *ANSI/AMCA Standard 230-12: Laboratory Methods of Testing Air Circulating Fans for Rating and Certification*. 2010. Arlington Heights, IL. (Last accessed February 24, 2014) https://www.amca.org/store/item.aspx?ItemId=37

Addition of a test method for multi-headed ceiling fans

DOE proposes to test low-volume, multi-headed ceiling fans by positioning the fan such that one fan head is centered in the test set-up and then testing that head in the same manner as all other low-volume ceiling fans. If the ceiling fan includes more than one type of ceiling fan head, then at least one of each unique type should be tested. The airflow for the ceiling fan at a given speed can be determined by multiplying the airflow of a measured fan head by the number of ceiling fan heads of that type and summing over all types included in the ceiling fan. The power consumption at a given speed should be measured separately, with all ceiling fan heads turned on.

Addition of a test method for ceiling fans where the airflow is not directed vertically

For low-volume ceiling fans where the airflow is not directed vertically, DOE proposes to clarify that the ceiling fan head should be adjusted such that the airflow is directed as vertically downward as possible prior to testing. If the airflow is still not vertical, the air velocity results from an offset series of sensors would be substituted for the typical symmetric set to calculate total airflow.

Addition of a test method for power consumption in standby mode

DOE proposes to add a test method for measuring the power consumption of ceiling fans in standby mode. This test method would be applicable to both low and high-volume ceiling fans.

III. Discussion

A. Scope of Applicability

The test procedures described in this notice are proposed to apply to all ceiling fans. According to the statutory definition, a "ceiling fan" is "a non-portable device that is suspended from a ceiling for circulating air via the rotation of fan blades." (42 U.S.C. 6291(49)) This includes ceiling fans for all applications, including applications where large airflow volume may be needed. The test procedures do not apply to air circulators (or air-circulating fan heads) that are typically mounted on a pedestal but could also include wall, ceiling, or I-beam mounting brackets. Such air-circulating fan heads are defined in section 5.1.1 of AMCA 230. [3]

1. Clarification of the Statutory Definition of a Ceiling Fan

DOE previously interpreted the definition of a ceiling fan such that it excluded certain types of ceiling fans commonly referred to as hugger fans. 71 FR 71343 (Dec. 8, 2006). Hugger ceiling fans are typically understood to be set flush to the ceiling (e.g., mounted without a downrod). The previous interpretation exempted hugger fans from standards on the basis that they are set flush to the ceiling. DOE has reconsidered the validity of this distinction and is proposing a determination that "suspended from the ceiling" does not depend upon whether the unit is mounted with a downrod. The concept of suspension does not require any length between the object and the point of support. This interpretation more accurately reflects the statutory definition and does not draw an artificial distinction between units that serve the same functional purpose. This is also in line with the scope of CAN/CSA-C814-10, which includes hugger fans.

Hugger fans generally are indistinguishable from other types of ceiling fans in that they move air via rotation of fan blades, are intended to improve comfort, and are rated on their ability to move air (as measured in cubic feet per minute). Under this reinterpretation, a multi-mount ceiling fan, *i.e.*, a ceiling fan which can be mounted in both the hugger and standard ceiling fan configurations, would also fall under the definition of a ceiling fan. In response to the Framework Document for the ceiling fan energy conservation standards rulemaking, several commenters, including the American Lighting Association (ALA), the Appliance Standards Awareness Project (ASAP), the National Consumer Law Center (NCLC), the National Resources Defense Council (NRDC), and the Northwest Energy Efficiency Alliance (NEEA) supported DOE's proposed reinterpretation. (ALA, No. 39[4] at p. 3; ASAP-NCLC-NEEA-NRDC, No. 14 at p. 4) DOE received no comments objecting to its proposed reinterpretation. DOE proposes that any ceiling fan sold with the option of being mounted in either a hugger configuration or a standard configuration would also be included within the "ceiling fan" definition.

Under DOE's proposed reinterpretation, DOE would consider the following fans to be explicitly covered under the definition of "ceiling fan" in 10 CFR 430.2:

1. Fans suspended from the ceiling using a downrod or other means of suspension such that the fan is not mounted directly to the ceiling;
2. Fans suspended such that they are mounted directly or close to the ceiling; and
3. Fans sold with the option of being suspended with or without a downrod.

[4] Hereafter, all ALA comments from EERE-2012-BT-STD-0045-0039 reference the powerpoint presentation included in that docket number, unless otherwise noted.

In the Framework Document for the ceiling fan energy conservation standards rulemaking, DOE considered interpreting ceiling fans without external blades as meeting the statutory definition of a ceiling fan and asked for comment on this issue. (78 FR 16443 (Mar. 15, 2013)) ALA agreed that the definition of "ceiling fan" may cover ceiling fans without external blades, but ALA advised DOE to delay including these fans in this rulemaking until new test procedures are developed to appropriately test the performance of these fans. (ALA, No. 39 at p. 3) At this time, DOE takes no position on whether centrifugal fans (commonly referred to as "bladeless" ceiling fans) fit within the EPCA definition of a ceiling fan. DOE may consider this issue in a future rulemaking proceeding.

Although the Framework Document did not specifically discuss ceiling fans capable of producing large volumes of airflow, such as those ceiling fans typically used in non-residential applications, DOE clarifies that any ceiling fan that meets the statutory definition is considered a covered product for which the test methods in this rulemaking apply.[5] (78 FR 16443 (Mar. 15, 2013)) Ceiling fans capable of producing large volumes of airflow are functionally similar to ceiling fans that produce less airflow and meet the definition of a ceiling fan, in that they are suspended from the ceiling, are nonportable, and produce airflow via the rotation of fan blades. Therefore, DOE clarifies that ceiling fans capable of producing large volumes of airflow are considered covered products.

[5] The EPCA definition of a consumer product includes products of a type that, to any significant extent, are distributed in commerce for personal use, without regard to whether a particular article is in fact distributed in commerce for personal use. 42 U.S.C. 6291(1) Therefore, any product that meets the definition of a ceiling fan, even those fans used in non-residential applications, are considered covered products for which DOE can establish a test procedure.

DOE notes that the proposed changes in interpretation of the ceiling fan definition discussed above would result in the applicability of the design standards set forth in EPCA at 42 USC 6295(ff)(1) to the following types of fans 30 days after the publication of any final test procedure adopting such changes in interpretation:

1. Fans suspended from the ceiling using a downrod or other means of suspension such that the fan is not mounted directly to the ceiling;
2. Fans suspended such that they are mounted directly or close to the ceiling;
3. Fans sold with the option of being suspended with or without a downrod; and
4. Fans capable of producing large volumes of airflow.

Because ceiling fan light kits are defined as "equipment designed to provide light from a ceiling fan that can be integral, such that the equipment is attached to the ceiling fan prior to the time of retail sale; or attachable, such that at the time of retail sale the equipment is not physically attached to the ceiling fan, but may be included inside the ceiling fan at the time of sale or sold separately for subsequent attachment to the fan" (42 U.S.C. 6291(50)(A), and (B)), DOE notes that light kits attached to any of the four fan types listed above would be covered ceiling fan light kits under these proposed changes in interpretation.

In the concurrent energy conservation standards rulemaking for ceiling fans, DOE is considering a separate product class for highly decorative ceiling fans that would be exempt from performance standards. The current design standards specified in EPCA would still apply to such fans.

2. Definitions of Low-Volume and High-Volume Ceiling Fans

DOE proposes to define a "low-volume ceiling fan" as "a ceiling fan that:

(1) Is less than or equal to 7 feet in diameter,

AND

(2) Has a blade thickness greater than or equal to 3.2 mm at the edge and a maximum tip speed less than or equal to the limit in Table 1,

OR

Has a maximum airflow volume less than or equal to 5,000 CFM."

DOE proposes to define a "high-volume ceiling fan" as "a ceiling fan that:

(1) Is greater than 7 feet in diameter,

OR

(2) Has a blade thickness of less than 3.2 mm at the edge or a maximum tip speed that exceeds the threshold in Table 1

AND

Has a maximum airflow volume greater than 5,000 CFM."

Table 1 indicates maximum speed tip for low-volume ceiling fans, dependent on blade thickness. The values in Table 1 are based on the Underwriters Laboratory (UL) ceiling fan safety standard (UL Standard 507-1999, "UL Standard for Safety for Electric Fans") which designates maximum fan tip speeds (for a given thicknesses at the edge of the blades) that are safe for use in applications where the distance between the fan blades and the floor is 10 feet or less.[6]

Table 1: Low-Volume Ceiling Fans, 7 Feet or Less in Diameter

Airflow Direction*	Thickness (t) of edges of blades		Maximum speed at tip of blades	
	Mm	(inch)	m/s	(feet per minute)
Downward-Only	4.8 > t ≥ 3.2	(3/16 > t ≥ 1/8)	16.3	(3200)
Downward-Only	t ≥ 4.8	(t ≥ 3/16)	20.3	(4000)
Reversible	4.8 > t ≥ 3.2	(3/16 > t ≥ 1/8)	12.2	(2400)
Reversible	t ≥ 4.8	(t ≥ 3/16)	16.3	(3200)

* The "downward-only" and "reversible" airflow directions are mutually exclusive; therefore, a ceiling fan that can only produce airflow in the downward direction need only meet the "downward-only" blade edge thickness and tip speed requirements and a ceiling fan that can produce airflow in the downward and upward directions need only meet the "reversible" requirements.

3. Definition of Hugger Ceiling Fan

In the Framework Document for the ceiling fan energy conservation standards rulemaking, DOE considered establishing a definition for hugger ceiling fans. (78 FR 16443 (Mar. 15, 2013)) Specifically, DOE stated it would consider defining a hugger ceiling fan: as "a ceiling fan where the average vertical distance between the fan blades and the ceiling fan is no more than [a specified number of] inches". DOE received several comments on the Framework Document regarding this definition. Most commenters, with the exception of ALA, were generally supportive of the proposed definition.

[6] Underwriters Laboratories Inc. UL Standard for Safety for Electric Fans, UL 507. 1999. Northbrook, IL. (Last accessed February 24, 2014) http://www.comm-2000.com/ProductDetail.aspx?UniqueKey=8782

The California investor-owned utilities, including the Pacific Gas and Electric Company, Southern California Edison, the San Diego Gas and Electric Company, and the Southern California Gas Company (hereafter the "CA IOUs") agreed with the definition. (CA IOUs, No. 45 at p. 2) Hunter, during the public meeting for the Framework Document, suggested that DOE consider specifying the definition in terms of maximum blade distance instead of average blade distance from the ceiling. (Hunter, No. 9 at p. 32) Big Ass Fans (BAF) suggested that DOE consider a minimum vertical distance between the fan blades and ceiling not exceeding 10 inches. (BAF, No. 43 at p. 2) In contrast, ALA disagreed with DOE's assertion that the primary point of differentiation is that hugger fans are "safe to use in rooms with low ceilings", believing that this definition is misleading and open to interpretation. Instead ALA proposed defining a hugger fan as a fan "where the only option is for the motor to be directly mounted to the ceiling". (ALA, No. 39 at p. 3-4)

In determining an appropriate boundary between hugger and standard ceiling fans, an analysis was conducted of all ceiling fans available from Hansen Wholesale, an online wholesaler that sells a wide variety of ceiling fan brands. Ninety percent of ceiling fans described as hugger fans had blades that were an average distance of nine inches or less from the ceiling, suggesting that nine inches may be an appropriate threshold. By contrast, half of all ceiling fans that were described as standard ceiling fans had blades that were an average distance of twelve inches or less from the ceiling, suggesting that a higher threshold may result in the categorization of significant numbers of standard ceiling fans as hugger ceiling fans.

Additionally, DOE agrees with Hunter that the maximum distance between the blades and the ceiling, instead of average distance, may be a more appropriate metric when considering whether a ceiling fan is safe to operate in a room with a low ceiling. Therefore, DOE is proposing to define a hugger ceiling fan in terms of the vertical distance between the ceiling and the lowest point on the fan blades. To account for the additional vertical distance between the average vertical position of the fan blades and the lowest point on the fan blades, DOE is proposing a modification to the vertical distance specified in the definition. Based on DOE's analysis, one additional inch is appropriate given the typical width and pitch of a fan blade. Therefore, DOE is proposing to define a hugger ceiling fan as "a ceiling fan where the lowest point on the fan blades is no more than ten inches from the ceiling."

4. Definitions of Standard Ceiling Fan and Multi-Mount Ceiling Fan

In accordance with the definition of a hugger ceiling fan, DOE is proposing to define a standard ceiling fan as "a ceiling fan where the lowest point on the fan blades is more than ten inches from the ceiling." A multi-mount ceiling fan would be defined as "a ceiling fan that can be mounted in both the standard and hugger ceiling fan configurations."

DOE proposes to clarify that ceiling fans exist that can be mounted at more than one height, but that do not include at least one mounting option that meets that hugger ceiling fan definition and one option that meets the standard ceiling fan definition, would not meet the definition of a multi-mount fan (e.g., a ceiling fan where all mounting options result in the lowest point on the fan blades being more than ten inches from the ceiling would be classified as a standard ceiling fan). Such fans would be tested as described in section III.E.5, whereas multi-mount fans would be tested as described in section III.F.2.

B. Effective Date and Compliance Date

DOE is proposing amendments to its ceiling fan test procedure in Appendix U that would alter the way ceiling fans are currently tested and the dates for use of the test procedures. Because DOE does not currently have performance-based standards for ceiling fans as measured by the airflow efficiency, the proposals for Appendix U would not affect a manufacturer's ability to comply with current energy conservation standards.

Manufacturers would be required to use the revised Appendix U for representations of ceiling fan efficiency 180 days after the publication of any final amended test procedures in the Federal Register. If DOE were to establish minimum energy conservation standards for ceiling fans as measured in airflow efficiency in the concurrent energy conservation standards rulemaking, manufacturers would be required to use the revised Appendix U for determining compliance with any amended standards.

DOE notes that the proposed changes in interpretation of the ceiling fan definition discussed above would result in the applicability of the design standards set forth in EPCA at 42 USC 6295(ff)(1) to the following types of fans 30 days after the publication of any final test procedure adopting such changes in interpretation:

1. Fans suspended from the ceiling using a downrod or other means of suspension such that the fan is not mounted directly to the ceiling;

2. Fans suspended such that they are mounted directly or close to the ceiling;

3. Fans sold with the option of being suspended with or without a downrod; and

4. Fans capable of producing large volumes of airflow.

In the concurrent energy conservation standards rulemaking for ceiling fans, DOE is considering a separate product class for highly decorative ceiling fans that would be exempt from performance standards. The current design standards specified in EPCA would still apply to such fans.

To ensure that any amended energy conservation standards developed in the ongoing ceiling fan standards rulemaking account for any changes to the test procedure, DOE is proposing to consider standards based on the measured ceiling fan efficiency generated by the test procedure proposed in this rulemaking.

C. Existing Test Procedure

As noted above, DOE's test procedure for ceiling fans is codified at 10 CFR 430.23(w) and 10 CFR part 430, subpart B, appendix U. The current DOE test procedure references the “ENERGY STAR Testing Facility Guidance Manual: Building a Testing Facility and Performing the Solid State Test Method for ENERGY STAR Qualified Ceiling Fans,” version 1.1. DOE notes that ENERGY STAR has since revised its test procedure, creating version 1.2 of ENERGY STAR’s guidance manual. DOE’s proposed test procedure is consistent with the EPCA requirement that the test procedure for ceiling fans be based on version 1.1, but the proposal set forth in this rule adopts portions of version 1.2 as appropriate.

There are some slight differences between the proposed DOE test procedure and the ENERGY STAR test procedure. For instance, DOE proposes no modification in today's rule to the ceiling fan warm-up time at a given fan speed. This means that the warm-up time in the proposed DOE test procedure is the same as the 15 minute warm-up time specified in the current DOE test procedure (and not the 30 minute warm-up time before low speed specified in the ENERGY STAR test procedure v1.2). .

D. Proposed Metric

DOE proposes to apply a metric, ceiling fan efficiency, to all ceiling fans. The metric would be based on airflow efficiency and would account for variations in fan design, fan speeds, and typical usage patterns. Airflow efficiency appears to be a universal metric used to describe the efficiency of ceiling fans and consists of airflow, *i.e.*, the service provided by a ceiling fan, as measured in cubic feet per minute (CFM), divided by power consumption, which is measured in watts (W).

1. Low-Volume Fans

For low-volume ceiling fans, DOE is proposing to calculate ceiling fan efficiency based on the weighted average of airflow and power consumption at high and low fan speeds.

The Framework Document for the ceiling fan energy conservation standards rulemaking requested comment on defining "high," "medium," and "low" speeds. (78 FR 16443 (Mar. 15, 2013)) Few comments were received on this topic, but the American Lighting Association (ALA) suggested defining "high" as the highest available fan speed and “low” as the lowest available fan speed. (ALA, No. 39 at p.2) [7] These suggested definitions appear reasonable, and DOE proposes to define “high speed” as the highest available speed, and to define “low speed” as the lowest available speed. Most low-volume ceiling fans have one or more speeds between high and low, but DOE proposes to measure only high and low speeds to limit the testing burden and avoid confusion regarding the definition of medium speed for ceiling fans with more than three speeds.

DOE proposes to weight airflow and power consumption at high and low speeds in the ceiling fan efficiency metric for low-volume ceiling fans according to mean national hours of operation per day at each speed.

2. High-volume Ceiling Fans

For high-volume ceiling fans, DOE proposes to calculate ceiling fan efficiency based on measured airflow and power consumption at high speed. High-volume ceiling fans are often not equipped with discrete speeds (*e.g.*, low, medium, and high). Instead, high-volume ceiling fans may have a speed controller that is continuously adjustable. Given that speeds other than high may be ill-defined, DOE is proposing to test high-volume ceiling fans at high speed only.

3. Incorporating Standby Power Consumption

---

[7] A notation in this form provides a reference for information that is in the docket of DOE’s rulemaking to develop energy conservation standards for ceiling fans and ceiling fan light kits (Docket No. EERE–2012–BT–STD–0045), which is maintained at www.regulations.gov. This notation indicates that the statement preceding the reference is document number 39 in the docket for the ceiling fan and ceiling fan light kits energy conservation standards rulemaking and appears at page 2 of that document.

DOE is also addressing standby-mode and off-mode power consumption of ceiling fans in this NOPR. For both low and high-volume ceiling fans, DOE proposes to integrate standby-mode power consumption into the ceiling fan efficiency metric, as required by EPCA. (42 U.S.C. 6295(gg)(2)(A)) EPCA defines “standby mode” as the condition in which an energy-using product: (1) is connected to a main power source, and (2) offers one or more of the following user-oriented or protective functions:

(i) To facilitate the activation or deactivation of other functions (including active mode) by remote switch (including remote control), internal sensor, or timer.

(ii) Continuous functions, including information or status displays (including clocks), or sensor-based functions.

(42 U.S.C. 6295(gg)(1)(A)(iii)) “Off mode” is the condition in which the ceiling fan is connected to a main power source and is not providing any standby or active mode function. (42 U.S.C. 6295(gg)(1)(A)(ii))

DOE is proposing a test method for measuring standby power consumption in both low-volume and high-volume fans (see section III.F.5). DOE proposes to incorporate the standby power value obtained from this test into the overall efficiency metric for the ceiling fan.

DOE proposes to perform the standby-mode test immediately following the active mode test. For those ceiling fans packaged with a light kit, this means that the light kit will still be attached during standby-mode testing, i.e., the configuration will be the same as for active mode testing. In the framework document, DOE proposed to assign all standby power consumption from a ceiling fan with a ceiling fan light kit to the ceiling fan only. Further research has indicated that for the typical configuration in which a remote device controls a ceiling fan paired with a ceiling fan light kit, the remote provides equal service to each device—the ability to turn on/off/adjust—and it requires no more or less energy to provide that service for the ceiling fan light kit than for the ceiling fan. The energy required to provide that service depends on the nature of the remote receiver, and not on the features of the ceiling fan or ceiling fan light kit. This would suggest that if a ceiling fan and a ceiling fan light kit share a remote, it would be appropriate to attribute half of the standby power to the ceiling fan. To include standby power consumption in the efficacy metric of a ceiling fan light kit, however, would be technically infeasible, because doing so would cause the efficacy of the ceiling fan light kit to differ from the efficacy of the lamps in the light kit. Therefore, to account for this standby power consumption, DOE proposes to attribute all the standby power consumption of a ceiling fan with a ceiling fan light kit to the ceiling fan only. DOE requests comments on this approach.

Because DOE research and feedback from manufacturers indicates that there is no off-mode power consumption for these products, DOE is proposing not to include off-mode power in the ceiling fan efficiency metric.

4. Operating Hours

At the public meeting on the Framework Document, Fanimation commented that most consumers use their [low-volume] ceiling fan at low or medium speed, citing a social media poll. (Fanimation, No.9 at p.68) In written comments on the Framework

Document, Capital Lighting stated that the typical user operates a ceiling fan at low or medium speed. (Capital Lighting, No. 27 at p. 3) Progress Lighting also commented that high speed is not the most common mode of operation. (Progress Lighting, No. 6 at p.2) Hunter Fans and ALA both cited an AcuPOLL® Precision Research, Inc. survey submitted by ALA and commissioned by Hunter, which reports that low is the typical operating speed of about 30 percent of ceiling fans, that medium is the typical speed of about 50 percent of ceiling fans, and that high is the typical speed of about 20 percent of ceiling fans. (ALA, No. 39 at p. 2 and Hunter, No.37 at p.3)

A report on ceiling fan energy use (the Lawrence Berkeley National Laboratory (LBNL) titled "*Ceiling Fan and Ceiling Fan Light Kit Use in the U.S.*"[8]) suggests, however, that high speed may be the most commonly used speed. In the LBNL survey, a representative sample of more than 2,500 ceiling fan users were asked to break down the fraction of ceiling fan on-time spent at each speed, and the responses indicated that in aggregate, high is the most commonly used speed (on average 41% of the time a fan is in operation), and low is the least commonly used speed (on average 22% of the time a fan is in operation). By contrast, the AcuPOLL survey did not inquire into the fraction of time spent at each speed, instead asking respondents for a single "typical" speed. Therefore, the LBNL survey provides a more disaggregated dataset on which DOE can base its usage profile.. DOE proposes to use the daily national-average hours of operation reported in LBNL's survey as the basis for weighting energy consumption at

[8] Kantner, C.L.S., S.J. Young, S.M. Donovan, K. Garbesi. *Ceiling Fan and Ceiling Fan Light Kit Use in the U.S.—Results of a Survey on Amazon Mechanical Turk* (2013) Lawrence Berkeley National Laboratory: Berkeley, CA. Report No. LBNL-6332E.

high and low speed (see Table 2). To convert the values reported at high, medium, and low in LBNL's survey to high and low speed only, DOE allocated the operating hours reported for medium speed to high and low speeds using the ratio of time spent at high and low speeds. DOE seeks comment on its proposed operating hours for calculating ceiling fan efficiency for low-volume ceiling fans.

For ceiling fans that operate in standby mode, DOE assumes that the ceiling fan is always activated by remote and is, therefore, assumed to never be "off." This assumption is likely to have little impact on measured ceiling fan efficiency, because it is DOE's understanding that the majority of ceiling fans with built-in remotes do not include built-in on/off switches and so cannot be placed into off mode. Therefore, this split between standby and off mode is rarely, if ever, applicable.

To estimate the hours of operation data for high-volume ceiling fans, DOE used feedback from manufacturers indicating that, while the hours of operation may vary significantly across industry and application (e.g., warehouses or manufacturing facilities), 12 hours per day spent in active mode may be a representative value. DOE, therefore, proposes to assume 12 hours of daily operation in active mode for high-volume ceiling fans. DOE seeks comment and any available data on operating hours for high-volume ceiling fans.

Table 2: Daily Operating Hours for Calculating Ceiling Fan Efficiency

Daily Operating Hours for Low-Volume Ceiling Fans		
	No Standby	With Standby

High Speed	4.2	4.2
Low Speed	2.2	2.2
Standby Mode	0.0	17.6
Off Mode	17.6	0
Daily Operating Hours for High-Volume Ceiling Fans		
	No Standby	With Standby
Active Mode	12.0	12.0
Standby Mode	0.0	12.0
Off Mode	12.0	0

5. Metric for Ceiling Fan Efficiency

DOE proposes the following equations to determine ceiling fan efficiency.

Low-volume ceiling fans:

$$\boldsymbol{Ceiling\ Fan\ Efficiency\ (CFM/W)} = \left(\frac{\sum_{i=H,L} \boldsymbol{CFM_i} \times \boldsymbol{OH_i}}{\boldsymbol{W_{Sb}} \times \boldsymbol{OH_{Sb}} + \sum_{i=H,L} \boldsymbol{W_i} \times \boldsymbol{OH_i}}\right)$$

Where:

CFM_i = airflow at a given speed,

OH_i = operating hours at a given speed,

W_i = power consumption at a given speed,

H = high speed,

L = low speed,

OH_{Sb} = operating hours in standby mode, and

W_{Sb} = power consumption in standby mode.

DOE is not aware of any low-volume ceiling fans with continuously variable speed control currently on the market. If such ceiling fans are manufactured in the future, DOE will consider amendments to the test procedure to accommodate these fans, where other speeds may not be well-defined, as needed.

High-volume ceiling fans:

$$\boldsymbol{Ceiling\ Fan\ Efficiency\ (CFM/W) = \left(\frac{CFM_H \times OH_A}{W_{Sb} \times OH_{Sb} + W_H \times OH_A}\right)}$$

Where:

CFM_H = airflow at high speed,

OH_A = operating hours in active mode,

W_H = power consumption at high speed,

OH_{Sb} = operating hours in standby mode, and

W_{Sb} = power consumption in standby mode.

6. Power Factor

DOE received a comment in response to the Framework Document from PG&E, SCGC, SDG&E, and SCE (CA IOUs) stating that evaluation of power factor should be included in the test procedure for ceiling fans due to the impact of power factor on power quality and transmission efficiency of the electric grid. CA IOUs also commented that the significance of power factor increases as brushless permanent magnet motors become more popular. (CA IOUs, No. 12 at p.5) DOE acknowledges that phase shifts introduced into the grid by loads could theoretically increase power production and transmission system demands. However, it is the net impact of many loads that ultimately determines the impact, which in turn depends on a dynamically changing load mix. DOE is not aware of field data quantifying the impact of power factor on the electric grid. DOE is not proposing a change in the test procedure to account for power factor.

E. Other Proposed Modifications to Current Test Procedure

1. Clarification that Low-Volume Ceiling Fans Should be Tested at High and Low Speeds

DOE proposes to require testing at high and low fan speeds for low-volume ceiling fans because low-volume ceiling fans typically have more than one speed setting that may be selected by the consumer. Such an approach would allow the ceiling fan efficiency metric to be representative of average use. The current DOE test procedure for ceiling fans allows for testing at all available fan speeds but does not specify how many speeds should be tested. In the Framework Document for the ceiling fans energy conservation standards rulemaking, DOE considered testing at one or multiple ceiling fan speeds and sought comment. A number of commenters weighed in on this subject, with some in favor of testing at multiple speeds and others in favor of testing at a single speed.

The Appliance Standards Awareness Project (ASAP), the National Consumer Law Center (NCLC), the National Resources Defense Council (NRDC), and the Northwest Energy Efficiency Alliance (NEEA) commented that DOE should develop a test procedure that includes measurements of airflow efficiency at multiple fan speeds. These commenters presented ENERGY STAR data at different fan speeds, arguing that airflow efficiency at a given speed is not necessarily a good predictor of airflow efficiency at other speeds. (ASAP, NCLC, NRDC, and NEEA, No. 14 at pp.4-5) ALA commented that the assumption is being made that the testing mentioned is for ENERGY

STAR qualification; if that assumption is true, then high is the only speed that needs to be tested because it is always the least efficient of the speeds. (ALA, No. 39 at p.11) Progress Lighting noted that testing at multiple speeds is already required by both Energy Star and California Title 20. (Progress Lighting, No. 6 at p.3)

In assessing how many speeds should be tested, DOE notes that data from Hunter Fans (included in a 2004 report by Pacific Gas and Electric (PG&E), "Analysis of Standards Options For Ceiling Fans") suggest that high speed is usually, but not always, the least-efficient speed. For 4 out of 26 ceiling fans tested, low speed was actually the least-efficient speed setting, and the variability of efficiency at low speed was significantly larger than at high speed, suggesting more opportunity for improvement in efficiency at low speed.

DOE is obligated to have a test procedure that reflects "a representative average use cycle or period of use", but which is not "unduly burdensome to conduct". (42 U.S.C. 6293(b)(3)) Testing at more than one speed allows for a more representative indication of ceiling fan efficiency and increases the usefulness of efficiency labels for consumers. Additionally, as high speed is not always the least-efficient speed, DOE proposes to test at both high and low speeds. The proposed approach would limit the test burden and maintain a consistent test burden for all low-volume ceiling fans, the vast majority of which have between three and six speeds. Testing specifically at the highest and lowest available speeds, instead of at three speeds, would also avoid any ambiguity regarding the definition of medium speed for ceiling fans with more than three speeds.

DOE requests comment on testing low-volume ceiling fans at the highest and lowest fan speeds.

2. Elimination of the Requirement for a Test Cylinder to be Used During Testing

A test cylinder is included in the experimental setup of the current DOE test procedure for ceiling fans. Its intended purpose is to control the direction of airflow. During the public meeting for the Framework Document in the ceiling fans energy conservation standards rulemaking, Hunter Fans commented that there was little variation in airflow test results regardless of whether a test cylinder was used when conducting testing under the DOE test procedure. (Hunter, No. 9 at p.56) In a written comment on the Framework Document, ALA stated that: (1) test results from a certified laboratory found that the measured CFM (cubic feet per minute) [at high speed] on 28 different test samples (various diameters) using the specified cylinder (with a diameter 8" larger than the fan diameter) vs. no cylinder at all varied on average by 1.1 percent without the use of the cylinder; (2) the standard deviation was 1.0 percent and the max/min was 3.1/0.1 percent respectively; (3) based on these data, the manufacturers suggest that use of the cylinder should not be required. (ALA, No. 39 at p.9)

To determine the effect of the test cylinder on airflow measurements, DOE conducted testing on three ceiling fans both with and without a test cylinder. The 44-inch, 52-inch, and 56-inch ceiling fans used were tested at all three available speeds. The airflow measurements indicated a difference of 2-10 percent between the two testing scenarios, but there was no consistent dependence on ceiling fan size or fan speed. The calculated variance of the measurement data, however, was almost 20 percent lower overall when testing without a test cylinder, suggesting that testing without a cylinder is a statistically less noisy approach to measuring airflow. This difference in measurement error could perhaps be due to turbulence created by the interaction of the airflow with the side of the test cylinder.

Because testing without a test cylinder appears to be a more accurate approach to measuring airflow and more closely simulates installed usage conditions than with a cylinder in place, DOE proposes to eliminate the requirement to test with a test cylinder. This reduces test burden for manufacturers who may want to introduce new ceiling fan sizes and would otherwise have to pay for a new test cylinder, as well as reducing potential market distortions that would favor ceiling fans at sizes corresponding to existing test cylinders. Additionally, this would more closely harmonize with the test procedure for high-volume ceiling fans (see section III.F.1), which does not include a test cylinder.

DOE proposes that the effective area and the number of sensors used to measure airflow for a given ceiling fan would still be the same as in the current test procedure—that is, the effective area over which airflow is calculated would be a circle 8 inches larger in diameter than the fan blade span. The distance between the ceiling fan blades and the air velocity sensors also would not change. The test cylinder would simply not be installed prior to testing.

3. Addition of a False Ceiling to the Experimental Set-up

In the Framework Document, DOE suggested investigating methodologies for testing hugger ceiling fans (*i.e.*, fans mounted very close to the ceiling) and mentioned the existence of a hugger fan test method in CAN/CSA-C814-10, "Energy Performance of Ceiling Fans," which includes a false ceiling in the test set-up.[9] The comments received on this topic were generally in favor of testing with a false ceiling, although Big Ass Fans commented that it is important to maintain the same distance between the ceiling fan blades and the test sensors as in a standard test set-up for low-volume ceiling fans to ensure an appropriate measurement for comparison to a standard low-volume ceiling fan. (BAF, No. 43 at p.2)

DOE conducted testing on ceiling fans advertised as hugger fans both with and without a false ceiling in place. Having a false ceiling in place for these fans resulted in a 30-percent to 50-percent decrease in measured airflow compared to testing without a false ceiling. One ceiling fan was tested in both the hugger and standard configurations with a false ceiling in place, in addition to being tested without a false ceiling. For this fan, a 50-percent reduction in airflow was found in the hugger configuration with the false ceiling in place when compared to the airflow from the same fan without a false ceiling. When tested in the standard configuration with the false ceiling in place, a 35-percent reduction in airflow was still observed when compared to the airflow from the same fan without a false ceiling. The implication was that the presence of a false ceiling

[9] Canadian Standards Association. *CAN/CSA-C814-10 - Energy Performance of Ceiling Fans*. 2010. (Last accessed February 24, 2014) http://shop.csa.ca/en/canada/energy-efficiency/cancsa-c814-10/invt/27005372010

had a larger impact on airflow than switching from the standard to the hugger configuration.

Using a false ceiling when testing all low-volume ceiling fans is more representative of actual ceiling fan use in a home, where fans are mounted directly to the ceiling. Using a different experimental setup for hugger fans than for other low-volume ceiling fans would also affect efficiency representations on the labels of different types of ceiling fans and result in market representations of ceiling fan efficiency that cannot be readily compared. Such an approach would potentially put fans tested with a false ceiling (such as hugger or multi-mount ceiling fans) at a competitive disadvantage compared to standard ceiling fans. While this change to the test procedure would involve a one-time test burden for testing facilities to install a false ceiling, it should not result in an additional cost per test thereafter.

DOE also compared the effect on airflow measurements of having a false ceiling in place that was 8 inches versus 16 inches larger in width and breadth than the blade span of the ceiling fan. DOE found no appreciable reduction in airflow with a larger false ceiling in place. This implies that a false ceiling 8 inches larger than the blade span of a ceiling fan is sufficiently large to approximate a ceiling.

DOE proposes to test all low-volume ceiling fans with the addition of a false ceiling directly above the ceiling fan. The distance between the lowest point on the ceiling fan blades and the air velocity sensors should be the same as in the current DOE test procedure. The length and breadth of the false ceiling should be at least 8 inches larger than the blade span of the ceiling fan. DOE seeks comment on its proposal to add a false ceiling to the experimental setup for all low-volume ceiling fan testing.

4. Clarification of the Distance Between the Ceiling Fan Blades and the Air Velocity Sensors

As the Framework Document for the ceiling fans energy conservation standard rulemaking notes, the test set-up for the current DOE test procedure assumes that ceiling fan blades are reasonably flat.[10] The test procedure specifies that a test cylinder is to be hung below the ceiling fan such that there is a 6-inch vertical gap between the middle of the fan blade tips and the top of the test cylinder. Without a test cylinder in place, this is effectively a specification of the vertical gap between the middle of the fan blade tips and the heads of the air velocity sensors. It may be unclear as to how the "middle of blade tip" measurements should be made for fans having non-flat blades or unusual shapes.

ALA commented in response to the Framework Document that: (1) the manufacturers suggest maintaining the same test methodology regardless of blade shape; (2) while nontraditional blade shapes may affect airflow, they should not be tested differently based on improved or reduced airflow capability; and (3) changing the test method based on blade shape could potentially create advantages or disadvantages, so a uniform method is suggested. (ALA, No. 39 at p.9)

[10] U.S. Department of Energy–Office of Energy Efficiency and Renewable Energy. Energy Conservation Program for Consumer Products: Framework Document: Energy Efficiency Program for Consumer Products: Energy Conservation Standards for Ceiling Fans and Ceiling Fan Light Kits. March 2013. Washington, D.C. http://www.regulations.gov/#!documentDetail;D=EERE-2012-BT-STD-0045-0002

DOE performed tests to assess the impact of measuring airflow using a vertical distance measured from the bottom of the blade tip compared to a vertical distance measured from the middle of the blade tip. Airflow was measured for two 52-inch fans on low, medium, and high speeds in the two different vertical distance configurations. One fan was chosen specifically for having a nontraditional curved blade shape with an ambiguous middle of the blade tip. Testing for both fans indicated that measurements of airflow using the two configurations were consistent to within 3 percent on medium and high speeds and 6 percent on low speed. Therefore, to avoid the potential ambiguity of the phrase "middle of blade tip," DOE proposes to instead define the vertical gap in terms of the distance between the lowest point on the ceiling fan blades and the heads of the air velocity sensors. This would apply to all low-volume ceiling fan blades to ensure a congruent test for airflow.

5. Clarification of the Appropriate Fan Configuration During Testing for Low-Volume Ceiling Fans

DOE research indicates that a number of low-volume ceiling fans can be mounted at more than one height while still being classified as either a standard or hugger ceiling fan (rather than meeting DOE's definition of a multi-mount fan). As an example, a ceiling fan that can be mounted at three different heights, all of which result in the lowest point on the fan blades being more than ten inches from the ceiling, would be classified as a standard ceiling fan. Therefore, DOE proposes to clarify that if more than one mounting option is included with a fan that would meet the definition of a standard low-volume ceiling fan, that ceiling fan should be tested in the configuration with the smallest distance between the ceiling and the lowest part of the fan blades. Similarly, if more than one mounting option is included with a fan that would meet the definition of a hugger low-volume ceiling fan, that ceiling fan should be tested in the configuration with the smallest distance between the ceiling and the lowest part of the fan blades. DOE seeks data and comment on how these fans are actually configured in the field.

6. Clarification of the Test Method for Ceiling Fans with Heaters

The Framework Document for the ceiling fans energy conservation standards rulemaking noted that some ceiling fans are sold with combined heating elements, although the extent to which such heaters are used is unclear.[10] DOE preliminarily concluded that it would not consider the power consumption by the heater in the rulemaking and asked for comment. The only comment received on this topic supported DOE's planned approach. (ALA, No. 39 at p. 11) DOE proposes to clarify that during testing, any ceiling fan packaged with a heater should be tested with the heater in place (representative of the configuration when the fan is used by a consumer) but switched off.

7. Revision of the Allowable Tolerance for Air Velocity Sensors Used During Testing

As noted in the Framework Document for the ceiling fans energy conservation standard rulemaking, the current DOE test procedure incorporates by reference ENERGY STAR guidance manual v1.1, which requires air speed sensors with an accuracy of +/- 1 percent or better. ENERGY STAR guidance manual v1.2, however, requires air speed sensors with an accuracy of only +/- 5 percent or better. The Framework Document suggested that the appropriate tolerance may need to be reevaluated.[10]

ALA commented that ceiling fan manufacturers are of the opinion that the accuracy sensor specified in the current ENERGY STAR guidance manual (+/-5%) is acceptable, but they recommended that a test fan be distributed among all laboratories certified to perform DOE's ceiling fan test procedure and that testing be conducted to ensure that all of the labs correlate. (ALA, No. 39 at p. 7)

To determine whether sensor accuracy affects airflow measurements, DOE compared the variation in mean air speeds when testing with sensors with different accuracy ratings and investigated the variation in raw air speed readings from a single sensor type. First, DOE compared the average air speeds reported by two different test laboratories for the same ceiling fan. One laboratory used sensors matching the tolerance allowed by ENERGY STAR guidance manual v1.2: the maximum of 5 percent of the reading or 1 percent of the full-range sensor accuracy. The other laboratory used sensors with a better accuracy: the maximum of 2 percent of the reading or 0.5 percent of the selected range. If the uncertainty in mean air speed was due to sensor accuracy, the ratio of the standard errors between the labs should have been similar to the ratio of sensor accuracies (*i.e.*, 5:2). DOE found, however, that both laboratories had a similar standard error of mean air speed, which significantly exceeded the expected error due to sensor accuracy. Second, DOE investigated the coefficients of variation for raw air speed measurements from several ceiling fans tested in a single laboratory. The coefficients of variation were approximately ten times greater than would be expected if the measurement uncertainty came only from the sensor accuracy.

Based on these analyses, DOE concluded that the variation in measured air speed was not greatly affected by the accuracy of the sensors used in the two test laboratories. As a result, there appears to be no reason to require the use of sensors with accuracy better than +/-5 percent of the reading. Accordingly, DOE proposes to change the sensor tolerances from the current test procedure value of 1 percent to 5 percent.

F. Proposed Additional Test Methods

1. Addition of a Test Method for High-Volume Ceiling Fans

High-volume ceiling fans (where volume refers to airflow volume) are typically offered in a range of diameters from 36 inches to 24 feet. The large size of some high-volume ceiling fans cannot be accommodated by existing ceiling fan test facilities for low-volume ceiling fans without significant modifications. In some cases, the ceiling fans would simply not fit into the test room.

AMCA 230, "Laboratory Methods of Testing Air Circulating Fans for Rating and Certification," is the industry test procedure for high-volume ceiling fans. The test procedure describes a ceiling fan hung from a load cell. When the ceiling fan is turned on, the measured change in force on the load cell allows thrust to be calculated, and AMCA 230 provides an equation for calculating airflow based on thrust. This is a different approach than the current DOE test procedure for low-volume ceiling fans, which measures air velocity directly. Given the large dimensions of some high-volume ceiling fans, an approach based on AMCA 230 (requiring only a load cell) appears to be more practical than an approach based on the current DOE test procedure for low-volume ceiling fans, which requires an array of sensors.

The latest version of the AMCA 230 test procedure (AMCA 230-12) specifies that it is to be applied to ceiling fans 6 feet in diameter or smaller. A previous version of AMCA 230 (AMCA 230-07), however, allows for testing larger ceiling fans with no restriction on fan size, using a modified version of the test procedure. In the modified version, the restrictions on the room dimensions with respect to the fan size are relaxed and not specified. Even for those ceiling fans with diameters in the 20-24 feet range, performance specifications (such as airflow and airflow efficiency) can be found on websites and in manuals of several manufacturers, suggesting that it is possible to test ceiling fans with large diameters.

For ceiling fans up to 24 feet in diameter, DOE proposes testing high-volume ceiling fans in keeping with industry practice, using a test procedure based on AMCA 230-12, and incorporating AMCA 230-12 by reference. It appears plausible to test even large high-volume ceiling fans according to such a test procedure, with some modification to the specified room dimensions. DOE proposes to modify the specified room dimensions for high-volume ceiling fans in the following ways: (1) the minimum distance between the ceiling and the blades of a ceiling fan being tested is 44 inches for all blade diameters, (2) ceiling fans larger than 6 feet in diameter must have a 20 foot clearance between the floor and the blades of the fan being tested, and (3) for ceiling fans larger than 6 feet in diameter, the minimum distance between the centerline of a ceiling fan being tested and walls and large obstructions all around is half the ceiling fan blade span plus 10 feet. The proposed requirement for a minimum distance between the ceiling and the blades would mean that even the largest ceiling fans, at 24 feet in diameter, would have a clearance of at least 15 percent of the fan blade diameter, and that the clearance will be roughly equivalent to the clearance for low-volume ceiling fans. The proposed minimum clearance between the blades and the floor is based on the typical installation environment for fans larger than 6 feet in diameter. Distances greater than 20 feet could impose testing burden by requiring very tall testing rooms. Additionally, a distance of 20 feet between the floor and the fan blades is one of the distances recommended by researchers on this topic.[11] The proposed minimum clearance laterally about the blades is designed to balance the need for unobstructed airflow patterns in the room with not requiring a testing facility that would be excessively burdensome to create. DOE seeks comment on these proposed changes to the room specifications.

DOE is not aware of any third-party testing facility that currently tests large-diameter, high-volume ceiling fans. The large amount of space required to conduct the proposed test procedure may be the primary constraint in establishing such a test facility. For example, the proposed room requirements for a ceiling fan 24 feet in diameter are a room that is at least 44 feet square, that is free of large obstructions, and has a ceiling height of approximately 24 feet. DOE requests information on how manufacturers currently test large-diameter, high-volume ceiling fans, as well as the availability of suitable third-party testing facilities that can conduct the proposed test procedure and the ability to develop such facilities.

2. Addition of a Test Method for Low-Volume Multi-Mount Ceiling Fans

---

[11] Rohles, F.H., Jr., J.E. Laviana, T.E. Shrimplin, *Assessing Air Velocities from the Industrial Ceiling Fan* (1986). ASHRAE Transactions, vol. 92, pt. 1A: San Francisco, CA.

DOE is proposing to define multi-mount ceiling fans as ceiling fans that can be mounted in both the standard and hugger ceiling fan configurations (see Section III.A.4). The Framework Document for the ceiling fans energy conservation standards rulemaking suggested that multi-mount ceiling fans should be tested with the fan installed in the hugger configuration. (78 FR 16443 (Mar. 15, 2013))

ALA commented that multi-mount ceiling fans should be tested in the standard ceiling fan configuration. ALA cited the AcuPOLL survey, which indicates that 73 percent of multi-mount ceiling fans are installed in the standard configuration. (ALA, No. 39 at pp.8-9) ALA also suggested that, if needed, a statement can be added to show which configuration was used for the CFM test. King of Fans (KOF) commented that it does not agree with testing the multi-mount fans in the hugger/flush mount configuration, as it can make the multi-mount fans (which provide a consumer benefit) noncompetitive with fans that do not have the flush mount option, at least in terms of reported energy efficiency. KOF stated that testing multi-mount fans in this manner would cause the CFM ratings to be affected, which may in turn cause a customer to default to a higher-rated CFM product; this would put the multi-mount fans at a competitive disadvantage. (KOF, No.42 at p.1) Progress Lighting also commented that multi-mount ceiling fans should be tested in the standard configuration, stating that customized configurations have many variables that cannot be controlled for in the analysis. (Progress Lighting, No. 6 at pp.2-3)

On the other hand, CA IOUs suggested establishing two performance standards for multi-mount ceiling fans: (1) one for when the fan is in the hugger position (same as the hugger product class standard), and (2) another for when the fan is in a standard position. (CA IOUs, No. 12 at p. 2)

Since multi-mount ceiling fans can be installed in either standard or hugger configuration, DOE proposes to test low-volume multi-mount ceiling fans in both configurations: 1) in the configuration that meets the definition of a standard ceiling fan, while minimizing the distance the ceiling and the lowest part of the fan blades, and 2) in the configuration that meets the definition of a hugger ceiling fan, while minimizing the distance between the ceiling and the lowest part of the fan blades. DOE seeks comment on whether manufacturers should be required to test multi-mount ceiling fans in the standard configuration, hugger configuration, both configurations, or all configurations for which they are capable of being installed.

3. Addition of a Test Method for Multi-headed Ceiling Fans

In the Framework Document for the ceiling fans standards rulemaking, DOE discussed the challenges presented regarding testing of multi-head ceiling fans.[10] One challenge is that the variable geometry of multi-head fans may make it difficult to compare test results among either different types of multi-head ceiling fans or between multi-head fans and fans with a single head. Another challenge is that the effective blade span of some multi-head ceiling fans may exceed the area that can currently be tested with air velocity sensors. DOE stated that it was considering testing only one of the ceiling fan heads, with the other fan head motors turned off, and treating the fan head like a standard single-head ceiling fan. The airflow and power consumption associated with one head could then be multiplied by the number of fan heads in the multi-head ceiling fan. DOE asked for comment on this approach. Comments on the Framework Document were generally in favor of testing a single fan head for a multi-head fan, with some exceptions.

In its comments, Fanimation recommended that DOE test only one of the ceiling fan heads, with the other fan head motors turned off, treating the fan head like a standard single-head ceiling fan. Fanimation further suggested that: (1) the airflow and airflow efficiency could be rated for the individual head, and (2) the total airflow for multiple heads could be determined by multiplying the airflow from one fan by the number of heads, assuming all are of equal construction and diameter. Fanimation concluded that no alternative testing strategy is necessary and that testing multiple fan heads would be overly burdensome. (Fanimation, No. 32 at p. 3) ALA commented that, provided the fan blades of each fan head turn at approximately the same RPM (revolutions per minute), it suggests measuring the CFM of one fan head and multiplying the results times the total number of fan heads. (ALA, No. 39 at p.10)

ASAP, NCLC, NRDC, and NEEA commented that one potential approach would be for manufacturers to certify that the fan heads that are not tested do not have any characteristics that are different from those of the tested fan head that affect efficiency (similar to the language used for determining "basic models"). Furthermore, ASAP, NCLC, NRDC, and NEEA suggested that, for the case where individual fan heads do have different characteristics that affect efficiency, multiple fan heads would need to be tested. (ASAP, NCLC, NRDC, and NEEA, No. 14 at p. 4)

CA IOUs recommended conducting testing with multiple fan heads running simultaneously to account for interactive effects, stating that testing only one fan head could be overlooking a significant drop in fan performance that DOE should take into account. (CA IOUs, No 12 at p.3)

To assess the impact of measuring airflow and power consumption based on a single fan head versus more than one head operating simultaneously, DOE conducted a series of tests on a multi-head ceiling fan with two identical fan heads. The ceiling fan system was first tested with both fan heads operating simultaneously, with the midpoint of the fan system centered where the four sensor axes meet. The fan heads were oriented along the A-C sensor axis and faced straight downwards. Next, with the ceiling fan system still in the same position and orientation, DOE measured the results for each individual fan head with the other fan head turned off via a switch on the center housing of the fan. In addition to airflow measurements, DOE recorded the power consumption of the fan system for each test.

Overall, the airflow velocity profile for the two fan heads turned on simultaneously was roughly similar to the sum of testing each fan head individually. Tests with individual fan heads produced more airflow along the outermost sensors along the A-C axis. Both heads running simultaneously directed more air towards the center of the system. Compared to the sum of measurements from individual fan heads, the test done with both heads running simultaneously measured 7-20 percent less total airflow, depending on fan speed.

However, DOE notes that multi-head ceiling fans are designed to provide airflow over a larger area than single-head fans. When testing multiple fan heads simultaneously, it is unclear whether the airflow measurements made by sensors designed to capture the airflow of an individual fan head is an adequate representation of the airflow that consumers with a multi-head fan may experience. Unlike a single-head ceiling fan, which is centered on the meeting point of the four sensor axes, the individual fan heads of a multi-head fan are displaced from where the sensor axes meet, and airflow may not be adequately measured because the sensors are no longer directly beneath the fan heads. This will likely underestimate the airflow directly underneath the fan heads. This problem would be compounded for multi-head fans with more than two fan heads. This suggests that testing an individual fan head, and multiplying by the number of fan heads, may yield a more representative measurement.

Additionally, DOE recognizes that testing large multi-head fans with all fan heads operating simultaneously is not feasible due to the size constraints of testing facilities and the number of sensors required to adequately measure the fan's velocity profile. In light of this testing constraint, and the possibility that the sensor apparatus will not yield representative results because it is designed to measure airflow near the intersection of the sensor axes, DOE proposes to test multi-headed ceiling fans by testing a single fan head, with the fan head in the same position as when a fan with a single head is tested, such that it is directly over sensor 1 (*i.e.*, at the center of the test set-up, where the four sensor axes meet). This can be accomplished by either offsetting the entire false ceiling, or the multi-head fan with respect to the false ceiling, as long as the requirement that the false ceiling extend at least 8 inches beyond the blade span of the centered fan head is maintained. Supporting chains, wires, or ropes may be used to keep the false ceiling level, if the multi-head ceiling fan is offset with respect to the false ceiling. The distance between the air velocity sensors and the fan blades of the centered fan head should be the same as for all other low-volume ceiling fans. Switching on only the centered fan head, the airflow measurements should be made in the same manner as for all other low-volume ceiling fans.

If a multi-head ceiling fan includes more than one type of ceiling fan head, then at least one of each unique type should be tested. Differences in fan head construction such as housing, blade pitch, or motor could affect air movement or power consumption and would constitute a different type of fan head. If all the fan heads are of the same type, then only one fan head needs to be tested. The airflow at a given speed should be measured for an individual head, and total airflow determined by multiplying the results by the number of fan heads of each type.

DOE also assessed the potential for measuring the power consumption of a single fan head, and then multiplying by the total number of fan heads to determine total power consumption. DOE found that the power consumption measured for one individual fan head was 75 percent of the power consumption measured when both fan heads operated simultaneously. As such, measuring the power consumption of one fan head and multiplying by the number of fan heads would significantly overestimate the power consumption of both fan heads operating simultaneously. Therefore,the power consumption at a given speed should be measured with all ceiling fan heads turned on. It is not necessary to measure power consumption at multiple airflow sensor arm positions, however. An average over 100 seconds with the sensor arm in any position is sufficient, given the relatively low variability of the wattage measurement.

The effective blade span for a multi-head ceiling fan is the blade span of an individual fan head, if all fan heads are the same size. If the fan heads are of varying sizes, the effective blade span is the blade span of the largest fan head.

4. Addition of a Test Method for Ceiling Fans Where the Airflow is Not Directed Vertically

As noted in the Framework Document for the ceiling fans standards rulemaking, DOE has observed that some ceiling fans on the market can be oriented in various positions that direct the airflow and that sometimes the fans cannot be oriented such that airflow is directed straight down (*i.e.*, the typical configuration).[10] A non-vertical orientation could result in some of the airflow produced being undetected by the airflow sensors directly beneath the ceiling fan. In response to the Framework Document, ALA commented that: (1) the manufacturers recommend that the velocity of the air must be measured perpendicular to the flow of the air, and (2) if a ceiling fan, installed as intended, is constructed such that the airflow is not directed vertically, then steps must be taken through special fixtures or other acceptable means to position the fan head so that the airflow is directed vertically for measurement purposes. (ALA, No. 39 at p. 11)

Regarding this issue, DOE conducted tests of a fan head with an adjustable tilt to explore the impact of measuring airflow at an angle other than directly downward. In comparison to airflow measurements of the fan head directed straight down, tilting the fan head at a 15-degree angle along the A-axis shifted the velocity profile along the A-C axis and reduced the airflow measured along the B-D axis. Average measurements from all four sensor axes result in airflow measurements that are 6-17 percent lower than that measured directly downward, depending on fan speed. The systematically lower measurements are not unexpected, since most of the airflow in the tilted configuration was offset from the center of the four axes along the A-axis. Due to constraints on the arrangement of the sensor axes, sensors are not in an appropriate position to measure airflow in the direction perpendicular to the A-C axis. However, DOE found that using average measurements from only those sensors which maximize airflow along the A-C axis improved agreement with measurements of the fan directed straight down to within 2-10 percent. This calculation assumes that, if sensors were placed in the appropriate positions along the orthogonal axis, the airflow measurements would be the same as along the A-C axis.

For ceiling fans where the airflow is not directed vertically, DOE proposes to clarify that the ceiling fan head should be adjusted such that the airflow is as vertical as possible prior to testing so that the measured airflow is representative of airflow in the direction the fan head faces during normal operation. The distance between the lowest point on the blades and the air velocity sensors should be the same as for all other low-volume ceiling fans. For ceiling fans where a fully vertical orientation of airflow cannot be achieved, DOE proposes to orient the ceiling fan such that any remaining tilt is aligned along one of the four sensor axes. Instead of measuring the air velocity for only those sensors directly beneath the ceiling fan, the air velocity should be measured at all sensors along that axis, as well as the axis oriented 180 degrees with respect to that axis. Using the same total number of sensors as would be utilized if the airflow was directly downward, the airflow should be calculated based on the continuous set of sensors with the largest air velocity measurements. For example, if the tilt is oriented along axis A, air velocity measurements should be taken for all sensors along the A-C axis. The air velocity measurements would normally be drawn from a symmetric set of sensors for each axis, but because of the tilt, the air velocity may be maximized for a set of sensors offset by several sensor positions along the A axis. See Figure 1 for an example. The air velocity results from that offset series of sensors would be substituted for the typical symmetric set in order to calculate total airflow, for both the A-C axis as well as the B-D axis. The effective area used to calculate airflow would be the same as for an untilted ceiling fan with the same blade span.

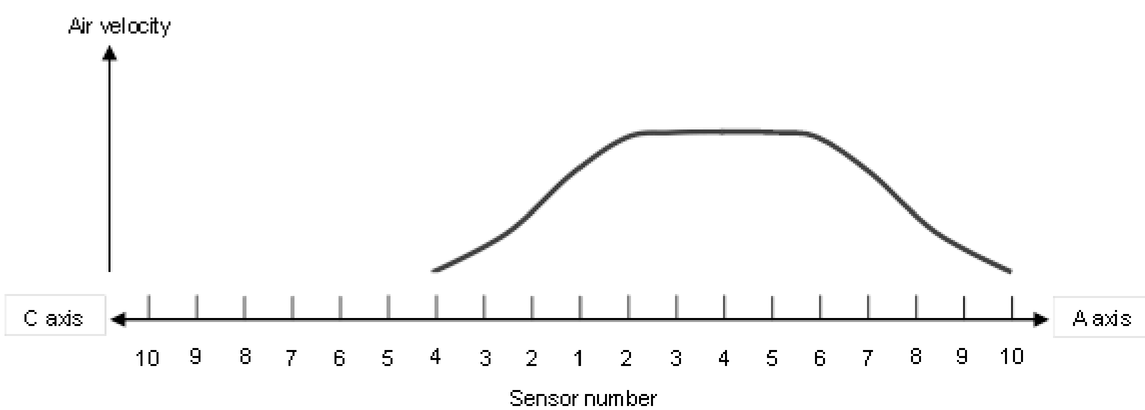

Figure 1: Example Air Velocity Pattern for Airflow Not Directly Downward

Given that many of the ceiling fans that cannot achieve vertical airflow are multi-headed fans, using an adjustable mount to achieve a vertical orientation may be experimentally impractical. Additionally, making significant adjustments to the tilt beyond what the ceiling fan is capable of achieving when installed may not provide an accurate representation of expected airflow to a potential consumer. For ceiling fans that cannot achieve vertical airflow, directing the airflow as downward as possible, even if the airflow is not vertical, may be the most realistic representation of expected airflow for potential consumers.

5. Addition of a Test Method for Power Consumption in Standby Mode

DOE proposes to add standby-mode power consumption testing for low-volume and high-volume ceiling fans. Specifically, standby-mode testing would be applicable to any ceiling fan sold with hardware to maintain any of the standby functions defined in 42 U.S.C. § 6295(gg)(1)(A)(iii)(II).

For low-volume ceiling fans, DOE's research suggests that standby mode typically exists for only those low-volume ceiling fans that include a radio frequency (RF) receiver to facilitate interaction with a remote controller. DOE understands that high-volume ceiling fans, on the other hand, often have power consumption in standby mode even if they do not include a remote control: for example, if they utilize a variable frequency drive (VFD) to control the speed of the motor. Standby testing would be required, and included in the metric, for any high-volume ceiling fan with a VFD, as well as any high-volume ceiling fan with a remote control. DOE requests comment on this approach.

For both low and high-volume ceiling fans, the standby test would be performed following testing in active mode and would require putting the ceiling fan in standby mode (if controlled by a remote control or other sensor) and measuring the input power draw. As required by 42 U.S.C. 6295 (gg)(2)(A), DOE considered the most current versions of Standards 62301 and 62087 of the International Electrotechnical Commission (IEC) as a basis for standby-mode testing. DOE considered IEC 62087 and determined that it is not applicable to ceiling fans.[12] DOE also considered IEC 62301 (Edition 2.0, 2011-01). IEC 62301 would require the addition of at least 40 minutes to the test procedure for those fans subject to standby testing. Because this may result in an excessive test burden for these ceiling fans, DOE proposes to incorporate IEC 62301 by reference, but reduce the interval of time over which testing occurs, as well as the period of time prior to standby testing. DOE proposes to wait three minutes after active mode functionality has been switched off to begin the standby-mode test and then to collect data for 100 seconds. By that point in the test procedure, the ceiling fan will have already been energized for over 30 minutes for the active mode test (15 minute warm-up plus more than 15 minutes for each speed tested), so DOE believes additional warm-up time is unnecessary. The 100 second duration for standby-mode testing matches the requirement for active mode testing at each sensor arm position.

Standby power consumed by low-volume ceiling fans appears to be fairly minimal. DOE conducted standby power testing on four low-volume ceiling fans with remote control receivers and found an average standby power consumption of approximately 0.81 watts. Additionally, ALA provided comments to the Framework Document indicating that low-volume ceiling fans with wireless remote controls typically have standby power consumption of 1.4W. (ALA, 39 at pg.13) Given that standby power consumption is fairly minimal, but does require some additional testing, an

[12] IEC 62087 is applicable to television sets, video recording equipment, set top boxes, audio equipment and multifunction equipment for consumer use.

alternative approach to accounting for standby power consumption would be to use a representative value, such as the 1.4 W estimate provided by ALA. However, the additional testing for standby mode would take less than 5 minutes, be conducted immediately after active mode testing, and requires no additional equipment, so the testing burden would be minimal. DOE requests comment on its approach to standby-mode testing and the appropriateness of testing standby power for ceiling fans.

In the Framework Document for the ceiling fans energy conservation rulemaking, DOE said that it understands that ceiling fans have no off-mode power consumption, and thus off-mode power consumption would not need to be included in the test procedure or in the metric, and asked for comment.[10] DOE received no comments indicating that there was any off-mode power consumption for ceiling fans but did receive a comment affirming that there is no off-mode power consumption for ceiling fans, with ALA commenting that ceiling fans consume 0W in off mode. (ALA, No. 39 at p.13) Zero power consumption in off mode is also supported by the UL safety standard for electrical fans (UL 507), which covers ceiling fans, and which says that fans must include an air-gap switch which would open the circuit and provide no off-mode power consumption.6 Because there appears to be no off-mode energy consumption for ceiling fans, DOE proposes not to conduct testing of off-mode power consumption.

G. Certification and Enforcement

Ceiling fan manufacturers must submit certification reports on products before they are distributed in commerce per 10 CFR 429.12. Components of similar design may be substituted without additional testing, if the substitution does not affect the energy consumption of the ceiling fan. (10 CFR 429.11) Ceiling fan certification reports must follow the product-specific sampling and reporting requirements specified in 10 CFR 429.32. If any amended test procedures are finalized, and consistent with the dates specified for use in section III.B., ceiling fan manufacturers would be required to calculate ceiling fan efficiency utilizing the calculations provided in revised Appendix U and follow the reporting requirements provided at 10 CFR 429.32 for each ceiling fan model.

As discussed in sections III.A.1. and III.B., the proposed changes in interpretation of the ceiling fan definition discussed above would result in the applicability of the design standards set forth in EPCA at 42 USC 6295(ff)(1) to the following types of fans 30 days after the publication of any final test procedure adopting such changes in interpretation:

1. Fans suspended from the ceiling using a downrod or other means of suspension such that the fan is not mounted directly to the ceiling;
2. Fans suspended such that they are mounted directly or close to the ceiling;
3. Fans sold with the option of being suspended with or without a downrod; and
4. Fans capable of producing large volumes of airflow.

In the concurrent energy conservation standards rulemaking for ceiling fans, DOE is considering creating a separate product class for highly decorative ceiling fans that would be exempt from performance standards. The current design standards specified in EPCA would still apply to such fans.

IV.Procedural Issues and Regulatory Review

A. Review Under Executive Order 12866

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

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of a regulatory flexibility analysis (RFA) 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 (Feb. 19, 2003)). DOE has made its procedures and policies available on the Office of the General Counsel's Web site: http://energy.gov/gc/office-general-counsel.

DOE reviewed today's proposed rule under the provisions of the Regulatory Flexibility Act (RFA) and the policies and procedures published on February 19, 2003. The proposed rule prescribes test procedure amendments that would be used to determine compliance with any amended energy conservation standards that DOE may prescribe for ceiling fans. As discussed in more detail below, DOE found that although the Federal Trade Commission (FTC) requires testing of ceiling fans, because DOE does not currently require efficiency testing of ceiling fans, all manufacturers, including small manufacturers, could potentially experience a financial burden if new testing becomes required as a result of the concurrent energy conservation standards rulemaking. While examining this issue, DOE determined that it could not certify that the proposed rule, if promulgated, would not have a significant effect on a substantial number of small entities. Therefore, DOE has prepared an initial regulatory flexibility analysis (IRFA) for this rulemaking. The IRFA describes potential impacts on small businesses associated with ceiling fan testing requirements. DOE seeks comment on the discussion below and will develop a final regulatory flexibility analysis (FRFA) for any final test procedures developed in this test procedure rulemaking.

DOE has transmitted a copy of this IRFA to the Chief Counsel for Advocacy of the Small Business Administration for review.

(1) Description of the reasons why action by the agency is being considered.

A description of the reasons why DOE is considering this test procedure are stated elsewhere in the preamble and not repeated here.

(2) Succinct statement of the objectives of, and legal basis for, the proposed rule.

The objectives of and legal basis for the proposed rule are stated elsewhere in the preamble and not repeated here.

(3) Description of and, where feasible, an estimate of the number of small entities to which the proposed rule will apply.

For the manufacturers of the covered ceiling fan products, the Small Business Administration (SBA) has set a size threshold, which defines those entities classified as "small businesses" for the purposes of the statute. DOE used the SBA's small business size standards to determine whether any small entities would be subject to the requirements of the rule. 13 CFR part 121. The size standards are listed by North American Industry Classification System (NAICS) code and industry description and are available at: *http://www.sba.gov/sites/default/files/Size_Standards_Table.pdf*. Ceiling fan manufacturing is classified under NAICS code 335210, "Small Electrical Appliance Manufacturing" or NAICS code 333412, "Industrial and Commercial Fan and Blower Manufacturing." The SBA sets a threshold for NAICS classification for 335210 and 333412 of 750 employees or less and 500 employees or less, respectively.[13] DOE reviewed ALA's list of ceiling fan manufacturers,[14] the ENERGY STAR Product Databases for Ceiling Fans,[15] the California Energy Commission's Appliance Database for Ceiling Fans,[16] and the Federal Trade Commission's Appliance Energy Database for Ceiling Fans.[17] Based on this review, using data on the companies for which DOE was able to obtain information on the numbers of employees, DOE estimates that there are

[13] U.S. Small Business Administration, Table of Small Business Size Standards (August 22, 2008) (Available at: http://www.sba.gov/sites/default/files/Size_Standards_Table.pdf).
[14] The American Lighting Association, list of Manufacturers & Representatives (Available at: http://www.americanlightingassoc.com/Members/Resources/Manufacturers-Representatives.aspx).
[15] The U.S. Environmental Protection Agency and the U.S. Department of Energy, ENERGY STAR Ceiling Fans—Product Databases for Ceiling Fans (Available at: http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=CF).
[16] The California Energy Commission, Appliance Database for Ceiling Fans (Available at: http://www.appliances.energy.ca.gov/QuickSearch.aspx).
[17] The Federal Trade Commission, Appliance Energy Databases for Ceiling Fans (Available at: http://www.ftc.gov/bcp/conline/edcams/eande/appliances/ceilfan.htm).

between 25 and 35 small business manufacturers of low-volume ceiling fans. To determine the number of small business manufacturers of high-volume ceiling fans, DOE reviewed SBA's website, high-volume ceiling fan manufacturers websites, and company reports from Hoovers.com, in addition to speaking with industry experts. Based on this review, DOE estimates that there are between 15 and 25 small business manufacturers of high-volume ceiling fans. DOE invites interested parties to comment on the estimated number of small business manufacturers of ceiling fans.

(4) Description of the projected compliance requirements of the proposed rule.

In this test procedure NOPR, DOE proposes to reinterpret the statutory definition of a ceiling fan to include hugger ceiling fans. DOE also proposes that high-volume fans meet the definition of a ceiling fan. The proposed changes in interpretation of the ceiling fan definition discussed above would result in the applicability of the design standards set forth in EPCA at 42 USC 6295(ff)(1) to the following types of fans 30 days after the publication of any final test procedure adopting such changes in interpretation:

1. Fans suspended from the ceiling using a downrod or other means of suspension such that the fan is not mounted directly to the ceiling;
2. Fans suspended such that they are mounted directly or close to the ceiling;
3. Fans sold with the option of being suspended with or without a downrod; and
4. Fans capable of producing large volumes of airflow.

DOE research indicates that all ceiling fans currently on the market, including hugger ceiling fans and high-volume ceiling fans, appear to meet the EPCA design standards. DOE conducted an analysis of Hansen Wholesale, an online wholesaler that sells over 2000 models of ceiling fans, including a wide variety of ceiling fan brands. Hansen Wholesale provides product specifications on its website, including the number of speeds and whether a ceiling fan is reversible. DOE examined all of the ceiling fans that were self-identified as hugger ceiling fans and found that they all had fan controls separate from lighting controls, were capable of being operated at more than one speed, and were capable of being operated in reverse.

For high-volume ceiling fans, DOE searched for product specifications on the websites of manufacturers of high-volume large-diameter ceiling fans and from websites of retailers of high-volume small-diameter ceiling fans. Only one high-volume ceiling fan was found with a light kit, and the fan controls were separate from the lighting controls for that fan. All high-volume ceiling fans appeared to be capable of operating at more than one speed (typically with an adjustable speed control). High-volume ceiling fans are primarily sold for industrial purposes and are therefore not subject to the requirement to be capable of operating in reverse.

Based on this research, DOE does not expect any cost of complying with the design requirements for manufacturers of hugger or high-volume ceiling fans.

DOE proposes measures to limit the burden of testing on all manufacturers, including small business manufacturers, while providing a representative measurement of ceiling fan efficiency for consumers. Low-volume ceiling fans (excluding hugger fans) are currently required to test at high speed due to FTC's labeling requirement for ceiling fans. As discussed in more detail elsewhere in the preamble, DOE proposes to specify that low speed is to be tested as well as high speed to have a test procedure that is representative of typical use. DOE estimates that the cost to test at low speed, in addition to high speed, represents an additional cost of $75 (or $150 per basic model) above the high-speed test cost.

DOE notes that if the concurrent rulemaking regarding energy conservation standards for ceiling fans results in efficiency performance standards, DOE would require testing for certification of two ceiling fans per basic model, the minimum sample size required by 10 CFR 429.11. To determine the potential cost of the proposed test procedure on small ceiling fan manufacturers under a potential energy conservation standard for ceiling fans, DOE estimated the cost of testing two ceiling fans. The cost of testing was then multiplied over the estimated number of basic models produced by a small manufacturer. The estimated cost of testing is discussed in further detail below.

In today's test procedure proposal, DOE has proposed to reinterpret the statutory definition of a ceiling fan such that it would include hugger ceiling fans. The proposed test method for hugger ceiling fans would be the same as the proposed test method for all other low-volume ceiling fans.

DOE estimated the cost to test a low-volume ceiling fan based on estimates from third-party testing facilities of the cost to perform the current ENERGY STAR test procedure for ceiling fans, which is similar to DOE's proposed test procedure, and the changes in cost associated with the key differences between the two test procedures. DOE's proposed test procedure for low-volume ceiling fans differs from the current

ENERGY STAR test procedure in that it (1) requires testing at only two fan speeds instead of three, (2) requires the use of a false ceiling, (3) does not require the use of a test cylinder, (4) requires less warm up time before testing at low speed, and (5) requires standby-mode testing.

In aggregate, DOE estimates that these differences will result in a lower test cost for the proposed DOE test procedure for low-volume ceiling fans when compared to the ENERGY STAR test procedure for ceiling fans. Testing at only two speeds instead of three yields a total test time that is approximately 35 minutes shorter than the ENERGY STAR test procedure. The proposed test procedure would also add a false ceiling to the experimental setup which, as discussed in section III.E.3, requires a one-time lab cost to install a false ceiling in a testing facility. Based on the materials employed and test quotes from third-party labs, DOE estimates the cost to construct and install a false ceiling is $1000 or less. Because the same false ceiling could be used to test all low-volume ceiling fans, the false ceiling could be left in place and would not add substantial test cost thereafter.

DOE's proposed test procedure, which would not require use of a test cylinder, also eliminates any potential costs associated with purchasing new test cylinders. If the test procedure required the use of test cylinders, then a new cylinder would be necessary to test any ceiling fan with a diameter that does not correspond to one of the cylinders in a test lab's existing inventory. Based on discussions with third-party testing facilities, DOE estimates that new test cylinders would cost approximately $2000-3000 per cylinder. By not using a cylinder, these costs will be avoided. Not requiring a test cylinder also shortens the test time of DOE's proposed test procedure relative to ENERGY STAR's test procedure for all low-volume ceiling fans, because time is not required to put a test cylinder in place for each test (estimated to take 15 minutes). Additionally, DOE's proposed test procedure only requires 15 minutes of warm up time before testing at low speed compared to 30 minutes in the ENERGY STAR test procedure, further reducing the relative amount of time required for DOE's proposed test procedure by 15 minutes. In total, DOE estimates that the typical time to perform the proposed test procedure will be shorter by 65 minutes compared to ENERGY STAR's test procedure.

DOE's proposed test procedure does add a requirement for standby-mode testing, for ceiling fans with standby functionality. However, as noted in section III.F.5, the additional testing for standby would take less than 5 minutes, be conducted immediately after active mode testing, and requires no additional equipment, so the testing burden would be minimal.

Based on all of these differences with respect to the ENERGY STAR test procedure, and estimates from third-party testing facilities of the labor costs associated with these differences, DOE estimates that the proposed test procedure for low-volume ceiling fans will cost between $600 and $1800 per test, for a total of $1200 to $3600 per basic model of ceiling fan for standard and hugger ceiling fans. For multi-mount ceiling fans, DOE estimates that the test cost will be approximately double the cost for standard and hugger ceiling fans. DOE also estimates that multi-mount ceiling fans represent approximately 20% of ceiling fan basic models for small business manufacturers. The test method for multi-head ceiling fans may require somewhat more time to set up compared to the time required for a single-headed fan, and DOE estimates the cost to be between $1300 and $2000 per test, or $2600 to $4000 per basic model. However, DOE notes that multi-head ceiling fans appear to represent 5% or less of ceiling fan basic models for small business manufacturers. Based on best estimates from third party testing facilities, DOE estimates that a typical test for a single-headed ceiling fan would cost approximately $950, or $1900 per basic model for standard or hugger ceiling fans, and $3800 per basic model for multi-mount ceiling fans.

For the approximately 30 small business manufacturers of low-volume ceiling fans that DOE identified, the number of basic models produced per manufacturer varies significantly from one to approximately 80. Therefore, based on the test cost per ceiling fan basic model, the testing cost in the first year would range from approximately $1900 to $182,400 for small manufacturers of ceiling fans. DOE expects this cost to be lower in subsequent years because only new or redesigned ceiling fan models would need to be tested.

DOE estimated the cost to test a high-volume ceiling fan based on discussions with testing facilities capable of performing the AMCA 230 test procedure as well as cost estimates based on the time and labor costs necessary to perform the proposed test procedure on larger high-volume ceiling fans. DOE estimates that the one-time cost for a lab to buy a load-cell, a fabricated load-cell frame, power meter, and one air velocity sensor is approximately $4500. DOE estimates that the proposed test procedure for high-volume ceiling fans will cost manufacturers between $1000 and $3500 per test, for a total of $2000 to $7000 per basic model of ceiling fan. Based on the mid-point of the testing range, DOE estimates that the typical test would cost $2250 per test, or $4500 per basic model.

For the approximately 15-25 small business manufacturers of high-volume ceiling fans that DOE identified, the number of basic models produced per manufacturer varies from one to 30. Therefore, based on the test cost per ceiling fan basic model, the testing cost in the first year would range from approximately $4500 to $135,000 for small manufacturers of high-volume ceiling fans. DOE expects this cost to be lower in subsequent years because only new or redesigned ceiling fan models would need to be tested.

DOE used company reports from Hoovers.com, information from manufacturers' websites and feedback from manufacturers to estimate the revenue for the small business manufacturers of low and high-volume ceiling fans identified. The median revenue of the small business manufacturers of low-volume ceiling fans is approximately $15M. Relative to the median revenue for a small business manufacturer, the total testing cost ranges from 0.01 percent to 1 percent of the median revenue. The median revenue of the small business manufacturers of high-volume ceiling fans is approximately $8M. Relative to the median revenue for a small business manufacturer of high-volume ceiling fans, the total testing cost ranges from 0.05 percent to 1.5 percent of the median revenue.

For both low and high-volume ceiling fans, DOE does not expect that small manufacturers would necessarily have fewer basic models than large manufacturers, because ceiling fans are highly customized throughout the industry. A small manufacturer could have the same total cost of testing as a large manufacturer, but this cost would be a higher percentage of a small manufacturer's annual revenues. DOE requests comments on its analysis of burden to small businesses for testing ceiling fans according to the proposed test procedure.

(5) Relevant Federal rules which may duplicate, overlap or conflict with the proposed rule.

DOE is not aware of any other Federal rules that would duplicate, overlap or conflict with the rule being proposed.

(6) Description of any significant alternatives to the proposed rule.

DOE considered a number of industry and governmental test procedures that measure the efficiency of ceiling fans to develop the proposed test procedure in today's rulemaking. There appear to be two common approaches to testing ceiling fans: an approach based on using air velocity sensors to calculate airflow, such as the current DOE test procedure for ceiling fans, ENERGY STAR's test procedure, and CAN/CSA-C814-10, and an approach based on using a load cell to measure thrust, such as AMCA 230.

In principle, either approach could be used to measure the airflow efficiency of all ceiling fans, but maintaining consistency with industry practice would minimize test burden for all ceiling fan manufacturers. Though a load-cell based approach appears to be a potentially simpler method of estimating airflow efficiency, in industry, low-volume ceiling fans have historically been tested according to the air-velocity sensor based approach. High-volume ceiling fans, on the other hand, have historically been tested according to the load-cell based approach. It also appears to be cost-prohibitive to scale up the air-velocity sensor based approach to the larger diameter high-volume ceiling fans currently on the market given the number of sensors that would be required to cover ceiling fans 24 feet in diameter and the cost of constructing an appropriate rotating sensor arm.

DOE seeks comment and information on any alternative test methods that, consistent with EPCA requirements, would reduce the economic impact of the rule on small entities. DOE will consider the feasibility of such alternatives and determine whether they should be incorporated into the final rule.

C. Review Under the Paperwork Reduction Act of 1995

Manufacturers of ceiling fans must certify to DOE that their products comply with all applicable energy conservation standards. In certifying compliance, manufacturers must test their products according to the DOE test procedure for ceiling fans, including any amendments adopted for the test procedure on the date that compliance is required. DOE has established regulations for the certification and recordkeeping requirements for all covered consumer products and commercial equipment, including ceiling fans. 76 FR 12422 (Mar. 7, 2011). This rule contains a collection-of-information requirement that is subject to review and approval by OMB under the Paperwork Reduction Act (PRA). This requirement has been approved by OMB under control number 1910–1400. The public reporting burden for certification for energy and water conservation standards is estimated to average 20 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. Send comments regarding this burden estimate, or any other aspect of this data collection, including suggestions for reducing the burden, to DOE (see **ADDRESSES**) and by e-mail to Chad_S_Whiteman@omb.eop.gov. 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 proposed rule, DOE proposes test procedure amendments that it expects will be used to develop and implement future energy conservation standards for ceiling fans. DOE has determined that this rule falls into a class of actions that are categorically excluded from review under the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.) and DOE's implementing regulations at 10 CFR part 1021. Specifically, this proposed rule would amend the existing test procedures without affecting the amount, quality, or distribution of energy usage, and, therefore, would not result in any environmental impacts. Thus, this rulemaking is covered by Categorical Exclusion A5 under 10 CFR part 1021, subpart D, which applies to any rulemaking that interprets or amends an existing rule without changing the environmental effect of that rule. Accordingly, neither an environmental assessment nor an environmental impact statement is required.

E. Review Under Executive Order 13132

Executive Order 13132, "Federalism," 64 FR 43255 (Aug. 10, 1999), imposes certain requirements on Federal agencies formulating and implementing policies or regulations that preempt State law or that have Federalism implications. The Executive Order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive Order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have Federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. (65 FR 13735 (Mar. 14, 2000)). DOE has examined this proposed rule and has tentatively 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 today's 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. Regarding the review required by section 3(a), 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 tentatively 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. Pub. L. No. 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 them. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. (62 FR 12820 (Mar. 18, 1997)). (This policy is also available at http://energy.gov/gc/office-general-counsel.) DOE examined today's proposed rule according to UMRA and its statement of policy and has tentatively determined that the rule contains neither an intergovernmental mandate, nor a mandate that may result in the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector, of $100 million or more in any year. Accordingly, no further assessment or analysis is required under UMRA.

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 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

Pursuant to Executive Order 12630, "Governmental Actions and Interference with Constitutionally Protected Property Rights," 53 FR 8859 (Mar. 18, 1988), DOE has determined 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 Federal agencies to review most disseminations of information to the public under information quality guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). DOE has reviewed today's 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 OIRA at 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 promulgates 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.

Today's regulatory action to amend the test procedure for measuring the energy efficiency of ceiling fans is not a significant regulatory action under Executive Order 12866 or any successor order. 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 for this rulemaking.

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 et seq.), DOE must comply with all laws applicable to the former Federal Energy Administration, including section 32 of the Federal Energy Administration Act of 1974 (Pub. L. 93-275), as amended by the Federal Energy Administration Authorization Act of 1977 (Pub. L. 95-70). (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 FTC concerning the impact of the commercial or industry standards on competition.

Today's proposed rule would incorporate testing methods contained in the following commercial standard: ANSI/AMCA Standard 230-12, "Laboratory Methods of Testing Air Circulating Fans for Rating and Certification." The Department has evaluated this standard and is unable to conclude whether it fully complies with the requirements of section 32(b) of the FEAA, (*i.e.*, that it was developed in a manner that fully provides for public participation, comment, and review). DOE will consult with the Attorney General and the Chairman of the FTC concerning the impact on competition of requiring manufacturers to use the test methods contained in this standard prior to prescribing a final rule.

V. Public Participation

A. Attendance at the Public Meeting

The time, date and location of the public meeting are listed in the **DATES** and **ADDRESSES** sections at the beginning of this document. If you plan to attend the public meeting, please notify Ms. Brenda Edwards at (202) 586-2945 or Brenda.Edwards@ee.doe.gov. As explained in the **ADDRESSES** section, foreign nationals visiting DOE Headquarters are subject to advance security screening procedures. Any foreign national wishing to participate in the meeting should advise DOE of this fact as soon as possible by contacting Ms. Brenda Edwards to initiate the necessary procedures.

In addition, you can attend the public meeting via webinar. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's website at:

http://www1.eere.energy.gov/buildings/appliance_standards/rulemaking.aspx/ruleid/65. Participants are responsible for ensuring their systems are compatible with the webinar software.

B. Procedure for Submitting Requests to Speak and Prepared General Statements For Distribution

Any person who has an interest in the topics addressed in this notice, 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 public meeting. Such persons may hand-deliver requests to speak to the address shown in the **ADDRESSES** section at the beginning of this notice of proposed rulemaking between 9:00 a.m. and 4:00 p.m., Monday through Friday, except Federal holidays. Requests may also be sent by mail or email to Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Office, Mailstop EE-5B, 1000 Independence Avenue, SW, Washington, DC 20585-0121, or Brenda.Edwards@ee.doe.gov. Persons who wish to speak should include in their request a computer diskette or CD-ROM 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 one week before the public meeting. 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.

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

C. Conduct of the Public Meeting

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

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

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

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

D. Submission of Comments

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

Submitting comments via www.regulations.gov. The www.regulations.gov webpage 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. Otherwise, persons viewing comments will see only first and last names, organization names, correspondence containing comments, and any documents submitted with the comments.

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

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

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

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

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

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

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

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

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

E. Issues on Which DOE Seeks Comment

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

1. DOE is reinterpreting the statutory definition of a ceiling fan to include hugger ceiling fans and clarifying that the definition includes multi-mount ceiling fans. DOE notes that CFLKs attached to hugger ceiling fans would become covered CFLKs under this reinterpretation. DOE invites comment on this reinterpretation and clarification.

2. DOE is also clarifying that high-volume ceiling fans are considered ceiling fans and covered under this rulemaking. DOE invites comment on this clarification.
3. DOE is proposing interpreting centrifugal fans to fall outside of the scope of this rulemaking. DOE invites comment on this interpretation.
4. DOE invites comment on the proposed definitions for low-volume ceiling fans, high-volume ceiling fans, hugger ceiling fans, standard ceiling fans, and multi-mount ceiling fans.
5. DOE seeks comment on its proposed approach to incorporate standby power consumption into the ceiling fan efficiency metric.
6. DOE seeks comment on its proposed approach to assign all standby power consumption for a remote receiver that controls both a ceiling fan and light kit to the ceiling fan.
7. DOE seeks comment on its proposed operating hours for calculating ceiling fan efficiency for low-volume ceiling fans.
8. DOE seeks comment and any available data on operating hours for high-volume ceiling fans.
9. DOE seeks comment on its proposed approach to test at high and low speed for low-volume ceiling fans.
10. DOE seeks comment on its proposed approach to test high-volume fans at high speed only.
11. DOE seeks comment on its proposal to add a false ceiling to the experimental setup for all low-volume ceiling fan testing.

12. DOE seeks comment and data on how ceiling fans with more than one mounting option that would meet the definition of a standard ceiling fan are configured in the field. DOE also seeks comment and data on how hugger ceiling fans with more than one mounting option are configured in field.
13. DOE seeks comment on the proposed modifications to the testing room dimensions for high-volume ceiling fans. DOE specifically requests information on how manufacturers currently test large-diameter, high-volume ceiling fans, as well as the availability of suitable third-party testing facilities that can conduct the proposed test procedure and the ability to develop such facilities.
14. DOE seeks comment on whether manufacturers should be required to test multi-mount ceiling fans in the standard configuration, hugger configuration, both configurations, or all configurations for which they are capable of being installed.
15. DOE invites interested parties to comment on the estimated number of small business manufacturers of ceiling fans.
16. DOE requests comment on whether there are currently any hugger ceiling fan or high-volume ceiling fan features that are not in compliance with EPCA design standards for ceiling fans.
17. DOE requests comments on its analysis of burden to small businesses for testing ceiling fans according to the proposed test procedure.

18. DOE seeks comment and information on any alternative test methods that, consistent with the statutory requirements, would reduce the economic impact of the rule on small entities.
19. Several comments were received in response to the Framework Document for the ceiling fans energy conservation standards rulemaking suggesting that the testing could be improved if there were inter-lab calibration between testing facilities. DOE seeks comment on how calibration between testing facilities could be facilitated.

VI. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of today's notice of proposed rulemaking.

List of Subjects

10 CFR Part 429

Confidential business information, Energy conservation, Household appliances, Imports, Reporting and recordkeeping requirements.

10 CFR Part 430

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

Issued in Washington, DC, on September 19, 2014.

Kathleen B. Hogan
Deputy Assistant Secretary for Energy Efficiency
Energy Efficiency and Renewable Energy

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

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

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

Authority: 42 U.S.C. 6291-6317.

2. Section 429.32 is amended by revising paragraph (a) to read as follows:

§429.32 Ceiling fans.

(a) *Determination of Represented Value*. (1)Manufacturers must determine the represented value, which includes the certified rating, for each basic model of ceiling fan by:

(i) Units to be tested.

(A) The requirements of §429.11 are applicable to ceiling fans; and

(B) For each basic model of ceiling fan selected for testing, a sample of sufficient size shall be randomly selected and tested to ensure that—

(1) Any represented value of the efficiency or airflow shall be less than or equal to the lower of:

(i) The mean of the sample, where:

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

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

(b) The lower 90 percent confidence limit (LCL) of the true mean divided by 0.9, where:

$$LCL = \bar{x} - t_{0.90}(\frac{s}{\sqrt{n}})$$

And $\bar{x}$ is the sample mean; s is the sample standard deviation; n is the number of samples; and $t_{0.90}$ is the t statistic for a 90% one-tailed confidence interval with n-1 degrees of freedom (from Appendix A to subpart B); and,

(2) Any represented value of the wattage shall be greater than or equal to the higher of:

(i) The mean of the sample, where:

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

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

(ii) The upper 95 percent confidence limit (UCL) of the true mean divided by 1.1, where:

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

And $\bar{x}$ is the sample mean; s is the sample standard deviation; n is the number of samples; and $t_{0.95}$ is the t statistic for a 95% one-tailed confidence interval with n-1 degrees of freedom (from Appendix A to subpart B).

* * * * *

PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS.

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

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

4. Section 430.2 is amended by adding the definitions for “high-volume ceiling fan”, “hugger ceiling fan”, “low-volume ceiling fan”, “multi-mount ceiling fan”, and “standard ceiling fan” in alphabetical order to read as follows:

§430.2 Definitions.

*** * * * ***

High-volume ceiling fan means a ceiling fan that:

(1) Is greater than 7 feet in diameter,

OR

(2) Has a blade thickness of less than 3.2 mm at the edge or a maximum tip speed that exceeds the threshold in Table 1 of this section

AND

Has a maximum airflow volume greater than 5,000 CFM.

* * * * *

Hugger ceiling fan means a ceiling fan where the lowest point on the fan blades is no more than ten inches from the ceiling.

* * * * *

Low-volume ceiling fan means a ceiling fan that:

(1) Is less than or equal to 7 feet in diameter,

AND

(2) Has a blade thickness greater than or equal to 3.2 mm at the edge and a maximum tip speed less than or equal to the limit in Table 1 of this section,

OR

Has a maximum airflow volume less than or equal to 5,000 CFM.

Table 1: Low-Volume Ceiling Fans, 7 Feet or Less in Diameter

Airflow Direction*	Thickness (t) of edges of blades Mm	(inch)	Maximum speed at tip of blades m/s	(feet per minute)
Downward-Only	$4.8 > t \geq 3.2$	$(3/16 > t \geq 1/8)$	16.3	(3200)
Downward-Only	$t \geq 4.8$	$(t \geq 3/16)$	20.3	(4000)
Reversible	$4.8 > t \geq 3.2$	$(3/16 > t \geq 1/8)$	12.2	(2400)
Reversible	$t \geq 4.8$	$(t \geq 3/16)$	16.3	(3200)

* The “downward-only” and “reversible” airflow directions are mutually exclusive; therefore, a ceiling fan that can only produce airflow in the downward direction need only meet the “downward-only” blade edge thickness and tip speed requirements and a ceiling fan that can produce airflow in the downward and upward directions need only meet the “reversible” requirements.

* * * * *

Multi-mount ceiling fan means a ceiling fan that can be mounted in both the standard and hugger ceiling fan configurations.

* * * * *

Standard ceiling fan means a ceiling fan where the lowest point on the fan blades is more than ten inches from the ceiling.

* * * * *

5. Section 430.3 is amended by:

a. Adding a new paragraph (d)(19); and

b. Removing in paragraph (o)(4), “appendices C1, D1, D2, G, H, I, J2, N, O, P, and X to subpart B” and adding in its place, “appendices C1, D1, D2, G, H, I, J2, U, N, O, P, and X to subpart B”.

§430.3 Materials incorporated by reference.

*** * * * ***

(d) *** * ***

(19) ANSI/AMCA 230-12 (“AMCA 230”), Air Movement and Control Association Laboratory Methods of Testing Air Circulating Fans for Rating and Certification, approved February 22, 2012, IBR approved for appendix U to subpart B.

*** * * * ***

6. Section 430.23 is amended by revising paragraph (w) to read as follows:

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

*** * * * ***

(w) *Ceiling fans.* The efficiency of a ceiling fan, expressed in cubic feet per minute per watt (CFM/watt), shall be measured in accordance with sections 2.3, 2.5, 2.6 and 3 of appendix U.

*** * * * ***

7. Appendix U to Subpart B of Part 430 is added to read as follows:

APPENDIX U TO SUBPART B OF PART 430—UNIFORM TEST METHOD FOR MEASURING THE ENERGY CONSUMPTION OF CEILING FANS

Note: After [DATE 30 DAYS AFTER PUBLICATION OF THE FINAL RULE IN THE FEDERAL REGISTER] and prior to [DATE 180 DAYS AFTER PUBLICATION OF THE FINAL RULE IN THE FEDERAL REGISTER], manufacturers must make any representations with respect to the energy use or efficiency of ceiling fans, except hugger ceiling fans, multi-mount ceiling fans in the hugger configuration, and high-volume ceiling fans, as defined in 10 CFR part 430.2 in accordance with the results of testing pursuant to this Appendix U or the procedures in Appendix U as it appeared at 10 CFR part 430, subpart B, Appendix U, in the 10 CFR parts 200 to 499 edition revised as of January 1, 2014. After [DATE 180 DAYS AFTER DATE OF PUBLICATION OF THE FINAL RULE], manufacturers of ceiling fans must make any representations with respect to energy use or efficiency in accordance with the results of testing pursuant to this appendix.

1. Definitions:

1.1. *Airflow* means the rate of air movement at a specific fan-speed setting expressed in cubic feet per minute (CFM).

1.2. *Ceiling fan efficiency* means the ratio of the total airflow to the total power consumption, in units of cubic feet per minute per watt (CFM/W).

1.3. *High speed* means the highest available ceiling fan speed.

1.4. *Low speed* means the lowest available ceiling fan speed.

1.5. *Multi-head ceiling fan* means a ceiling fan with more than one fan head, i.e., more than one set of rotating fan blades.

1.6. *Total airflow* means the following: For low-volume ceiling fans, *total airflow* means the sum of the product of airflow and hours of operation at high and low speeds. For high-volume ceiling fans, *total airflow* is the product of airflow at high speed and the hours of operation in active mode.

2. General Instructions, Test Apparatus, and Test Measurement:

General instructions apply to characterizing the energy performance of both low-volume and high-volume ceiling fans. The test apparatus and test measurement used to characterize energy performance depend on whether the ceiling fan is low volume or high volume.

2.1. General instructions

Record measurements at the resolution of the test instrumentation. Round off calculations to the same number of significant digits as the previous step. Round the final ceiling fan efficiency value to the nearest whole number as follows:

2.1.1. A fractional number at or above the midpoint between the two consecutive whole numbers shall be rounded up to the higher of the two whole numbers; or

2.1.2. A fractional number below the midpoint between the two consecutive whole numbers shall be rounded down to the lower of the two whole numbers.

For multi-head ceiling fans, the effective blade span is the blade span of an individual fan head, if all fan heads are the same size. If the fan heads are of varying sizes, the effective blade span is the blade span of the largest fan head.

2.2. Test apparatus for low-volume ceiling fans

All instruments are to have tolerances within ±1% of reading, except for the air velocity sensors, which should have tolerances within ±5% of reading. **Note:** Equipment is to be calibrated at least once a year to compensate for variation over time.

2.2.1. <u>Air Delivery Room Requirements</u>

The air delivery room dimensions are to be 20 ±0.75 ft. x 20 ±0.75 ft. with an 11 ±0.75 ft. high ceiling. The control room shall be constructed external to the air delivery room.

The ceiling shall be constructed of sheet rock or stainless plate. The walls shall be of adequate thickness to maintain the specified temperature and humidity during the test. The paint used on the walls, as well as the wall material, must be of a type that minimizes absorption of humidity and that keeps the temperature of the room constant during the test (e.g., oil-based paint).

The room shall have no ventilation other than an air conditioning and return system used to control the temperature and humidity of the room. The construction of the room must ensure consistent air circulation patterns within the room. Vents must have electronically-operated damper doors controllable from a switch outside of the testing room.

2.2.2. Equipment Set-Up

Hang the ceiling fan to be tested directly from a false ceiling, according to the manufacturer's installation instructions. All standard and hugger ceiling fans shall be hung in the fan configuration that minimizes the distance between the false ceiling and the fan blades. Multi-mount fans shall be hung and tested in two configurations: 1) in the configuration that meets the definition of a standard ceiling fan, while minimizing the distance the ceiling and the lowest part of the fan blades, and 2) in the configuration that meets the definition of a hugger ceiling fan, while minimizing the distance between the ceiling and the lowest part of the fan blades. The length and breadth of the false ceiling must be at least 8 inches larger than the blade span of the ceiling fan. If a false ceiling is at least 8 inches larger than the blade span of the largest low-volume ceiling fan that will be tested by a testing facility, the same false ceiling may be used for all fans. The thickness of the false ceiling must be sufficient to maintain a flat bottom surface or be supported by additional structural fixtures or stiffeners on the top surface to maintain that shape. The false ceiling may be made of more than one piece, provided that the pieces are joined together such that the bottom surface is smooth. The false ceiling is to be constructed of heavyduty plywood or drywall, or a material with similar surface roughness. The false ceiling must be level when the ceiling fan is suspended from it.

Hang the false ceiling from an actuator hanging system, which supports the weight of both the false ceiling and the ceiling fan and controls the height of the false ceiling such that the distance between the fan blades and the air velocity sensors can be adjusted through automatic (motor-driven) action.

Either a rotating sensor arm or four fixed sensor arms can be used to take airflow measurements along four axes, labeled A-D. Axes A, B, C, and D are at 0, 90, 180, and 270 degree positions. Note: Axes A – D can be designated either by using the four walls or four corners of the room. See Figure 1.

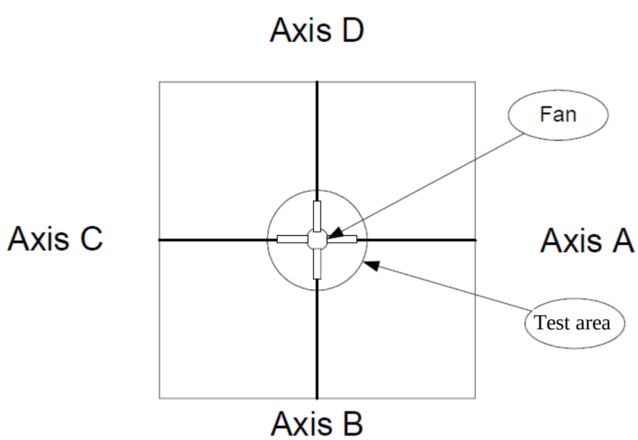

Figure 1: Testing Room and Sensor Arm Axes

The amount of exposed wiring must be minimized. All sensor lead wires must be stored under the floor, if possible.

The sensors shall be placed at exactly 4-inch intervals along a sensor arm, starting with the first sensor at the point where the four axes intersect. Note: Do not touch the actual sensor prior to testing. Enough sensors shall be used to record air delivery within a circle 8 inches larger in diameter than the blade span of the ceiling fan being tested. A proper experimental set-up is shown in Figure 2.

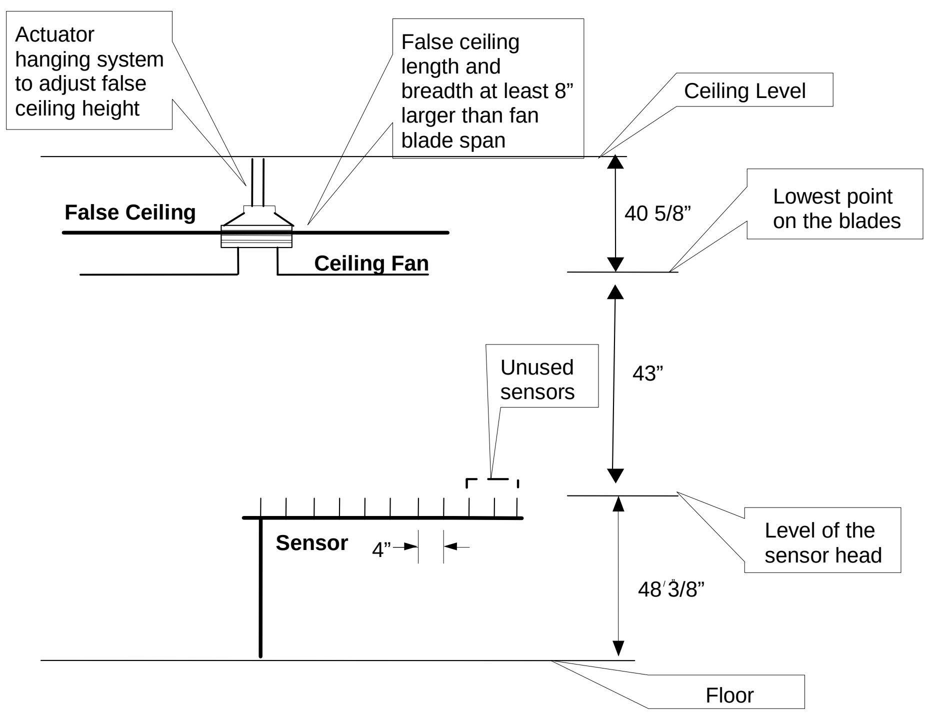

Figure 2: Air Delivery Room Set-Up For Low-Volume Ceiling Fans

Table 2 shows the appropriate number of sensors needed per each of four axes (including the first sensor at the intersection of the axes) for each fan size.

Table 2: Sensor Selection Guide

Fan Blade Span* (inches)	Number of sensors

36	6
42	7
44	7
48	7
52	8
54	8
56	8
60	9
72	10

*Note that the fan sizes listed are intended simply to be illustrative and do not restrict which ceiling fan sizes can be tested.

An RPM (revolutions per minute) meter, or tachometer, should be installed hanging from the ceiling and passing through the false ceiling so that the RPM of the ceiling fan blades can be measured during testing.

Use an RMS sensor capable of measuring power with an accuracy of ±1% to measure ceiling fan power consumption. Prior to testing, the test laboratory must verify the performance of the sensor and sensor software to be used during the test.

2.2.3. Multi-Head Ceiling Fan Test Set-Up

Multi-headed ceiling fans are to be hung from the false ceiling such that one of the ceiling fan heads is directly over sensor 1 (*i.e.*, at the intersection of axes A, B, C, and D). This can be achieved by either offsetting the entire false ceiling, or the multi-head fan with respect to the false ceiling, as long as the requirement that the false ceiling extend at least 8 inches beyond the blade span of the centered fan head is maintained. Supporting chains, wires, or ropes may be used to keep the false ceiling level if the multi-head ceiling fan is offset with respect to the false ceiling. The distance between the lowest point on the fan blades of the centered fan head and the air velocity sensors is to be such that it is the same as for all other low-volume ceiling fans (see Figure 2). Switching on only the centered fan head, the airflow measurements are to be made in the same manner as for all other low-volume ceiling fans. The power consumption measurements are to be made separately, with all fan heads on.

2.2.4. Test Set-Up for Ceiling Fans with Airflow Not Directly Downward

For ceiling fans where the airflow is not directly downward, the ceiling fan head is to be adjusted such that the airflow is as vertical as possible prior to testing. The distance between the lowest point on the blades and the air velocity sensors should be the same as for all other low-volume ceiling fans. For ceiling fans where a fully vertical orientation of airflow cannot be achieved, the ceiling fan is to be oriented such that any remaining tilt is aligned along one of the four sensor axes. Instead of measuring the air velocity for only those sensors directly beneath the ceiling fan, the air velocity is to be measured at all sensors along that axis, as well as the axis oriented 180 degrees with respect to that axis. For example, if the tilt is oriented along axis A, air velocity measurements are to be taken for all sensors along the A-C axis. No measurements would need to be taken along the B-D axis in this case.

2.3. Active mode test measurement for low-volume ceiling fans

2.3.1. Test conditions to be followed when testing:

- The temperature and humidity setting shall be 76 degrees ±2 degrees Fahrenheit and 50% ±5% relative humidity. These shall be held constant during the entire test process.
- Allow the sensors to be turned on and the fan to run for 15 minutes at each fan speed/setting before taking readings.
- If present, the ceiling fan light fixture is to be installed but turned off during testing.

- If present, any heater is to be installed but turned off during testing.
- The tests shall be conducted with the fan connected to a supply circuit with a voltage of (a) 120 V for fans rated on the nameplate from 105 to 125 V; and (b) 240 V for fans rated on the nameplate from 208 to 250 V. The test voltage shall not vary by more than ±1% during the tests.
- The test shall be conducted with the fan connected to a supply circuit at the rated frequency.
- Air conditioning vents shall be closed during testing.

2.3.2. Airflow and Power Consumption Testing Procedure:

Measure the airflow (CFM) and power consumption (watt) for low-volume ceiling fans at high and low speed.

Step 1: Make sure the transformer power is off. Hang fan at the actuator hanging system, and connect wires as directed by manufacturer's wiring instructions. Note: Assemble fan prior to the test; lab personnel must follow the instructions provided by the fan manufacturer. The fan blade assembly shall be balanced in accordance with the manufacturer's instructions to avoid excessive vibration of the motor assembly (at any speed) during operation.

Step 2: Adjust the actuator such that the lowest point on the fan blades is 43 inches above the height of the sensor heads. If necessary, use the hoist's toggle switch and adjust height.

Step 3: Set the first sensor arm (if using four fixed arms) or single sensor arm (if using a single rotating arm) to the 0 degree Position (Axis A). If necessary, use marking as reference. If using a single rotating arm, adjust the sensor arm alignment until it is at the 0 degree position by remotely controlling the antenna rotator.

Step 4: Set software up to read and record air velocity, expressed in feet per minute (FPM) in 1 second intervals. (Temperature does not need to be recorded in 1 second intervals.) Record current barometric pressure.

Step 5: Allow test fan to run 15 minutes at rated voltage and at blade speed to be tested. Turn off all environmental conditioning equipment entering the chamber (*e.g.*, air conditioning), close all doors and vents, and wait an additional 3 minutes prior to starting test session.

Step 6: Begin recording readings. Take 100 readings (100 seconds run-time) and save these data.

Step 7: Similarly, take 100 readings (100 seconds run-time) for Axes B, C, and D; save these data as well. If using four fixed sensor arms, the readings for all sensor arms should be taken simultaneously.

Step 8: Repeat steps 3 through 7 above for the remaining fan speed. Note: Ensure that temperature and humidity readings are held within the required tolerances for the duration of the test (all tested speeds). It may be helpful to turn on environmental conditioning equipment between test sessions to ready the room for the following speed test.

Step 9: If testing a multi-mount ceiling fan, repeat steps 1 through 8 with the ceiling fan hung in the configuration (either hugger or standard) not already tested.

Note: If a multi-head ceiling fan includes more than one type of ceiling fan head, then test at least one of each unique type. A fan head with different construction that could affect air movement or power consumption, such as housing, blade pitch, or motor, would constitute a different type of fan head.

Measure power input at a point that includes all power-consuming components of the ceiling fan (but without any attached light kit or heater energized). Measure power continuously at the rated voltage that represents normal operation over the time period for which the airflow test is conducted for each speed, and record the average value of the power measurement at that speed in watts (W).

Measure ceiling fan power consumption simultaneously with the airflow test, except for multi-head ceiling fans. For multi-head ceiling fans, measure power consumption at each speed continuously for 100 seconds with all fan heads turned on, and record the average value at each speed in watts (W).

2.4. Test apparatus for high-volume ceiling fans

The test apparatus and instructions for testing high-volume ceiling fans shall conform to the requirements specified in Section 3 (“Units of Measurement”), Section 4 (“Symbols and Subscripts”), Section 5 (“Definitions”), Section 6 (“Instruments and Methods of Measurement”), and Section 7 (“Equipment and Setups”) of the Air Movement and Control Association (AMCA) International’s “AMCA 230: Laboratory Methods of Testing Air Circulating Fans for Rating and Certification,” February 22, 2012 (incorporated by reference, see §430.3), with the following modifications:

2.4.1. The test procedure is applicable to high-volume ceiling fans up to 24 feet in diameter.

2.4.2. A "ceiling fan" is defined as in 10 CFR 430.2.

2.4.3. For all ceiling fans, the minimum distance between the ceiling and the blades of a ceiling fan being tested is 44 inches.

2.4.4. For a ceiling fan larger than 6 feet in diameter, the clearance between the floor and the blades of a ceiling fan being tested is 20 feet.

2.4.5. For a ceiling fan larger than 6 feet in diameter, the minimum distance between the centerline of a ceiling fan being tested and the walls and large obstructions all around is half the ceiling fan blade span plus 10 feet.

2.5. Active mode test measurement for high-volume ceiling fans

Calculate the airflow (CFM) and measure the power consumption (watt) for ceiling fans at high speed, in accordance with the test requirements specified in Section 8 ("Observations and Conduct of Test") and Section 9 ("Calculations") of AMCA 230 (incorporated by reference, see §430.3), with the following modifications:

2.5.1. Measure power consumption at a point that includes all power-consuming components of the ceiling fan (but without any attached light kit or heater energized).

2.5.2. Measure power consumption continuously at the rated voltage that represents normal operation over the time period for which the load differential test is conducted.

2.6. Test measurement for standby power consumption

Standby power consumption must be measured for both low and high-volume ceiling fans that offer one or more of the following user-oriented or protective functions:

(1) The ability to facilitate the activation or deactivation of other functions (including active mode) by remote switch (including remote control), internal sensor, or timer.

(2) Continuous functions, including information or status displays (including clocks), or sensor-based functions.

Standby power consumption must be measured after completion of the airflow test for low-volume ceiling fans, or the load differential test for high-volume ceiling fans, and after the active mode functionality has been switched off (i.e., the rotation of the ceiling fan blades is no longer energized). The ceiling fan must remain connected to the main power supply and be in the same configuration as in active mode (i.e., any ceiling fan light fixture should still be attached). Measure standby power consumption according to IEC 62301 (incorporated by reference; see §430.3) with the following modifications:

2.6.1. Allow 3 minutes between switching off active mode functionality and beginning the standby power test. (No additional time before measurement is required.)

2.6.2. Measure power consumption continuously for 100 seconds, and record the average value of the standby power measurement in watts (W).

3. Calculation of Ceiling Fan Efficiency from the Test Results:

The efficacy of a ceiling fan is the *ceiling fan efficiency* (as defined in section 1 of this appendix).

Using the airflow and power consumption measurements from section 2, calculate ceiling fan efficiency for a low-volume ceiling fan as follows:

$$\boldsymbol{Ceiling\ Fan\ Efficiency\ (CFM/W) = \left(\frac{\sum_{i=H,L} CFM_i \times OH_i}{W_{Sb} \times OH_{Sb} + \sum_{i=H,L} W_i \times OH_i}\right)} \quad \textbf{Eq. 1}$$

Where:

CFM_i = airflow at a given speed,

OH_i = operating hours at a given speed,

W_i = power consumption at a given speed,

H = high speed,

L = low speed,

OH_{Sb} = operating hours in standby mode, and

W_{Sb} = power consumption in standby mode.

Using the airflow and power consumption measurements from section 3, calculate ceiling fan efficiency for a high-volume ceiling fan as follows:

$$\boldsymbol{Ceiling\ Fan\ Efficiency\ (CFM/W) = \left(\frac{CFM_H \times OH_A}{W_{Sb} \times OH_{Sb} + W_H \times OH_A}\right)} \quad \textbf{Eq. 2}$$

Where:

CFM_H = airflow at high speed,

OH_A = operating hours in active mode,

W_H = power consumption at high speed,

OH_{Sb} = operating hours in standby mode, and

W_{Sb} = power consumption in standby mode.

Table 3 specifies the daily hours of operation to be used in calculating ceiling fan efficiency:

Table 3: Daily Operating Hours for Calculating Ceiling Fan Efficiency

Daily Operating Hours for Low-Volume Ceiling Fans		
	No Standby	With Standby
High Speed	4.2	4.2
Low Speed	2.2	2.2
Standby Mode	0.0	17.6
Off Mode	17.6	0.0
Daily Operating Hours for High-Volume Ceiling Fans		
	No Standby	With Standby
Active Mode	12.0	12.0
Standby Mode	0.0	12.0
Off Mode	12.0	0.0

The effective area corresponding to each sensor is to be calculated with the following equations:

For sensor 1, the sensor located directly underneath the center of the ceiling fan, the effective width of the circle is 2 inches, and the effective area is:

$$\boldsymbol{Effective\ Area\ (sq.ft.) = \pi\left(\frac{2}{12}\right)^2 = 0.0873} \qquad \textbf{Eq. 3}$$

For the sensors between sensor 1 and the last sensor used in the measurement, the effective area has a width of 4 inches. If a sensor is a distance *d*, in inches, from sensor 1, then the effective area is:

$$\boldsymbol{Effective\ Area\ (sq.ft.) = \pi\left(\frac{d+2}{12}\right)^2 - \pi\left(\frac{d-2}{12}\right)^2} \qquad \textbf{Eq. 4}$$

For the last sensor, the width of the effective area depends on the horizontal displacement between the last sensor and the point on the ceiling fan blades furthest radially from the center of the fan. The total area included in an airflow calculation is the area of a circle 8 inches larger in diameter than the ceiling fan blade span.

Therefore, for example, for a 42-inch ceiling fan, the last sensor is 3 inches beyond the end of the ceiling fan blades. Because only the area within 4 inches of the end of the ceiling fan blades is included in the airflow calculation, the effective width of the circle corresponding to the last sensor would be 3 inches. The calculation for the effective area corresponding to the last sensor would then be:

$$\boldsymbol{Effective\ Area\ (sq.ft.) = \pi\left(\frac{d+1}{12}\right)^2 - \pi\left(\frac{d-2}{12}\right)^2 = \pi\left(\frac{24+1}{12}\right)^2 - \pi\left(\frac{24-2}{12}\right)^2 = 3.076} \qquad \textbf{Eq. 5}$$

For a 46-inch ceiling fan, the effective area of the last sensor would have a width of 5 inches, and the effective area would be:

$$\boldsymbol{Effective\ Area\ (sq.ft.) = \pi\left(\frac{d+3}{12}\right)^2 - \pi\left(\frac{d-2}{12}\right)^2 = \pi\left(\frac{24+3}{12}\right)^2 - \pi\left(\frac{24-2}{12}\right)^2 = 5.345} \qquad \textbf{Eq. 6}$$

3.1.1. Ceiling fan efficiency calculations for multi-head ceiling fans

To determine the airflow at a given speed for a multi-head ceiling fan, measure the airflow for each fan head. Repeat for each fan head. Testing of each fan head is not required if the fan heads are essentially identical (i.e., do not have differences in construction such as housing, blade pitch, or motor could affect air movement or power consumption); instead, the measurements for one fan head can be used for each essentially identical fan head. Sum the measured airflow for each fan head included in the ceiling fan. The power consumption is the measured power consumption with all fan heads on.

Using the airflow and power consumption measurements from section 2 of this appendix, calculate ceiling fan efficiency for a low-volume, multi-head ceiling fan as follows:

$$\textbf{\textit{Ceiling Fan Efficiency}}\ (\textbf{\textit{CFM/W}}) = \left(\frac{\sum_{i=H,L} CFM_i \times OH_i}{W_{Sb} \times OH_{Sb} + \sum_{i=H,L} W_i \times OH_i}\right) \qquad \textbf{Eq. 1}$$

Where:

CFM_i = sum of airflow at a given speed for each head,

OH_i = operating hours at a given speed,

W_i = total power consumption at a given speed,

H = high speed,

L = low speed,

OH_{Sb} = operating hours in standby mode, and

W_{Sb} = power consumption in standby mode.

3.1.2. Ceiling fan efficiency calculations for ceiling fans with airflow not directly downward

Using a set of sensors that cover the same diameter as if the airflow was directly downward, the airflow at each speed should be calculated based on the continuous set of sensors with the largest air velocity measurements. This continuous set of sensors should be along the axis that the ceiling fan tilt is directed in (and along the axis that is 180 degrees from the first axis). For example, a 42-inch fan tilted toward axis A may create the pattern of air velocity shown in Figure 3. As shown in Table 2 of this appendix, a 42-inch fan would normally require 7 active sensors. However because the fan is not directed downward, all sensors must record data. In this case, because the set of sensors corresponding to maximum air velocity are centered 3 sensor positions away from the sensor 1 along the A axis, substitute the air velocity at A axis sensor 4 for the average air velocity at sensor 1. Take the average of the air velocity at A axis sensors 3 and 5 as a substitute for the average air velocity at sensor 2, take the average of the air velocity at A axis sensors 2 and 6 as a substitute for the average air velocity at sensor 3, etc. Lastly, take the average of the air velocities at A axis sensor 10 and C axis sensor 4 as a substitute for the average air velocity at sensor 7. Note that any air velocity measurements made along the B-D axis are not included in the calculation of average air velocity.

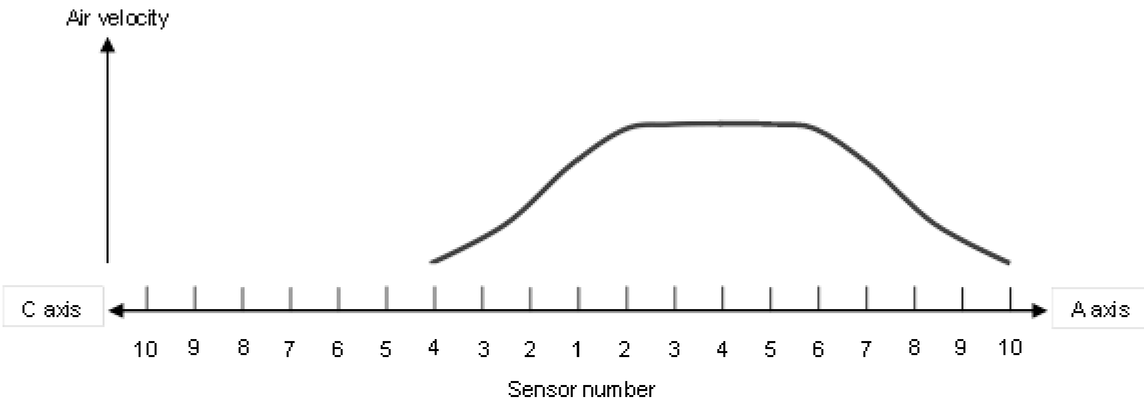

Figure 3: Example Air Velocity Pattern for Airflow Not Directly Downward