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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: Final rule.

SUMMARY: In this final rule, the Department of Energy ("DOE") is further harmonizing its test procedures with industry practice by updating a currently incorporated testing standard to reference that standard's latest version, incorporating a new industry testing standard that manufacturers would be permitted to use in addition to those industry standards currently incorporated by reference, and harmonizing certain test conditions with current industry standards to improve the comparability of test results for small electric motors. None of these 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: The effective date of this rule is **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**. The final rule changes will be mandatory for product testing starting [**INSERT DATE 180 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER***]. The incorporation by reference of

certain publications listed in the rule is approved by the Director of the Federal Register on [**INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER***]. The incorporation by reference of certain other publications listed in this rulemaking was approved by the Director of the Federal Register on June 4, 2012.

ADDRESSES: 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.

A link to the docket web page can be found at *https://www.regulations.gov/docket?D=EERE-2017-BT-TP-0047*. The docket web page contains instructions on how to access all documents, including public comments, in the docket.

For further information on how to review the docket contact the Appliance and Equipment Standards Program staff at (202) 287-1445 or by e-mail: *ApplianceStandardsQuestions@ee.doe.gov*.

FOR FURTHER INFORMATION CONTACT:

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SUPPLEMENTARY INFORMATION:

DOE maintains or updates previously approved incorporations by reference and newly incorporates by reference the following industry standards into 10 CFR part 431:

Canadian Standards Association ("CSA") C390-10, "Test methods, marking requirements, and energy efficiency levels for three-phase induction motors," March 2010.

CSA C747-09, "Energy efficiency test methods for small motors," October 2009.

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 by visiting *http://www.shopcsa.ca/onlinestore/welcome.asp*.

Institute of Electrical and Electronics Engineers ("IEEE") 112–2017, "IEEE Standard Test Procedure for Polyphase Induction Motors and Generators," approved December 6, 2017.

IEEE 114–2010, "Test Procedure for Single-Phase Induction Motors," approved September 30, 2010.

Copies of IEEE 112–2017 and IEEE 114–2010 can be obtained from Institute of Electrical and Electronics Engineers, 445 Hoes Lane, P.O. Box 1331, Piscataway, NJ 08855-1331, (732) 981-0060, or by visiting *http://www.ieee.org*.

International Electrotechnical Commission ("IEC") 60034-1:2010, Edition 12.0 2010-02, "Rotating electric machines – Part 1: Rating and performance."

IEC 60034-2-1:2014, Edition 2.0 2014-06, "Rotating electrical machines – Part 2-1: Standard methods for determining losses and their efficiency from tests (excluding machines for traction vehicles)."

IEC 60051-1:2016, Edition 6.0 2016-02, "Direct acting indicating analogue electrical measuring instruments and their accessories --- Part 1: Definitions and general requirements common to all parts."

Copies of IEC 60034-2-1:2014, IEC 60034-1:2010, and IEC 60051-1:2016 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 visiting *https://webstore.iec.ch/home*.

National Electrical Manufacturers Association ("NEMA") MG 1-2016, "American National Standard for Motors and Generators ("NEMA MG 1-2016"), ANSI approved June 1, 2018.

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 visiting *https://www.nema.org*.

For a further discussion of these standards, see section IV.O.

Table of Contents

I. Authority and Background

The Department of Energy ("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

[1] EPCA authorized DOE to prescribe test procedures and energy conservation standards 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. DOE is obligated to review (and amend as needed) its test procedures and standards under 42 U.S,C. 6314(a) and 6316(a).

electric motors appear at subpart X, part 431 of Title 10 of the Code of Federal Regulations ("CFR"). See 10 CFR 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.

A. Authority

The Energy Policy and Conservation Act, 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. Title III, Part C[3] of EPCA, added by Title IV, section 441(a) of the National Energy Conservation Policy Act (Public Law 95-619 (Nov. 9, 1978)), established the Energy Conservation Program for Certain Industrial Equipment, which set forth a variety of provisions designed to improve the energy efficiency of certain industrial equipment. Later, 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), 42 U.S.C. 6311(2)(B)(xiii); 42 U.S.C. 6317(b))

[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 (Oct. 23, 2018).
[3] For editorial purposes, upon codification into the U.S. Code, Part C was re-designated as Part A-1.

The energy conservation program under EPCA consists essentially of four parts: (1) testing, (2) labeling, (3) Federal energy conservation standards, and (4) certification and enforcement procedures. Relevant provisions of EPCA include definitions (42 U.S.C. 6311), test procedures (42 U.S.C. 6314), labeling provisions (42 U.S.C. 6315), energy conservation standards (42 U.S.C. 6313), and the authority to require information and reports from manufacturers (42 U.S.C. 6316). EPCA includes specific authority for DOE 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 and requires that test procedures 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 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 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 test procedures. (42 U.S.C. 6314(b)) DOE is publishing this final rule to satisfy the 7-year review requirement for small electric motors 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)) This final rule also responds to petitions for rulemaking received from the National Electrical Manufacturers Association ("NEMA") and Underwriters Laboratory ("UL") pertaining to small electric motors and electric motors. (See section I.B)

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))

EPCA directed DOE to establish a test procedure for those 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. DOE later adopted test procedures for small electric motors. 74 FR 32059 (July 7, 2009) ("July 2009 final rule"). 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)) DOE complied with this requirement when it established energy conservation standards for small electric motors. 75 FR 10874 (March 9, 2010) ("March 2010 final rule").[4]

Subsequently, DOE published an update to the test procedures for small electric motors on May 4, 2012. 77 FR 26608. The 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
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

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

More recently, DOE published a request for information pertaining to the test procedures for small electric motors and electric motors in July 2017. 82 FR 35468 (July 31, 2017) ("July 2017 RFI"). In the July 2017 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 35470-35474. At the request of commenters, DOE extended the comment period for the July 2017 RFI in a notice published on August 30, 2017. 82 FR 41179.

Separate from the July 2017 RFI, NEMA and Underwriter Laboratories ("UL") independently submitted written petitions requesting that certain portions of International Electrotechnical Commission ("IEC") 60034-2-1:2014 be adopted as a permitted alternative test method for small electric motors and electric motors.[5] DOE published a notice of receipt of these petitions on November 2, 2017. 82 FR 50844 ("November 2017 notice of petition").

On April 23, 2019, DOE published a NOPR ("April 2019 NOPR") responding to the comments received to the July 2017 RFI and proposing to further clarify the test procedures for small electric motors and incorporate an additional industry test method, IEC 60034-2-1:2014 industry test standard, for testing small electric motors and electric

[5] The NEMA petition and work paper are available at *https://www.regulations.gov/document?D=EERE-2017-BT-TP-0047-0028*. The UL petition and supporting documentation are available at *https://www.regulations.gov/document?D=EERE-2017-BT-TP-0047-0029*.

motors.[6] 84 FR 17004 (April 23, 2019). The April 2019 NOPR also addressed the test procedures for electric motors in response to the November 2017 notice of petition. *Id.*

DOE received four comments in response to the April 2019 NOPR from the interested parties listed in Table I-2.

Table I-2: April 2019 NOPR Written Comments

Organization(s)	**Reference in this Final Rule**	**Organization Type**
Appliance Standards Awareness Project, Alliance to Save Energy, California Energy Commission, Natural Resources Defense Council	Efficiency Advocates	Efficiency Organizations
Association of Home Appliance Manufacturers & Air-Conditioning, Heating, and Refrigeration Institute	AHAM and AHRI	Trade Associations
Pacific Gas and Electric Company, San Diego Gas and Electric, and Southern California Edison	CA IOUs	Utilities
National Electrical Manufacturers Association	NEMA	Trade Association

II. Synopsis of the Final Rule

In this final rule, DOE is amending 10 CFR part 431 as follows:

1) Updating the referenced industry testing standard for measuring the energy efficiency of small electric motors and electric motors to its latest version, IEEE 112-2017, "IEEE Standard Test Procedure for Polyphase Induction Motors and Generators;"

2) Incorporating by reference as an alternative test procedure for the measurement of energy efficiency in small electric motors and electric motors testing standard IEC 60034-2-1:2014, "Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles);"

[6] 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.

3) Adding definitions for "rated load," "rated output power," and "breakdown torque" of small electric motors based on NEMA MG 1-2016; and[7]

4) Specifying the frequency used for testing by defining "rated frequency," and specify that manufacturers select the voltage used for testing by defining "rated voltage."

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

[7] Approved by ANSI on June 1, 2018 with 2018 supplements. DOE is not incorporating by reference these supplements as part of this final rule.

Table II-1 Synopsis of the Notice of Test Procedure

Current Test Procedure	NOPR Test Procedure	Final Rule Test Procedure	Reason
Incorporates by reference IEEE 112-2004 to measure full-load efficiency of polyphase small electric motors	- Proposed adding IEEE 112-2017 as an alternative to IEEE 112-2004. The IEEE 112-2017 version includes the following updates compared to IEEE 112-2004: (1) Updates to certain requirements regarding measurement instrument selection and accuracy. (2) Alignment of core loss calculation with CSA 390-10 and Method 2-1-1B of IEC 60034-2-1:2014	Replaces IEEE 112-2004 with IEEE 112-2017 (considered equivalent).	- Achieves consistency with industry update to IEEE 112-2017. - Addresses comments in response to the April 2019 NOPR that including both the 2004 and 2017 versions of IEEE 112 is unnecessary because they are equivalent. See section III.B.1 for further discussion.
Does not incorporate by reference IEC 60034-2-1:2014	- Proposed adding 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 - Proposed adding 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	Identical to the NOPR.	Addresses 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	- Proposed defining "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	Similar to the NOPR. Clarifies that DOE will not require additional testing and measurement of breakdown torque. Also clarifies the definition of breakdown torque.	- Reflects industry practice and improves the representativeness of the test procedure. - Addresses comments to the April 2019 NOPR regarding testing and reporting. See section III.C for further discussion.
For Small Electric Motors: Specifies testing at rated voltage and rated frequency, but does not define those terms	- Proposed defining "rated voltage," which provides that manufacturers select the voltage that is used for testing, and "rated frequency."	Similar to the NOPR. Clarifies further that the rated voltage must be one of the voltages used by the manufacturer for making representation of the small electric motor performance.	Improves repeatability of the test procedure.

DOE has determined that the amendments described in section III of this notice will not alter the measured efficiency of small electric motors or electric motors, and that

the test procedures will not be unduly burdensome to conduct. Discussion of DOE's actions are addressed in detail in section III of this document.

III. Discussion

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

This final rule does not change the scope of the test procedure with respect to small electric motors and electric motors. The scope of the test procedure as applied to currently regulated motors is discussed in sections III.A.1 through III.A.3.

1. Definition of "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) In the July 2009 final rule, DOE adopted a modified version of this definition at 10 CFR 431.442 to specify that the term also encompasses those motors that are built as "IEC metric equivalent motors." 74 FR 32059, 32062; 10 CFR 431.442. This specification ensures that motors that otherwise satisfy the small electric motor definition but are built in accordance with metric-units are treated in a like manner as their counterparts that are built in accordance with U.S. customary units of measurement.

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[8] that:

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[8] In response to questions from NEMA and various motor manufacturers, DOE issued a guidance document that identifies some key design elements for consideration when determining whether a given individual

- Uses alternating current,
- Is single-speed,
- 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.

DOE did not propose to modify the definition of "small electric motor" in the April 2019 NOPR (*See* 84 FR 17004, 17007) and DOE did not receive any comments suggesting that it do so. Accordingly, DOE is not modifying the current definition of small electric motor.

2. Scope of the Small Electric Motor Test Procedure

In the March 2010 final rule, DOE concluded that the following motor topologies satisfy the small electric motor definition: capacitor-start induction-run ("CSIR"), capacitor-start capacitor-run ("CSCR"), and certain polyphase motors. 75 FR 10874, 10882-10883. DOE determined for purposes of its regulations that only CSIR, CSCR, and polyphase motors are able to meet the performance requirements in NEMA MG1 and are widely considered general purpose alternating current motors, as shown by the listings found in manufacturers' catalogs. *Id.* As such, DOE concluded that CSIR, CSCR, and polyphase motors are the only motor categories that would satisfy the relevant criteria set by EPCA to be regulated as small electric motors. 75 FR 10874, 10883. DOE established test procedures for these three topologies in subpart X of 10 CFR part 431.

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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*

In response to the April 2019 NOPR, DOE received a number of comments relevant to the scope of applicability for the small electric motors test procedures. NEMA commented that there have been no significant technological advancements for small electric motors since the last rulemaking and that it supported maintaining the current scope of applicability. (NEMA, No. 84 at p. 2)[9] AHAM and AHRI also supported the current scope of the test procedure, (AHAM and AHRI, No. 85 at pp. 1-2), and opposed developing separate test procedures and energy conservation standards for special and definite purpose motors. In their view, an expanded test procedure scope would increase costs (equipment cost, testing costs, and costs related to certification) and would not increase energy savings because original equipment manufacturers already consider efficient small electric motors as a design option to meet the energy conservation standards for those finished products regulated by DOE. *Id*. They added that an expanded scope to include definite and special purpose motors could impact the availability of replacement parts. They noted that home appliances and heating, ventilation, and air conditioning ("HVAC") equipment have long lifetimes and often have sizing constraints. They asserted that, if motor sizes increase in response to efficiency requirements, replacement motors may no longer fit in those products using small electric motors.[10] (AHAM and AHRI, No. 85 at p. 3)

The CA IOUs and Efficiency Advocates supported expanding the scope of the small electric motors test procedures to cover a broader range of motors. In their view, DOE should expand the scope of the small electric motors test procedure to address a

[9] A notation in the form "NEMA, No. 84 at p. 2" identifies a written comment: (1) made by NEMA; (2) recorded in document number 84 that is filed in the docket of this test procedure rulemaking (Docket No. EERE-2017-BT-TP-0047) and available for review at *http://www.regulations.gov*; and (3) which appears on page 2 of document number 84.

[10] One of the methods for improving the efficiency of an electric motor is to increase its stack length – i.e., the number of rotors and stators that are stacked together to fit along a given motor's shaft. While this may increase the efficiency of a given motor with specified horsepower and torque ratings, it also results in increasing the overall dimensions of the motor, thereby affecting its ability to fit within a given application.

wide range of motors that the market considers "small." (CA IOUs, No. 86 at p. 2) The Efficiency Advocates stated that DOE previously found that motors with the same characteristics as currently regulated small electric motors are widely available in larger horsepower ranges. They referenced DOE's preliminary identification presented in the July 2017 RFI of 11 motor categories that may represent significant shipment volumes and energy consumption and that were capable of being tested using existing test procedures. The Efficiency Advocates stated that these motor categories include both inefficient designs (*e.g.*, shaded-pole) and high-efficiency topologies (*e.g.*, permanent magnet and switched reluctance). (Efficiency Advocates, No. 87 at p. 1)

As previously stated, DOE is not modifying the test procedure's scope. The test procedure continues to apply only to small electric motors that are currently subject to DOE's existing test procedure at 10 CFR 431.444. As explained in the March 2010 final rule, under the definition of "small electric motor" prescribed by EPCA, CSIR, CSCR, and polyphase motors are the only motor categories that are general purpose motors (which is a key element to the statutory definition of this term), and therefore the only categories for which DOE has authority to regulate as a small electric motor. 75 FR 10874, 10881. Special purpose and definite purpose motors are not general purpose motors and therefore are not covered under the statutory or regulatory definition of "small electric motor" and are not "small electric motors" under DOE's statutory or regulatory framework.[11] (*See* 42 U.S.C. 6311(13)(G) (defining "small electric motor"),

[11] Under EPCA, the term "definite purpose motor" means "any motor designed in standard ratings with standard operating characteristics or standard mechanical construction for use under service conditions other than usual or for use on a particular type of application and which cannot be used in most general purpose applications." 42 U.S.C. 6311(13)(C). Similarly, EPCA defines a "special purpose motor" as "any motor, other than a general purpose motor or definite purpose motor, which has special operating characteristics or special mechanical construction, or both, designed for a particular application." 42 U.S.C. 6311(13)(D). Given that EPCA treats these motors as being separate from small electric motors, and that these two categories of motors generally fall outside of general purpose motor applications, coverage of definite purpose and special purpose motors cannot be accomplished through DOE's authority to regulate small electric motors.

42 U.S.C. 6311(13)(C) (defining "definite purpose motor") and 42 U.S.C. 6311(13)(D) (defining "special purpose motor"); *see also generally* 10 CFR 431.442)

In the July 2017 RFI, DOE indicated that it may consider setting test procedures for electric motors that are considered "small" by customers and the electric motors industry, but that are not currently subject to the small electric motor test procedure. 82 FR 35468, 35470-35471. DOE discussed that the motors identified in the July 2017 RFI may have similarities to motors that are currently regulated as small electric motors (such as horsepower) and may be used in similar applications. However, DOE had not concluded that the identified motors are small electric motors or electric motors (nor did DOE propose such a conclusion). While certain commenters urged DOE to expand the scope of the test procedures to include some or all of the 11 categories of motors identified in the July 2017 RFI, these commenters did not provide an explanation for how such expansion would be consistent with DOE's authority under EPCA, or how such motors should be classified and tested.

AHAM and AHRI referenced the statutory exemption regarding the application of energy conservation standards for small electric motors that are components of covered products (42 U.S.C. 6317(b)(3)) and requested that DOE interpret the exemption to apply to all small electric motors destined for or used in covered products or equipment. (AHAM and AHRI, No. 85 at p. 4)

By statute, the small electric motor standards established by DOE shall not apply to any such motor that is a component of a covered product, or of covered equipment. (42 U.S.C. 6317(b)(3)) Accordingly, consistent with the statute, the test procedure as

amended in this final rule does not apply to a motor that is a component of a covered product, or of covered equipment.

3. Scope of the Electric Motor Test Procedure

As noted in section I.B, this final rule also addresses the test procedure for electric motors in response to a petition for rulemaking.[12] The current electric motor test procedure is codified at subpart B of 10 CFR part 431. DOE did not propose to amend the scope of the electric motor test procedure. Accordingly, this final rule does not change the scope of that test procedure.

B. Industry Standards

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

(1) For single-phase small electric motors: either IEEE 114-2010, or CSA C747-09 (*see* 10 CFR 431.443(b)(1); 10 CFR 431.443(c)(2); 10 CFR 431.444(b)(1));

(2) 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" ("IEEE 112-2004") or CSA C747-09 (*see* 10 CFR 431.443(b)(1); 10 CFR 431.443(c)(1)(i); 10 CFR 431.444(b)(2)); *and*

[12] The NEMA petition and work paper are available at *https://www.regulations.gov/document?D=EERE-2017-BT-TP-0047-0028*. The UL petition and supporting documentation are available at *https://www.regulations.gov/document?D=EERE-2017-BT-TP-0047-0029*.

(3) 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 (*see* 10 CFR 431.443(b)(2); 10 CFR 431.443(c)(1)(ii); 10 CFR 431.444(b)(3); 10 CFR 431.16 and Appendix B).

In preparation for the April 2019 NOPR, DOE reviewed each of the referenced industry standards to determine whether they still represent the most current procedures developed by industry. On February 14, 2018, IEEE published an updated edition of the IEEE 112 standard. The other referenced industry standards incorporated into DOE's test procedure developed by CSA and IEEE remain current or have been reaffirmed without changes.[13] This final rule maintains the references to IEEE 114-2010, CSA C390-10, and CSA C747-09. As discussed in Section III.B.1 of this document, DOE is updating the reference to IEEE 112 to reference the updated IEEE 112-2017 standard. As discussed in section III.B.2, DOE is also incorporating by reference IEC 60034-2-1:2014 as an additional alternative test procedure for small electric motors and electric motors. IEEE 112-2017 and IEC 60034-2-1:2014 are discussed in the following paragraphs.

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 that revised testing standard to identify any changes made relative to the industry test methods that are incorporated by reference from IEEE 112-2004. In the April 2019 NOPR, DOE highlighted the following changes between the 2004 and 2017 version: (1) Section 4, "Measurements" of IEEE 112-2017, includes several updates regarding instrument selection and measurement accuracy; and (2) the method for

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

calculating core loss used in Section 6.4, "Efficiency Test Method B – Input-Output with Loss Segregation" of IEEE 112-2017 was revised and aligned with the efficiency test method specified in CSA C390-10, currently incorporated by reference at 10 CFR 431.443(b)(2). 84 FR 17004, 17011. DOE further noted that this change also aligns with the Method 2-1-1B approach of IEC 60034-2-1:2014. *Id.* In the April 2019 NOPR, DOE noted that the revisions in the 2017 version aligned measurement, calculation methods, and instrumentation requirements with industry practice, and that the differences between the IEEE 112-2004 and IEEE 112-2017 calculation methods were minimal, with both tests resulting in an accurate and similar measurement of efficiency. 84 FR 17004, 17011-17012. DOE noted that, 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. 84 FR 17004, 17012 *citing* 77 FR 26608, 26622. DOE stated that the core loss calculation in IEEE 112–2017 aligns with the core loss calculation in CSA C390–10, and that 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. 84 FR 17004, 17012. To avoid any potential need to retest motors that have relied on IEEE 112–2004 for purposes of compliance, DOE proposed to incorporate the IEEE 112–2017 test method as an alternative to the test methods incorporated in the current test procedure, while retaining the currently incorporated IEEE 112–2004 method, and requested data comparing the results of the IEEE 112–2004 and IEEE 112–2017. 84 FR 17004, 17012.

In response to the April 2019 NOPR, NEMA supported updating the reference to IEEE 112 to its latest 2017 version and noted that IEEE 112-2017 Method B resolves previous technical differences between IEEE 112-2004 Method B and CSA C390-10.

NEMA added that both versions of IEEE 112 led to equivalent results. (NEMA, No. 84 at p. 2) The Efficiency Advocates supported referencing the latest version of IEEE 112 and urged DOE not to continue referencing the older version since referencing two different procedures introduces additional variability into the DOE test procedure. (Efficiency Advocates, No. 87 at p. 2)

DOE has determined that IEEE 112–2017 will result in an accurate and similar measurement of efficiency as compared to IEEE 112–2004. Given the expected variation of tested efficiency values for small electric motors and electric motors due to manufacturing and material differences, any minor differences between IEEE 112–2004 and IEEE 112–2017 will not result in any significant change in overall energy efficiency test results. This determination is consistent with DOE's prior comparison of IEEE 112-2004 and CSA C390-10, as affirmed by NEMA's comment. Given the functional equivalency of testing under IEEE 112-2004 and IEEE 112-2017, DOE is incorporating IEEE 112-2017 in place of IEEE 112-2004. Referencing only the most recent version of IEEE 112 avoids the potential concerns identified by the Efficiency Advocates. Additionally, incorporating this update further aligns DOE's test procedures with current industry practice and reduces manufacturer test burden, while ensuring that motors that have demonstrated compliance under IEEE 112-2004 methods do not require retesting (see section III.F.1 for more details).

Therefore, the updates to IEEE 112-2017 are in the following sections of the CFR (as amended by this final rule):

For small electric motors, 10 CFR 431.443 "Materials incorporated by reference," paragraph (d)(1); 10 CFR 431.444 "Test procedures for the measurement of

energy efficiency," paragraphs (b)(1)(vi), (b)(3)(i) and (b)(4)(i); and 10 CFR 431.447 "Department of Energy recognition of nationally recognized certification programs," paragraphs (b)(4) and (c)(4).

For electric motors, 10 CFR 431.12 "Definitions" (the definition for "accreditation"); 10 CFR 431.15 "Materials incorporated by reference," paragraph (d)(1); 10 CFR 431.19 "Department of Energy recognition of accreditation bodies," paragraphs (b)(4) and (c)(4); 10 CFR 431.20 "Department of Energy recognition of nationally recognized certification programs," paragraphs (b)(4) and (c)(4); and Appendix B to Subpart B of Part 431 "Uniform test method for measuring nominal full load efficiency of electric motors," Sections 0(d)[14], 2(3), 3.

2. IEC 60034-2-1:2014

As discussed in section I.B, NEMA and 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. Specifically, NEMA's petition requested that DOE incorporate IEC 60034-2-1:2014 Method 2-1-1B[15] 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 Method 2-1-1B be approved for Appendix B and section

[14] Appendix B to subpart B of part 431 was reorganized to include a new section 0 in this final rule. Section 0 details the applicability of the industry testing standards incorporated by reference and provides the specific provisions of the industry testing standards that are applicable to the DOE test procedure and the sections of the DOE test procedure in which the industry testing standards are incorporated. Because of this re-organization, the instruction in section 3 of Appendix B to subpart B of part 431 regarding the applicability of subsequent editions of the incorporated industry testing standards was duplicative to those in section 0, and therefore removed in this final rule.

[15] 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."

431.444 of 10 CFR part 431 (as an alternative to IEEE 112-2004 Test Method B and CSA C390-10) and (2) that IEC 60034-2-1:2014 Method 2-1-1A[16] be approved for section 431.444 of 10 CFR part 431 (as an alternative to IEEE 112-2004 Test method A, IEEE 114-2010, and 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 to 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 IEC 60034-2-1:2014 Method 2-1-1B 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-Québec Research Institute, and (3) reference to one scientific research paper (the "Angers *et al*. study"), which also concluded that all three methods provide results that are very closely aligned. (NEMA, No. 28.3 at pp. 1– 3)

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, which 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

[16] IEC 60034-2-1:2014 Method 2-1-1A (2014), "Rotating Electrical Machines – Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)," "Direct Measurement of Input and Output."

member Wenping Cao, compared the IEEE 112 and IEC 60034-2-1 standards and concluded that the resulting efficiency values were found to be equal or otherwise closely aligned. (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 IEC 60034-2-1:2014 Method 2-1-1B is currently being used.

In the April 2019 NOPR, DOE proposed to permit use of IEC 60034-2-1:2014 Method 2-1-1A, with certain limitations regarding torque measurement, as an alternative to IEEE 112-2004 Test Method B and CSA C390-10. 84 FR 17004, 17012-17013. DOE also proposed to permit use of IEC 60034–2–1:2014 Method 2–1–1B as a permitted alternative to the test methods IEEE 112–2004 Test Method B and CSA C390–10. 84 FR 17004, 17014. DOE requested comment on its proposals regarding IEC 60034–2–1:2014 Method 2–1–1A and Method 2-1-1B, including data comparing test results of those standards with the corresponding CSA and IEEE test procedures. 84 FR 17004, 17013-17014.

The CA IOUs questioned whether alternative testing standards are truly equivalent to one another and commented that DOE should evaluate the possibility that one equivalent test procedure may produce a disproportionately favorable result compared to another. The CA IOUs recommended that, to avoid confusion in the market and maintain consistency in results, the DOE should specify a single version of a test procedure to be used for enforcement testing. (CA IOUs, No. 86 at p. 2-3)

As discussed in the April 2019 NOPR and in the following sections, DOE evaluated the various industry tests as well as the results of comparative testing and concludes that the relevant test methods in IEC 60034–2–1:2014 are equivalent to the corresponding industry standards currently referenced in the test procedures for small electric motors and electric motors. Permitting use of the test methods in IEC 60034-2-1:2014 further harmonizes DOE's test standards with industry and reduces test burden while ensuring that the test procedure reflects the energy efficiency of the relevant motors during a representative average use cycle.

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.

In the April 2019 NOPR, DOE tentatively determined 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. 84 FR 17004, 17013. DOE proposed to incorporate by reference IEC 60034–2–1:2014 Method 2–1–1A as an alternative to the currently incorporated industry testing standards IEEE 112– 2004 Test Method A and CSA C747–09 in 10 CFR 431.443. *Id*.

However, DOE also initially determined that the process for dynamometer torque correction in section 6.1.2.2 of IEC 60034-2-1:2014, Method 2-1-1A is insufficiently described. 84 FR 17004, 17013. Specifically, IEEE 114-2010[17] and CSA C747-09[18] 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. Consequently, DOE proposed to permit use of IEC 60034-2-1:2014 with limitations to limit torque measurement to methods that do not require dynamometer torque correction (*i.e.*, either in-line, shaft-coupled, rotating torque transducers or stationary, stator reaction torque transducers). 84 FR 17004, 17012-17013.

In response to the April 2019 NOPR, NEMA reiterated its support to have the option of using IEC 60034-2-1:2014 Method 2-1-1A. (NEMA, No. 84 at p. 3) DOE did not receive any other comment on the incorporation of IEC 60034-2-1:2014 Method 2-1-1A generally, or regarding the proposal to limit torque measurement.

For the reasons discussed in the April 2019 NOPR, DOE is referencing IEC 60034-2-1:2014 Method 2-1-1A as an alternative to the referenced industry testing standards IEEE 112-2017 Test Method A (per the amendment in this final rule) and CSA C747-09 in 10 CFR 431.443. As proposed, this final rule requires torque measurement, when using IEC 60034-2-1:2014 Method 2-1-1A, to be made using either in-line, shaft-coupled, rotating torque transducers or stationary, stator reaction torque transducers. This

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

change will further harmonize DOE's test procedures with current industry practice and reduce manufacturer test burden (see section III.F.1 for more details).

For small electric motors, DOE is adding a reference to IEC 60034-2-1 in 10 CFR 431.443 "Materials incorporated by reference," paragraph (c)(2) and making a more specific set of references to IEC 60034-2-1:2014 Method 2-1-1A in 10 CFR 431.444 "Test procedures for the measurement of energy efficiency," paragraphs (b)(2)(iii) and (b)(3)(iii) and in 10 CFR 431.447 "Department of Energy recognition of nationally recognized certification programs," paragraphs (b)(4) and (c)(4).

In addition, section 6.1.2.2 of IEC 60034-2-1:2014 Method 2-1-1A 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. For clarity and consistency, in the April 2019 NOPR, DOE proposed to modify these instructions by replacing the term "required load" with "rated load." 84 FR 17004, 17013. DOE did not receive any stakeholder comments on this proposal and is modifying these instructions by replacing the term "required load" with "rated load."

Furthermore, IEC 60034-2-1:2014 references IEC 60034-1:2010 and IEC 60051-1:2016 to specify required test conditions and procedures when applying the test methods for measuring energy efficiency in the following sections: (1) section 5.4.1 of IEC 60034-2-1:2014 specifies that the supply voltage shall be in accordance with sections 7.2 (and 8.3.1 for thermal tests) of IEC 60034-1:2010; (2) section 5.5.2 of IEC 60034-2-1:2014 specifies that the measuring instruments shall have the equivalent of an accuracy class of 0.2 in case of a direct test and 0.5 in case of an indirect test in accordance with IEC

60051[19]; and (3) section 5.7.1 of IEC 60034-2-1:2014 states that the measured resistance at the end of the thermal test shall be determined in a similar way to the extrapolation procedure as described in section 8.6.2.3.3 of IEC 60034-1, using the shortest possible time instead of the time interval specified in Table 5 therein, and extrapolating to zero. Therefore, in this final rule, DOE is also incorporating by reference IEC 60034-1:2010 and IEC 60051-1:2016 to specify the test conditions and procedures as referenced in IEC 60034-2-1:2014.

b. Method 2-1-1B

Among the 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. This method relies 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 method is analogous to the methods of the other industry standards, IEEE 112-2004 and CSA C390-10, currently incorporated by reference for testing polyphase small electric motors of output power greater than one horsepower and electric motors.

DOE reviewed IEC 60034-2-1:2014, Method 2-1-1B, and stakeholder responses to the November 2017 notice of petition, as well as all of the research papers referenced in the NEMA and UL petitions. The research papers evaluated IEC 60034-2-1:2014,

[19] Section 3.8.2 of IEC 60051-1:2016 defines "accuracy class" as a "class of measuring instruments, all of which are intended to comply with a set of specifications regarding uncertainty." Furthermore, IEC 6005-1:2016 specifies that an accuracy class always specifies a limit of uncertainty, whatever other metrological characteristics it specifies. While IEC 60051-1:2006 does not define a metric for this term, in practice, accuracy classes are used to designate percentage uncertainties. For example, section 5.5.2 of IEC 60034-2-1:2014 states that "for an accuracy class of 0.2, the measuring equipment shall reach an overall uncertainty of 0.2% of reading at power factor of 1.0."

Method 2-1-1B and the IEEE 112-2004 Test Method B and CSA C390-10 testing standards with respect to a comparison of the instrumentation accuracy, test method, and calculation approach, in addition to an analysis of any variability of actual test results. DOE also considered a comparison of results from a round robin test program among 11 participants, which concluded that the same motor tested at multiple test facilities showed a maximum deviation of ±0.4 percentage points, using the same IEEE 112–2004 Test Method B for each test.[20] 84 FR 17013-17014. DOE noted that the largest difference reported by stakeholders between measured efficiency values using IEC 60034–2–1:2014, Method 2-1-1B and IEEE 112–2004 Test Method B did not exceed ±0.2 percentage points. 84 FR 17004, 17014.

DOE initially concluded 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 significant change in overall energy efficiency test results. 84 FR 17004, 17014. Accordingly, in the April 2019 NOPR, DOE proposed 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 112-2017 Test Method B. *Id*.

[20] 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*.

In response to the April 2019 NOPR, NEMA reaffirmed its request for the addition of IEC 60034-2-1:2014 Method 2-1-1B as an alternative test standard for polyphase small electric motors greater than 1 hp and electric motors. (NEMA, No. 84 at p. 3)

Based on the considerations presented in the April 2019 NOPR, DOE affirms its initial conclusions regarding IEC 60034-2-1:2014 Method 2-1-1B. Allowing manufacturers to test according to IEC 60034-2-1:2014 Method 2-1-1B further harmonizes DOE's test procedures with current industry practice and reduces manufacturer test burden (see section III.F.2 for more details) while ensuring that the test procedure reflects the energy efficiency of the relevant motors during a representative average use cycle. Therefore, in this final rule, DOE is referencing IEC 60034-2-1:2014 Method 2-1-1B as a permitted alternative to the current test methods IEEE 112-2004 Test Method B (which in this final rule will be replaced with IEEE 112-2017 Test Method B) and CSA C390-10. In addition, as described in section III.B.2.a, DOE is also incorporating by reference IEC 60034-1:2010 and IEC 60051-1:2016, which specify the test conditions and procedures for IEC 60034-2-1:2014.

Accordingly, reference to IEC 60034-2-1:2014 Method 2-1-1B is being added to the following sections of the CFR:

For small electric motors, IEC 60034-2-1 is referenced in 10 CFR 431.443 "Materials incorporated by reference," paragraph (c)(2). The specific references to IEC 60034-2-1:2014 Method 2-1-1B are in 10 CFR 431.444 "Test procedures for the measurement of energy efficiency," paragraph (b)(4)(iii) and 10 CFR 431.447

"Department of Energy recognition of nationally recognized certification programs," paragraphs (b)(4) and (c)(4).

For electric motors, IEC 60034-2-1 is referenced in 10 CFR 431.12 "Definitions" (the definition for "accreditation"); and 10 CFR 431.15 "Materials incorporated by reference," paragraph (c)(3). The specific references to IEC 60034-2-1:2014 Method 2-1-1B are in 10 CFR 431.19 "Department of Energy recognition of accreditation bodies," paragraphs (b)(4) and (c)(4); 10 CFR 431.20 "Department of Energy recognition of nationally recognized certification programs," paragraphs (b)(4) and (c)(4); and Appendix B to Subpart B of Part 431 "Uniform test method for measuring nominal full load efficiency of electric motors," Sections 2(2) and 3.

C. Rated Output Power and Breakdown Torque of Small Electric Motors

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. The industry testing standards referenced in the small electric motor test procedure do not provide a method to determine the rated load of the tested unit but instead rely on manufacturer-specified output power, which is typically listed on a motor's nameplate, to determine average full-load efficiency at full rated load.[21] The industry standards do not define rated output power; rather, the output power is a manufacturer declaration.

[21] See e.g., CSA C747-09, Section 3, Definition of "full load"; CSA C390-10, Section 3.1, Definition of "rating"; IEEE 112-2017, Section 3.3.2 ("Specified temperature"); and IEEE 114-2010, Section 8.2 ("Determination of efficiency").

As explained in the April 2019 NOPR, the motors subject to the small electric motors test procedures are capable of operating over a continuous range of loads. 84 FR 17004, 17014. 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 of 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.

In the April 2019 NOPR, DOE proposed to define rated output power using breakdown torque as specified in NEMA MG 1-2016. 84 FR 17004, 17014-17016. In concept, breakdown torque describes the maximum torque the 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. As explained in the April 2019 NOPR, breakdown torque corresponds to a local maximum torque (on a plot of torque versus speed) that is nearest to the rated torque. 84 FR 17004, 17014. 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 permanent-split capacitor ("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.

In the April 2019 NOPR, DOE initially determined that NEMA MG 1-2016's Table 10-5 can apply to all small electric motors subject to DOE's standards and that most manufacturers already use the breakdown torque method as a standard practice to determine rated output power. 84 FR 17004, 17016. Accordingly, DOE proposed 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."[22] *Id.* DOE also proposed defining "breakdown torque" as "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." *Id.* DOE requested comment on the proposed definitions for "rated output power" and "breakdown torque." Additionally, DOE requested 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. *Id*.

In response to the April 2019 NOPR, NEMA commented that there is no need to define "breakdown torque" or "abrupt drop in speed" for the purposes of testing electric

[22] 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.

motors. (NEMA, No. 84 at p. 3) Specifically, NEMA stated that incorporating breakdown torque as the method to define the rated output power of the motor is unnecessary because NEMA MG 1-2016, Part 1.40 already states the output rating of a machine "shall" consist of the output power. Instead, NEMA recommended that the declared values of output power be used as provided on the manufacturer's nameplate and that DOE not require a declaration of breakdown torque. (NEMA, No. 84 at pp. 3-4). NEMA further stated that the "abrupt drop in speed" corresponds to the expectations that the motor will slow down or stall if the torque applied to the motor exceeds the local maximum value of torque that is most closely located to the rated torque of the motor (*i.e.,* the breakdown torque). Finally, NEMA claimed that performing any additional speed-torque tests for determining "abrupt drop in speed" would increase manufacturer burden. (NEMA, No. 84 at pp. 3-5) No other comments were received in regard to this issue.

In the April 2019 NOPR, DOE did not intend to suggest that it would require manufacturers to test or report the value of breakdown torque used to establish the rated output power of a small electric motor. Rather, the intent of defining "breakdown torque," through reference to the industry standard NEMA MG 1-2016, was to in turn define "rated output power" for the purpose of measuring average full-load efficiency. As noted previously, NEMA responded to the April 2019 NOPR by explaining that NEMA MG 1-2016 Part 1.40 already states the output rating of a machine shall consist of the output power. (NEMA, No. 84 at p. 3-4) As indicated by its inclusion in NEMA MG 1-2016, the breakdown torque method is commonly used by industry for determining rated output power. Defining rated output power based on NEMA MG 1-2016 provides additional detail that allows for the accurate comparison of small electric motors.

Therefore, in this final rule, DOE defines "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 is defining "breakdown torque." Consistent with the proposed definition, DOE is defining "breakdown torque," in part, as "the maximum torque that the motor will develop with rated voltage and frequency applied without an abrupt drop in speed." As previously noted, the phrase "abrupt drop in speed" references the intrinsic behavior of motors, in which a motor will slow down or stall if the load applied to the motor exceeds the breakdown torque, and indicates that minor reductions in speed observed due to measurement sensitivities are not considered. To provide additional specification for determining breakdown torque based on the physical attributes of a small electric motor, DOE is also including in the definition that the breakdown torque of a motor is the local maximum of the torque-speed plot of the motor, closest to the synchronous speed of the motor.[23]

Both the April 2019 NOPR and NEMA's comments explained that on a torque-speed plot, the breakdown torque is the local maximum torque in the region of the plot characterized through reference to the rated torque. The relevant region of the plot can also be characterized through reference to the synchronous speed. The local maximum of

[23] The synchronous speed of a motor is calculated as follows: $120 \times f \div p$ where f is the frequency at which the motor is operating and p is the number of poles of the motor.

the torque-speed plot in the region characterized by the rated torque is the same value as the local maximum of the torque-speed plot in the region characterized by the synchronous speed. DOE is providing additional detail to define breakdown torque using the synchronous speed, as it is a physical attribute of the motor rather than rated torque, which is a manufacturer declared value.

For the reasons discussed in the preceding paragraphs, DOE is defining "breakdown torque" as the maximum torque that the motor will develop with rated voltage and frequency applied without an abrupt drop in speed. The breakdown torque is the local maximum of the torque-speed plot of the motor, closest to the synchronous speed of the motor, determined in accordance with NEMA MG 1-2016.

D. Rated Values Specified 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 these 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 provide additional specificity regarding these terms, in the April 2019 NOPR, DOE proposed to define them to further ensure the comparability of results between motors, and to better ensure reproducible testing for all equipment. 84 FR 17004, 17017-17018. In this final rule, DOE is amending 10 CFR 431.442 to establish definitions for "rated frequency," "rated load," and "rated voltage," as discussed in the following sections.

1. Rated Frequency

The test procedures and energy conservation standards established under EPCA apply to those regulated motors that are distributed in commerce within the United States. Within the United States, electricity is supplied at 60 hertz ("Hz"); in other regions of the world, electricity is supplied at 50 Hz. 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). Therefore, it could be unclear at which frequency the test should be performed. DOE proposed to amend the small electric motor test procedure at 10 CFR 431.442 by defining the term "rated frequency" as "60 hertz." See 84 FR 17004, 17017.

NEMA commented that explicitly stating that rated frequency is 60 Hz would be beneficial in the case of a motor marked as 60/50 hertz. (NEMA, No. 84 at p. 4) The CA IOUs supported DOE's proposal that all tests be performed using a rated frequency of 60 Hz. (CA IOUs, No. 86 at p. 3) The Efficiency Advocates supported DOE's proposal to specify that all small electric motor tests be performed using a rated frequency of 60 Hz to remove ambiguity in the test procedure and to ensure that the test procedure reflects the operating frequency in the U.S. (Efficiency Advocates, No. 87 at p. 2) DOE did not receive any comments opposing the proposed definition.

DOE notes that 60 Hz as the tested input frequency matches the frequency experienced by the motor when installed in the field. In addition, commenters also recommended DOE require testing at a rated frequency of 60 Hz, as noted. Therefore, in this final rule, DOE is amending 10 CFR 431.442 to establish a definition of "rated frequency" as "60 hertz."

2. Rated Load

"Rated load"[24] is a term 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 horsepower value on the nameplate). The rated load will have a corresponding rated speed and rated torque. In the April 2019 NOPR, DOE proposed to amend 10 CFR 431.442 by defining "rated load" as "the rated output power of a small electric motor" (see section III.C for definition of rated output power). 84 FR 17004, 17017. DOE also proposed 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. *Id*

The Efficiency Advocates supported DOE's proposed definition for rated load, commenting that this specification will help ensure that test procedures are applied consistently. (Efficiency Advocates, No. 87 at p. 2) The CA IOUs supported the definition for "rated load" for small electric motors based on NEMA MG 1-2016. (CA IOUs, No. 86 at p. 3) NEMA commented that qualifying that the rated output power stamped on the name plate of a small motor is equivalent to rated load, full rated load, rated full load or full-load in an industry standard is beneficial and eliminates questions regarding interpretation. (NEMA, No. 84 at p. 4)

Providing a definition for "rated load" further ensures the comparability of results between motors, and better ensures reproducible testing. In addition, qualifying that the rated output power is equivalent to rated load, rated full-load, full rated load, or full-load in an industry standard used for testing small electric motors removes any confusion on the interpretation of terms. Commenters also supported clarifying the term "rated load."

[24] Also referred to as "rated full-load," "full rated load," or "full-load" interchangeably.

Accordingly, consistent with its proposal, DOE is amending 10 CFR 431.442 to establish a definition of "rated load" as "the rated output power of a small electric motor."

3. Rated Voltage

Industry testing standards use "rated voltage" to specify the voltage supplied to the motor under test (*e.g.*, section 6.1 in IEEE 112-2004, section 6.1 in IEEE 112-2017, and section 3 in IEEE 114-2010). The industry test procedures incorporated into DOE's regulations permit manufacturers to select the input voltage for testing. DOE proposed to continue to permit small electric motors to be tested at the nameplate voltage[25] value selected by the manufacturer and to define "rated voltage" at 10 CFR 431.442 as "the input voltage of a small electric motor selected by the motor's manufacturer to be used for testing the motor's efficiency." 84 FR 17004, 17017-17018.

In response to the April 2019 NOPR, the Efficiency Advocates commented that small electric motors should be tested at all nameplate voltages[26] and were concerned that allowing the manufacturer to select the voltage for testing will result in inconsistent ratings across products and will allow for gaming of the test procedure because of the fact that efficiency can vary with input voltage. The Efficiency Advocates suggested that DOE require that small electric motors be tested at all nameplate voltages and meet the minimum efficiency standards at all nameplate voltages. (Efficiency Advocates, No. 87 at p. 3) The CA IOUs opposed allowing motor manufacturers to select the voltage to be used when testing small electric motors, asserting that this creates uncertainty for

[25] The April 2019 NOPR used the term "nameplate voltage" but DOE does not require that a nameplate be affixed to small electric motors. "Nameplate voltage" was used generally to describe representations made by a manufacturer either on a nameplate affixed to the unit or in equipment literature provided by the manufacturer.

[26] As discussed previously, DOE does not require that a nameplate be affixed to small electric motors. DOE understands the commenter to be referring to representations made by a manufacturer either on a nameplate affixed to the unit or in equipment literature provided by the manufacturer. It is in this context that DOE uses the term "nameplate" in this document.

consumers as to the motor's energy performance in the field. Instead, they recommended a prescribed voltage in the test procedure or that the motor be tested at all voltages listed on the motor nameplate, and that, if the motor is tested at multiple voltages, an efficiency level for each tested voltage should be listed on the nameplate. (CA IOUs, No. 86 at p. 3-4)

In the March 2010 final rule, DOE noted that the industry test procedures incorporated into DOE's regulations permit manufacturers to select the input voltage for testing. 75 FR 10874, 10892. In the April 2019 NOPR, DOE proposed to maintain the practice of permitting 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. 84 FR 17004, 17081.

DOE is adopting the proposed definition of "rated voltage" with additional clarification. In the April 2019 NOPR, DOE stated that the proposed definition of "rated voltage" would allow small electric motors to be tested at any nameplate voltage value. *Id.* As noted, DOE does not require a nameplate to be affixed to a small electric motor. To properly describe the voltages from which the voltage is selected for testing, DOE is specifying that the selected input voltage must be one of the voltages used by the manufacturer for making representations of the small electric motor performance (*i.e.*, a represented input voltage). Specifically, DOE is defining "rated voltage" as "the input voltage of a small electric motor used when making representations of the performance characteristics of a given small electric motor and selected by the motor's manufacturer to be used for testing the motor's efficiency." Based on DOE's experience in reviewing manufacturer reports and literature, the additional description reflects manufacturer

practice (*i.e.,* small electric motors are tested at one of the voltages at which manufacturer representations are made). The additional language also avoids any potential confusion as to the input voltage required for testing.

DOE is not requiring a specific input voltage for testing. As discussed in the April 2019 NOPR, NEMA previously indicated that the input voltage setting can affect efficiency, noting that, if DOE were to require motors to comply with testing performed at the input voltage that resulted in 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. 84 FR 17004, 17017-17018. In its prior comment, NEMA explained that 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) While the selection of the input voltage for testing may affect the measured efficiency, DOE does not have data to fully characterize any such impact.

Moreover, EPCA requires that the test procedures shall be reasonably designed to produce test results which reflect energy efficiency of small electric motors during a representative average use cycle and shall not be unduly burdensome to conduct. (42 U.S.C. 6314(a)(1) and (2)) DOE does not have data to indicate that a represented input voltage selected by a manufacturer is inappropriately representative of the average use of that small electric motor as compared to a different represented input voltage. Commenters did not provide data to indicate that the represented values being selected by manufacturers are not representative of average use. Therefore, DOE is maintaining the

current test procedure direction allowing manufacturers to select the input voltage for testing.

E. Effective and Compliance Date

The effective date (*i.e.,* the date the final rule is legally operative after being published in the *Federal Register*) for the adopted test procedure amendments will be 30 days after publication of this final rule in the *Federal Register*. See 10 CFR part 430, subpart C, appendix A, section 12(b) and 10 CFR 431.4 (applying 10 CFR part 430, subpart C, appendix A to commercial/industrial equipment). The compliance date (the specific date when manufacturers are required to use the amended test procedures requirements to make representations concerning the energy efficiency or use of a small electric motor and electric motor, including certification that the covered equipment meets an applicable energy conservation standard) is 180 days after the date of publication of this final rule in the *Federal Register. See id.* at section 12(c).

EPCA prescribes that all representations 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 the final rule in the *Federal Register*. (42 U.S.C. 6314(d)(1)) EPCA also provides an allowance for individual manufacturers of consumer products 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*.)

F. Test Procedure Costs and Impacts

EPCA requires that test procedures prescribed by DOE not be unduly burdensome to conduct. 42 U.S.C. 6314(a)(2). DOE is amending (1) the existing test procedure for small electric motors by clarifying the existing scope and testing instructions, updating the reference to industry standard IEEE 112 to reference the 2017 version in place of the 2014 version, and permitting the use of IEC 60034-2-1:2014 as an additional alternative test procedure; and (2) the existing test procedure for electric motors by permitting the use of IEC 60034-2-1:2014 as an additional alternative and equivalent test procedure. DOE has determined that the test procedures as amended by this final rule will not be unduly burdensome for manufacturers to conduct and instead will reduce test burden for manufacturers.

This final rule will result in a net cost savings to manufactures, as summarized in Table III-1 and Table III-2.

Table III-1: 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	0.2	3
	0.1	7
Reduction in Future Testing Costs for Electric Motors	3.7	3
	1.4	7
Total Net Cost Impact		
Total Net Cost Impact	(4.0)	3
	(1.5)	7

Table III-2: 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	7	3
	6	7
Reduction in Future Testing Costs for Electric Motors	112	3
	100	7
Total Net Annualized Cost Impact		
Total Net Cost Impact	(119)	3
	(106)	7

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

1. Cost Impacts for Small Electric Motors

The clarifications of the existing scope and test instructions will not impose any new requirements on manufacturers of regulated small electric motors. Instead, this final rule will provide manufacturers with greater certainty in the conduct of the test procedures, offer additional equivalent testing options, and do not increase test burden. Reference to IEEE 112-2017 in place of IEEE 112-2004 will not increase test burden or require new testing. As discussed, results under the 2017 version of IEEE 112 are equivalent to results from testing under the 2004 version. Manufacturers will be able to rely on data generated under the current test procedure. Additionally, the incorporation of IEC 60034-2-1:2014 as an additional alternative test procedure further harmonizes DOE's test procedures with current industry practice and international standards. Permitting manufacturers to test according to IEC 60034-2-1:2014 enables manufacturers who use IEC 60034-2-1:2014 for business purposes (for international markets), or to comply with regulatory requirements in other countries, to 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.B.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.

Recognizing that some, but not all, manufacturers already test their motors using IEC 60034-2-1:2014, DOE (as explained later in this section) 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.

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 not have to be tested to both the amended DOE test procedure and the IEC test method when brought to market. First, DOE reviewed the product catalogs of four major small electric motor manufacturers published over a seven-year period.[29] DOE compared the current product offerings to the historical catalogs to identify the total number of new models listed over that period of time.[30] DOE then annualized that total

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[27] CSA 747-09, CSA 390-10, IEEE 112-2017 (per the amended reference under this final rule), or IEEE 114-2010 depending on the category of small electric motor.

[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 a small fraction of motors are designed for operation on 50 Hz and 60 Hz power (indicating they are suitable for sale in both the U.S. and foreign markets), or use NEMA and IEC units of measure (hp vs. kW) and other designators. As noted, the U.S. electrical grid is operated at 60 Hz, while many other countries and regions (*e.g.*, Europe) operate at 50 Hz.

[29] The seven-year period for which DOE reviewed product catalogs was from 2009 to 2016. DOE expects this approach will also be representative of the market from 2016 to the present. DOE did not receive comment on this approach following the publication of the April 2019 NOPR.

[30] DOE identified 598 small electric motor models introduced into the U.S. market by these four manufacturers during the period 2009-2016.

number of new models.[31] 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.[32] Then, DOE estimated that 10 percent of new models would be tested each year.[33] 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 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). Finally, DOE assumed that 10 percent 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. Based on these calculations, DOE determined that approximately 1 new small electric motor basic model per year (*i.e.*, 10 percent of 13) that already would be tested with the IEC 60034-2-1 method would no longer have to conduct an additional test to comply with DOE's amended test procedure when introduced into the U.S market and therefore would realize costs savings due to the test procedure amendments. [34]

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.[35] DOE requires at

[31] Based on this count, DOE estimates that these four small electric motor manufacturers collectively introduced approximately 85 small electric motor models into the U.S. market each year.
[32] This scaled-up calculation yielded a value of 128 small electric motor models introduced each year for the entire U.S. market, as DOE assumed these four small electric motor manufacturers represented approximately 67 percent of the entire U.S. market.
[33] DOE estimates that approximately 13 new small electric motor models are tested each year.
[34] This yields an estimate of 1.28, since DOE estimates 10 percent of the 12.8 new small electric motor models introduced each year are already tested with the IEC 60034-2-1 method.
[35] Estimate based on standard rates charged by third party laboratories.

least five units to be tested per basic model. 10 CFR 431.445(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 $28.00 and the total hourly compensation paid by the employer (including all fringe benefits) is $36.25.[36] The mean hourly wage for a mechanical engineer is $44.62 and the total hourly compensation paid by the employer (including all fringe benefits) is $57.76.[37] 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.

2. Cost Impacts for Electric Motors

Regarding electric motors, DOE is not amending the scope of applicability of the test procedure at Appendix B. Consistent with the small electric motors analysis, the incorporation of IEC 60034-2-1:2014 in this test procedure provides manufacturers additional flexibility by permitting an alternative and equivalent 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 change will reduce the number of tests

[36] See Bureau of Labor Statistics, Occupational Employment and Wages, 17-3027 Mechanical Engineer Technician, May 2018. *https://www.bls.gov/oes/2018/may/oes173027.htm*. Last accessed February 20, 2020. United States Census Bureau, Annual Survey of Manufacturers, 2016 for NAICS Code 335312 "Motor and Generator Manufacturing". *https://www.census.gov/data/tables/2016/econ/asm/2016-asm.html*. Last accessed February 20, 2020

[37] See Bureau of Labor Statistics, Occupational Employment and Wages, 17-2141 Mechanical Engineer, May 2018. *https://www.bls.gov/oes/2018/may/oes172141.htm*. Last accessed February 20, 2020. United States Census Bureau, Annual Survey of Manufacturers, 2016 for NAICS Code 335312 "Motor and Generator Manufacturing". *https://www.census.gov/data/tables/2016/econ/asm/2016-asm.html*. Last accessed February 20, 2020.

that manufacturers perform by avoiding the need to conduct a test according to the CSA or IEEE methods[38] 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 not have to test to both the amended DOE test procedure and the IEC test method when brought to market. First, DOE reviewed the product catalogs of four major electric motor manufacturers published over a six-year period.[39] DOE compared the current product offerings to the historical catalogs to identify the total number of new models listed over that period of time. [40] DOE then annualized that total number of new models.[41]

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. [42] Then, DOE estimated that only 10 percent of new models would be tested each year. [43] 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)

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[38] CSA 390-10 or IEEE 112-2017 (per the amended reference under this final rule) depending on the category of electric motor.

[39] The six-year period for which DOE reviewed product catalogs was from 2010 to 2016. DOE expects this approach will also be representative of the market from 2016 to the present. DOE did not receive comment on this approach following the publication of the April 2019 NOPR.

[40] DOE identified 8,110 electric motor models introduced into the U.S. market by these four manufacturers during the period 2010-2016.

[41] Based on this count, DOE estimates that these four electric motor manufacturers collectively introduced approximately 1,352 electric motor models into the U.S. market each year.

[42] This scaled-up calculation yielded a value of 2,028 electric motor models introduced each year for the entire U.S. market, as DOE assumed these four electric motor manufacturers represented approximately 67 percent of the entire U.S. market.

[43] DOE estimates that approximately 203 new electric motor models are tested each year.

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. Based on these calculations, DOE determined that approximately 20 new electric motor basic models per year (*i.e.*, 10 percent of 203) that already would be tested with the IEC 60034-2-1 method would no longer have to conduct an additional test to comply with DOE's amended test procedure when introduced into the U.S market and therefore would realize costs savings due to the test procedure amendments.[44]

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.

3. Additional Amendments

The remainder of the amendments adopted in this final rule will not impact test costs. The other amendments adopted in this final rule include new definitions for "rated load," "rated output power," "breakdown torque," "rated frequency," and "rated voltage".

[44] This yields an estimate of 20.28, since DOE estimates 10 percent of the 202.8 new electric motor models introduced each year are already tested with the IEC 60034-2-1 method.

The addition of these definitions will improve test procedure repeatability. Furthermore, the definitions reflect current industry practice, and therefore do not impose any new requirements on manufacturers of regulated small electric motors and electric motors.

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 does not constitute a "significant regulatory action" under section 3(f) of Executive Order ("E.O.") 12866, Regulatory Planning and Review, 58 FR 51735 (Oct. 4, 1993). Accordingly, this action was not subject to review under the Executive Order by the Office of Information and Regulatory Affairs ("OIRA") in OMB.

B. Review Under Executive Orders 13771 and 13777

On January 30, 2017, the President issued E.O. 13771, "Reducing Regulation and Controlling Regulatory Costs." See 82 FR 9339 (Feb. 3, 2017). 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." 82 FR 12285 (March 1, 2017). 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:

(1) Eliminate jobs, or inhibit job creation;

(2) Are outdated, unnecessary, or ineffective;

(3) Impose costs that exceed benefits;

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

(5) Are inconsistent with the requirements of the 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

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

DOE concludes that this rulemaking is consistent with the directives set forth in these executive orders. This final rule is estimated to result in a cost savings. The final rule yields annualized cost savings of approximately $106,000 using a perpetual time horizon discounted to 2016 at a 7 percent discount rate. Therefore, this final rule is 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 a final regulatory flexibility analysis ("FRFA") for any final rule where the agency was first required by law to publish a rule 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 E.O. 13272, "Proper Consideration of Small Entities in Agency Rulemaking," 67 FR 53461 (Aug. 16, 2002), DOE published procedures and policies on February 19, 2003 to ensure that the potential impacts of its rules on small entities are properly considered during the DOE rulemaking process. 68 FR 7990. DOE has made its procedures and policies available on the Office of the General Counsel's website: *http://energy.gov/gc/office-general-counsel*.

These amendments 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 rule to retest any existing small electric motors or electric motors already subject to DOE's test procedures.

These amendments would also not increase testing costs nor would it impose any additional testing burden on any manufacturers, including all small businesses. Therefore, DOE concludes that the cost effects accruing from this rule would not have a "significant economic impact on a substantial number of small entities," and that the preparation of a FRFA is not warranted. DOE has submitted a 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).

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 all covered consumer products and industrial equipment, including electric motors. (See generally 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 National Environmental Policy Act of 1969

Pursuant to the National Environmental Policy Act of 1969 ("NEPA"), DOE has analyzed this action in accordance with NEPA and DOE's NEPA implementing regulations (10 CFR part 1021). DOE has determined that this rule qualifies for categorical exclusion ("CX") under 10 CFR part 1021, Subpart D, Appendix A5 because it is an interpretive rulemaking that does not change the environmental effect of the rule and meets the requirements for application of a CX. See 10 CFR 1021.410. Therefore, DOE has determined that promulgation of this rule is not a major Federal action significantly affecting the quality of the human environment within the meaning of NEPA, and does not require an environmental assessment or environmental impact statement.

F. Review Under Executive Order 13132

Executive Order 13132, "Federalism," 64 FR 43255 (Aug. 10, 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 examined this final rule and determined that it will 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 final rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297(d)) No further action is required by E.O. 13132.

G. Review Under Executive Order 12988

Regarding the review of existing regulations and the promulgation of new regulations, section 3(a) of E.O. 12988, "Civil Justice Reform," 61 FR 4729 (Feb. 7, 1996), imposes on Federal agencies the general duty to adhere to the following requirements: (1) eliminate drafting errors and ambiguity; (2) write regulations to minimize litigation; (3) provide a clear legal standard for affected conduct rather than a general standard; and (4) promote simplification and burden reduction. Section 3(b) of E.O. 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 E.O. 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 final rule meets the relevant standards of E.O. 12988.

H. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 ("UMRA") requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Public Law 104-4, sec. 201 (codified at 2 U.S.C. 1531). For a regulatory action resulting 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 "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 final rule according to UMRA and its statement of policy and determined that the rule contains neither an intergovernmental mandate, nor a mandate that may result in the expenditure of $100 million or more in any year, so these requirements do not apply.

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

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

J. Review Under Executive Order 12630

DOE has determined, under E.O. 12630, "Governmental Actions and Interference with Constitutionally Protected Property Rights" 53 FR 8859 (March 18, 1988), that this regulation will 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 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). DOE has reviewed this final 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

E.O. 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 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 significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use if the regulation is implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

This regulatory action is not a significant regulatory action under E.O.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 (Public Law 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 rule authorizes or requires use of commercial standards, the notice of 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 modifications to the test procedure for small electric motors and electric motors adopted in this final rule incorporate certain testing methods contained of the following commercial standards: "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);" IEC 60034-1:2010, "Rotating electric machines—Part 1: Rating and performance;" IEC 60051-1:2016, "Direct acting indicating analogue electrical measuring instruments and their accessories --- Part 1: Definitions and general requirements common to all parts;" "IEEE 112-2017, IEEE Standard Test Procedure for Polyphase Induction Motors and Generators;" and NEMA MG 1-2016 Motors and Generators. DOE has evaluated these standards and is unable to conclude whether they fully comply with the requirements of section 32(b) of the FEAA (*i.e.*, whether they were developed in a manner that fully provides for public participation, comment, and review.) DOE has consulted with both the Attorney General and the Chairman of the FTC about the impact on competition of using the methods contained in these standards and has received no comments objecting to their use.

N. Congressional Notification

As required by 5 U.S.C. 801, DOE will report to Congress on the promulgation of this rule before its effective date. The report will state that it has been determined that the rule is not a "major rule" as defined by 5 U.S.C. 804(2).

O. Description of Materials Incorporated by Reference

In this final rule, DOE incorporates by reference standards published by IEC, IEEE and NEMA. The IEC standard, 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)," is an 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.B for more details).

IEC 60034-2-1:2014 establishes methods of determining efficiencies from tests and to specify methods of obtaining specific losses. In addition, DOE incorporates by reference two additional IEC standards, titled "IEC 60034-1:2010, Rotating electrical machines – Part 1: Rating and performance" and "IEC 60051-1:2016, Direct acting indicating analogue measuring instruments and their accessories – Part 1: Definitions and general requirements common to all parts." IEC 60034-1:2010 and IEC 60051-1:2016 specify test conditions and procedures that are required for application of the test methods for measurement of energy efficiency established in IEC 60034-2-1:2014.

The IEEE standard, titled "IEEE 112-2017, Test Procedure for Polyphase Induction Motors and Generators" establishes methods of measurement for current and frequency for both small electric motors and electric motors. DOE incorporates IEEE 112-2017 Test Method A and Test Method B as an update to the industry test methods that are currently incorporated by reference from IEEE 112-2004 (See section III.B for more details). Such action will 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.

The NEMA standard, titled "NEMA MG 1-2016 Motors and Generators" establishes industry definitions for breakdown torque of small electric motors (See section III.C for more details).

In summary, DOE incorporates by reference the following standards:

1) 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)".

2) IEC 60034-1:2010, “Rotating electric machines – Part 1: Rating and performance”.

3) IEC 60051-1:2016, “Direct acting indicating analogue electrical measuring instruments and their accessories - Part 1: Definitions and general requirements common to all parts”.

4) IEEE 112–2017, “IEEE Standard Test Procedure for Polyphase Induction Motors and Generators”.

5) NEMA MG 1-2016, “Motors and Generators”.

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

- IEC, 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*.

IV. Approval of the Office of the Secretary

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

List of Subjects in 10 CFR Part 431

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

Signing Authority

This document of the Department of Energy was signed on December 11, 2020, by Daniel R Simmons, Assistant Secretary for Energy Efficiency and Renewable Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the *Federal Register*.

Signed in Washington, DC, on December 11, 2020.

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Treena V. Garrett,
Federal Register Liaison Officer,
U.S. Department of Energy.

For the reasons stated in the preamble, DOE is amending part 431 of Chapter II of Title 10, Code of Federal Regulations as set forth as follows:

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 431.12 is amended by revising the definition of "Accreditation" to read as follows:

§ 431.12 Definitions.

* * * * *

Accreditation means recognition by an accreditation body that a laboratory is competent to test the efficiency of electric motors according to the scope and procedures given in IEEE 112-2017 Test Method B, CSA C390-10, or IEC 60034-2-1:2014 Method 2-1-1B (incorporated by reference, see § 431.15).

* * * * *

3. Section 431.15 is amended by:

a. Throughout this section, removing the words "subpart B of part 431" and adding, in their place, "this subpart"

b. Revising paragraph (a);

c. Redesignating paragraph (c)(4) as paragraph (c)(7) and paragraphs (c)(2) and (3) as paragraphs (c)(4) and (5), respectively;

d. Adding new paragraphs (c)(2), (3), and (6); and

e. Revising paragraph (d)(1).

The additions and revisions read as follows:

§ 431.15 Materials incorporated by reference.

(a) *General.* Certain material is incorporated by reference into this subpart with the approval of the Director of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51. To enforce any edition other than that specified in this section, the Department of Energy must publish a document in the Federal Register and the material must be available to the public. Standards can be obtained from the sources below. All approved material is available for inspection at U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, Sixth Floor, 950 L'Enfant Plaza SW, Washington, DC 20024, (202) 586-2945, or go to *http://www1.eere.energy.gov/buildings/appliance_standards/*.It is also available at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, email: *fedreg.legal@nara.gov*, or go to: *www.archives.gov/federal-register/cfr/ibr-locations.html*.

* * * * *

(c) * * *

(2) IEC 60034-1, Edition 12.0 2010-02, ("IEC 60034-1:2010"), Rotating Electrical Machines – Part 1: Rating and Performance, IBR approved for appendix B to this subpart.

(3) IEC 60034-2-1:2014, Edition 2.0 2014-06, ("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 §§431.12; 431.19; 431.20; appendix B to this subpart.

* * * * *

(6) IEC 60051-1:2016, Edition 6.0 2016-02, ("IEC 60051-1:2016"), Direct acting indicating analogue electrical measuring instruments and their accessories - Part 1: Definitions and general requirements common to all parts, IBR approved for appendix B to this subpart.

* * * * *

(d) * * *

(1) IEEE 112™-2017 ("IEEE 112-2017"), IEEE Standard Test Procedure for Polyphase Induction Motors and Generators, approved December 6, 2017, IBR approved for §§ 431.12; 431.19; 431.20; appendix B to this subpart.

* * * * *

4. Section 431.19 is amended by revising paragraphs (b)(4) and (c)(4) to read as follows:

§ 431.19 Department of Energy recognition of accreditation bodies.

* * * * *

(b) * * *

(4) It must be expert in the content and application of the test procedures and methodologies in IEEE 112-2017 Test Method B, CSA C390-10, or IEC 60034-2-1:2014 Method 2-1-1B, (incorporated by reference, see § 431.15).

(c) * * *

(4) *Expertise in electric motor test procedures*. The petition should set forth the organization's experience with the test procedures and methodologies in IEEE 112-2017 Test Method B, CSA C390-10, or IEC 60034-2-1:2014 Method 2-1-1B, (incorporated by

reference, see § 431.15). 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 the guidelines contained in the ISO/IEC Guide 25, General Requirements for the Competence of Calibration and Testing Laboratories, (referenced for guidance only, see §431.14) to energy efficiency testing for electric motors.

* * * * *

5. Section 431.20 is amended by revising paragraphs (b)(4) and (c)(4) to read as follows:

§ 431.20 Department of Energy recognition of nationally recognized certification programs.

* * * * *

(b) * * *

(4) It must be expert in the content and application of the test procedures and methodologies in IEEE 112-2017 Test Method B, CSA C390-10, or IEC 60034-2-1:2014 Method 2-1-1B, (incorporated by reference, see § 431.15). It must have satisfactory criteria and procedures for the selection and sampling of electric motors tested for energy efficiency.

(c) * * *

(4) *Expertise in electric motor test procedures.* The petition should set forth the program's experience with the test procedures and methodologies in IEEE 112-2017 Test Method B, CSA C390-10, or IEC 60034-2-1:2014 Method 2-1-1B, (incorporated by reference, see § 431.15). 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 (referenced for guidance only, see 431.14) to energy efficiency testing for electric motors.

* * * * *

6. Appendix B to subpart B of part 431 is amended by:

a. Removing the introductory note;

b. Adding Section 0;

c. Revising Section 2;

d. Removing Section 3;

e. Redesignating Sections 4, 4.1,4.2, 4.3, 4.4, 4.5, 4.6, 4.7, and 4.8 as Sections 3, 3.1, 3.2, 3.4, 3.5, 3.6, 3.7, and 3.8 respectively;

f. Revising newly redesignated Section 3; and

g. In newly redesignated Section 3.8, remove "IEEE 112 (Test Method B)" at each occurrence and add in its place, "IEEE 112-2017 Test Method B."

The additions and revisions read as follows:

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

0. **Incorporation by reference**

(a) In § 431.15, DOE incorporated by reference the entire standard for CSA C390-10, IEC 60034-1:2010, IEC 60034-2-1:2014, IEC 60051-1:2016, and IEEE 112-2017; however, only enumerated provisions of those documents are applicable as follows:

(i) CSA C390-10:

(1) Section 1.3 “Scope,” as specified in section 2(1) of this appendix;

(2) Section 3.1 “Definitions,” as specified in section 2(1) of this appendix;

(3) Section 5 “General test requirements – Measurements,” as specified in section 2(1) of this appendix;

(4) Section 7 “Test method,” as specified in section 2(1) of this appendix;

(5) Table 1 “Resistance measurement time delay,” as specified in section 2(1) of this appendix;

(6) Annex B “Linear regression analysis,” as specified in section 2(1) of this appendix; and

(7) Annex C “Procedure for correction of dynamometer torque readings” as specified in section 2(1) of this appendix.

(ii) IEC 60034-1:2010:

(1) Section 7.2 as specified in section 2(2) of this appendix;

(2) Section 8.6.2.3.3 as specified in section 2(2) of this appendix; and

(3) Table 5 as specified in section 2(2) of this appendix.

(iii) IEC 60034-2-1:2014:

(1) Method 2-1-1B as specified in section 2(2) and section 3, of this appendix;

(2) Section 3 “Terms and definitions” as specified in section 2(2) of this appendix;

(3) Section 4 “Symbols and abbreviations” as specified in section 2(2) of this appendix;

(4) Section 5 “Basic requirements” as specified in section 2(2) of this appendix; and

(5) Section 6.1.3 “Method 2-1-1B - Summation of losses, additional load losses according to the method of residual losses” as specified in section 2(2) of this appendix.

(iv) IEEE 112-2017:

(1) Test Method B, Input-Output With Loss Segregation as specified in section 2(3), section 3, and section 3.8 of this appendix;

(2) Section 3 “General” as specified in section 2(3) of this appendix;

(3) Section 4 “Measurements” as specified in section 2(3) of this appendix;

(4) Section 5 “Machine losses and tests for losses” as specified in section 2(3) of this appendix;

(5) Section 6.1 “General” as specified in section 2(3) of this appendix;

(6) Section 6.4 “Efficiency test method B – Input-output with loss segregation” as specified in section 2(3) of this appendix; and

(7) Section 9.4 “Form B – Method B”, and Section 9.5 “Form B2 – Method B calculations” as specified in section 2(3) of this appendix.

(b) In § 431.15, DOE incorporated by reference the following enumerated provisions of NEMA MG 1-2009:

(i) Paragraph 12.58.1, “Determination of Motor Efficiency and Losses” as specified in the introductory paragraph to section 2 of this appendix, and

(ii) [Reserved]

(c) In cases where there is a conflict, the language of this appendix takes precedence over those documents. Any subsequent amendment to a referenced document by the standard-setting organization will not affect the test procedure in this appendix, unless and until the test procedure is amended by DOE. Material is incorporated as it exists on the date of the approval, and a notice of any change in the material will be published in the *Federal Register*.

* * * * *

2. *Test Procedures.*

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

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

(2) IEC 60034-2-1:2014 (incorporated by reference, see §431.15), Method 2-1-1B, Section 3 “Terms and definitions”, Section 4 “Symbols and abbreviations”, Section 5 "Basic requirements", Section 6.1.3 "Method 2-1-1B - Summation of losses, additional load losses according to the method of residual losses." The supply voltage shall be in accordance with section 7.2 of IEC 60034-1:2010 (incorporated by reference, see §431.15). The measured resistance at the end of the thermal test shall be determined in a similar way to the extrapolation procedure described in section 8.6.2.3.3 of IEC 60034-1:2010, using the shortest possible time instead of the time interval specified in Table 5 therein, and extrapolating to zero. The measuring instruments for electrical quantities shall have the equivalent of an accuracy class of 0,2 in case of a direct test and 0,5 in case of an indirect test in accordance with IEC 60051-1:2016 (incorporated by reference, see §431.15), or

(3) IEEE 112-2017, (incorporated by reference, see §431.15), Test Method B, Input-Output With Loss Segregation, Section 3 “General”, Section 4 “Measurements”, Section 5 “Machine losses and tests for losses”, Section 6.1 “General”, Section 6.4 “Efficiency

test method B – Input-output with loss segregation", Section 9.4 "Form B – Method B", and Section 9.5 "Form B2 – Method B calculations."

3. 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, or IEEE 112-2017 Test Method B, 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.

* * * * *

7. 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. The breakdown torque is the local maximum of the torque-speed plot of the motor, closest to the synchronous speed of the motor, determined in accordance with NEMA MG 1-2016 (incorporated by reference, see § 431.443).

* * * * *

Rated frequency means 60 hertz.

Rated load (or *full load*, *full rated load*, or *rated full 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 used when making representations of the performance characteristics of a given small electric motor and selected by the motor's manufacturer to be used for testing the motor's efficiency.

* * * * *

8. Section 431.443 is amended by:

a. Revising paragraph (a);

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

c. Adding new paragraph (c);

d. Revising newly redesignated paragraph (d)(1); and

e. Adding paragraph (e).

The revisions and additions read as follows:

§ 431.443 Materials incorporated by reference.

(a) *General.* Certain material is incorporated by reference into subpart X of part 431 with the approval of the Director of the Federal Register under 5 U.S.C. 552(a) and 1 CFR part 51.Material is incorporated as it exists on the date of the approval, and a

notification of any change in the material will be published in the *Federal Register*. Standards can be obtained from the sources below. All approved material is available for inspection at U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, Sixth Floor, 950 L'Enfant Plaza SW., Washington, DC 20024, (202) 586-2945, or go to *http://www1.eere.energy.gov/buildings/appliance_standards/*. It is also available at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, email: *fedreg.legal@nara.gov*, or go to: *www.archives.gov/federal-register/cfr/ibr-locations.html*.

* * * * *

(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 60034-1, Edition 12.0 2010-02, ("IEC 60034-1:2010"), Rotating electrical machines – Part 1: Rating and performance, IBR approved for §§431.444.

(2) IEC 60034-2-1:2014, Edition 2.0 2014-06, ("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 §§431.444, and 431.447.

(3) IEC 60051-1:2016, Edition 6.0 2016-02, ("IEC 60051-1:2016), Direct acting indicating analogue electrical measuring instruments and their accessories - Part 1: Definitions and general requirements common to all parts, IBR approved for §§431.444.

(d) * * *

(1) IEEE 112™-2017 ("IEEE 112-2017"), IEEE Standard Test Procedure for Polyphase Induction Motors and Generators, approved December 6, 2017, IBR approved for §§431.444, and 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, American National Standard for Motors and Generators, ANSI approved June 1, 2018, IBR approved for § 431.442.

(2) [Reserved]

9. Section 431.444 is revised to read as follows:

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

(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 paragraphs (b)(1) through (4) of this section.

(1) *Incorporation by reference:* In §431.443, DOE incorporated by reference the entire standard for CSA C747-09, CSA C390-10, IEC 60034-1:2010, IEC 60034-2-1:2014, IEC 60051-1:2016, IEEE 112-2017, and IEEE 114-2010 into this section; however, only enumerated provisions of those documents referenced in this section are applicable as follows:

(i) CSA C747-09:

(A) Section 1.6 “Scope” as specified in paragraphs (b)(2)(ii) and (b)(3)(ii) of this section;

(B) Section 3 “Definitions” as specified in paragraphs (b)(2)(ii) and (b)(3)(ii) of this section;

(C) Section 5 “General test requirements” as specified in paragraphs (b)(2)(ii) and (b)(3)(ii) of this section; and

(D) Section 6 “Test method” as specified in paragraphs (b)(2)(ii) and (b)(3)(ii) of this section.

(ii) CSA C390-10:

(A) Section 1.3, “Scope” as specified in paragraph (b)(4)(ii) of this section;

(B) Section 3.1, “Definitions” as specified in paragraph (b)(4)(ii) of this section;

(C) Section 5, “General test requirements – Measurements” as specified in paragraph (b)(4)(ii) of this section;

(D) Section 7, “Test method” as specified in paragraph (b)(4)(ii) of this section;

(E) Table 1, “Resistance measurement time delay” as specified in paragraph (b)(4)(ii) of this section;

(F) Annex B, “Linear regression analysis” as specified in paragraph (b)(4)(ii) of this section; and

(G) Annex C, “Procedure for correction of dynamometer torque readings” as specified in paragraph (b)(4)(ii) of this section.

(iii) IEC 60034-1:2010:

(A) Section 7.2 as specified in paragraphs (b)(2)(iii), (b)(3)(iii), and (b)(4)(iii) of this section;

(B) Section 8.6.2.3.3 as specified in paragraphs (b)(2)(iii), (b)(3)(iii), and (b)(4)(iii) of this section; and

(C) Table 5 as specified in paragraphs (b)(2)(iii), (b)(3)(iii), and (b)(4)(iii) of this section.

(iv) IEC 60034-2-1:2014:

(A) Method 2-1-1A as specified in paragraphs (b)(2)(iii) and (b)(3)(iii) of this section;

(B) Method 2-1-1B as specified in paragraph (b)(4)(iii) of this section;

(C) Section 3 “Terms and definitions” as specified in paragraphs (b)(2)(iii), (b)(3)(iii), and (b)(4)(iii) of this section;

(D) Section 4 “Symbols and abbreviations” as specified in paragraphs (b)(2)(iii), (b)(3)(iii), (b)(4)(iii) of this section;

(E) Section 5 "Basic requirements" as specified in paragraphs (b)(2)(iii), (b)(3)(iii), and (b)(4)(iii) of this section;

(F) Section 6.1.2 "Method 2-1-1A - Direct measurement of input and output" (except Section 6.1.2.2, “Test Procedure”) as specified in paragraphs (b)(2)(iii) and (b)(3)(iii) of this section;

(G) Section 6.1.3 "Method 2-1-1B – Summations of losses, additional load losses according to the method of residual losses” as specified in paragraph (b)(4)(iii) of this section; and

(H) Annex D, “Test report template for 2-1-1B” as specified in paragraph (b)(4)(iii) of this section.

(v) IEC 60051-1:2016:

(A) Section 5.2 as specified in paragraphs (b)(2)(iii), (b)(3)(iii) and (b)(4)(iii), of this section; and

(B) [Reserved]

(vi) IEEE 112-2017:

(A) Test Method A as specified in paragraph (b)(3)(i) of this section;

(B) Test Method B as specified in paragraph (b)(4)(i) of this section;

(C) Section 3, “General” as specified in paragraphs (b)(3)(i) and (b)(4)(i) of this section;

(D) Section 4, “Measurements” as specified in paragraphs (b)(3)(i) and (b)(4)(i) of this section;

(E) Section 5, “Machine losses and tests for losses” as specified in paragraphs (b)(3)(i) and (b)(4)(i) of this section;

(F) Section 6.1, “General” as specified in paragraphs (b)(3)(i) and (b)(4)(i) of this section;

(G) Section 6.3, “Efficiency test method A – Input-output” as specified in paragraph (b)(3)(i) of this section;

(H) Section 6.4, “Efficiency test method B – Input-output” as specified in paragraph (b)(4)(i) of this section;

(I) Section 9.2, “Form A – Method A” as specified in paragraph (b)(3)(i) of this section;

(J) Section 9.3, “Form A2 – Method A calculations” as specified in paragraph (b)(3)(i) of this section;

(K) Section 9.4, “Form B – Method B” as specified in paragraph (b)(4)(i) of this section; and

(L) Section 9.5, “Form B2 – Method B calculations” as specified in paragraph (b)(4)(i) of this section.

(vii) IEEE 114-2010:

(A) Section 3.2, “Test with load” as specified in paragraph (b)(2)(i) of this section;

(B) Section 4, “Testing Facilities as specified in paragraph (b)(2)(i) of this section;

(C) Section 5, “Measurements” as specified in paragraph (b)(2)(i) of this section;

(D) Section 6, “General” as specified in paragraph (b)(2)(i) of this section;

(E) Section 7, “Type of loss” as specified in paragraph (b)(2)(i) of this section;

(F) Section 8, “Efficiency and Power Factor” as specified in paragraph (b)(2)(i) of this section;

(G) Section 10 “Temperature Tests” as specified in paragraph (b)(2)(i) of this section;

(H) Annex A, Section A.3 “Determination of Motor Efficiency” as specified in paragraph (b)(2)(i) of this section; and

(I) Annex A, Section A.4 “Explanatory notes for form 3, test data” as specified in paragraph (b)(2)(i) of this section.

(viii) In cases where there is a conflict, the language of this appendix takes precedence over those documents. Any subsequent amendment to a referenced document by the standard-setting organization will not affect the test procedure in this appendix, unless and until the test procedure is amended by DOE.

(2) *Single-phase small electric motors.* For single-phase small electric motors, use one of the following methods:

(i) IEEE 114-2010, Section 3.2, “Test with load”, Section 4, “Testing Facilities, Section 5, “Measurements”, Section 6, “General”, Section 7, “Type of loss”, Section 8, “Efficiency and Power Factor”; Section 10 “Temperature Tests”, Annex A, Section A.3 “Determination of Motor Efficiency”, Annex A, Section A.4 “Explanatory notes for form 3, test data”;

(ii) CSA C747-09, Section 1.6 “Scope”, Section 3 “Definitions”, Section 5, “General test requirements”, and Section 6 “Test method”;

(iii) IEC 60034-2-1:2014 Method 2-1-1A, Section 3 “Terms and definitions”, Section 4 “Symbols and abbreviations”, Section 5 "Basic requirements", and Section

6.1.2 "Method 2-1-1A - Direct measurement of input and output" (except Section 6.1.2.2, “Test Procedure”). The supply voltage shall be in accordance with section 7.2 of IEC 60034-1:2010 (incorporated by reference, see §431.443). The measured resistance at the end of the thermal test shall be determined in a similar way to the extrapolation procedure described in section 8.6.2.3.3 of IEC 60034-1:2010, using the shortest possible time instead of the time interval specified in Table 5 therein, and extrapolating to zero. The measuring instruments for electrical quantities shall have the equivalent of an accuracy class of 0,2 in case of a direct test and 0,5 in case of an indirect test in accordance with section 5.2 of IEC 60051-1:2016 (incorporated by reference, see § 431.443).

(A) *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)(iii)(B) of this section, instead of section 6.1.2.2 of IEC 60034-2-1:2014;

(B) 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.

(3) *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:

(i) IEEE 112-2017 Test Method A, Section 3, “General”, Section 4, “Measurements”, Section 5, “Machine losses and tests for losses”, Section 6.1, “General”, Section 6.3, “Efficiency test method A – Input-output”, Section 9.2, “Form A – Method A”, and Section 9.3, “Form A2 – Method A calculations”;

(ii) CSA C747-09, Section 1.6 “Scope”, Section 3 “Definitions”, Section 5, “General test requirements”, and Section 6 “Test method”;

(iii) IEC 60034-2-1:2014 Method 2-1-1A, Section 3 “Terms and definitions”, Section 4 “Symbols and abbreviations”, Section 5 "Basic requirements", and Section 6.1.2 "Method 2-1-1A - Direct measurement of input and output" (except Section 6.1.2.2, “Test Procedure”). The supply voltage shall be in accordance with section 7.2 of IEC 60034-1:2010. The measured resistance at the end of the thermal test shall be determined in a similar way to the extrapolation procedure described in section 8.6.2.3.3 of IEC 60034-1:2010 using the shortest possible time instead of the time interval specified in Table 5 therein, and extrapolating to zero. The measuring instruments for electrical quantities shall have the equivalent of an accuracy class of 0,2 in case of a direct test and 0,5 in case of an indirect test in accordance with section 5.2 of IEC 60051-1:2016.

(A) *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)(3)(iii)(B) of this section, instead of section 6.1.2.2 of IEC 60034-2-1:2014;

(B) 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.

(4) *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:

(i) IEEE 112-2017 Test Method B, Section 3, “General”; Section 4, “Measurements”; Section 5, “Machine losses and tests for losses”, Section 6.1,

"General", Section 6.4, "Efficiency test method B – Input-output with loss segregation", Section 9.4, "Form B – Method B", and Section 9.5, "Form B2 – Method B calculations"; or

(ii) CSA C390-10, 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"; or

(iii) IEC 60034-2-1:2014 Method 2-1-1B Section 3 "Terms and definitions", Section 4 "Symbols and abbreviations", Section 5 "Basic requirements", Section 6.1.3 "Method 2-1-1B - Summation of losses, additional load losses according to the method of residual losses.", and Annex D, "Test report template for 2-1-1B. The supply voltage shall be in accordance with section 7.2 of IEC 60034-1:2010. The measured resistance at the end of the thermal test shall be determined in a similar way to the extrapolation procedure described in section 8.6.2.3.3 of IEC 60034-1:2010 using the shortest possible time instead of the time interval specified in Table 5 therein, and extrapolating to zero. The measuring instruments for electrical quantities shall have the equivalent of an accuracy class of 0,2 in case of a direct test and 0,5 in case of an indirect test in accordance with section 5.2 of IEC 60051-1:2016.

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

§ 431.447 Department of Energy recognition of nationally recognized certification programs.

* * * * *

(b) * * *

(4) It must be expert in the content and application of the test procedures and methodologies in IEEE 112-2017 Test Method A, IEEE 112-2017 Test Method B, IEEE 114-2010, IEC 60034-2-1:2014 Method 2-1-1A, IEC 60034-2-1:2014 Method 2-1-1B, CSA C390-10, or CSA C747-09 (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, as applicable, with the test procedures and methodologies in, IEEE 112-2017 Test Method A, IEEE 112-2017 Test Method B, IEEE 114-2010, IEC 60034-2-1:2014 Method 2-1-1A, IEC 60034-2-1:2014 Method 2-1-1B, CSA C390-10, and CSA C747-09 (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.

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