[6450-01-P]

DEPARTMENT OF ENERGY

10 CFR Part 431

[EERE-2017-BT-TP-0047]

RIN 1904-AE18

Energy Conservation Program: Test Procedures for Small Electric Motors and Electric Motors

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

ACTION: Notice of proposed rulemaking and request for comment.

SUMMARY: The U.S. Department of Energy (DOE) proposes amending its test procedures for small electric motors. First, DOE proposes further harmonizing its procedures with industry practice by incorporating a new industry standard manufacturers would be permitted to use in addition to the industry standards currently incorporated by reference as options for use when testing small electric motor efficiency. Second, with respect to electric motors, DOE proposes further harmonizing its test procedures by incorporating an additional industry standard to the two that are already incorporated by reference as options when testing the efficiency of this equipment. Each of these changes is expected to reduce testing burdens on manufacturers. Finally, DOE proposes to adopt industry provisions related to the test conditions to ensure the comparability of test results

for small electric motors. None of these proposed changes would affect the measured average full-load efficiency of small electric motors or the measured nominal full-load efficiency of electric motors when compared to the current test procedures.

DATES: DOE will accept comments, data, and information regarding this proposal no later than [**INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER***]. See section V, "Public Participation," for details. DOE will hold a public meeting on this proposed test procedure if one is requested by [**INSERT DATE 14 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER***].

ADDRESSES: Any comments submitted must identify the Test Procedure NOPR for small electric motors and electric motors and provide docket number EERE-2017-BT-TP-0047 and/or regulatory information number (RIN) 1904-AE18. Comments may be submitted using any of the following methods:

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

E-mail: *SmallElectricMotors2017TP0047@ee.doe.gov* Include the docket number and/or RIN in the subject line of the message.

Postal Mail: Appliance and Equipment Standards Program, U.S. Department of Energy, Building Technologies Office, Mailstop EE-5B, 1000 Independence Avenue, SW., Washington, DC, 20585-0121. Telephone: (202) 287-1445. If possible, please submit all

items on a compact disc ("CD"), in which case it is not necessary to include printed copies.

Hand Delivery/Courier: Appliance and Equipment Standards Program, U.S. Department of Energy, Building Technologies Office, 950 L'Enfant Plaza, SW., Suite 600, Washington, DC, 20024. Telephone: (202) 287-1445. If possible, please submit all items on a CD, in which case it is not necessary to include printed copies.

No telefacsimilies (faxes) will be accepted. For detailed instructions on submitting written 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 *http://www.regulations.gov*. All documents in the docket are listed in the *http://www.regulations.gov* index. However, some documents listed in the index, such as those containing information that is exempt from public disclosure, may not be publicly available.

The docket web page can be found at *http://www.regulations.gov/#!docketDetail;D= EERE-2017-BT-TP-0047*. The docket web page contains instructions on how to access all documents, including public comments, in the docket. See section V.A for information on how to submit comments through *http://www.regulations.gov*.

FOR FURTHER INFORMATION CONTACT:

Mr. Jeremy Dommu, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, EE–5B, 1000 Independence Avenue SW., Washington, DC 20585–0121. Telephone: (202) 586-9870. Email: *ApplianceStandardsQuestions@ee.doe.gov*.

Michael Kido, U.S. Department of Energy, Office of the General Counsel, GC-33, 1000 Independence Avenue, SW., Washington, DC 20585-0121. Telephone: (202) 586-8145. E-mail: *Michael.Kido@hq.doe.gov*.

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

SUPPLEMENTARY INFORMATION:

DOE proposes to maintain previously approved incorporations by reference or newly incorporate by reference the following industry standards into 10 CFR part 431:

1) Canadian Standards Association (CSA) CSA Standard C390-10, "Test methods, marking requirements, and energy efficiency levels for three-phase induction motors."

2) CSA Standard C747-09, "Energy efficiency test methods for small motors."

Copies of CSA C390-10 and CSA C747-09 can be obtained from Canadian Standards Association, Sales Department, 5060 Spectrum Way, Suite 100, Mississauga, Ontario, L4W 5N6, Canada, 1–800–463–6727, or *http://www.shopcsa.ca/onlinestore/welcome.asp*.

3) Institute of Electrical and Electronics Engineers (IEEE) Standard 1-2000, "IEEE Recommended Practice - General Principles for Temperature Limits in the Rating of Electrical Equipment and for the Evaluation of Electrical Insulation."

4) Standard 112–2004, "IEEE Standard Test Procedure for Polyphase Induction Motors and Generators."

5) IEEE Standard 112–2017, "IEEE Standard Test Procedure for Polyphase Induction Motors and Generators."

6) IEEE Standard 114–2010, "Test Procedure for Single-Phase Induction Motors."

7) IEEE Standard 118-1978, "IEEE Standard Test Code for Resistance Measurement."

8) IEEE Standard 119-1974, "IEEE Recommended Practice for General Principles of Temperature Measurement as Applied to Electrical Apparatus."

9) IEEE Standard 120-1989, "IEEE Master Test Guide for Electrical Measurements in Power Circuits."

Copies of IEEE 1-2000, IEEE 112-2004, IEEE 112-2017, IEEE 114–2010, IEEE 118-1978, IEEE 119-1974, and IEEE 120-1989 can be obtained from: IEEE, 445 Hoes

Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, (732) 981-0060, or by visiting *http://www.ieee.org*.

10) International Electrotechnical Commission (IEC) 60027:1992, "Letter symbols to be used in electrical technology."

11) IEC 60034-2-1:2014, "Rotating electrical machines - Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)."

12) IEC 60034-29:2008, "Rotating electrical machines - Part 29: Equivalent loading and superposition techniques - Indirect testing to determine temperature rise."

13) IEC 60051:2016, "Direct acting indicating analogue electrical measuring instruments and their accessories."

Copies of IEC 60027:1992, IEC 60034-2-1:2014, IEC 60034-29:2008, and IEC 60051:2016 may be purchased from International Electrotechnical Commission, 3 rue de Varembé, 1st floor, P.O. Box 131, CH – 1211 Geneva 20 – Switzerland, +41 22 919 02 11, or by going to *https://webstore.iec.ch/home*.

14) National Electrical Manufacturers Association (NEMA) MG 1-2016, "Motors and Generators."

Copies of NEMA MG 1-2016 may be purchases from National Electrical Manufacturers Association, 1300 North 17th Street, Suite 900, Arlington, Virginia 22209, +1 703 841 3200, or by going to *https://www.nema.org*.

For a further discussion of these standards, see section III.C.

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I. Authority and Background

DOE is authorized to establish and amend energy conservation standards and test procedures for small electric motors and electric motors.[1] (42 U.S.C. 6311(1)(A); 42 U.S.C. 6317(b)) The current DOE test procedures for small electric motors appear at Title 10 of the Code of Federal Regulations ("CFR") section 431.444. The current DOE test procedures for electric motors appear in appendix B to subpart B of 10 CFR part 431 ("Appendix B"). The following sections discuss DOE's authority to amend test procedures for small electric motors and electric motors, as well as relevant background information regarding DOE's consideration of test procedures for these motors.

[1] EPCA authorized DOE to establish and amend energy conservation standards and test procedure for small electric motors pending a determination of feasibility and justification (42 U.S.C. 6317(b)), completed on July 10, 2006. 71 FR 38799

A. Authority

The Energy Policy and Conservation Act of 1975, as amended ("EPCA")[2] (42 U.S.C. 6291–6317), among other things, authorizes DOE to regulate the energy efficiency of a number of consumer products and industrial equipment. In 1978, Title III, Part C[3] of EPCA was added by section 441(a) of Title IV of the National Energy Conservation Policy Act, Public Law 95-619 (November 9, 1978), which established the Energy Conservation Program for Certain Industrial Equipment, and set forth a variety of provisions designed to improve the energy efficiency of certain industrial equipment. Later, in 1992, the Energy Policy Act of 1992, Public Law 102-486 (October 24, 1992), further amended EPCA by adding, among other things, provisions governing the regulation of small electric motors. EPCA was further amended by the American Energy Manufacturing Technical Corrections Act, Public Law 112-210 (December 18, 2012), which explicitly permitted DOE to examine the possibility of regulating "other motors" in addition to those electric and small electric motors that Congress had already otherwise defined and required DOE to regulate. (42 U.S.C. 6311(1)(A), 6311(2)(B)(xiii); 42 U.S.C. 6317(b))

Under EPCA, DOE's energy conservation program consists of four parts: (1) testing, (2) labeling, (3) Federal energy conservation standards, and (4) certification and enforcement procedures. Relevant provisions of the Act include definitions (42 U.S.C. 6311), energy conservation standards (42 U.S.C. 6313), test procedures (42 U.S.C. 6314),

[2] All references to EPCA in this document refer to the statute as amended through America's Water Infrastructure Act of 2018, Public Law 115–270 (October 23, 2018).
[3] For editorial purposes, upon codification into the U.S. Code, Part C was re-designated as Part A-1.

labeling provisions (42 U.S.C. 6315), and the authority to require information and reports from manufacturers (42 U.S.C. 6316). EPCA includes specific authority to establish test procedures and standards for small electric motors. (42 U.S.C. 6317(b))

Federal energy efficiency requirements for covered equipment established under EPCA generally supersede State laws and regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6316(a) and (b); 42 U.S.C. 6297)

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

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

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. 6314(b))

EPCA also requires that, at least once every 7 years, DOE evaluate test procedures for each type of covered equipment including small electric motors, to determine whether amended test procedures would more accurately or fully comply with the requirements for the test procedures to not be unduly burdensome to conduct and be reasonably designed to produce test results that reflect the energy efficiency, energy use, and estimated operating costs during a representative average use cycle. (42 U.S.C. 6314(a)(1)) If the Secretary determines that a test procedure amendment is warranted, the Secretary must publish proposed test procedures in the *Federal Register*, and afford interested persons an opportunity (of not less than 45 days' duration) to present oral and written data, views, and arguments on the proposed test procedures. (42 U.S.C. 6314(b)) DOE is publishing this NOPR to satisfy the 7-year review requirement specified in EPCA, which requires that DOE publish either a final rule amending the test procedures or a determination that amended test procedures are not required. (42 U.S.C. 6314(a)(1)(A))

B. Background

EPCA defines "small electric motor," as "a NEMA general purpose alternating current single-speed induction motor, built in a two-digit frame number series in accordance with NEMA Standards Publication MG 1–1987." (42 U.S.C. 6311(13)(G))

(The term "NEMA" refers to the National Electrical Manufacturers Association.) EPCA directed DOE to establish a test procedure for small electric motors for which DOE makes a determination that energy conservation standards would be technologically feasible and economically justified, and would result in significant energy savings. (42 U.S.C. 6317(b)(1)) On July 10, 2006, DOE published its determination that energy conservation standards for certain polyphase and certain single-phase, capacitor-start, induction-run, small electric motors are technologically feasible and economically justified, and would result in significant energy savings. 71 FR 38799. In a final rule published July 7, 2009, DOE adopted test procedures for small electric motors. 74 FR 32059. EPCA also required that following establishment of the required test procedures, DOE establish energy conservation standards for those small electric motors for which test procedures were prescribed. (42 U.S.C. 6317(b)(2)) In a final rule published on March 9, 2010 (the "March 2010 ECS final rule"), DOE adopted energy conservation standards for small electric motors. 75 FR 10874.[4]

Subsequently, DOE updated the test procedures for small electric motors on May 4, 2012 (the "May 2012 EM/SEM TP final rule"). 77 FR 26608. The existing test procedures for small electric motors appear at 10 CFR 431.444, and incorporate certain industry standards from the Institute of Electrical and Electronics Engineers ("IEEE") and Canadian Standards Association ("CSA"), as listed in Table I-1.

Table I-1 Industry Standards Currently Incorporated by Reference for Small Electric Motors

Equipment Description	Industry Test Procedure

[4] A technical correction was published on April 5, 2010, to correct the compliance date. 75 FR 17036.

Single-phase small electric motors	IEEE 114-2010 CSA C747-09
Polyphase small electric motors less than or equal to 1 horsepower	IEEE 112-2004 Test Method A CSA C747-09
Polyphase small electric motors greater than 1 horsepower	IEEE 112-2004 Test Method B CSA C390-10

DOE published a request for information pertaining to the test procedures for small electric motors and electric motors. 82 FR 35468 (July 31, 2017) (the "July 2017 TP RFI"). In the July 2017 TP RFI, DOE solicited public comments, data, and information on all aspects of, and any issues or problems with, the existing DOE test procedure for small electric motors, including on any needed updates or revisions. DOE also discussed potential categories of electric motors (as defined at 10 CFR 431.12) that may be considered in future DOE test procedures. 82 FR at 35470-35474. At the request of commenters, DOE extended the comment period for the July 2017 TP RFI in a notice published on August 30, 2017. 82 FR 41179.

DOE received a number of comments in response to the July 2017 TP RFI.[5] This NOPR proposes to further clarify the test procedures for small electric motors and incorporate an additional industry test method for testing small electric motors and electric motors. Comments regarding other matters related to electric motors are not addressed in this document. DOE also notes that it received a number of comments unrelated to either small electric motors or electric motors – these are also not addressed.[6]

[5] All comments received in response to the July 2017 TP RFI are available for review at *http://www.regulations.gov* under docket number EERE-2017-BT-TP-0047.
[6]Anonymous, No. 9, No. 11, No. 12, No. 13, No. 14, No. 15, and No. 17; Raymond Calore, No. 10.

II. Synopsis of the Notice of Proposed Rulemaking

In this notice of proposed rulemaking ("NOPR"), DOE proposes to update 10 CFR part 431 as follows:

1) Incorporate by reference a revised test procedure for the measurement of energy efficiency in small electric motors and electric motors, the Institute of Electrical and Electronics Engineers ("IEEE") 112-2017, "IEEE Standard Test Procedure for Polyphase Induction Motors and Generators;"
2) Incorporate by reference an alternative test procedure for the measurement of energy efficiency in small electric motors and electric motors, the International Electrotechnical Commission ("IEC") 60034-2-1:2014, "Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles);"

Add definitions for "rated load", "rated output power", and "breakdown torque" of small electric motors based on NEMA MG 1-2016; and

Specify the frequency used for testing and specify that manufacturers select the voltage used for testing

Table II-1 summarizes the proposed test procedure amendments compared to the current test procedure as well as the reason for the change.

Table II-1 Synopsis of the Notice of Proposed Test Procedure

Current Test Procedure	Proposed Test Procedure	Reason for Proposed Change

Incorporates by reference IEEE 112-2004 to measure full-load efficiency of polyphase small electric motors	- Adds IEEE 112-2017 as an alternative to IEEE 112-2004. This latest version: - Updates certain requirements regarding measurement instrument selection and accuracy - Aligns core loss calculation with CSA 390-10 and Method 2-1-1B of IEC 60034-2-1:2014	Achieve consistency with industry update to IEEE 112
Does not incorporate by reference IEC 60034-2-1:2014	- Adds Method 2-1-1B of IEC 60034-2-1:2014 as an alternative to IEEE 112-2004 Test Method B, IEEE 112-2017 Test Method B and CSA C390-10 - Adds method 2-1-1A of IEC 60034-2-1:2014 as an alternative to IEEE 114-2010, IEEE 112-2004, IEEE 112-2017 Test Method A and CSA C747-09	Address suggestions offered in industry petition (EERE-2017-BT-TP-0047-0030)
For Small Electric Motors: Specifies testing at rated load but does not define that term	- Adds definition for "rated load" (and "rated output power" and "breakdown torque" to support the definition of "rated load") of small electric motors based on NEMA MG 1-2016	Harmonize with definitions from industry standards
For Small Electric Motors: Specifies testing at rated voltage and rated frequency, but does not define those terms	- Adds a definition for rated voltage, which provides that manufacturers select the voltage that is used for testing, and a definition for rated frequency.	Improved repeatability of the test procedure.

DOE has tentatively determined that the proposed amendments described in section III of this notice would not alter the measured efficiency of small electric motors or electric motors, and that the proposed test procedures would not be unduly burdensome to conduct. Discussion of DOE's proposed actions are addressed in detail in section III of this notice.

III. Discussion

A. Scope of the Test Procedures for Currently Regulated Small Electric Motors and Electric Motors

This NOPR does not propose changes to the scope of the test procedure with respect to small electric motors and electric motors. DOE discusses test procedure scoping issues for currently regulated motors in sections III.A.1 through III.A.3.

1. Definitions Relevant to "Small Electric Motor"

EPCA defines the term "small electric motor" as "a NEMA general purpose alternating-current single-speed induction motor, built in a two-digit frame number series in accordance with NEMA Standards Publication MG 1–1987." 42 U.S.C. 6311(13)(G) After considering comments received on its proposal for establishing test procedures for evaluating small electric motor efficiency, DOE adopted a modified version of this definition at 10 CFR 431.442 in an attempt to clarify that the term also encompassed those motors that were built as "IEC metric equivalent motors." 74 FR 32059, 32062. DOE made this adjustment to its regulatory definition to ensure that those motors that otherwise satisfied the small electric motor definition but were built in accordance with metric-units would be treated in a like manner as their counterparts that were built in accordance with U.S. customary units of measurement. DOE offered three primary reasons in support of this approach.

First, IEC-equivalent small electric motors generally can perform the identical functions of those motors strictly defined under EPCA. DOE noted that the differences in

criteria between the relevant IEC and MG 1-1987 provisions lay in the nomenclature, units of measurement, standard motor configurations and design details – not in the function of the motor itself. Consequently, DOE concluded that in most general purpose applications, IEC motors can be used interchangeably with small electric motors built in accordance with MG 1-1987. See 74 FR 32059, 32062.

Second, a broad exclusion of IEC-equivalent motors from DOE's regulatory framework would create a regulatory gap. Moreover, any efficiency standards applying to small electric motors built according to MG 1-1987's specified units of measurement would be readily applicable to IEC motors. See 74 FR 32059, 32062.

Finally, treating IEC-based motors as falling outside of the small electric motor definition would effectively provide preferential treatment to manufacturers of IEC motors. DOE noted at the time that the creation of such a situation would likely lead to a reduction in the production of NEMA (*i.e.*, MG 1-1987-based) motors while encouraging the increased production of IEC motors that, if unaddressed, would be inadvertently treated as unregulated motors. See 74 FR 32059, 32062.

The current definition at 10 CFR 431.442 lists the criteria that must be met for a motor to be defined as a "small electric motor." Under these criteria, a small electric motor is:

- A NEMA general purpose motor[7] that
    - Uses alternating current, and
    - Is single-speed, and
    - Is an induction motor; and
    - Is built in a two-digit frame size in accordance with NEMA Standards Publication MG 1-1987, including IEC metric equivalent motors.

See 10 CFR 431.442.

In response to the July 2017 TP RFI, NEMA supported maintaining all existing criteria specified in the current regulatory definition. (NEMA, No. 24, at p. 7)[8] No other commenters argued in favor of altering the current definition. Accordingly, DOE is not proposing to modify the definition of small electric motor. However, a number of issues relevant to small electric motors were also raised and are discussed in the following sections.

a. Synchronous Operation

In the July 2017 TP RFI, DOE included a table of motor topologies, categorized by induction or synchronous operation. 82 FR 35468, 35471. In response to the July 2017

[7] In response to questions from NEMA and various motor manufacturers, DOE issued a guidance document that identifies some key design elements that manufacturers should consider when determining whether a given individual motor meets the small electric motor definition and is subject to the energy conservation standards promulgated for small electric motors. See https://www.regulations.gov/document?D=EERE-2017-BT-TP-0047-0082

[8] A notation in this form provides a reference for information that is in the docket of DOE's rulemaking to develop test procedures for small electric motors and electric motors (EERE-2017-BT-TP-0047), which is maintained at *http://www.regulations.gov*. This notation indicates that the statement preceding the reference is document number 0024 in the docket for small electric motor and electric motor test procedure rulemaking, and appears at page 7 of that document.

TP RFI, Advanced Energy commented that line-start permanent magnet motors are better classified as synchronous motors rather than as induction (or asynchronous) motors. Advanced Energy noted that these motors do not operate on the principle of induction (*i.e.*, production of electric current in a conductor by varying the magnetic field applied to it), and the presence of the squirrel cage is only for starting the motor. (Advanced Energy, No. 25 at p. 3)

DOE agrees that line-start permanent magnet motors are more properly considered synchronous, rather than induction, motors. Line-start permanent magnet motors contain inductive elements, but these elements are used only to start the motor and bring it to synchronous operation. As a result, the inductive portions of the motor are not representative of the motor's operation. As noted earlier, the definition of "small electric motor" limits the test procedure's scope to induction motors. Accordingly, line-start permanent magnet motors are best classified as synchronous motors rather than induction motors, and would not fall under the small electric motor definition or be subject to the small electric motor test procedure.

b. Rated output power

DOE's regulations provide a method for evaluating small electric motor efficiency. See 10 CFR 431.444. As part of its review of the current test procedures for this equipment, DOE discussed the possibility of revising the output power range for motors considered in the scope of applicability of this test procedure. 82 FR 35468, 35470. As explained in the 2017 TP RFI, only motors with a power rating of greater than

or equal to 0.25 horsepower ("hp") and less than or equal to 3 hp[9] are subject to the regulations in subpart X to 10 CFR part 431. 82 FR 35468, 35470. DOE used the existing scope for small electric motors as a starting point, and reviewed market data to determine whether the limits could be revised. Specifically, DOE discussed considering a lower output power limit of 0.125 hp. *Id.*. In the July 2017 TP RFI, DOE also discussed applying an upper limit of 15 hp for single-phase electric motors and of 5 hp for 2-digit frame size polyphase electric motors. *Id.*.

NEMA opposed changes to the current output power range of regulated motors. (NEMA, No. 24 at p. 6) Advanced Energy commented that 15 hp and 5 hp upper limits for single and polyphase motors in two-digit frames are reasonable. However, Advanced Energy noted that expanding the scope to include motors in the subfractional horsepower range may not lead to significant energy savings. (Advanced Energy, No. 25, at p. 2) The Pacific Gas and Electric Company, Southern California Gas Company, San Diego Gas and Electric, and Southern California Edison (hereafter referred to as the "CA IOUs") commented in support of expanding the scope of small electric motor test procedures to 0.125 hp through 15 hp. The CA IOUs noted that having greater information about the small motor market has many benefits, such as aiding in the development of new utility incentive programs. (CA IOUs, No. 26 at p. 2)

As stated in section III.A, DOE is not proposing to modify the present scope of test procedure applicability; DOE is not proposing to include motors with additional

[9] For certain motor configurations within this range, DOE has not established standards. See 10 CFR 431.446.

horsepower ratings. If finalized as proposed, the test procedure would continue to apply to small electric motors as pursuant to EPCA. See 10 CFR 431.444.

DOE requests comments on its proposal to maintain the current scope of applicability, with respect to horsepower ratings, of the small electric motors test procedure.

c. Motors Used as a Component of Another Covered Product

Under EPCA, no standard prescribed for small electric motors shall apply to any such motor that is a component of a covered product under section 322(a) of EPCA (42 U.S.C. 6292(a)), or of covered equipment under section 340 (42 U.S.C. 6311). (42 U.S.C. 6317(b)(3). In the July 2017 TP RFI, DOE requested comment on the feasibility of testing motors that are components of other equipment. While not offering comment on testing, NEMA, AHAM and AHRI, McMillan Electric Company, Detech Inc., and Lennox International indicated that they do not support regulating motors as components of covered products or equipment but instead supported a finished-product approach to energy efficiency regulations. (NEMA, No. 24 at p. 1; AHAM and AHRI, No. 21 at p. 2-3; McMillian Electric Company, No. 16 at p. 1; Detech Inc., no. 18 at p. 1; Lennox, No. 22 at p. 1-2) As noted, EPCA directed DOE to establish test procedures and energy conservation standards for small electric motors, except those motors that are a component of a covered product or covered equipment, (42 U.S.C. 6317(b)), and this NOPR, which focuses solely on test procedure issues, does not propose altering the scope of applicability of that procedure or related energy conservation standards.

d. Air-Over Motors

DOE defines the term "air-over electric motor" as "an electric motor rated to operate in and be cooled by the airstream of a fan or blower that is not supplied with the motor and whose primary purpose is providing airflow to an application other than the motor driving it." 10 CFR 431.12. In the July 2017 TP RFI, DOE sought comment on defining "air-over electric motors" – among others -- based on physical and technical features of the motor. 82 FR 35468, 35473.

Air-over electric motors do not have a factory-attached fan and require a separate means of convecting air over the frame of the motor. The external cooling keeps internal motor winding temperatures beneath the motor's insulation class' permissible temperature rise or the maximum temperature value specified by the manufacturer. Without external cooling, the air-over electric motor would overheat during continuous operation. Air-over motors can be found in direct-drive axial fans, blowers and several other applications. Single-phase air-over motors are widely used in residential and commercial HVAC systems, appliances, and equipment as well as in agricultural applications.

DOE reviewed catalog offerings of air-over motors to understand the typical configurations available on the market. Air-over motors can be broadly categorized into open air-over and enclosed air-over motors and into polyphase and single-phase motors.

In terms of physical construction, DOE did not find clear differences between air-over motors and non-air-over motors. For example, there is little difference between a totally-enclosed fan-cooled motor ("TEFC") and a totally-enclosed air-over motor ("TEAO"). In fact, a user could remove the fan on a TEFC motor, and then place the motor in an airstream of the application to obtain an air-over motor configuration. Further, the absence of a fan is not a differentiating feature as with other motor categories, such as totally-enclosed non-ventilated ("TENV") motors, which do not have internal fans or blowers and are similar in construction to TEAO motors.

Based on these observations, DOE initially finds that what differentiates air-over motors from non-air-over motors is that air-over motors require external cooling by a free flow of air to avoid overheating during continuous operation. That is, the internal motor winding temperatures would exceed the maximum temperature value corresponding to the motor's insulation class or specified by the manufacturer. The risk of overheating can be verified by observing whether the motor's temperature keeps rising during a rated load temperature test instead of stabilizing. During a rated load temperature test, the motor is loaded at its rated full load using a dynamometer until it is thermally stable. The current industry standards referenced by the existing DOE small electric motors test procedure each contain a rated load temperature test, wherein thermal stability is defined as the condition where the motor temperature does not change by more than 1 ºC over either 30 minutes or 15 minutes, depending on the motor category (See section 5.8.4.4 of IEEE 112-2004 and section 10.3.1.3 of IEEE 114-2010). Further, specifying that external

cooling is obtained by a free flow of air would differentiate air-over motors from other totally-enclosed pipe-ventilated motors.

In the July 2017 TP RFI, DOE discussed potentially revising the definition of an air-over electric motor as a motor that does not thermally stabilize without the application of external cooling by a free flow of air during a rated temperature test according to either IEEE 112-2004, CSA C747-09, or CSA C390-10 for polyphase motors or IEEE 114-2010 or CSA C747-09 for single-phase motors." 82 FR 35468, 35472-35473.

NEMA and Advanced Energy asserted that it would be extremely difficult or impossible to identify air-over motors by physical and technical features alone. (NEMA, No. 24 at p. 6; Advanced Energy, No. 25 at p. 4) Advanced Energy stated that air-over motors could be defined by their inability to achieve a stable temperature under standard test conditions. (Advanced Energy, No. 25 at p. 4) Advanced Energy suggested that the term "rated temperature test" be replaced by "rated load temperature test," and emphasized the need to specify that the external cooling air comes from a source that is not mechanically attached to the motor. Advanced Energy suggested that air-over motors be defined as "a motor that does not reach thermal equilibrium (or thermal stability) during a rated load temperature test according to test standards incorporated by reference, without the application of forced cooling by a free flow of air from an external device not mechanically connected to the motor." (Advanced Energy, No. 25 at pp. 4-5) Advanced Energy further added that the term "thermal equilibrium" in its recommended air-over motor definition is defined in the referenced test standards, but that DOE could consider

adding a definition for that term as part of the air-over motor definition. (Advanced Energy, No. 25 at p. 5) Finally, Lennox commented that air-over motors are already defined at 10 CFR 431.12, and did not see a need to make changes to this definition. (Lennox, No. 22, at p. 4)

As stated in section III.A, DOE is not proposing to modify the scope of applicability of the current test procedures for small electric motors and electric motors. The definition of air-over electric motors implicates equipment beyond those electric and small electric motors DOE already regulates under subpart B of 10 CFR part 431. As a result, DOE is not proposing to amend the definition at this time.

2. Scope of the Small Electric Motor Test Procedure

In the March 2010 ECS final rule, DOE identified motor topologies that met the small electric motor definition. DOE reviewed the topologies of alternating-current single-speed induction motors, identifying six in total: split-phase, shaded-pole, capacitor-start induction-run ("CSIR"), capacitor-start capacitor-run ("CSCR"), permanent-split capacitor ("PSC"), and polyphase (see descriptions in Table III-1). 75 FR 10874, 10882.

Table III-1 Alternating Current, Single-Speed, Induction Motor Topologies

Topology	Description
Permanent-Split Capacitor	A capacitor motor* having the same value of capacitance for both starting and running conditions. (MG 1-2014, 1.20.3.3.2)
Capacitor-Start Induction-Run	A capacitor motor* in which the capacitor phase is in the circuit only during the starting period. (MG 1-2014, 1.20.3.3.1)
Capacitor-Start Capacitor-Run	A capacitor motor* using different values of effective capacitance for the starting and running conditions. (MG 1-2014, 1.20.3.3.3)
Shaded-Pole	A single-phase induction motor provided with an auxiliary short-circuited winding or windings displaced in magnetic position from the main winding. (MG 1-2014, 1.20.3.4)
Split-phase	A single-phase induction motor equipped with an auxiliary winding, displaced in magnetic position from, and connected in parallel with the main winding. (MG 1-2014, 1.20.3.1)
Polyphase induction, squirrel cage	A polyphase induction motor in which the secondary circuit (squirrel-cage winding) consists of a number of conducting bars having their extremities connected by metal rings or plates at each end. (MG 1-2014, 1.18.1.1)

* A capacitor motor is a single-phase induction motor with a main winding arranged for direct connection to a source of power and an auxiliary winding connected in series with a capacitor. (MG 1-2014 1.20.3.3)

Of these six topologies, DOE concluded that three would satisfy the small electric motor definition: CSIR, CSCR, and certain polyphase motors. *Id.* Therefore, DOE added subpart X of 10 CFR part 431 to address energy conservation standards and test procedures regarding these three topologies that meet the definition of a small electric motor.

DOE received a number of comments related to the test procedure's scope in response to the July 2017 TP RFI. Many of these comments addressed whether the test procedure should be expanded to apply to additional motors. Parties commenting on the test procedure's scope are listed in Table III-2:

Table III-2 Parties Commenting on the Test Procedure's Scope

Party	Affiliation
Advanced Energy	Laboratory

AHAM and AHRI (Association of Home Appliance Manufacturers and Air-conditioning, Heating, and Refrigeration Institute)	Trade Association - Manufacturer
Anonymous Commenters (7 total)	Anonymous
APSP (Association of Pool and Spa Professionals)	Trade Association - Manufacturer
CA IOUs (Pacific Gas and Electric Company, Southern California Gas Company, San Diego Gas and Electric, Southern California Edison)	Utility
CEC (California Energy Commission)	State Government
Detech Inc. (Detector Technology Inc.)	Manufacturer
EEI (Edison Electric Institute)	Association – Utility
Gent University	University
Joint Advocates (American Council for an Energy-efficient Economy, Appliance Standards Awareness Project, Northwest Power and Conservation Council, Northwest Energy Efficiency Alliance)	Efficiency Advocate
Lennox (Lennox International Inc.)	Manufacturer
McMillan Electric Company	Manufacturer
NEMA (National Electrical Manufacturers Association)	Trade Association - Manufacturer
Raymond Calore	Individual

As stated, DOE is not proposing to modify the test procedure's scope; instead, the test procedure would continue to apply only to small electric motors that are currently subject to the DOE's existing test procedure at 10 CFR 431.444.

3. Scope of the Electric Motor Test Procedure

As noted, this NOPR also addresses the test procedure for electric motors in response to a petition for rulemaking. The current electric motor test procedure is at subpart B of 10 CFR part 431. DOE is not proposing any changes to the scope of applicability of the electric motor test procedure.

B. Metric for Small Electric Motors

DOE's existing test procedure for small electric motors requires that motor efficiency of this equipment be determined using the average full-load efficiency of the

small electric motor's basic model. 10 CFR 431.445(b)(1). This formulation of efficiency represents the mechanical output power at full-load (*i.e.*, the rated output power) divided by the electrical input power, and is expressed as a percentage. DOE further requires manufacturers to test at least five units of a basic model to determine the limit on represented value of average full-load efficiency by applying the equations at 10 CFR 431.445(c)(3). See 10 CFR 431.445(c)(2).

1. Average and Nominal Efficiency

In response to the July 2017 TP RFI, NEMA and Advanced Energy suggested that DOE's test procedure use the NEMA nominal, rather than average, full load efficiency metric for small electric motors.[10] (NEMA, No. 24 at p. 8; Advanced Energy, No. 25 at p. 9) NEMA stated that the NEMA nominal full load efficiency metric is established in the industry and is harmonized with global IEC standards. NEMA asserted that the difference between the metrics used for electric motor standards and small electric motor standards causes confusion in the industry. (NEMA, No. 24 at p. 8) Advanced Energy stated that if DOE decided to use the NEMA nominal efficiency metric for small electric motors, DOE would need to ensure that the translation from average efficiencies to nominal efficiencies would not change the stringency of existing energy conservation standards. (Advanced Energy, No. 25 at p. 8)

The nominal efficiency values for electric motors are based on a sequence of discretized standard values in NEMA Standard MG 1-2016 Table 12–10, and are familiar

[10] Currently, small electric motor efficiency is based on *average* full load efficiency while electric motor efficiency is based on *nominal* full load efficiency.

to motor users. Under this approach, the full-load efficiency is identified on the electric motor nameplate by a nominal efficiency selected from Table 12-10 that shall not be greater than the average efficiency of a large population of motors of the same design. However, NEMA has not adopted a comparable set of standardized values for small electric motors. Because no standardized nominal values are published for small electric motors, DOE is unable to consider at this time their appropriateness as a small electric motors performance metric. Absent standardized nominal values for small electric motors, DOE is unable to ascertain whether existing energy conservation standards would require the same level of stringency if based on nominal values. As a result, this NOPR does not propose to adopt NEMA's suggestion to amend the metric for small electric motor energy conservation standards (*i.e.*, average full-load efficiency).

2. Representations

In response to the July 2017 TP RFI, AHAM and AHRI commented that if DOE elects to expand the scope of the small electric motors and electric motors test procedures, DOE should not make these newly expanded test procedures mandatory, including for representations, until or unless energy conservation standards are established. (AHAM and AHRI, No. 21 at p. 4)

As discussed in section III.A, DOE is not proposing to expand the scope of applicability of the small electric motors test procedure.

C. Industry Standards for Existing Test Procedures

The DOE test procedures rely on industry standards that are incorporated by reference at 10 CFR 431.443 and 10 CFR 431.15. Specifically, the existing DOE test procedures for small electric motors and electric motors rely on the following test methods:

(1) for polyphase small electric motors of less than or equal to 1 hp, either Section 6.3 "Efficiency Test Method A, Input-Output" of IEEE 112-2004, "IEEE Standard Test Procedure for Polyphase Induction Motors and Generators;" or CSA C747-09, "Energy Efficiency Test Methods for Small Motors" (10 CFR 431.444(b)(2));

(2) for polyphase small electric motors of greater than 1 hp and electric motors, either Section 6.4 "Efficiency Test Method B, Input-Output with Loss Segregation" of IEEE 112-2004; or CSA C390-10, "Test Methods, Marking Requirements, and Energy Efficiency Levels for Three-Phase Induction Motors" (10 CFR 431.444(b)(3); 10 CFR 431.16 and Appendix B); and

(3) for single-phase small electric motors: either IEEE 114-2010, "IEEE Standard Test Procedure for Single-Phase Induction Motors;" or CSA C747-09 (10 CFR 431.444(b)(1)).

In response to the July 2017 TP RFI, Advanced Energy commented generally that the existing test procedures for small electric motors do not require any revisions. (Advanced Energy, No. 25 at p. 9) Comments suggesting revisions to specific aspects of the current test procedure (*e.g.*, scope, metric, and incorporation of new test methods) are discussed elsewhere in this document (see sections III.A.2, III.B, and III.C.2).

DOE conducted a review of each of the referenced industry standards to determine whether they still represent the most current procedures accepted and used by industry. After the July 2017 TP RFI comment period closed (September 13, 2017), IEEE approved an updated edition of the IEEE 112 standard on February 14, 2018. Section III.C.1 of this document describes DOE's consideration of the updated IEEE 112-2017 standard. The other referenced industry standards incorporated into DOE's test procedure developed by CSA remain current or have been reaffirmed without changes.[11] All of these standards remain among the most commonly used industry consensus standards for determining motor efficiency. Therefore, as explained later in this section, in recognition of the wide acceptance of these testing standards, DOE proposes to modify 10 CFR 431.15 and 431.443 by incorporating by reference the latest version of IEEE 112, while retaining the incorporation by reference of the IEEE 112-2004 standard. In addition, section III.C.2 of this document addresses DOE's consideration of incorporating by reference an additional industry standard also commonly used by the industry.

Table III-3 summarizes the industry standards DOE proposes to incorporate by reference to use as the basis for measuring motor efficiency of currently regulated small electric motors and electric motors. The specific industry standards that would be referenced are listed in section IV.N of this document.

Table III-3: Summary of the Proposed Industry Test Methods

Equipment	Description	Industry Test Methods
Small Electric Motors	Single-phase	• IEEE 114-2010*

[11] Both CSA C747-09 and CSA C390-10 have been reaffirmed in 2014 and 2015, respectively.

		• CSA C747-09* • IEC 60034-2-1:2014 Test Method 2-1-1A
	Polyphase with rated output power less or equal to 1 hp	• IEEE 112-2004 Test Method A* • IEEE 112-2017 Test Method A • CSA C747-09* • IEC 60034-2-1:2014 Test Method 2-1-1A
	Polyphase with rated output power greater than 1 hp	• IEEE 112-2004 Test Method B* • IEEE 112-2017 Test Method B • CSA C390-10* • IEC 60034-2-1:2014 Test Method 2-1-1B
Electric Motors	Electric Motors – regulated at 10 CFR 431.25	• IEEE 112-2004 Test Method B* • IEEE 112-2017 Test Method B • CSA C390-10* • IEC 60034-2-1:2014 Test Method 2-1-1B

* These IEEE and CSA standards are already incorporated by reference in the current test procedure and would be maintained as part of this proposal.

1. IEEE 112-2017

On February 14, 2018, IEEE approved IEEE 112-2017, "IEEE Standard Test Procedure for Polyphase Induction Motors and Generators." DOE conducted a full review of the revised standard to identify any changes made relative to the industry test methods that are incorporated by reference from IEEE 112-2004.

Section 4, "Measurements", of IEEE 112-2017 includes several updates regarding instrument selection and measurement accuracy. Specifically, the 2017 revision includes updates to the permissible limits of error for general measurement instrumentation, the limits of error for torque measurement, and the limits of error for speed measurement. In addition, the 2017 revision specifies new requirements for limits of error in current measurement, power measurement, and frequency measurement. Section 4 also indicates that alcohol thermometers are no longer permitted for measuring temperature in the 2017 revision of IEEE 112.

The method for calculating core loss used in Section 6.4, "Efficiency test method B – Input-output with loss segregation" was revised for the 2017 edition of IEEE 112. Core loss at each load point is now determined directly based on the no-load test data at the stator core voltage instead of being calculated by subtracting friction, windage, and resistive core losses from total no-load losses. This change in calculation methodology for core losses aligns the IEEE 112-2017 Test Method B with the efficiency test method specified in CSA C390-10, currently incorporated by reference at 10 CFR 431.444(b)(3). DOE further notes that this change also aligns with the Method 2-1-1B approach of IEC 60034-2-1:2014.

Previously, when DOE added CSA 390-10 as a permissible test method for small electric motors, DOE concluded that the differences between IEEE 112-2004 and CSA 390-10 are minimal, and both tests will result in an accurate and similar measurement of efficiency. 77 FR 26608, 26622. IEEE 112-2017 uses the same core-loss calculation as CSA C390-10. However, DOE has initially determined that the core-loss calculation in IEEE 112-2017 may result in a difference in the measured efficiency value as compared to the core-loss calculation under the currently referenced IEEE 112-2004. In the small electric motor and electric motor final rule published on May 4, 2012, commenters indicated the difference in efficiency outcome between IEEE 112-2004 and CSA C390-10 to be within 0.2 percent. 77 FR 26608, 26622. As discussed, the core loss calculation in IEEE 112-2017 aligns with the core loss calculation in CSA C390-10. Based on this comparison of IEEE 112-2004 and CSA C390-10, the impact of the core-loss calculation between IEEE 112-2004 and IEEE 112-2017 should be no greater than 0.2 percent. To

avoid any potential need to retest motors that have relied on IEEE 112-2004 for purposes of compliance, DOE is proposing to incorporate the IEEE 112-2017 test methods as alternatives to the test methods incorporated in the current test procedure, while retaining the currently incorporated IEEE 112-2004 methods. DOE has initially determined that IEEE 112-2017 will result in an accurate and similar measurement of efficiency as compared to IEEE 112-2004. Given the variable nature of tested efficiency values for electric motors and small electric motors due to manufacturing and material differences, the variation in the calculated efficiency is not likely to result in any significant change in overall energy efficiency test results.

Since the introduction of the IEEE 112 standard in 1964, IEEE has made periodic updates to the standard to keep the test methods current with improvements to instrumentation and test techniques, and incorporating this update would help to align DOE's test procedures with current industry practice. Accordingly, DOE proposes to incorporate by reference IEEE 112-2017 Test Method A and Test Method B as alternatives to the industry test methods that are currently incorporated by reference from IEEE 112-2004 (see 10 CFR 431.15 and 10 CFR 431.443). This proposal would further harmonize the permitted test methods under subparts X (for small electric motors) and B (for electric motors) of 10 CFR part 431 and align measurement and instrumentation requirements with industry practice, while ensuring that motors that have demonstrated compliance under IEEE 112-2004 methods do not require retesting.

DOE requests comment on its proposal to incorporate by reference IEEE 112-2017 Test Method A and Test Method B as alternatives to the currently incorporated industry test standards in IEEE 112-2004. In particular, DOE requests data comparing test results of these standards.

2. IEC 60034-2-1:2014

Separate from DOE's July 2017 TP RFI, NEMA and Underwriter Laboratories ("UL") independently submitted written petitions requesting that certain portions of IEC 60034-2-1:2014 be adopted as a permitted alternative test method for small electric motors and electric motors. DOE published a notice regarding its receipt of these petitions in November 2017. See 82 FR 50844 (November 2, 2017) (hereinafter, "the November 2017 notice of petition") (announcing the receipt of petitions from UL and NEMA seeking the incorporation of certain test methods from IEC 60034-2-1:2014 into DOE's regulations).

Specifically, NEMA's petition requested that DOE incorporate IEC 60034-2-1:2014 Method 2-1-1B[12] as an alternative to IEEE 112-2004 Test Method B and CSA C390-10, which are currently referenced in Appendix B. (NEMA, No. 28.2 at p.1) UL requested that (1) IEC 60034-2-1:2014 test method 2-1-1B be approved for Appendix B and section 431.444 of 10 CFR part 431 (as an alternative to CSA C390-10) and (2) that

[12] IEC 60034-2-1:2014 Method 2-1-1B (2014), "Rotating Electrical Machines – Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)," "Summation of losses, additional load losses according to the method of residual loss."

IEC 60034-2-1:2014 test method 2-1-1A be approved for section 431.444 of 10 CFR part 431 (as an alternative to CSA C747-09). (UL, No. 29.1 at p.1)

The NEMA and UL petitions included and referenced papers that compare the testing methodologies presented in IEC 60034-2-1:2014 and the IEEE and CSA standards currently referenced in the small electric motors and electric motors test procedures at 10 CFR part 431.

The NEMA petition included a "work paper" that summarizes an evaluation conducted by the NEMA Motor and Generator Section technical committee, which found that the IEC 60034-2-1:2014 Method 2-1-1B test method was a suitable alternative to the IEEE 112-2004 Test Method B and CSA C390-10 test methods. (NEMA, No. 28.3 at p. 1) This evaluation relied on (1) comparison of instrumentation accuracy, test method, and calculation approach among the IEC, IEEE, and CSA industry standards, (2) analysis of test results from over 500 motors tested at the Hydro-Quebec Research Institute, and (3) reference to one scientific research paper (the "Angers et al. paper") which also concluded that all three methods provide results that are very closely aligned. (NEMA, No. 28.3 at pp. 1– 3) NEMA's work paper claimed that the results of the Hydro-Quebec Research Institute testing typically showed a loss deviation of less than ±2 percent. The NEMA petition letter also stated a loss difference of 2 percent is (1) within the variation of two tests performed using the same motor and test equipment but with different operators and at different times of day; and (2) well below the typical variation of 10 percent of losses when different labs are used to test the same motor. (NEMA, No. 28.3 at

p. 2) NEMA commented that incorporating IEC 60034-2-1:2014 Method 2-1-1B test method as an alternative to the IEEE 112-2004 Test Method B and CSA C390-10 test methods would reduce the unnecessary burden of performing a second test for motors originally tested to the IEC 60034-2-1:2014 Method 2-1-1B test method. (NEMA, No. 28.3 at pp. 3–4) NEMA did not specify the number of motors that would benefit from such burden reduction.

The UL petition included two papers comparing the IEC 60034-2-1 test methods with the respective IEEE and CSA standards. The first paper was the Angers et. al. study, that concluded that the IEC 60034-2-1:2014 Method 2-1-1B test method provides results that are very closely aligned with the IEEE 112-2004 Test Method B and CSA C390-10 test methods. (UL, No 29.2 at pp. 1–8) The second paper, written by IEEE member Wenping Cao, compared the IEEE 112 and IEC 60034-2-1 standards. The study evaluated test results from six induction motors with ratings between 5.5 and 150 kW (7.5 to 200 hp) and determined that the overall power losses found using the two standards is similar. The resulting efficiency values were found to be equal or otherwise closely aligned, with respective maximum and mean deviations of 0.1 and 0.03 percentage points. (UL, No. 29.3 at p. 7) UL requested that DOE incorporate IEC 60034-2-1:2014 Method 2-1-1B as an alternative to IEEE 112-2004 Test Method B and CSA C390-10 because of an increased use of the IEC 60034-2-1:2014 Method 2-1-1B. (UL, No 29.1 at p.1) In its comments, UL did not quantify how broadly the IEC 60034-2-1:2014 Method 2-1-1B is currently being used.

Comments in response to the November 2017 notice of petition are discussed in sections III.C.2.a through III.C.2.b of this notice of proposed rulemaking.

DOE also received several anonymous comments in response to the November 2017 notice of petition. Those comments, however, raised topics unrelated to the test procedures at issue and are, consequently, not addressed.

a. Method 2-1-1A

Among multiple testing methods provided in IEC 60034-2-1:2014, Method 2-1-1A "Direct measurement of input and output" is the standard's preferred testing method for single-phase motors. It is based on direct measurement of electrical input power to the motor and mechanical output power (in the form of torque and speed) from the motor. This approach is analogous to the methods of the other industry standards, IEEE 114-2010 and CSA C747-09, currently incorporated by reference for testing single-phase motors, and IEEE 112-2004 Test Method A, currently incorporated by reference for the purpose of testing polyphase motors of output power less than or equal to one horsepower.

Regarding equivalency among IEC 60034-2-1:2014 Method 2-1-1A, IEEE 114-2010, and CSA C749-09, Advanced Energy commented that previous comparisons finding equivalence between the latter two still held, but that Method 2-1-1A had not been formally compared to the others through testing. (Advanced Energy, No. 81 at p. 4 that IEC 60034-2-1:2014 Method 2-1-1A is likely to produce results that are accurate,

reproducible, and consistent with results from the other test methods permitted under subparts X and B of 10 CFR part 431.

To identify ways to resolve the concern surrounding the torque correction procedure in IEC 60034-2-1:2014 Method 2-1-1A, DOE reviewed analogous provisions in other industry standards. IEEE 114-2010[13] and CSA C747-09[14] contain more detailed descriptions of torque correction procedures, but both state that torque correction is not required when torque is measured using either an inline, rotating torque transducer or stator reaction torque transducer. The insufficient specificity of IEC 60034-2-1:2014 Method 2-1-1A regarding dynamometer torque correction can be avoided by using a torque measurement method that does not require correction. As a result, DOE proposes to incorporate by reference the provisions of IEC 60034-2-1:2014 Method 2-1-1A as a permitted alternative to IEEE 114-2010 and CSA C747-09, but to limit torque measurement to methods which do not require dynamometer torque correction. Specifically, DOE proposes to limit torque measurement, when using IEC 60034-2-1:2014 Method 2-1-1A, to either in-line, shaft-coupled, rotating torque transducers or stationary, stator reaction torque transducers, and to reflect these changes in 10 CFR 431.444 (b)(1) and 431.444(b)(2).

In addition, the IEC 60034-2-1:2014 2-1-1A test method specifies that motors under test should be operated at the "required load" until thermal equilibrium is achieved. As required under DOE's test procedure, the motor must be rated and tested at rated load.

[13] Section 5.2.1.1.1 of IEEE 114-2010 addressees when torque correction is required.
[14] Section 6.7.1 of CSA C747-09 addresses when torque correction is required.

For clarity and consistency, DOE proposes to modify these instructions by replacing the term "required load" with "rated load."

DOE tentatively agrees with NEMA and Advanced Energy that IEC 60034-2-1:2014 Method 2-1-1A is likely to produce accurate and reproducible results that are consistent with results from the other test methods permitted under subparts X and B of 10 CFR part 431. In light of this likely outcome, DOE proposes to incorporate by reference IEC 60034-2-1:2014 Method 2-1-1A as an alternative to currently incorporated industry testing standards IEEE 112-2004 Test Method A and CSA C747-09 in 10 CFR 431.433. This proposal would further harmonize DOE's test procedures with current industry practice and reduce manufacturer test burden (see section III.F.1 for more details).

DOE requests comment on its proposal to incorporate by reference IEC 60034-2-1:2014 Method 2-1-1A as an alternative to currently incorporated industry testing standards IEEE 112-2004 Test Method A and CSA C747-09. In particular, DOE requests data comparing the average full-load efficiency test results of those standards. DOE requests comments on its proposal to limit torque measurement, when using IEC 60034-2-1:2014 Method 2-1-1A, to either in-line, shaft-coupled, rotating torque transducers or stationary, stator reaction torque transducers.

b. Method 2-1-1B

Among multiple testing methods provided in IEC 60034-2-1:2014, Method 2-1-1B "Summation of losses, additional load losses according to the method of residual loss" is the IEC 60034-2-1:2014 standard's preferred testing method for three-phase motors. It is based on the indirect calculation of motor losses using a combination of measured values (*e.g.*, winding resistance) and assumptions so that direct measurement of motor torque is not needed. This is analogous to the methods of the other industry standards, IEEE 112-2004 and CSA C390-10, currently incorporated by reference for testing polyphase motors of output power greater than one horsepower.

In response to the November 2017 notice of petition, NEMA encouraged DOE to recognize IEC 60034-2-1:2014 as valid for demonstrating compliance with the DOE energy conservation standards. (NEMA, No. 80 at p. 1) Advanced Energy commented that, of its analysis of 117 motors, 112 were found to have full-load efficiency differences of ±0.2 or fewer percentage points between their respective IEC 60034-2-1:2014-measured and IEEE 112 Test Method B-measured efficiency values. (Advanced Energy, No. 81 at p. 2) Advanced Energy commented that, although the comparison was performed using IEC 60034-2-1:2007, the 2014 version is similar enough that results should continue to hold. [15] (Advanced Energy, No. 81 at p. 5) On that basis, Advanced Energy considered the loss segregation methods of IEC 60034-2-1:2014 and IEEE 112-2004 Test Method B to be in close agreement with each other. (Advanced Energy, No. 81 at p. 2)

[15] Advanced Energy's study published in 2011, before the 2014 version of IEC 60034-2-1 was available, but Advanced Energy expects the conclusion to extend to 2014.

Advanced Energy also generally supported the assessments of variation between IEC 60034-2-1 and IEEE 112-2004 Test Method B:

- Regarding UL's claim that IEEE 112-2004 Test Method B/IEC 60034-2-1:2014 Method 2-1-1B alignment is less than 0.1 percentage points, Advanced Energy commented that motors of lower rated output power, especially, sometimes varied by more. (Advanced Energy, No. 81 at p. 5)

- Regarding differences in IEEE 112-2004 Test Method B/IEC 60034-2-1:2014 Method 2-1-1B alignment across motors with respective energy conservation standards at Subparts B and X of 10 CFR part 431, Advanced Energy commented that the results of its analysiswould hold for motors of both subparts, but that error may grow as motor output power falls. (Advanced Energy, No. 81 at p. 4)

- Regarding a Hydro-Quebec study finding a characteristic loss estimation difference of ±2 percent of losses between IEEE 112-2004 Test Method B and IEC 60034-2-1, Advanced Energy commented that this result approximately aligned with its own. (Advanced Energy, No. 81 at p. 5)

- Advanced Energy also commented that although the core loss estimation method varied somewhat between IEEE 112-2004 Test Method B, IEC 60034-2-1:2014,

and CSA C390-10, the difference was modest and, further, that a 2018 update of IEEE 112 was expected to eliminate it. (Advanced Energy, No. 81 at pp. 3-4)

In addition to the studies submitted by the stakeholders, DOE notes that a recent comparison of results from a round robin between 11 participants concluded that the same motor tested at multiple locations showed a maximum deviation of ±0.4 percentage points, using the same IEEE 112-2004 Test Method B for each test.[16] DOE further notes that the largest difference reported by stakeholders between measured efficiency values using IEC 60034-2-1:2014 and IEEE 112-2004 Test Method B did not exceed ±0.2 percentage points. (Advanced Energy, No. 81 at p. 2). This difference is comparable to the difference in efficiency observed when testing using CSA 390-10 and IEEE 112-2004 Test Method B. DOE also determined that given the variable nature of tested efficiency values for electric motors and small electric motors due to manufacturing and material differences, the variation in the calculated efficiency is not likely to result in any significant change in overall energy efficiency test results.

Regarding variance in the core loss calculation between IEEE 112 Test Method B and IEC 60034-2-1:2014 Method 2-1-1B, the proposed incorporation by reference of the updated IEEE 112-2017 test methods is expected to resolve this discrepancy and further reduce differences in test results between the IEEE 112-2017 Test Method B and IEC 60034-2-1:2014 Method 2-1-1B. See section III.C.1 for details on this aspect of DOE's proposal.

[16] Hydro-Quebec Research Institute, NEMA Motor Round Robin, November 2018. Motor Summit 2018 Proceedings. Available at *https://www.motorsummit.ch/sites/default/files/2018-11/MS18_proceedings.pdf*

When amending a test procedure, DOE must determine the extent to which a proposed procedure will alter the measured energy efficiency of a given type of covered equipment when compared to the current procedure. (See 42 U.S.C. 6314(a)(5)(C) (incorporating the procedural steps of 42 U.S.C. 6293(e) for electric motors)) In view of the comments regarding the comparison among IEEE 112-2004 Test Method B, CSA 390-10, and IEC 60034-2-1:2014 Method 2-1-1B, including the results of the Hydro Quebec study, the paper written by IEEE member Wenping Cao, and the Advanced Energy study, along with the additional information gathered by DOE, DOE initially concludes that (1) these methods are not identical, but the differences between these standards are within the expected measurement variation of the existing test procedure; (2) all three tests would result in measurements of efficiency that would yield the same results with respect to motor compliance; and (3) given the variable nature of tested efficiency values for electric motors and small electric motors due to manufacturing and material differences, the variation in the calculated efficiency is insignificant and not likely to result in any manipulation of energy efficiency test results. Therefore, DOE proposes to incorporate by reference the relevant provisions of IEC 60034-2-1:2014 Method 2-1-1B as a permitted alternative to the current test methods IEEE 112-2004 Test Method B and CSA C390-10 in 10 CFR 431.15 and 10 CFR 431.443. Allowing manufacturers to test according to IEC 60034-2-1:2014 Method 2-1-1B would further harmonize DOE's test procedures with current industry practice and reduce manufacturer test burden (see section III.F.1 for more details).

DOE requests comment on its proposal to incorporate by reference IEC 60034-2-1:2014 Method 2-1-1B as an alternative to the currently incorporated industry testing standards IEEE 112-2004 Test Method B and CSA C390-10 and to IEEE 112-2017Test Method B. In particular, DOE requests data comparing test results of those standards.

D. Rated Output Power of Small Electric Motors

1. Background

The current regulations for small electric motors specify that the metric for energy conservation standards, average full-load efficiency, is to be measured at "full rated load." 10 CFR 431.442. However, the industry testing standards discussed in section III.C do not provide a method to determine the rated load of the tested unit. Rather, the standards rely on a manufacturer-specified output power, which is typically listed on a motor's nameplate. Motors subject to the test procedures for small electric motors are capable of operating over a continuous range of loads. For example, a motor that is rated at 1 hp is also capable of delivering 0.75 hp, but likely with a different speed, torque, and efficiency than those of when it is delivering its rated load of 1 hp. The output power of the motor depends on the load and the design of the motor. Therefore, the load point at which the motor must be tested is not an intrinsic parameter to the motor, but rather a parameter that must be defined or specified. The test's load point is relevant to efficiency testing because the efficiency of small electric motors varies according to load.

To provide for more accurate comparisons of similar motors from different manufacturers, DOE considered specifying objective rating points. However, DOE

recognizes that in some instances it may be more appropriate to allow manufacturers to rate and test their equipment at a selected load point within an allowable range that reflects a manufacturer preference (*e.g.*, a nominal value, increasing the service factor, or the load resulting in the highest efficiency) and that more appropriately matches the operating conditions likely to be experienced by operators of small electric motors.

In the July 2017 TP RFI, DOE described potential methods of determining motor output power based on factors other than manufacturer declaration, including deriving motor output power from either breakdown torque or service factor load. 82 FR 35468, 35476-77.

Details of the options considered and the proposed approach are discussed in sections III.D.2 and III.D.3.

2. NEMA Breakdown Torque Method

DOE investigated whether breakdown torque (a directly measurable quantity) corresponds to rated output power, and if it could be used as a means for determining rated output power. NEMA MG 1-2016, section 10.34, specifies that the horsepower rating of a small or medium single-phase induction motor is based on breakdown torque. Breakdown torque is defined in section 1.50 of NEMA MG 1-2016 as the maximum torque which the motor will develop with rated voltage and frequency applied without an abrupt drop in speed.[17] In concept, breakdown torque describes the maximum torque the

[17] NEMA MG 1-2016 does not quantify what would constitute "an abrupt drop in speed."

motor can develop without slowing down and stalling. The maximum torque over the entire speed range could occur at a different condition (*e.g.*, the motor start-up, zero speed condition) than the breakdown condition. Therefore, breakdown torque corresponds to a local maximum torque (on a plot of torque versus speed) that is nearest to the rated torque. The phrase "abrupt drop in speed" corresponds to the expectation that the motor will slow down or stall if the load increases and indicates that minor reductions in speed observed due to measurement sensitivities are not considered.

The breakdown torque for a specific horsepower rating is specified as a range as a function of input frequency and synchronous speed of the motor in two tables: Table 10-5 of NEMA MG 1-2016, which applies to induction motors, except PSC and shaded-pole motors; and Table 10-6 of NEMA MG 1-2016, which applies to shaded-pole and PSC motors for fan and pump applications. For polyphase motors, section 12.37 of NEMA MG 1-2016 specifies that the breakdown torque of a general-purpose polyphase squirrel-cage small motor shall not be less than 140 percent of the breakdown torque of a single-phase general purpose motor of the same horsepower and speed rating. As an example, according to Table 10-5 of NEMA MG 1-2016, a 60 hertz ("Hz")[18] motor rated for 1 hp with a synchronous speed of 1,800 revolutions per minute ("RPM") must have a breakdown torque between 5.16 and 6.8 pound-feet.

Not all small electric motors subject to standards are directly addressed by NEMA MG 1-2016. The highest horsepower rating for small motors for which breakdown torque

[18] Hertz is a unit of measure of frequency – or the rate at which current cycles. One hertz equals one cycle per second.

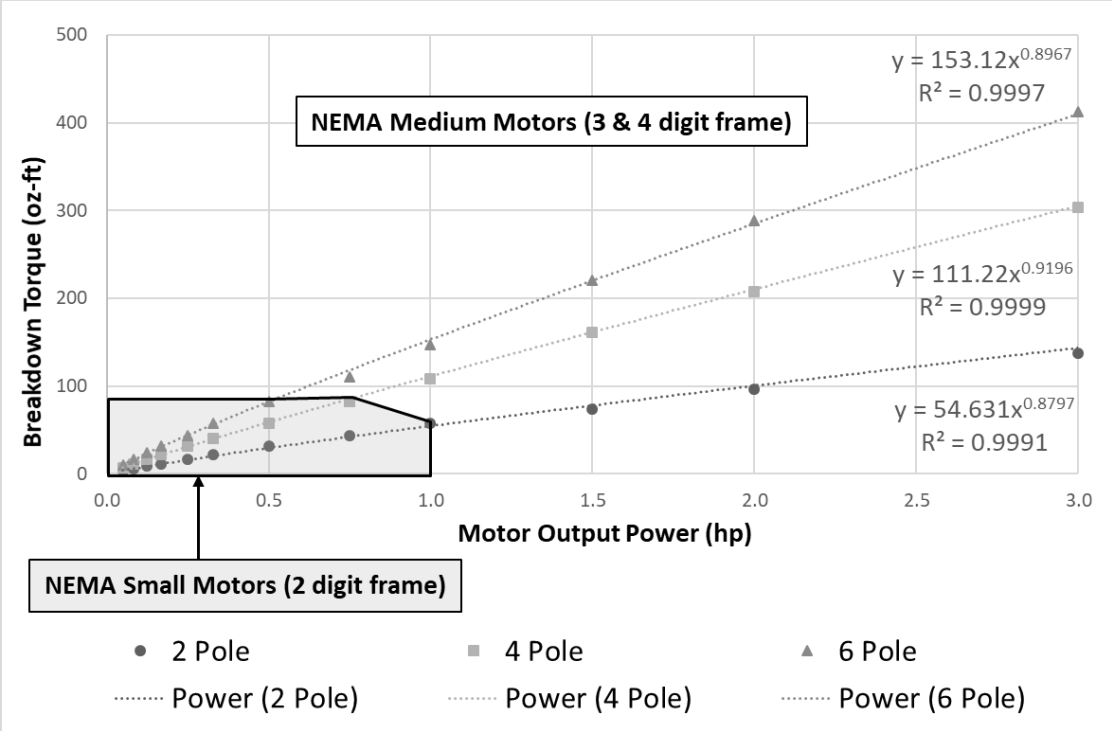
is provided in NEMA MG 1-2016 Table 10-5 is 1 hp for 2-pole motors, 0.75 hp for 4-pole motors, and 0.5 hp for 6-pole motors. Table 10-5 provides breakdown torque values for motors with horsepower ratings greater than these values, but specifies that these ratings correspond to 3-digit frame number series "medium motors" rather than 2-digit number series "small motors." The energy conservation standards for small electric motors at 10 CFR 431.446 apply only to motors with a two-digit frame number series. However, the upper output power bound of energy conservation standards for single-phase small electric motors is 3 hp for 2- and 4-pole motors, and 1.5 hp for 6-pole motors. The upper output power bound of energy conservation standards for polyphase small electric motors is 3 hp for 2-pole motors, 2 hp for 4-pole motors, and 1 hp for 6-pole motors.

DOE investigated the possibility of applying the breakdown torque ranges associated with NEMA medium motors in Table 10-5 of NEMA MG 1-2016 to small electric motors not identified as small motors in NEMA MG 1-2016.[19] DOE converted the breakdown torque values in NEMA MG 1-2016 Table 10-5 to units of oz-ft and plotted the upper limits of the breakdown torque range versus horsepower for NEMA small and medium motors up to 3 hp for 2-, 4-, and 6-pole motors operating at 60 Hz. DOE found that the relationship between breakdown torque and horsepower can be expressed as a power law, with continuity across the horsepower ratings at the transition point from motors designated by NEMA MG 1-2016 as "small" versus "medium". This

[19] These include small electric motors with horsepower ratings greater than the ratings provided in NEMA MG 1-2016 Table 10-5 for NEMA small motors and less than or equal to the upper horsepower bound for regulated small electric motors,

continuity indicates that the breakdown torque to horsepower relationship for motors designated "medium" is no different than those motors designated "small." DOE tentatively concludes from this review that the portions of NEMA MG 1-2016 Table 10-5 corresponding to "medium" motors, as that term is applied in the context of NEMA MG 1-2016, can be applied to 2-digit frame number series small electric motors of the same horsepower, and which are subject to DOE's test procedure. Figure III-1 shows breakdown torque plotted against horsepower, with power law relationships fitted to the data from NEMA MG 1-2016 Table 10-5.

Figure III-1: Breakdown Torque of Induction Motors



In response to the July 2017 TP RFI, NEMA commented that single-phase small electric motors are typically rated based on breakdown torque per NEMA MG 1 limits.

(NEMA, No. 25 at p. 11-12) To confirm that the breakdown torque method is commonly used by industry, DOE compared the values of breakdown torque specified in Table 10-5 of NEMA MG 1-2016 to values listed in manufacturer catalogs and product literature for small electric motors. For most single-phase small electric motors, breakdown torque corresponded to the associated NEMA range in Table 10-5 of NEMA MG 1-2016.[20] Similarly, for polyphase small electric motors, nearly all models had a manufacturer listed breakdown torque which was not less than 140 percent of the lower bounds of the NEMA ranges listed in Table 10-5.[21]

Also in response to the July 2017 TP RFI, Advanced Energy commented that an approach for determining the full load output power of a motor based on breakdown torque is possible, but with potentially inconsistent results due to the sensitivity of breakdown torque to voltage and temperature. Advanced Energy stated that in NEMA MG1-2014, the ranges of breakdown torque for single-phase motors are likely provided as guidance for the user and not intended to serve as a method for determining rated output power. Advanced Energy commented that the full load or rated output power of a motor is best declared by the manufacturer. (Advanced Energy, No. 25 at p. 13-14)

Regarding potentially inconsistent results when measuring breakdown torque, DOE notes that Section 12.30 of NEMA MG 1-2016 specifies that the tests to determine

[20] 88% of single-phase small electric motor models collected from major manufacturer's catalogs listed values for breakdown torque that corresponded to the associated NEMA range.
[21] DOE reviewed data from five major manufacturer's catalogs. Of the reviewed catalog listings, approximately 98% of polyphase small electric motor models listed values for breakdown torque that were not less than 140 percent of the associated range in Table 10-5 of NEMA MG 1.

performance characteristics, including breakdown torque, shall be made in accordance with IEEE 114 for single-phase motors and IEEE 112 for polyphase motors. These methods include requirements for instrument calibration and measurement accuracy pertaining to voltage and temperature (see sections 4 and 5 of IEEE 114 and section 4 of IEEE 112). Further, the range of breakdown torque values that correspond to a rated horsepower value provides flexibility for some variation in test results.

Based on the ability to apply NEMA MG 1-2016 to all small electric motors subject to standards, and evidence that most manufacturers already use this method as a standard practice, DOE proposes to use breakdown torque to define rated output power. DOE proposes to define rated output power as, "the mechanical output power that corresponds to the small electric motor's breakdown torque as specified in NEMA MG 1-2016 Table 10-5 for single-phase motors or 140 percent of the breakdown torque values specified in NEMA MG 1-2016 Table 10-5 for polyphase motors. For purposes of this definition, NEMA MG 1-2016 Table 10-5 can be applied to all small electric motors, regardless of whether elements of NEMA MG 1-2016 Table 10-5 are identified as for small or medium motors." DOE also proposes defining "breakdown torque" as referring to the maximum torque that the motor will develop with rated voltage and frequency applied without an abrupt drop in speed, determined in accordance with NEMA MG 1-2016.

DOE requests comment on the proposed definitions for "rated output power" and "breakdown torque."

DOE requests comment on how to determine when an "abrupt drop in speed" (*e.g.*, the local maximum of the torque-speed plot closest to the rated torque) has occurred when testing the breakdown torque of a small electric motor.

3. NEMA Service Factor Load Method

DOE also researched a method of establishing rated output power based on the service factor load of a motor. NEMA MG 1-2016 defines service factor in section 1.42 as a multiplier that, when applied to the rated output power at full-load, indicates a permissible horsepower loading that may be carried under the conditions specified in NEMA MG 1-2016 section 14.37. While it is possible for a motor to operate at the service factor load, there are advantages when the motor operates at a load less than the service factor load (*e.g.*, longer motor life and greater ability to withstand occasional higher ambient temperatures). Nonetheless, DOE explored the potential use of service factor load as an intermediate step to determination of rated output power.

Section 14.37 of NEMA MG 1-2016 specifies that when operated at the service factor load, small and medium alternating current motors will have a temperature rise as specified in section 12.42.1 and 12.43 item a.2, respectively.[22] The temperature rises in these sections are specified according to insulation class (*i.e.*, A, B, F, or H).

[22] DOE notes that NEMA MG 1-2016 section 14.37 contains a typo and refers to section 12.44 item a.2 and 12.43.1.

DOE examined sections in NEMA MG 1-2016 relevant to the insulation class of a motor, which is a standardized way to describe an electrical insulation system. Section 1.65 of NEMA MG 1-2016 defines an insulation system as an assembly of insulating materials in association with the conductors and the supporting structural parts. An insulation system is composed of coil insulation with its accessories, connection and winding support insulation, and associated structural parts. Insulation systems are designated as one of four insulation classes in section 1.66 of NEMA MG 1-2016. The insulation classes are designated as A, B, F, and H, where each class has an associated maximum temperature rise at which the insulation system can safely operate. Section 1.66 of NEMA MG 1-2016 describes that these insulation classes are determined through experience or an accepted test.[23]

DOE investigated the motor industry's current use of insulation class markings to determine if insulation class is suitable to be used as a starting point for determining service factor load. DOE is aware that service factor load is related to the temperature rise of a motor, according to section 14.37 in NEMA MG 1-2016. Additionally, section 14.37 references two sections (*i.e.*, sections 12.43 item a.2 and 12.42.1), which describe temperature rise based on insulation class. Insulation class is defined in NEMA MG 1-2016 section 1.66. This information indicates that insulation class is fairly well established according to industry standards.

[23] In NEMA MG 1-2016, "experience" means successful operation for a "long time" under actual operating conditions of machines designated with temperature rise at or near the temperature rating limit; "accepted test" means a test on a system or model system which simulates the electrical, thermal, and mechanical stresses occurring in service. The test must also be made in accordance with IEEE 43, IEEE 117, IEEE 275, and IEEE 304 when appropriate for the motor construction.

In examining whether insulation class is commonly used by industry for equipment within the scope of 10 CFR 431.444, DOE found that MG 1-2016 includes nameplate markings (sections 10.39 and 10.40) and that NEMA requires that small electric motor nameplates include insulation class designations. Additionally, DOE reviewed catalog data from various manufacturers, and found that catalog data usually include the insulation class of the motor. However, neither DOE nor industry require including insulation class information in catalog data. In rare cases[24] where catalog data omit the insulation class of the motor, the manufacturer knows the insulation class, as it is part of the design process for selecting materials for the motor with appropriate thermal properties. Based on the information in NEMA MG 1-2016 and the prevalence of insulation class in manufacturer literature, standard industry practice is to rate motors according to NEMA insulation classes. DOE also notes that since insulation class information is included with manufacturer literature for nearly every motor model, it could be used by DOE in a test procedure without any additional testing burden. However, DOE was not able to determine whether insulation class and temperature rise, even if known, could be reliably used to derive a motor's service factor load.

In response to the July 2017 TP RFI, NEMA opposed the adoption of a method to determine full-load or rated output power of a motor based on the load which results in a temperature rise associated with the insulation class of the motor. NEMA reasoned that the insulation class for some motors is selected based on the potential for operation under

[24] DOE found that only 0.1% of 5,588 motor models with data collected from manufacturer catalogs did not include the insulation class of the motor.

harsher conditions than continuous duty in a laboratory setting. NEMA asserted that this additional design consideration would undermine a direct relationship between temperature rise, insulation class, and rated output power. NEMA commented that with respect to insulation classes, each insulation class is rated for continuous operation at a specified temperature limit. While all motors operate within the temperature limits of that insulation class, not all motors operate continuously at the same temperature. The insulation class for any given motor could be selected based on continuous use at an elevated temperature. Alternatively, it could be selected to protect motors due to spikes in temperature that cannot be controlled but are not the typical/normal operating points. (NEMA, No. 24 at p. 11-12)

Advanced Energy offered that it is possible to establish the output power rating of a motor by determining the load (*i.e.*, torque and speed) at which the motor will achieve a stable temperature that does not exceed the insulation class temperature. However, it added that there could be several loads that would meet this criterion, and therefore the horsepower determined with this method cannot necessarily be considered the correct rating of the motor. Advanced Energy commented that the full load or rated output power of a motor is best declared by the manufacturer. (Advanced Energy, No. 25 at p. 13-14)

DOE recognizes that testing at the service factor load may characterize a motor's maximum sustainable output, but may not be representative of the typical service conditions that a motor experiences. DOE also acknowledges that manufacturers may design their motors to operate optimally at a "rated" load that is less than the service

factor load. Further, DOE recognizes that manufacturer performance information is commonly given at nominal horsepower ratings,[25] which are not always equivalent to the service factor load, and that retesting all motors to evaluate performance at the service factor load rather than at the current nominal values may be burdensome. Finally, DOE does not have sufficient data to assess the potential impact on reproducibility given that multiple load points (*i.e.,* torque and speed) may generate the same temperature rise, but the different load points may have different measured efficiencies. As a result, DOE is not proposing to require determination of rated output power on the basis of service factor load.

E. Rated Values Specified for Testing Small Electric Motors

DOE is also proposing to clarify several values used for testing small electric motors. DOE notes that the definition of average full-load efficiency at 10 CFR 431.442 specifies that it is determined when the motor operates at the rated frequency, rated load, and rated voltage. Additionally, industry standards refer to "rated" values which are expected to be known or provided (*e.g.*, on the nameplate). However, "rated frequency," "rated load," and "rated voltage" are not defined. To resolve any ambiguity, DOE is proposing to include additional instruction on how to derive each of these values to allow for more accurate comparisons between motors, and better ensure reproducible testing for all equipment.

[25] Nominal horsepower ratings refer to horsepower ratings commonly used by manufacturers, and ratings for which NEMA provides specifications for (*e.g.*, 0.5, 0.75, 1, and 1.5 hp).

1. Rated Frequency

Rated frequency is a term commonly used by industry standards developed for testing small electric motors (*e.g.*, section 6.1 in IEEE 112-2004, and section 3 in IEEE 114-2010). The test procedures and energy conservation standards established under EPCA apply to motors distributed in commerce within the United States. Within the United States, electricity is supplied at 60 Hz. However, small electric motors could be designed to operate at frequencies in addition to 60 Hz (*e.g.*, motors designed to operate at either 60 or 50 Hz).

Small electric motors subject to 10 CFR 431.444 could potentially be marketed as capable of operating at two different frequencies and could have data provided for both (*e.g.*, 60 and 50 Hz). In this case, it could be unclear at which frequency the test should be performed. Therefore, DOE proposes, through the proposed referenced test methods, that all tests be performed using a rated frequency of 60 Hz. DOE proposes 60 Hz so that the tested input frequency matches the frequency experienced by the motor when installed in the field. To implement this proposal, DOE proposes to modify 10 CFR 431.442 to define the term "rated frequency" as "60 hertz."

2. Rated Load

Rated load[26] is used in industry standards to specify a loading point for motor testing (*e.g.*, sections 5.6 and 6.1 in IEEE 112-2004, and section 8.2.1 in IEEE 114-2010). Typically, a rated load represents a power output expected from the motor (*e.g.*, a

[26] Also referred to as full rated load, rated full-load, or full-load.

horsepower value on the nameplate). The rated load will have a corresponding rated speed and rated torque. DOE proposes to modify 10 CFR 431.442 to define the term "rated load" as "the rated output power of a small electric motor" (See section III.D.2 for definition of rated output power). DOE proposes that the rated output power (given on the motor nameplate) be used for any reference to rated load, full rated load, rated full-load, or full-load in an industry standard used for testing small electric motors.

3. Rated Voltage

Rated voltage is used in industry standards to specify the voltage supplied to the motor under test (*e.g.*, section 6.1 in IEEE 112-2004, and section 3 in IEEE 114-2010). DOE is proposing to clarify the permissible test voltage options when small electric motors are rated for use at multiple voltages (*e.g.*, 230 and 460 volts) by defining the term "rated voltage" at 10 CFR 431.442.

NEMA, Baldor, UL, ASAP, ACEEE, NEEA, and CA IOUs commented on this issue in response to a prior proposal related to certain certification, compliance, labeling, and enforcement issues involving electric and small electric motors. NEMA commented that with respect to single-phase capacitor run motors, DOE currently allows the manufacturer to select the voltage for compliance. NEMA also indicated that the input voltage setting can affect efficiency, noting that if DOE were to require motors to comply at the lowest level of efficiency, manufacturers would be forced to redesign these motors, since at least some motors would be out of compliance at voltages not currently selected for certification. These redesign efforts would result in larger motors to accommodate the

additional active material required to create a compliant motor and could result in the use of larger frame sizes, which would create utility problems for end users of the motors. (NEMA, EERE-2014-BT-CE-0019, No. 10 at p. 10) With respect to the input voltage setting for testing and representations, Baldor agreed with NEMA's comments. (Baldor, EERE-2014-BT-CE-0019, No. 11 at p. 6) UL and Advanced Energy also commented that the input voltage setting can affect efficiency and that DOE should either allow the manufacturer to select the input voltage for testing or require testing at all nameplate voltages. (UL, EERE-2014-BT-CE-0019, No. 9 at p. 8-9; Advanced Energy, EERE-2014-BT-CE-0019, No. 8 at p. 11) UL also commented that, should testing be required at all nameplate voltages, 208 volts should be excluded because it is typically listed as a "usable" voltage rather than a voltage for which the motor was designed and optimized. (UL, EERE-2014-BT-CE-0019, No. 9 at p. 9) ASAP, ACEEE, and NEEA, in a joint comment, indicated that clarification on the voltage used during the test would address ambiguity and ensure consistency. (ASAP, ACEEE, NEEA, EERE-2014-BT-CE-0019, No. 16 at p. 3) The CA IOUs also supported specifying a voltage for testing, reasoning that this would ensure consumers are unlikely to purchase a unit less efficient than advertised. (CA IOUs, EERE-2014-BT-CE-0019, No. 13 at p. 4)

In the March 2010 ECS final rule, DOE indicated the industry test procedures incorporated into DOE's regulations permit manufacturers to select the input voltage for testing. 75 FR 10874, 10892 ("DOE understands that it is at the manufacturer's discretion under which single voltage condition to test its motor."). After considering the regulatory history on this topic and the market data supporting the notion that efficiency can vary

with the input voltage setting, DOE proposes to continue to allow small electric motors to be tested at any nameplate voltage value and to specify this flexibility by defining the term "rated voltage" at 10 CFR 431.442 as referring to the input voltage of a small electric motor selected by the motor's manufacturer to be used for testing the motor's efficiency. In DOE's view, this change will help ensure consistency and clarity during testing and when making representations of the performance characteristics of a given motor (*i.e.*, on a motor nameplate or product catalog).

DOE requests comment on the proposed definitions, and procedures for determining the values of rated frequency and rated load for small electric motors.

F. Test Procedure Costs, Harmonization, and Other Topics

1. Test Procedure Costs and Impact

EPCA requires that test procedures prescribed by DOE not be unduly burdensome to conduct. 42 U.S.C. 6314(a)(2). DOE proposes to amend (1) the existing test procedure for small electric motors (by clarifying the existing scope and testing instructions, adding an authorized procedure incorporated by reference from IEEE 112-2017, and permitting the use of IEC 60034-2-1:2014) and (2) the existing test procedure for electric motors (by proposing to permit the use of IEC 60034-2-1:2014). DOE has tentatively determined that testing under these proposed amendments would not be unduly burdensome for manufacturers to conduct and that these proposed amendments would reduce test burden for manufacturers.

DOE's analyses of this proposal indicate that, if finalized, the proposal would result in a net cost savings to manufacturers.

Table III-4: Summary of Cost Impacts for Small Electric Motors and Electric Motors

Category	Present Value *(million 2016$)*	Discount Rate *(percent)*
Cost Savings		
Reduction in Future Testing Costs for Small Electric Motors	0.3	3
	0.1	7
Reduction in Future Testing Costs for Electric Motors	4.0	3
	1.6	7
Total Net Cost Impact		
Total Net Cost Impact	(4.2)	3
	(1.7)	7

Table III-5: Summary of Annualized Cost Impacts for Small Electric Motors and Electric Motors

Category	Annualized Value *(thousand 2016$)*	Discount Rate *(percent)*
Annualized Cost Savings		
Reduction in Future Testing Costs for Small Electric Motors	8	3
	7	7
Reduction in Future Testing Costs for Electric Motors	119	3
	111	7
Total Net Annualized Cost Impact		
Total Net Cost Impact	(127)	3
	(118)	7

Further discussion of the analyses of the cost impact of the proposed test procedure amendments is presented in the following paragraphs.

a) Cost Impacts for Small Electric Motors

Regarding small electric motors, the proposed clarifications of the existing scope and test instructions would not impose any new requirements on manufacturers of regulated small electric motors. Instead, DOE's proposal, if adopted, would provide

manufacturers with greater certainty in the conduct of the test procedures, offer additional testing options, and would not increase test burden. The proposed addition of IEEE 112-2017 is not expected to increase test burden or require new testing. Manufacturers would be able to rely on data generated under the current test procedure, should the proposed amendments for small electric motors be adopted, because the proposal would retain the existing test method options at 10 CFR 431.444, and none of the proposed changes would result in a change in measured efficiency under the existing test method options.. Additionally, the proposed incorporation of IEC 60034-2-1:2014 would further harmonize DOE's test procedures with current industry practice and international standards by providing manufacturers with an additional testing option. This change would enable manufacturers who use IEC 60034-2-1:2014 for everyday business purposes (for international markets) or to comply with regulatory requirements in other countries to significantly reduce the number of tests that they must perform by removing the need to conduct a test according to the CSA or IEEE methods[27] currently referenced in DOE's test procedure for small electric motors. As described in section III.C.2, NEMA and UL petitioned that certain portions of IEC test procedure 60034-2-1:2014 be adopted as a permitted alternative test method for small electric motors and electric motors. UL further noted in its petition the increasing use of the IEC test procedure 60034-2-1:2014 by the industry worldwide.

[27] CSA 747-09, CSA 390-10, IEEE 112-2004, or IEEE 114-2010 depending on the category of small electric motor.

Recognizing that some, but not all, manufacturers already test their motors using IEC 60034-2-1:2014, DOE assumed that 10 percent[28] of small electric motor models sold in the U.S. that are tested with either the CSA or IEEE methods referenced in the Federal test procedure are also tested with the IEC 60034-2-1 method. The savings calculated in this notice could be higher if a larger fraction of U.S.-market motor models are currently already tested to IEC 60034-2-1 (*i.e.*, greater than 10 percent).

To calculate the testing cost reduction associated with allowing the IEC 60034-2-1:2014 method for testing small electric motors, DOE estimated the number of motor models that would be tested each year for compliance. First, DOE reviewed the product catalogs of four major small electric motor manufacturers published over a seven-year period between 2009 and 2016. DOE compared the current product offerings to the historical catalogs to identify the total number of new models listed over that period of time. DOE then annualized that total number of new models. Next, DOE scaled up that annualized value based on the estimated market share of the manufacturers whose catalogs were reviewed. This scaled-up annualized value estimated the total number of new models listed for sale each year for the entire U.S. market. Then, DOE estimated that only 10 percent of new models would be tested each year. DOE made this estimate based on (1) knowledge that many motor models are grouped under a single basic model classification (and therefore each individual model would not need to be tested), (2)

[28] NEMA and UL did not provide quantitative information regarding the number of small electric motors that are tested with either the CSA method or the IEEE method, and the IEC method, although NEMA commented that this is an increasing trend. Based on a review of the market, only some motors appear suitable for sale in both the U.S. and foreign markets. A small fraction of motors are designed for operation on 50 Hz and 60 Hz power, or use NEMA and IEC units of measure (hp vs. kW) and other designators. The U.S. electrical grid is operated at 60 Hz, while many other countries and regions (*e.g.*, Europe) operate at 50 Hz.

observations that only a fraction of electric motor basic models are tested (the remainder have efficiency determined through an alternative efficiency determination method ["AEDM"]), and (3) recognition that many motor models may have been relabeled or rebranded but not redesigned (and therefore no new testing is needed). Based on these calculations, DOE tentatively determined that approximately 1 new small electric motor basic model per year would not require testing according to the existing test methods and therefore would realize costs savings due to the proposed test procedure.

DOE estimated the cost of testing a single small electric motor unit to be $2,000 at a third-party facility and approximately $500 at an in-house facility.[29] DOE requires at least five units to be tested per basic model. 10 CFR 431.455(c)(2) To estimate in-house testing costs, DOE assumed testing a single motor unit requires approximately nine hours of a mechanical engineer technician time and three hours from a mechanical engineer. The mean hourly wage for a mechanical engineer technician is $27.97 and the total hourly compensation paid by the employer (including all fringe benefits) is $36.21. The mean hourly wage for a mechanical engineer is $43.99 and the total hourly compensation paid by the employer (including all fringe benefits) is $56.95.[30] In addition, DOE assumed that 50 percent of tests are conducted at third-party facilities and 50 percent of tests are conducted at in-house facilities. Based on these estimates, DOE anticipates annual cost savings of approximately $8,000 for the small electric motors industry.

[29] Estimate based on standard rates charged by third party laboratories.
[30] Bureau of Labor Statistics, Occupational Employment and Wages, 17-3027 Mechanical Engineer Technician; 17-2141 Mechanical Engineer, May 2017. Last accessed January 30, 2019
United States Census Bureau, Annual Survey of Manufacturers, 2016 for NAICS Code 335312 "Motor and Generator Manufacturing". Last accessed January 30, 2019.

b) Cost Impacts for Electric Motors

Regarding electric motors, DOE is not proposing to amend the scope of applicability of the test procedure at Appendix B. Consistent with the small electric motors analysis, the proposed incorporation of IEC 60034-2-1:2014 in this test procedure would provide manufacturers additional flexibility by permitting an alternative test procedure for measuring energy loss and would further harmonize DOE's test procedures with current industry practice and international standards. DOE expects that, for those manufacturers who are already using IEC 60034-2-1:2014, this proposed change would reduce the number of tests that manufacturers perform by avoiding the need to conduct a test according to the CSA or IEEE methods[31] currently referenced in DOE's test procedure.

To calculate the testing cost reduction associated with allowing the IEC 60034-2-1:2014 method for testing electric motors, DOE employed a similar methodology to the small electric motors analysis and estimated the number of electric motor models that would be tested each year for compliance. First, DOE reviewed the product catalogs of four major electric motor manufacturers published over a six-year period between 2010 and 2016. DOE compared the current product offerings to the historical catalogs to identify the total number of new models listed over that period of time. DOE then annualized that total number of new models. Next, DOE scaled up that annualized value based on the estimated market share of the manufacturers whose catalogs were reviewed.

[31] CSA 390-10 or IEEE 112-2004 depending on the category of electric motor.

This scaled-up annualized value estimated the total number of new models listed for sale each year for the entire U.S. market. Then, DOE estimated that only 10 percent of new models would be tested each year. DOE made this estimate based on (1) knowledge that many motor models are grouped under a single basic model classification (and therefore each individual model would not need to be tested), (2) observations that only a fraction of electric motor basic models are tested (the remainder have efficiency determined through an AEDM), and (3) recognition that many motor models that may have been relabeled or rebranded but not redesigned (and therefore no new testing is needed). Similar to what was done for small electric motors, DOE assumed that 10 percent of electric motor models sold in the U.S. that are tested with either the CSA or IEEE methods referenced in the Federal test procedure are also tested with the IEC 60034-2-1 method. The savings calculated in this notice could be higher if a larger fraction of U.S.-market motor models are currently already tested to IEC 60034-2-1. Based on these calculations, DOE tentatively determined that approximately 20 new electric motor basic models per year would not require testing according to the existing test methods and therefore would realize costs savings due to the proposed test procedure.

DOE estimated the cost of testing a single electric motor unit to be $2,000 at a third-party facility and approximately $500 at an in-house facility. DOE requires at least five units to be tested per basic model. 10 CFR 431.17(b)(2) In addition, based on DOE's understanding that this equipment is tested both in-house and at third-party testing labs, DOE assumed an even split in testing between the two venues. Based on these

estimates, DOE anticipates annual industry cost savings of approximately $127,000 for electric motors that are currently subject to the standards at 10 CFR 431.25.

DOE seeks input on the testing cost impacts and manufacturer burden associated with the test procedure amendments described in this document. DOE also seeks comment and any additional data relevant to its assumptions in calculating these impacts.

2. Harmonization with Industry Standards

DOE's current test procedures for electric and small electric motors are based on the industry standards that have been incorporated by reference. The current test procedures for small electric motors at 10 CFR 431.444 incorporate by reference certain provisions of IEEE 114-2010, IEEE 112-2004, CSA C747-09, CSA C390-10, all of which contain methods for measuring the energy efficiency of small electric motors. The current test procedures for electric motors in Appendix B incorporate by reference certain provisions of IEEE 112-2004 and CSA C390-10. DOE proposes to also allow the use of IEEE 112-2017, to further harmonize IEEE 112 Test Method B with the other permitted industry test methods. This NOPR also proposes to incorporate by reference certain provisions of the IEC test procedure 60034-2-1:2014 for measuring the performance of small electric motors and electric motors.

DOE requests comment on the benefits and burdens of adopting any industry/voluntary consensus-based or other appropriate test procedure, without modification.

3. Other Test Procedure Topics

In addition to the issues identified earlier in this document, DOE welcomes comment on any other aspect of the existing test procedure for small electric motors and electric motors. DOE particularly seeks information that would ensure that the test procedure measures energy efficiency during a representative average use cycle or period of use, as well as information that would help DOE create a procedure that would limit manufacturer test burden. Comments regarding repeatability and reproducibility are also welcome.

DOE also requests information that would help it create procedures that would limit manufacturer test burden through streamlining or simplifying testing requirements without impacting testing accuracy. In particular, DOE notes that under Executive Order 13771, "Reducing Regulation and Controlling Regulatory Costs," Executive Branch agencies such as DOE must manage the costs associated with the imposition of expenditures required to comply with Federal regulations. See 82 FR 9339 (February 3, 2017). Consistent with that Executive Order, DOE encourages the public to provide input on measures DOE could take to lower the cost of its regulations applicable to small electric motors consistent with the requirements of EPCA.

G. Compliance Date

EPCA prescribes that all representations made in writing or broadcast advertisements of energy efficiency and energy use, including those made on marketing materials and product labels, must be made in accordance with an amended test

procedure, beginning 180 days after publication of such a test procedure final rule in the *Federal Register*. (See 42 U.S.C. 6314(d)(1)) If DOE were to publish an amended test procedure, EPCA allows individual manufacturers to petition DOE for an extension of the 180-day period if the manufacturer may experience undue hardship in meeting the deadline. (42 U.S.C. 6314(d)(2)) To receive such an extension, petitions must be filed with DOE no later than 60 days before the end of the 180-day period and must detail how the manufacturer will experience undue hardship. (*Id.*) By statute, any extension granted by DOE under this provision may not exceed 180 days in duration. (*Id.*)

IV. Procedural Issues and Regulatory Review

A. Review Under Executive Order 12866

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

B. Review Under Executive Orders 13771 and 13777

On January 30, 2017, the President issued Executive Order ("E.O.") 13771, "Reducing Regulation and Controlling Regulatory Costs." E.O. 13771 stated the policy of the executive branch is to be prudent and financially responsible in the expenditure of funds, from both public and private sources. E.O. 13771 stated it is essential to manage

the costs associated with the governmental imposition of private expenditures required to comply with Federal regulations.

Additionally, on February 24, 2017, the President issued E.O. 13777, "Enforcing the Regulatory Reform Agenda." E.O. 13777 required the head of each agency designate an agency official as its Regulatory Reform Officer ("RRO"). Each RRO oversees the implementation of regulatory reform initiatives and policies to ensure that agencies effectively carry out regulatory reforms, consistent with applicable law. Further, E.O. 13777 requires the establishment of a regulatory task force at each agency. The regulatory task force is required to make recommendations to the agency head regarding the repeal, replacement, or modification of existing regulations, consistent with applicable law. At a minimum, each regulatory reform task force must attempt to identify regulations that:

(i) Eliminate jobs, or inhibit job creation;

(ii) Are outdated, unnecessary, or ineffective;

(iii) Impose costs that exceed benefits;

(iv) Create a serious inconsistency or otherwise interfere with regulatory reform initiatives and policies;

(v) Are inconsistent with the requirements of Information Quality Act, or the guidance issued pursuant to that Act, in particular those regulations that rely in whole or in part on data, information, or methods that are not publicly available or that are insufficiently transparent to meet the standard for reproducibility; or

(vi) Derive from or implement Executive Orders or other Presidential directives that have been subsequently rescinded or substantially modified.

DOE initially concludes that this rulemaking is consistent with the directives set forth in these executive orders. This proposed rule is estimated to result in cost savings. This proposed rule would yield annualized cost savings of approximately $118,000 (2016$) using a perpetual time horizon discounted to 2016 at a 7 percent discount rate. Therefore, if finalized as proposed, this rule is expected to be an E.O. 13771 deregulatory action.

C. Review Under the Regulatory Flexibility Act

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

DOE reviewed the test procedures considered in this proposed rule to amend the test procedure for small electric motors and electric motors under the provisions of the Regulatory Flexibility Act and the procedures and policies published on February 19, 2003.

The Small Business Administration ("SBA") considers a business entity to be a small business, if, together with its affiliates, it employs less than a threshold number of workers specified in 13 CFR part 121. The size standards and codes are established by the 2017 North American Industry Classification System ("NAICS").

Small electric motor and electric motor manufacturers are classified under NAICS code 335312, motor and generator manufacturing. The SBA sets a threshold of 1,250 employees or fewer for an entity to be considered as a small business. DOE conducted a focused inquiry into small business manufacturers of equipment covered by this rulemaking. DOE used available public information to identify potential small manufacturers. DOE accessed the membership directories of NEMA and The Motor Control and Motor Association (MCMA) to create a list of companies that import or otherwise manufacture small electric motors and electric motors covered by this rulemaking. Using these sources, DOE identified a total of 56 distinct manufacturers of small electric motors and electric motors.

DOE then reviewed the data to determine whether the entities met the SBA's definition of "small business" as it relates to NAICS code 335312 and to screen out

companies that do not offer equipment covered by this rulemaking, do not meet the definition of a "small business," or are foreign owned and operated. Based on this review, DOE has identified 21 manufacturers that are potential small businesses. Through this analysis, DOE has determined the expected effects of the rule on these covered small businesses.

In response to the July 2017 TP RFI, NEMA provided input on the costs and time required for testing motors of different configurations. NEMA indicated that testing a motor can take as little as 8 hours and as long as 32 hours, depending on the size of the motor. NEMA noted that the teardown process also takes several hours. (NEMA, No. 24 at pp. 10-11) Advanced Energy commented that a properly conducted test could take a full working day for a large motor, excluding setup, or a minimum of half a day for a small motor. (Advanced Energy, No. 25 at p. 13) Advanced Energy commented that relative to the motors already subject to energy conservation standards and test procedure, no significant burden is expected in testing the motors categories identified by DOE in the July 2017 TP RFI. (Advanced Energy, No. 25 at p. 3) Advanced Energy noted one exception in the case of fractional horsepower motors. 82 FR 35468, 35471. Advanced Energy believes that the cost of testing these motors may far exceed the cost of the motors, themselves. (Advanced Energy, No. 25 at p. 3)

This proposal would neither expand the scope of test procedure applicability to small electric motors beyond those currently subject to test procedures, nor would it place additional requirements on those small electric motors currently subject to DOE's test

procedures. Furthermore, this proposal would not place any additional requirements on those electric motors that are already subject to DOE's test procedures, nor would it require manufacturers to retest existing electric motors. Accordingly, manufacturers would not be required under this proposal to retest any existing small electric motors or electric motors already subject to DOE's test procedures.

This proposal, if adopted, would also not increase testing costs nor would it impose any additional testing burden on manufacturers. Therefore, DOE concludes that the impacts of this proposal would not have a "significant economic impact on a substantial number of small entities," and the preparation of an IRFA is not warranted. DOE will transmit the certification and supporting statement of factual basis to the Chief Counsel for Advocacy of the Small Business Administration for review under 5 U.S.C. 605(b).

DOE seeks comments on whether the proposed test procedure would place new and significant burdens on a substantial number of small entities.

D. Review Under the Paperwork Reduction Act of 1995

Manufacturers of electric motors must certify to DOE that their equipment comply with any applicable energy conservation standards. To certify compliance, manufacturers must first obtain test data for their equipment according to the DOE test procedures, including any amendments adopted for those test procedures. DOE has established regulations for the certification and recordkeeping requirements for covered

consumer products and commercial equipment, including electric motors. (See subpart B of 10 CFR part 431) The collection-of-information requirement for the certification and recordkeeping is subject to review and approval by OMB under the Paperwork Reduction Act (PRA). This requirement has been approved by OMB under OMB control number 1910-1400. Public reporting burden for the certification is estimated to average 35 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

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.

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

Section 654 of the Treasury and General Government Appropriations Act, 1999 (Pub. L. 105-277) requires Federal agencies to issue a Family Policymaking Assessment for any rule that may affect family well-being. This proposed rule, if adopted, 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.

F. Review Under the National Environmental Policy Act of 1969

DOE is analyzing this proposed regulation in accordance with the National Environmental Policy Act (NEPA) and DOE's NEPA implementing regulations (10 CFR Part 1021). DOE's regulations include a categorical exclusion for rulemakings interpreting or amending an existing rule or regulation that does not change the environmental effect of the rule or regulation being amended. 10 CFR Part 1021, Subpart D, Appendix A5. DOE anticipates that this rulemaking qualifies for categorical exclusion A5 because it is an interpretive rulemaking that does not change the environmental effect of the rule and otherwise meets the requirements for application of a categorical exclusion. See 10 CFR Part 1021.410. DOE will complete its NEPA review before issuing the final rule.

G. Review Under Executive Order 13132

Executive Order 13132, "Federalism," 64 FR 43255 (August 4, 1999) imposes certain requirements on agencies formulating and implementing policies or regulations that preempt State law or that have Federalism implications. The Executive Order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive Order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have Federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation

process it will follow in the development of such regulations. 65 FR 13735. DOE has examined this proposed rule and has determined that it would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the products that are the subject of this proposed rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6316(a); 42 U.S.C. 6297(d)) No further action is required by Executive Order 13132.

H. 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 (February 7, 1996), imposes on Federal agencies the general duty to adhere to the following requirements: (1) eliminate drafting errors and ambiguity, (2) write regulations to minimize litigation, (3) provide a clear legal standard for affected conduct rather than a general standard, and (4) promote simplification and burden reduction. Section 3(b) of Executive Order 12988 specifically requires that Executive agencies make every reasonable effort to ensure that the regulation (1) clearly specifies the preemptive effect, if any, (2) clearly specifies any effect on existing Federal law or regulation, (3) provides a clear legal standard for affected conduct while promoting simplification and burden reduction, (4) specifies the retroactive effect, if any, (5) adequately defines key terms, and (6) addresses other important issues affecting clarity and general draftsmanship under

any guidelines issued by the Attorney General. Section 3(c) of Executive Order 12988 requires Executive agencies to review regulations in light of applicable standards in sections 3(a) and 3(b) to determine whether they are met or it is unreasonable to meet one or more of them. DOE has completed the required review and determined that, to the extent permitted by law, this proposed rule meets the relevant standards of Executive Order 12988.

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

http://energy.gov/gc/office-general-counsel. DOE examined this proposed rule according to UMRA and its statement of policy and determined that the proposal contains neither an intergovernmental mandate, nor a mandate that may result in the expenditure of $100 million or more in any year, so these requirements do not apply.

J. Review Under Executive Order 12630

DOE has determined, under Executive Order 12630, "Governmental Actions and Interference with Constitutionally Protected Property Rights" 53 FR 8859 (March 18, 1988), that this proposed regulation would not result in any takings that might require compensation under the Fifth Amendment to the U.S. Constitution.

K. Review Under Treasury and General Government Appropriations Act, 2001

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516 note) provides for agencies to review most disseminations of information to the public under guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (February 22, 2002), and DOE's guidelines were published at 67 FR 62446 (October 7, 2002). DOE has reviewed this proposed rule under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

L. Review Under Executive Order 13211

Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," 66 FR 28355 (May 22, 2001), requires

Federal agencies to prepare and submit to OMB, a Statement of Energy Effects for any proposed significant energy action. A "significant energy action" is defined as any action by an agency that promulgated or is expected to lead to promulgation of a final rule, and that (1) is a significant regulatory action under Executive Order 12866, or any successor order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (3) is designated by the Administrator of OIRA as a significant energy action. For any proposed significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use should the proposal be implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

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

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

Under section 301 of the Department of Energy Organization Act (Pub. L. 95–91; 42 U.S.C. 7101), DOE must comply with section 32 of the Federal Energy Administration Act of 1974, as amended by the Federal Energy Administration Authorization Act of 1977. (15 U.S.C. 788; FEAA) Section 32 essentially provides in

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

The proposed modifications to the test procedures for small electric motors and electric motors adopted in this NOPR incorporate testing methods contained in certain sections of the following commercial standard: "IEC 60034-2-1:2014 Rotating electrical machines - Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)." DOE 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., whether it was developed in a manner that fully provides for public participation, comment, and review.) DOE will consult with both the Attorney General and the Chairman of the FTC concerning the impact of these test procedures on competition, prior to prescribing a final rule.

N. Description of Materials Incorporated by Reference

In this NOPR, DOE proposes to incorporate by reference the standard published by IEC, titled "IEC 60034-2-1:2014 Rotating electrical machines - Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)" as a proposed alternative industry standard to those currently incorporated by reference (IEEE 112-2004, IEEE 114-2010, CSA C747-09, and CSA C390-10) for

measurement of small electric motor efficiency and electric motor efficiency (See section III.C.1 for more details). IEC 60034-2-1:2014 is intended to establish methods of determining efficiencies from tests and to specify methods of obtaining specific losses.

DOE is also proposing to incorporate by reference the industry standards that are referenced within the applicable sections of the industry standards already incorporated by reference for determination of small electric motor efficiency and electric motor efficiency at 10 CFR 431.444 and Appendix B. These industry standards are IEEE Standard 1-2000, "IEEE Recommended Practice - General Principles for Temperature Limits in the Rating of Electrical Equipment and for the Evaluation of Electrical Insulation"; IEEE Standard 118-1978, "IEEE Standard Test Code for Resistance Measurement"; IEEE Standard 119-1974, "IEEE Recommended Practice for General Principles of Temperature Measurement as Applied to Electrical Apparatus"; IEEE Standard 120-1989, "IEEE Master Test Guide for Electrical Measurements in Power Circuits"; IEC Standard 60051:2016, "Direct acting indicating analogue electrical measuring instruments and their accessories"; IEC Standard 60027-1:1992, "Letter symbols to be used in electrical technology"; and IEC Standard 60034-29:2008, "Rotating electrical machines - Part 29: Equivalent loading and superposition techniques - Indirect testing to determine temperature rise".

In summary, DOE proposes to incorporate by reference the following standards:

1) IEEE Standard 1-2000, “IEEE Recommended Practice - General Principles for Temperature Limits in the Rating of Electrical Equipment and for the Evaluation of Electrical Insulation”.
2) IEEE Standard 112–2017, “IEEE Standard Test Procedure for Polyphase Induction Motors and Generators”.
3) IEEE Standard 118-1978, “IEEE Standard Test Code for Resistance Measurement”.
4) IEEE Standard 119-1974, “IEEE Recommended Practice for General Principles of Temperature Measurement as Applied to Electrical Apparatus”.
5) IEEE Standard 120-1989, “IEEE Master Test Guide for Electrical Measurements in Power Circuits”.
6) International Electrotechnical Commission (IEC) 60027:1992, “Letter symbols to be used in electrical technology”.
7) IEC 60034-2-1:2014, "Rotating electrical machines - Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)".
8) IEC 60034-29:2008, “Rotating electrical machines - Part 29: Equivalent loading and superposition techniques - Indirect testing to determine temperature rise”.
9) IEC 60051:2016, “Direct acting indicating analogue electrical measuring instruments and their accessories”.

10) National Electrical Manufacturers Association (NEMA) MG 1-2016, "Motors and Generators".

Copies of these standards can be obtained from the organizations directly at the following addresses:

- International Electrotechnical Commission, 3 rue de Varembé, 1st floor, P.O. Box 131, CH – 1211 Geneva 20 – Switzerland, +41 22 919 02 11, or by visiting *https://webstore.iec.ch/home*.
- IEEE, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, (732) 981-0060, or by visiting *http://www.ieee.org*.
- NEMA, 1300 North 17th Street, Suite 900, Arlington, Virginia 22209, +1 703 841 3200, or by visiting *https://www.nema.org*.

V. Public Participation

A. Submission of Comments

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

Submitting comments via *http://www.regulations.gov*. The *http://www.regulations.gov* web page will require you to provide your name and contact information. Your contact information will be viewable to DOE Building Technologies

staff only. Your contact information will not be publicly viewable except for your first and last names, organization name (if any), and submitter representative name (if any). If your comment is not processed properly because of technical difficulties, DOE will use this information to contact you. If DOE cannot read your comment due to technical difficulties and cannot contact you for clarification, DOE may not be able to consider your comment.

However, your contact information will be publicly viewable if you include it in the comment or in any documents attached to your comment. Any information that you do not want to be publicly viewable should not be included in your comment, nor in any document attached to your comment. Persons viewing comments will see only first and last names, organization names, correspondence containing comments, and any documents submitted with the comments.

Do not submit to *http://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 *http://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 *http://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 *http://www.regulations.gov* provides after you have successfully uploaded your comment.

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

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

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

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

Confidential Business Information. According 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 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).

DOE considers public participation to be a very important part of the process for developing test procedures and energy conservation standards. DOE actively encourages the participation and interaction of the public during the comment period in each stage of this process. Interactions with and between members of the public provide a balanced discussion of the issues and assist DOE in the process. Anyone who wishes to be added to the DOE mailing list to receive future notices and information about this process should contact Appliance and Equipment Standards Program staff at (202) 586-6636 or via e-mail at *ApplianceStandardsQuestions@ee.doe.gov.*

B. Issues on Which DOE Seeks Comment

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

1) DOE requests comments on its proposal to maintain the current scope of applicability, with respect to horsepower ratings, of the small electric motors test procedure.
2) DOE requests comment on its proposal to incorporate by reference IEEE 112-2017 Test Method A and Test Method B as alternatives to the currently

incorporated industry test standards in IEEE 112-2004. In particular, DOE requests data comparing test results of these standards.

3) DOE requests comment on its proposal to incorporate by reference IEC 60034-2-1:2014 Method 2-1-1A as an alternative to currently incorporated industry testing standards IEEE 112-2004 Test Method A and CSA C747-09. In particular, DOE requests data comparing the average full-load efficiency test results of those standards. DOE requests comments on its proposal to limit torque measurement, when using IEC 60034-2-1:2014 Method 2-1-1A, to either in-line, shaft-coupled, rotating torque transducers or stationary, stator reaction torque transducers.

4) DOE requests comment on its proposal to incorporate by reference IEC 60034-2-1:2014 Method 2-1-1B as an alternative to the currently incorporated industry testing standards IEEE 112-2004 Test Method B and CSA C390-10 and to IEEE 112-2017Test Method B. In particular, DOE requests data comparing test results of those standards.

5) DOE requests comment on the proposed definitions for "rated output power" and "breakdown torque."

6) DOE requests comment on how to determine when an "abrupt drop in speed" (*e.g.*, the local maximum of the torque-speed plot closest to the rated torque) has occurred when testing the breakdown torque of a small electric motor.

7) DOE requests comment on the proposed definitions, and procedures for determining the values of rated frequency and rated load for small electric motors.

8) DOE seeks input on the testing cost impacts and manufacturer burden associated with the test procedure amendments described in this document. DOE also seeks comment and any additional data relevant to its assumptions in calculating these impacts.

9) DOE seeks comment on the degree to which the DOE test procedure should consider, and be harmonized further with, the most recent relevant industry standards for small electric motors and whether there are any changes to the Federal test method that would provide additional benefits to the public. DOE also requests comment on the benefits and burdens of adopting any industry/voluntary consensus-based or other appropriate test procedure, without modification.

10) DOE seeks comments on whether the proposed test procedure would place new and significant burdens on a substantial number of small entities.

VI. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of this proposed rule.

List of Subjects in 10 CFR Part 431

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

Signed in Washington, DC, on March 20, 2019.

Steven Chalk
Acting Deputy Assistant Secretary for
Energy Efficiency
Energy Efficiency and Renewable Energy

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

PART 431 – ENERGY EFFICIENCY PROGRAM FOR CERTAIN COMMERCIAL AND INDUSTRIAL EQUIPMENT

1. The authority citation for part 431 continues to read as follows:

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

2. Section 431.15 is amended by:

a. Redesignating paragraphs (c)(1), (c)(2), (c)(3), and (c)(4) as (c)(2), (c)(3), (c)(4) and (c)(5);

b. Adding new paragraphs (c)(1), (c)(2), (c)(3) and (c)(4); and

c. Adding paragraph (d)(2).

The additions read as follows:

§ 431.15 Materials incorporated by reference.

* * * * *

(c) * * *

(1) IEC 60027:1992, "Letter symbols to be used in electrical technology", IBR approved for appendix B to subpart B of this part.

* * * * *

(2) IEC 60034-2-1:2014, “Rotating electrical machines – Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)”, IBR approved for appendix B to subpart B of this part.

* * * * *

(3) IEC 60034-29:2008, “Rotating electrical machines - Part 29: Equivalent loading and superposition techniques - Indirect testing to determine temperature rise”, IBR approved for appendix B to subpart B of this part.

* * * * *

(4) IEC 60051:2016, “Direct acting indicating analogue electrical measuring instruments and their accessories”, IBR approved for appendix B to subpart B of this part.

* * * * *

(d) * * *

(2) IEEE 112-2017, “IEEE Standard Test Procedure for Polyphase Induction Motors and Generators”, approved February 14, 2018, IBR approved for §§ 431.12, 431.19, 431.20, and appendix B to subpart B of this part.

* * * * *

3. Appendix B to subpart B of part 431 is amended by revising the introductory note, Sections 2, 3, and 4, to read as follows:

Appendix B to Subpart B of Part 431—Uniform Test Method for Measuring Nominal Full Load Efficiency of Electric Motors

Note: For any electric motor type that is not currently covered by the energy conservation standards at 10 CFR 431.25, manufacturers of this equipment will need to use Appendix B 180 days after the effective date of the final rule adopting energy conservation standards for these motors.

DOE incorporated by reference in §431.15, the entire standard for CSA C390-10, IEC 60034-2-1:2014, IEEE 112-2004, and IEEE 112-2017; however, only enumerated provisions of those documents are applicable to Appendix B to Subpart B, as follows:

CSA 390-10, Section 1.3 “Scope”, Section 3.1 “Definitions”, Section 5 “General test requirements – Measurements”, Section 7 “Test method”, Table 1 “Resistance measurement time delay”, Annex B “Linear regression analysis” and Annex C “Procedure for correction of dynamometer torque readings.”

IEC 60034-2-1:2014, Section 3 “Terms and definitions”, Section 4 “Symbols and abbreviations”, Section 5 "Basic requirements", Section 6.1.2 "Method 2-1-1A - Direct measurement of input and output" (except Section 6.1.2.2, “Test Procedure”), and Section 6.1.3 "Method 2-1-1B - Summation of losses, additional load losses according to the method of residual losses."

IEEE 112-2004, Section 3 “General”, Section 4 “Measurements”, Section 5 “Machine losses and tests for losses”, Section 6.3 “Efficiency test method A – Input-output”, Section 6.1 “General”, Section 6.4 “Efficiency test method B – Input-output with loss segregation”, Section 7 “Other performance tests”, Section 9.2 “Form A – Method A”, Section 9.3 “Form A2 – Method A calculations”, Section 9.4 “Form B – Method B”, and Section 9.5 “Form B2 – Method B calculations.”

IEEE 112-2017, Section 3 “General”, Section 4 “Measurements”, Section 5 “Machine losses and tests for losses”, Section 6.3 “Efficiency test method A – Input-output”, Section 6.1 “General”, Section 6.4 “Efficiency test method B – Input-output with loss segregation”, Section 7 “Other performance tests”, Section 9.2 “Form A – Method A”, Section 9.3 “Form A2 – Method A calculations”, Section 9.4 “Form B – Method B”, and Section 9.5 “Form B2 – Method B calculations.”

* * * * *

2. *Test Procedures.*

Efficiency and losses must be determined in accordance with NEMA MG 1-2009, paragraph 12.58.1, “Determination of Motor Efficiency and Losses,” (incorporated by reference, see §431.15) and one of the following testing methods:

(1) CSA C390-10 (incorporated by reference, see §431.15),

(2) IEC 60034-2-1:2014 Method 2-1-1B (incorporated by reference, see §431.15),

(3) IEEE 112-2004 Test Method B, Input-Output With Loss Segregation (incorporated by reference, see §431.15), or

(4) IEEE 112-2017 Test Method B, Input-Output With Loss Segregation, (incorporated by reference, see §431.15).

3. *Amendments to test procedures.*

Any revision to CSA C390-10, IEC 60034-2-1:2014 Method 2-1-1B, IEEE 112-2004 Test Method B, IEEE 112-2017 Test Method B, or NEMA MG 1-2009, (incorporated by reference, see §431.15) are not effective for purposes of certification and compliance testing unless and until this appendix and 10 CFR part 431 are amended to incorporate that revision.

4. Procedures for the Testing of Certain Electric Motor Types.

Prior to testing according to CSA C390-10, IEC 60034-2-1:2014 Method 2-1-1B, IEEE 112-2004 (Test Method B), or IEEE 112-2017 (Test Method B) (incorporated by reference, see §431.15), each basic model of the electric motor types listed below must be set up in accordance with the instructions of this section to ensure consistent test results. These steps are designed to enable a motor to be attached to a dynamometer and run continuously for testing purposes. For the purposes of this appendix, a "standard bearing" is a 6000 series, either open or grease-lubricated double-shielded, single-row, deep groove, radial ball bearing.

* * * * *

4. Section 431.442 is amended by adding, in alphabetical order, definitions for "breakdown torque", "rated frequency", "rated load", "rated output power", and "rated voltage", to read as follows:

§ 431.442 Definitions.

* * * * *

Breakdown torque means the maximum torque that the motor will develop with rated voltage and frequency applied without an abrupt drop in speed, determined in accordance with NEMA MG 1-2016 (incorporated by reference, see §431.443).

* * * * *

Rated frequency means 60 hertz.

Rated load means the rated output power of a small electric motor.

Rated output power means the mechanical output power that corresponds to the small electric motor's breakdown torque as specified in NEMA MG 1-2016 Table 10-5 (incorporated by reference, see §431.443) for single-phase motors or 140 percent of the breakdown torque values specified in NEMA MG 1-2016 Table 10-5 for polyphase motors. For purposes of this definition, NEMA MG 1-2016 Table 10-5 is applied regardless of whether elements of NEMA MG 1-2016 Table 10-5 are identified as for small or medium motors.

Rated voltage means the input voltage of a small electric motor selected by the motor's manufacturer to be used for testing the motor's efficiency.

* * * * *

4. Section 431.443 is amended by:

a. Redesignating paragraph (c) as (d);

b. Adding new paragraph (c);

c. Redesignating newly designated paragraphs (d)(1) and (d)(2) as paragraphs (d)(2) and (d)(4);

d. Adding new paragraphs (d)(1), (d)(3), (d)(5), (d)(6), and (d)(7); and

e. Adding paragraph (e).

The additions read as follows:

§431.443 Materials incorporated by reference.

* * * * *

(c) IEC. International Electrotechnical Commission, 3 rue de Varembé, 1st floor, P.O. Box 131, CH – 1211 Geneva 20 – Switzerland, +41 22 919 02 11, or go to https://webstore.iec.ch/home.

(1) IEC 60027:1992, “Letter symbols to be used in electrical technology”, IBR approved for §§431.444, 431.447.

(2) IEC 60034-2-1:2014 (“IEC 60034-2-1”), “Rotating electrical machines - Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)”, approved June 2014, IBR approved for §§431.444, 431.447.

(3) IEC 60034-29:2008, “Rotating electrical machines - Part 29: Equivalent loading and superposition techniques - Indirect testing to determine temperature rise”, IBR approved for §§431.444, 431.447.

(4) IEC 60051:2016, “Direct acting indicating analogue electrical measuring instruments and their accessories”, IBR approved for §§431.444, 431.447.

(d) * * *

(1) IEEE Standard 1-2000, “IEEE Recommended Practice - General Principles for Temperature Limits in the Rating of Electrical Equipment and for the Evaluation of Electrical Insulation”, approved 2001 (reaffirmed 2005), IBR approved for §§431.444; 431.447.

* * * * *

(3) IEEE 112-2017, “IEEE Standard Test Procedure for Polyphase Induction Motors and Generators”, approved February 14, 2018, IBR approved for §§431.444, 431.447.

(5) IEEE Standard 118-1978, “IEEE Standard Test Code for Resistance Measurement”, approved 1992, IBR approved for §§431.444, 431.447.

(6) IEEE Standard 119-1974, "IEEE Recommended Practice for General Principles of Temperature Measurement as Applied to Electrical Apparatus", approved February 22, 1973, IBR approved for §§431.444, 431.447.

(7) IEEE Standard 120-1989, "IEEE Master Test Guide for Electrical Measurements in Power Circuits", approved 1989 (reaffirmed 2007), IBR approved for §§431.444, 431.447.

(e) *NEMA.* National Electrical Manufacturers Association, 1300 North 17th Street, Suite 900, Arlington, Virginia 22209, +1 703 841 3200, or go to *https://www.nema.org.*

(1) NEMA MG 1-2016, "Motors and Generators", approved March 2017, IBR approved for §§431.442.

(2) Reserved.

5. Section 431.444 is revised to read as follows:

§ 431.444 Test Procedures for the measurement of energy efficiency of small electric motors.

Note: DOE incorporated by reference in §431.443, the entire standard for CSA C747-09, CSA C390-10, IEC 60034-2-1:2014, IEEE 112-2004, and IEEE 112-2017; however, only enumerated provisions of those documents are applicable to §431.444, as follows:

CSA 747-09, Section 1.6 “Scope”, Section 3 “Definitions”, Section 5, “General test requirements”, and Section 6 “Test method.”

CSA 390-10, Section 1.3 “Scope”, Section 3.1 “Definitions”, Section 5 “General test requirements – Measurements”, Section 7 “Test method”, Table 1 “Resistance measurement time delay”, Annex B “Linear regression analysis” and Annex C “Procedure for correction of dynamometer torque readings.”

IEC 60034-2-1:2014, Section 3 “Terms and definitions”, Section 4 “Symbols and abbreviations”, Section 5 "Basic requirements", Section 6.1.2 "Method 2-1-1A - Direct measurement of input and output" (except Section 6.1.2.2, “Test Procedure”), and Section 6.1.3 "Method 2-1-1B - Summation of losses, additional load losses according to the method of residual losses."

IEEE 112-2004, Section 3 “General”, Section 4 “Measurements”, Section 5 “Machine losses and tests for losses”, Section 6.3 “Efficiency test method A – Input-output”, Section 6.1 “General”, Section 6.4 “Efficiency test method B – Input-output with loss segregation”, Section 7 “Other performance tests”, Section 9.2 “Form A – Method A”, Section 9.3 “Form A2 – Method A calculations”, Section 9.4 “Form B – Method B”, and Section 9.5 “Form B2 – Method B calculations.”

IEEE 112-2017, Section 3 “General”, Section 4 “Measurements”, Section 5 “Machine losses and tests for losses”, Section 6.3 “Efficiency test method A – Input-output”,

Section 6.1 “General”, Section 6.4 “Efficiency test method B – Input-output with loss segregation”, Section 7 “Other performance tests”, Section 9.2 “Form A – Method A”, Section 9.3 “Form A2 – Method A calculations”, Section 9.4 “Form B – Method B”, and Section 9.5 “Form B2 – Method B calculations.”

Prior to [DATE 180 days after publication of a final rule in the *Federal Register*], representations with respect to the energy use or efficiency of small electric motors must be based on testing conducted in accordance with §431.444 as it appeared in 10 CFR part 431 subpart X in the 10 CFR parts 200 through 499 edition revised as of January 1, 2019. Starting on [Date 180 days after publication of a final rule in the *Federal Register*] representations with respect to energy use or efficiency of small electric motors must be based on testing conducted in accordance with the results of testing pursuant to this appendix.

(a) *Scope*. Pursuant to section 346(b)(1) of EPCA, this section provides the test procedures for measuring the full-load efficiency of small electric motors pursuant to EPCA. (42 U.S.C. 6317(b)(1)) For purposes of this part 431 and EPCA, the test procedures for measuring the efficiency of small electric motors shall be the test procedures specified in paragraph (b) of this section.

(b) *Testing and Calculations*. Determine the full-load efficiency of a small electric motor using one of the test methods listed in this paragraph (b)(1) through (3) of this section.

Where the terms “rated frequency,” “rated load,” and “rated voltage” appear in the standards incorporated by reference, use the corresponding definitions provided at § 431.442.

(1) *Single-phase small electric motors.* For single-phase small electric motors, use one of the following methods: IEEE 114-2010, CSA C747-09, or IEC 60034-2-1:2014 Method 2-1-1A (incorporated by reference, see §431.443).

(i) *Additional IEC 60034-2-1:2014 Method 2-1-1A Torque Measurement Instructions*. If using IEC 60034-2-1:2014 Method 2-1-1A to measure motor performance, follow the instructions in paragraph (b)(1)(ii) of this section, instead of section 6.1.2.2 of IEC 60034-2-1:2014:

(ii) Couple the machine under test to a load machine. Measure torque using an in-line, shaft-coupled, rotating torque transducer or stationary, stator reaction torque transducer. Operate the machine under test at the rated load until thermal equilibrium is achieved (rate of change 1 K or less per half hour). Record U, I, Pel, n, T, θc.

(2) *Polyphase small electric motors of less than or equal to 1 horsepower (0.75 kW)).* For polyphase small electric motors with 1 horsepower or less, use one of the following methods: IEEE 112-2004 Test Method A, IEEE 112-2017 Test Method A, CSA C747-09, or IEC 60034-2-1:2014 Method 2-1-1A (incorporated by reference, see §431.443); or

(i) *Additional IEC 60034-2-1:2014 Method 2-1-1A Torque Measurement Instructions.* If using IEC 60034-2-1:2014 Method 2-1-1A to measure motor performance, follow the instructions in paragraph (b)(2)(ii) of this section, instead of section 6.1.2.2 of IEC 60034-2-1:2014;

(ii) Couple the machine under test to load machine. Measure torque using an in-line shaft-coupled, rotating torque transducer or stationary, stator reaction torque transducer. Operate the machine under test at the rated load until thermal equilibrium is achieved (rate of change 1 K or less per half hour). Record U, I, Pel, n, T, θc.

(3) *Polyphase small electric motors of greater than 1 horsepower (0.75 kW).* For polyphase small electric motors exceeding 1 horsepower, use one of the following methods: IEEE 112-2004 Test Method B, IEEE 112-2017 Test Method B, CSA C390-10, or IEC 60034-2-1:2014 Method 2-1-1B (incorporated by reference, see §431.443).

4. Section 431.447 is amended by revising paragraphs (b)(4) and (c)(4), to read as follows:

(b) * * *

(4) It must be expert in the content and application of the test procedures and methodologies in IEEE 112-2004, IEEE 112-2017, IEEE Std 114-2010, IEC 60034-2-1, CSA C390-10, and CSA C747 (incorporated by reference, see §431.443) or similar procedures and methodologies for determining the energy efficiency of small electric

motors. It must have satisfactory criteria and procedures for the selection and sampling of electric motors tested for energy efficiency.

(c) * * *

(4) *Expertise in small electric motor test procedures.* The petition should set forth the program's experience with the test procedures and methodologies in IEEE Std 112-2004, IEEE Std 112-2017, IEEE Std 114-2010, IEC 60034-2-1, CSA C390-10, and CSA C747 (incorporated by reference, see §431.443) and with similar procedures and methodologies. This part of the petition should include items such as, but not limited to, a description of prior projects and qualifications of staff members. Of particular relevance would be documentary evidence that establishes experience in applying guidelines contained in the ISO/IEC Guide 25, General Requirements for the Competence of Calibration and Testing Laboratories to energy efficiency testing for electric motors.

* * * * *