DEPARTMENT OF ENERGY

10 CFR Parts 429 and 431

[EERE–2020–BT–TP–0011]

RIN 1904–AE62

Energy Conservation Program: Test Procedure for Electric Motors

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

ACTION: Notice of proposed rulemaking and request for comment.

SUMMARY: The U.S. Department of Energy (''DOE'') proposes to amend the existing scope of the DOE test procedures consistent with related industry changes for nomenclature and test procedure developments (*i.e.,* for air-over electric motors, submersible electric motors, electric motors greater than 500 horsepower, electric motors considered small, inverter-only electric motors, and synchronous electric motors); add test procedures, metric, and supporting definitions for additional electric motors covered under the proposed scope; and update references to industry standards to reference current versions. Furthermore, DOE proposes to adopt industry provisions related to the prescribed test conditions to further ensure the comparability of test. In addition, DOE proposes to update certain testing instructions to reduce manufacturer burden. Further, DOE proposes to amend the provisions pertaining to certification testing and determination of represented values for electric motors other than dedicated-purpose pool pump motors, apply these provisions to the additional electric motors proposed for inclusion in the scope of the test procedure, and to move both provisions consistent with the location of other certification requirements for other covered products and equipment. Finally, DOE proposes to add provisions pertaining to certification testing and determination of represented values for dedicated-purpose pool pump motors. DOE is seeking comment from interested parties on the proposal.

DATES: DOE will accept comments, data, and information regarding this proposal no later than February 15, 2022. See section V, ''Public Participation,'' for details. DOE will hold a webinar on Tuesday, January 25, 2022, from 12:30 p.m. to 4:00 p.m. See section V, ''Public Participation,'' for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

ADDRESSES: Interested persons are encouraged to submit comments using the Federal eRulemaking Portal at *www.regulations.gov.* Follow the instructions for submitting comments. Alternatively, interested persons may submit comments, identified by docket number EERE–2020–BT–TP–0011, by any of the following methods:

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

(2) *Email: ElecMotors2020TP0011@ee.doe.gov.* Include the docket number EERE–2020–BT–TP–0011 or regulatory information number (''RIN'') 1904–AE62 in the subject line of the message.

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

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

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

The docket web page can be found at *www.regulations.gov/docket?D=EERE-2020-BT-TP-0011.* The docket web page contains instructions on how to access all documents, including public comments, in the docket. See section V for information on how to submit comments through *www.regulations.gov.*

FOR FURTHER INFORMATION CONTACT:

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

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

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

DOE has submitted the collection of information contained in the proposed rule to OMB for review under the Paperwork Reduction Act, as amended. (44 U.S.C. 3507(d)) Comments on the information collection proposal shall be directed to the Office of Information and Regulatory Affairs, Office of Management and Budget, Attention: Sofie Miller, OIRA Desk Officer by email: *sofie.e.miller@omb.eop.gov.*

SUPPLEMENTARY INFORMATION: DOE proposes to maintain a previously approved incorporation by reference and to incorporate by reference the following industry standards into part 431:

Canadian Standards Association (''CSA'') C390–10 (R2019), ''Test methods, marking requirements, and energy efficiency levels for three-phase induction motors,'' March 2010.

CSA C747–09 (R2019), ''Energy Efficiency Test Methods for Small Motors'', October 2009.

Copies of CSA C390–10 (R2019) and CSA C747–09 (R2019) 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.*

International Electrotechnical Commission (''IEC'') 60034–12:2016, Edition 3.0 2016–11, ''Rotating Electrical Machines, Part 12: Starting Performance of Single-Speed Three-Phase Cage Induction Motors,'' Published November 23, 2016.

IEC 60079–7:2015, Edition 5.0 2015–06, ''Explosive atmospheres—Part 7: Equipment protection by increased safety ''e'','' Published June 26, 2015.

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

IEC 61800–9–2:2017, ''Adjustable speed electrical power drive systems—Part 9–2: Ecodesign for power drive systems, motor starters, power electronics and their driven applications—Energy efficiency indicators for power drive systems and motor starters'', Edition 1.0, March 2017.

Copies of IEC 60034–2–1:2014, IEC 60034–12:2016, IEC 60079–7:2015 and IEC 61800–9–2:2017 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.*

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'', September 30, 2010.

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

National Electrical Manufacturers Association (''NEMA'') MG 1–2016, ''American National Standard for Motors and Generators, ANSI approved June 1, 2018. (''NEMA MG 1–2016 with 2018 Supplements'').

Copies of NEMA MG 1–2016 may be purchased 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.*

National Fire Protection Association (''NFPA'') 20, 2019 Edition, ''Standard for the Installation of Stationary Pumps for Fire Protection,'' Approved by American National Standard on May 24, 2018. (''NFPA 20–2019'').

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

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I. Authority and Background

Electric motors are included in the list of ''covered equipment'' for which DOE is authorized to establish and amend energy conservation standards and test procedures. (42 U.S.C. 6311(1)(A)) DOE's energy conservation standards and test procedures for electric motors are currently prescribed at title 10 of the Code of Federal Regulations (''CFR'') part 431 section 25 and appendix B to subpart B of 10 CFR part 431 (''Appendix B''), respectively. The following sections discuss DOE's authority to establish test procedures for electric motors and relevant background information regarding DOE's consideration of test procedures for this equipment.

A. Authority

The Energy Policy and Conservation Act, as amended (''EPCA''),[1] authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. (42 U.S.C. 6291–6317) Title III, Part C[2] of EPCA, added by Public Law 95–619, Title IV, section441(a), established the Energy Conservation Program for Certain Industrial Equipment (42 U.S.C. 6311–6317), which sets forth a variety of

[1] All references to EPCA in this document refer to the statute as amended through the Energy Act of 2020, Public Law 116–260 (Dec. 27, 2020).

[2] For editorial reasons, upon codification in the U.S. Code, Part C was redesignated Part A–1.

provisions designed to improve energy efficiency. This equipment includes electric motors, the subject of this document. (42 U.S.C. 6311(1)(A))

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)

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 must use these test procedures to determine whether the equipment complies with relevant standards promulgated under EPCA. (42 U.S.C. 6316(a); 42 U.S.C. 6295(s))

Federal energy efficiency requirements for covered equipment established under EPCA generally supersede State laws and regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6316(a) and (b); 42 U.S.C. 6297) DOE may, however, grant waivers of Federal preemption for particular State laws or regulations, in accordance with the procedures and other provisions of EPCA. (42 U.S.C. 6316(b)(2)(D))

Under 42 U.S.C. 6314, EPCA sets forth the criteria and procedures DOE must follow when prescribing or amending test procedures for covered equipment. EPCA requires that any test procedures prescribed or amended under this section must be reasonably designed to produce test results which reflect energy efficiency, energy use or estimated annual operating cost of a given type of covered equipment during a representative average use cycle and requires that test procedures not be unduly burdensome to conduct. (42 U.S.C. 6314(a)(2)) In addition, if DOE determines that a test procedure amendment is warranted, it must publish proposed test procedures and offer the public an opportunity to present oral and written comments on them. (42 U.S.C. 6314(b))

EPCA, pursuant to amendments made by the Energy Policy Act of 1992, Public Law 102–486 (Oct. 24, 1992), specifies that the test procedures for electric motors subject to standards are those specified in National Electrical Manufacturers Association (''NEMA'') Standards Publication MG1–1987 and Institute of Electrical and Electronics Engineers (''IEEE'') Standard 112 Test Method B, as in effect on October 24, 1992. (42 U.S.C. 6314(a)(5)(A)). If these test procedures are amended, DOE must amend its test procedures to conform to such amended test procedure requirements, unless DOE determines by rule, published in the **Federal Register** and supported by clear and convincing evidence, that to do so would not meet the statutory requirements related to the test procedure representativeness and burden. (42 U.S.C. 6314(a)(5)(B))

EPCA also requires that, at least once every 7 years, DOE evaluate test procedures for each type of covered equipment, including 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 energy efficiency, energy use, and estimated operating costs during a representative average use cycle. (42 U.S.C. 6314(a)(1)) In addition, if the Secretary determines that a test procedure amendment is warranted, the Secretary must publish proposed test procedures in the **Federal Register**, and afford interested persons an opportunity (of not less than 45 days' duration) to present oral and written data, views, and arguments on the proposed test procedures. (42 U.S.C. 6314(b)) If DOE determines that test procedure revisions are not appropriate, DOE must publish its determination not to amend the test procedures.

DOE is publishing this NOPR in satisfaction of the requirements specified in EPCA.

B. Background

DOE's existing test procedures for electric motors appear at appendix B. DOE updated the test procedures for electric motors in response to updates to NEMA MG–1 and IEEE 112 in a final rule published May 4, 2012. 77 FR 26608 (''May 2012 Final Rule''). In the May 2012 Final Rule, DOE amended the test procedures to incorporate NEMA MG 1–2009 ''American National Standard for Motors and Generators'' and IEEE 112–2011 ''IEEE Standard Test Procedure for Polyphase Induction Motors and Generators''. *Id.* The May 2012 Final Rule also updated the test procedure to reference the most current version of the Canadian Standards Association (''CSA'') C390 ''Test methods, marking requirements, and energy efficiency levels for three-phase induction motors,'' March 2010 (''CSA C390–10'').[3] *Id.*

On December 13, 2013, DOE again amended its electric motor test procedure by clarifying the test setup requirements for certain electric motors. 78 FR 75962 (''December 2013 Final Rule''). Amendments to EPCA made by the Energy Independence and Security Act of 2007 (Pub. L. 110–140; Dec. 19, 2007) and the American Energy Manufacturing Technical Corrections Act (Pub. L. 112–210; Dec. 18, 2012) enabled DOE to consider an expanded scope of electric motors for regulatory coverage. 78 FR 75962, 75965. DOE determined that the motors covered by the expanded scope could be tested using the testing methods provided in IEEE 112 (Test Method B) and CSA C390–10 (both of which were already incorporated as part of DOE's test procedure regulations) to accurately measure their losses and determine their energy efficiency. *Id.* However, some of these motors required additional testing set-up instructions prior to testing, which DOE established in the December 2013 Final Rule.[4] *Id., see* section 4 of appendix B.

On July 31, 2017, DOE published a request for information (''RFI'') focused on the test procedures for small electric motors, which are covered separately under 10 CFR part 431 subpart X. 82 FR 35468 (''July 2017 RFI''). The July 2017 RFI also identified issues pertaining to electric motors and additional motors currently not subject to either the small electric motor or electric motor test procedures. 82 FR 35468, 35470–35473.

[3] DOE had previously determined that CSA Standard C390 is a widely recognized alternative that is consistent with IEEE 112–1996. 64 FR 54114 (October 5, 1999).

[4] A 2011 version of NEMA MG 1 was released prior to the publication of the December 2013 Final Rule. The updates from the 2009 version, however, did not affect the sections of NEMA MG–1 incorporated by reference in the DOE regulations. Subsequently, DOE declined to incorporate by reference NEMA MG 1–2011. 78 FR 75962, 75963.

DOE also requested comment on potentially establishing test procedures for additional categories of motors currently not included in the test procedures for small electric motors and electric motors. *Id.* DOE received comments related to the scope in response to the July 2017 RFI from the interested parties listed in Table I.1, which are addressed in this document.[5]

TABLE I.1—SCOPE-RELATED WRITTEN COMMENTS RECEIVED IN RESPONSE TO THE JULY 2017 RFI

Commenter(s)	Reference in this NOPR	Commenter type
Advanced Energy	Advanced Energy	Independent Testing Laboratory.
Association of Home Appliance Manufacturers and Air-conditioning, Heating, and Refrigeration Institute.	AHAM and AHRI	Industry Trade Associations.
Pacific Gas and Electric Company (PG&E), San Diego Gas and Electric (SDG&E), and Southern California Edison (SCE).	CA IOUs	Utilities.
Detector Technology Inc	Detech	Manufacturer.
American Council for an Energy-efficient Economy, Appliance Standards Awareness Project, Northwest Power and Conservation Council, Northwest Energy Efficiency Alliance.	Joint Advocates	Efficiency Organizations.
Lennox International Inc	Lennox	Manufacturer.
McMillan Electric Company	McMillan Electric Company	Manufacturer.
National Electrical Manufacturers Association	NEMA	Industry Trade Association.

Subsequent to the July 2017 RFI, on April 23, 2019, DOE published a test procedure notice of proposed rulemaking (''NOPR'') for small electric motors and electric motors. 84 FR 17004 (''April 2019 NOPR''). As it relates to electric motors, DOE proposed to (1) incorporate by reference a revised test procedure for the measurement of energy efficiency, the IEEE 112–2017, ''IEEE Standard Test Procedure for Polyphase Induction Motors and Generators'' (''IEEE 112–2017''); and (2) incorporate by reference an alternative test procedure for the measurement of energy efficiency, the International Electrotechnical Commission (''IEC'') 60034–2–1:2014, ''Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)'' (''IEC 60034–2–1:2014''). 84 FR 17004, 17006, 17010–17014. On January 4, 2021, DOE published the test procedure final rule for small electric motors and electric motors. 86 FR 4 (''January 2021 Final Rule''). As it relates to electric motors, DOE amended the test procedure to finalize the proposals from the April 2019 NOPR, including the incorporation by reference of IEEE 112–2017 and IEC 60034–2–1:2014. 86 FR 4, 10, 11–13.

On June 3, 2020, DOE published an RFI pertaining to test procedures for electric motors in response to updates to the applicable industry testing standards and the 7-year look-back review required under EPCA. 85 FR 34111 (''June 2020 RFI''). DOE received comments in response to the June 2020 RFI from the interested parties listed in Table I.2.

TABLE I.2—WRITTEN COMMENTS RECEIVED IN RESPONSE TO THE JUNE 2020 RFI

Commenter(s)	Reference in this NOPR	Commenter type
Appliance Standard Awareness Project, American Council for an Energy-Efficient Economy and Natural Resources Defense Council.	Efficiency Advocates	Efficiency Organizations.
Advanced Energy	Advanced Energy	Independent Testing Laboratory.
Pacific Gas and Electric Company (PG&E), San Diego Gas and Electric (SDG&E), and Southern California Edison (SCE).	CA IOUs	Utilities.
Northwest Energy Efficiency Alliance (NEEA) and Northwest Power and Conservation Council (NWPCC).	NEEA and NWPCC	Efficiency Organizations.
National Electrical Manufacturers Association	NEMA	Industry Trade Association.

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

On July 29, 2021, DOE published a final rule adopting a test procedure for dedicated purpose pool pump motors (''DPPP motors''). 86 FR 40765. (''July 2021 Final Rule''). Specifically, the test procedure requires manufacturers to use CSA C747–09 (R2014), ''Energy Efficiency Test Methods for Small Motors'' for testing the full-load efficiency of DPPP motors and did not establish any certification, sampling plans, or Alternative Efficiency Determination Method (''AEDM'') requirements. The test procedure is currently located in subpart Z of 10 CFR part 431.

II. Synopsis of the Notice of Proposed Rulemaking

In this NOPR, DOE proposes the following updates to the test procedure for electric motors:

(1) Update existing definitions for IEC Design N and H to reflect updates in industry standard; specify the existing scope to reflect updates in industry nomenclature, specifically for new industry motor design designations IEC Design NE, HE, NEY and HEY, and include corresponding definitions;

(2) Amend the definition of ''basic model'' to rely on the term ''equipment class'' and add a definition for ''equipment class'' to make the electric motor provisions consistent with other DOE-regulated products and equipment.

(3) Add test procedures, full-load efficiency metric, and supporting

[5] Comments related to potential scope expansion received in response to the July 2017 RFI are identified by the Docket No. EERE–2017–BT–TP–0047.

[6] The parenthetical reference provides a reference for information located in the docket of DOE's rulemaking to develop test procedures for electric motors. (Docket No. EERE–2020–BT–TP–0011, which is maintained at *www.regulations.gov*). The references are arranged as follows: (commenter name, comment docket ID number, page of that document).

definitions for air-over electric motors, submersible electric motors, electric motors greater than 500 horsepower, electric motors considered small, inverter-only electric motors, and synchronous electric motor technologies;

(4) Incorporate by reference the most recent versions of NEMA MG 1 (*i.e.,* NEMA MG 1–2016 with 2018 Supplements) and CSA C390 (*i.e.,* CSA C390–10 (R2019)), as well as other referenced industry standards *i.e.,* IEC 60034–12:2016, Edition 3.0 2016–11, ''Rotating Electrical Machines, Part 12: Starting Performance of Single-Speed Three-Phase Cage Induction Motors,'' (''IEC 60034–12:2016''); IEC 60079–7:2015, Edition 5.0 2015–06, ''Explosive atmospheres—Part 7: Equipment protection by increased safety ''e'','' (''IEC 60079–7:2015''), which is referenced within IEC 60034–12:2016 and is necessary for the test procedure; and National Fire Protection Association (''NFPA'') 20–2019 ''Standard for the Installation of Stationary Pumps for Fire Protection '' (''NFPA 20–2019'');

(5) Incorporate by reference additional industry test standards and test instructions to support testing of the additional motors proposed for inclusion in the test procedure scope: CSA C747–09 (R2019), IEEE 114–2010, and IEC 61800–9–2:2017;

(6) Provide additional detail in the test instructions for electric motors by adding definitions for the terms ''breakdown torque,'' ''rated frequency,'' ''rated output power,'' ''rated load,'' and ''rated voltage;''

(7) Update the testing instructions for vertical electric motors to reduce manufacturer test burden;

(8) Explicitly provide that the current test procedure permits removal of contact seals for immersible electric motors only;

(9) Require that testing be conducted in a nationally recognized testing program and add a definition of ''independent'' for certification of a new basic model pursuant to 10 CFR 431.36(e), required on or after 180 days following the publication of this final rule;

(10) Permitting the certification of electric motors using one of three options: (i) A manufacturer can have the electric motor tested using a nationally recognized testing program and then certify on its own behalf or have a third party submit the manufacturer's certification report; (ii) a manufacturer can test the electric motor at a testing laboratory other than a nationally recognized testing program and then have a nationally recognized certification program certify the efficiency of the electric motor; or (iii) a manufacturer can use an alternative efficiency determination method and then have a third-party nationally recognized certification program certify the efficiency of the electric motor. DOE proposes to require that the use of these provisions be required for certification starting on the compliance date for any new or amended standards for electric motors published after January 1, 2021;

(11) Revise the provisions pertaining to the determination of represented values and propose that these provisions be required on or after the effective date of the final rule adopting new or amended energy conservation standards for electric motors and apply these provisions to the additional electric motors proposed for inclusion in the scope of the test procedure;

(12) Revise the provisions pertaining to alternative efficiency determination methods (''AEDMs'') as applied to electric motors and apply these provisions to the additional electric motors proposed for inclusion in the scope of the test procedure;

(13) Revise the procedures for recognition and withdrawal of recognition of accreditation bodies and certification programs as applied to electric motors and apply these provisions to the additional electric motors proposed for inclusion in the scope of the test procedure;

(14) Transition provisions pertaining to certification testing, AEDM, and determination of represented values from 10 CFR part 431 to 10 CFR part 429; and

(15) Add provisions pertaining to certification testing and determination of represented values for DPPP motors.

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

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

Current DOE test procedure	Proposed test procedure	Attribution
Applies to Design N and H motors defined at 10 CFR 431.12.	Specifies the existing scope to reflect updates in industry nomenclature, specifically, new motor design designations IEC Design HE, HY, HEY, NE, NY and NEY, and includes corresponding definitions.	Update to industry testing standard IEC 60034–12.
Exempts air-over electric motors	Proposes test methods, full-load efficiency metric, and supporting definitions for air-over electric motors.	Update to industry testing standard NEMA MG1 2016 with 2018 Supplements include a test method for air-over electric motors.
Exempts submersible electric motors.	Proposes test methods, full-load efficiency metric, and supporting definitions for submersible electric motors.	Update to industry testing standard NEMA MG1 2016 with 2018 Supplements include a test method for air-over electric motors, which is applicable to submersible motors.
Includes electric motors with a horsepower equal to or less than 500 hp.	Proposes test methods and full-load efficiency metric for electric motors with a horsepower greater than 500 and equal to or less than 750 hp.	DOE proposal to extend applicability of the test procedure to these electric motors.
Includes electric motors with a horsepower equal to or greater than 1 hp.	Proposes test methods and full-load efficiency metric for electric motors considered small (*i.e.,* small non-small-electric-motor electric motors, or SNEMs).	DOE proposal to extend applicability of the test procedure to these electric motors.
Exempts inverter-only electric motors.	Proposes test methods, full-load efficiency metric, and supporting definitions for inverter-only electric motors.	New industry testing standard (IEC 61800–9–2:2017).
Includes electric motors that are induction motors only.	Propose test methods, full-load efficiency metric, and supporting definitions for certain synchronous electric motors.	New developments in motor technologies and new industry testing standard (IEC 61800–9–2:2017).
Incorporates by reference NEMA MG 1–2009, CSA 390–10, IEC 60034–12 Edition 2.1 2007–09, and NFPA 20–2010.	Incorporate by reference the most recent versions of NEMA MG 1 (*i.e.,* NEMA MG 1–2016 with 2018 Supplements), CSA 390 (*i.e.,* CSA C390–10 (R2019)), as well as other referenced industry standards (*i.e.,* IEC 60034–12 Edition 3.0 2016 and NFPA 20–2019). In addition, incorporates by reference IEC 60079–7:2015, which is referenced within IEC 60034–12:2016 and is necessary for the test procedure.	Updates to industry testing standards NEMA MG1, CSA 390, IEC 60034–12 and NFPA 20–209.
	Incorporate by reference additional industry test standards and testing instructions to support testing of the additional motors proposed in scope: CSA C747–09 (R2019), IEEE 114–2010, and IEC 61800–9–2:2017.	

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

Current DOE test procedure	Proposed test procedure	Attribution
Specifies testing at rated frequency, rated load, and rated voltage but does not define these terms.	Would provide additional detail in the test instructions for electric motors by adding definitions for the terms ''rated frequency,'' ''rated load,'' and ''rated voltage''. Would also define ''breakdown torque'' and ''rated output power'' to support the definition of rated load.	Harmonizes with definitions from NEMA MG1 and improves the repeatability of the test procedure.
Specifies one method of connecting the dynamometer to vertical electric motors.	Update the vertical electric motor testing requirements to allow alternative methods for connecting to the dynamometer.	Suggestion by industry comments.
Specifies removal of contact seals for testing immersible electric motors.	Would explicitly require that shaft seals of any variety remain installed during testing unless the motor is an immersible electric motor.	Provide further direction to improve reproducibility.
Requires that testing be conducted in an accredited laboratory and includes certification testing requirements in 10 CFR part 431.	Would require that testing be conducted in a nationally recognized testing program and add a definition for ''independent'' for certification of a new basic model pursuant to 10 CFR 431.36(e), required starting 180 days following the publication of this final rule. Moves these provisions to 10 CFR part 429.	Statutory requirement at 42 U.S.C. 6316(c).
Allows a manufacturer to both test in its own laboratories and directly submit the certification of compliance to DOE for its own electric motors.	Would require certification of compliance using one of three options: (1) A manufacturer can have the electric motor tested using an nationally recognized testing program and then certify on its own behalf or have a third party submit the manufacturer's certification report; (2) a manufacturer can test the electric motor at a testing laboratory other than an nationally recognized testing program and then have a nationally recognized certification program certify the efficiency of the electric motor; or (3) a manufacturer can use an alternative efficiency determination method and then have a third-party nationally recognized certification program certify the efficiency of the electric motor. DOE proposes that these provisions be required on or after the compliance date for any amended standards for electric motors published after January 1, 2021.	Statutory requirement at 42 U.S.C. 6316(c).
Includes provisions pertaining to the determination of the represented value at 10 CFR 431.17.	Revise the provisions pertaining to the determination of the represented values (*i.e.,* nominal full-load efficiency and average full-load efficiency) and proposes that these provisions be required on or after the effective date of the final rule adopting new or amended energy conservation standards for electric motors. Moves the provisions to 10 CFR 429.64. Proposes to apply these provisions to the additional electric motors proposed for inclusion in the scope of the test procedure.	Align the determination of the average and nominal full-load efficiency with the definitions at 10 CFR 431.12.
Includes AEDM provisions at 10 CFR 431.17.	Revise the provisions pertaining to alternative efficiency determination methods (''AEDMs'') as applied to electric motors. Proposes to apply these provisions to the additional electric motors proposed for inclusion in the scope of the test procedure.	Harmonizes the AEDM requirements with other covered equipment and covered products at 10 CFR 429.70.
Includes provisions pertaining to nationally recognized accreditation bodies and certification programs at 10 CFR 431.19, 431.20, and 431.21.	Revise the procedures for recognition and withdrawal of recognition of accreditation bodies and certification programs as applied to electric motors. Proposes to apply these provisions to the additional electric motors proposed for inclusion in the scope of the test procedure.	Transfer provisions related to certification at 10 CFR part 429.
Includes a definition of basic model that relies on the term ''rating''.	Amend the definition of ''basic model'' to rely on the term ''equipment class''. Adds a definition for ''equipment class''.	Align the definition of basic model with other DOE-regulated products and equipment and eliminate the ambiguity of the term ''rating''.
Does not include any certification, sampling plans, and AEDM provisions for DPPP Motors.	Adds certification, sampling plans, and AEDM provisions for DPPP Motors.	Aligns DPPP motor provisions with the provisions for electric motors subject to the requirements in subpart B of 10 CFR part 431.

DOE has tentatively determined that the proposed amendments described in section III of this NOPR would not alter the measured efficiency of electric motors currently within the scope of the test procedure until such time as amended energy conservation standards are established for such electric motors. DOE notes that manufacturers of electric motors for which DOE is proposing to include within the scope of the test procedure would not be required to use the test procedure, if made final, for Federal certification or labeling purposes, until such time as energy conservation standards are established for such electric motors. But, if manufacturers, distributors, retailers, and private labelers choose to make any representations respecting the energy consumption or cost of energy consumed by such motors, then such voluntary representations must be made in accordance with the test procedure and sampling requirements. Discussion of DOE's proposed actions are addressed in detail in section III of this NOPR.

III. Discussion

A. Scope of Applicability

The term ''electric motor'' is defined as ''a machine that converts electrical power into rotational mechanical power.'' 10 CFR 431.12. Manufacturers are required to test those electric motors subject to energy conservation standards according to the test procedure in appendix B.[7] (See generally 42 U.S.C. 6314(a)(5)(A); see also the introductory paragraph to 10 CFR part 431, subpart B, appendix B) Currently, energy conservation standards apply to certain categories of electric motors provided

[7] The amendments proposed in this NOPR do not address *small electric motors,* which are covered separately under 10 CFR part 431, subpart X. A *small electric motor* is ''a NEMA general purpose alternating current single-speed induction motor, built in a two-digit frame number series in accordance with NEMA Standards Publication MG1–1987, including IEC metric equivalent motors.'' 10 CFR 431.442.

that they meet the criteria specified at 10 CFR 431.25(g). These categories of electric motors are NEMA Design A motors,[8] NEMA Design B motors,[9] NEMA Design C motors,[10] IEC Design N motors,[11] IEC Design H motors,[12] and fire pump electric motors.[13] See 10 CFR 431.25(h)-(j). The energy conservation standards apply to electric motors within the identified categories only if they:

(1) Are single-speed, induction motors;

(2) Are rated for continuous duty (MG 1) operation or for duty type S1 (IEC)

(3) Contain a squirrel-cage (MG 1) or cage (IEC) rotor;

(4) Operate on polyphase alternating current 60-hertz (Hz) sinusoidal line power;

(5) Are rated 600 volts or less;

(6) Have a 2-, 4-, 6-, or 8-pole configuration;

(7) Are built in a three-digit or four-digit NEMA frame size (or IEC metric equivalent), including those designs between two consecutive NEMA frame sizes (or IEC metric equivalent), or an enclosed 56 NEMA frame size (or IEC metric equivalent);

(8) Produce at least one horsepower (hp) (0.746 kilowatt (kW)) but not greater than 500 hp (373 kW), and

(9) Meet all of the performance requirements of one of the following motor types: A NEMA Design A, B, or C motor or an IEC Design N or H motor. 10 CFR 431.25(g).

DOE identified certain categories of motors that meet the definition of ''electric motor'' but for which DOE determined the referenced industry test procedures do not provide a standardized test method for determining the energy efficiency. 78 FR 75962, 75975, 75987–75989 (Dec. 13, 2013). Motors that fall into this grouping are not currently regulated by DOE and consist of the following categories:

- Air-over electric motors;
- Component sets of an electric motor;
- Liquid-cooled electric motors;
- Submersible electric motors; and
- Inverter-only electric motors. 10 CFR 431.25(l).

In this NOPR, DOE is proposing to specify that certain equipment that are designated with IEC Design letters are within the scope of the current electric motors test procedure. Furthermore, DOE is proposing to establish test procedure requirements for certain categories of electric motors not currently subject to energy conservation standards. These categories are (1) air-over electric motors; (2) submersible electric motors; (3) certain electric motors greater than 500 hp; (4) electric motors considered small; and (5) inverter-only electric motors. Finally, DOE is also proposing to include within the scope of the test procedure synchronous electric motor technologies.

As noted previously, manufacturers of electric motors for which DOE is proposing to include within the scope of the test procedure, but that are not currently subject to an energy conservation standard, would not be required to use the test procedure, if made final, for Federal certification or labeling purposes, until such time as energy conservation standards are established for such electric motors. However, if DOE were to establish test procedures for electric motors not currently subject to an energy conservation standard, any voluntary representations by manufacturers, distributors, retailers, or private labelers about the energy consumption or cost of energy for these motors must be based on the use of that test procedure beginning 180 days following publication of a final rule. DOE's rule would not require manufacturers who do not currently make voluntary representations to then begin making public representations of efficiency. (42 U.S.C. 6314(d)(1)) Manufacturers not currently making representations would be required to test such motors in accordance with the test procedure at such time as compliance is required with a labeling or energy conservation standard requirement should such a requirement be established. (42 U.S.C. 6315(b); 42 U.S.C. 6316(a); 42 U.S.C. 6295(s))

Each category of electric motor proposed for inclusion in the scope of the test procedure is discussed in the following sections.

1. ''E'' and ''Y'' Designations of IEC Design N and H Motors

Currently regulated electric motors include those motors designated as IEC Design N and IEC Design H motors. In the June 2020 RFI, DOE noted that IEC 60034–12:2016 provides further designation using ''E'' to indicate that a motor meets a ''premium efficiency'' attribute. 85 FR 34111, 34114. For example, IEC Design N and IEC Design H motors that meet a ''premium efficiency'' attribute are designated ''NE'' and ''HE''. DOE stated that the ''premium efficiency'' attribute generally aligns with the current DOE standards prescribed at 10 CFR 431.25. *Id.* As the ''E'' designation denotes premium efficiency performance of the Design N and Design H electric motors, ''NE'' and ''HE'' motors are equivalents to NEMA Design A and NEMA Design C motors, respectively, and are currently within the scope of the test procedure. See 10 CFR 431.12 (defining the term ''NEMA Design A motor'' and ''NEMA Design C motor'') and 10 CFR 431.25(g)-(i) and (l) (establishing the efficiency standards related to NEMA Design A and NEMA Design C motors and their applicable scope). DOE requested comment as to whether its understanding of the new nomenclature is correct. *Id.*

In an energy conservation standards RFI published on May 21, 2020 (85 FR 30878; ''May 2020 RFI''), DOE discussed that the updated version of IEC standard 60034–12 added new starting

[8] ''NEMA Design A'' motor means a squirrel-cage motor that: (1) Is designed to withstand full-voltage starting and developing locked-rotor torque as shown in NEMA MG 1–2009, paragraph 12.38.1 (incorporated by reference, see § 431.15); (2) Has pull-up torque not less than the values shown in NEMA MG 1–2009, paragraph 12.40.1; (3) Has breakdown torque not less than the values shown in NEMA MG 1–2009, paragraph 12.39.1; (4) Has a locked-rotor current higher than the values shown in NEMA MG 1–2009, paragraph 12.35.1 for 60 hertz and NEMA MG 1–2009, paragraph 12.35.2 for 50 hertz; and (5) Has a slip at rated load of less than 5 percent for motors with fewer than 10 poles. 10 CFR 430.12.

[9] ''NEMA Design B motor'' means a squirrel-cage motor that is: (1) Designed to withstand full-voltage starting; (2) Develops locked-rotor, breakdown, and pull-up torques adequate for general application as specified in sections 12.38, 12.39 and 12.40 of NEMA MG1–2009 (incorporated by reference, see § 431.15); (3) Draws locked-rotor current not to exceed the values shown in section 12.35.1 for 60 hertz and 12.35.2 for 50 hertz of NEMA MG1–2009; and (4) Has a slip at rated load of less than 5 percent for motors with fewer than 10 poles. *Id.*

[10] ''NEMA Design C'' motor means a squirrel-cage motor that: (1) Is Designed to withstand full-voltage starting and developing locked-rotor torque for high-torque applications up to the values shown in NEMA MG1–2009, paragraph 12.38.2 (incorporated by reference, see § 431.15); (2) Has pull-up torque not less than the values shown in NEMA MG1–2009, paragraph 12.40.2; (3) Has breakdown torque not less than the values shown in NEMA MG1–2009, paragraph 12.39.2; (4) Has a locked-rotor current not to exceed the values shown in NEMA MG1–2009, paragraphs 12.35.1 for 60 hertz and 12.35.2 for 50 hertz; and (5) Has a slip at rated load of less than 5 percent. *Id.*

[11] IEC Design N motor means an electric motor that: (1) Is an induction motor designed for use with three-phase power; (2) Contains a cage rotor; (3) Is capable of direct-on-line starting; (4) Has 2, 4, 6, or 8 poles; (5) Is rated from 0.4 kW to 1600 kW at a frequency of 60 Hz; and (6) Conforms to sections 6.1, 6.2, and 6.3 of the IEC 60034–12 edition 2.1 (incorporated by reference, see § 431.15) requirements for torque characteristics, locked rotor apparent power, and starting. *Id.*

[12] IEC Design H motor means an electric motor that (1) Is an induction motor designed for use with three-phase power; (2) Contains a cage rotor; (3) Is capable of direct-on-line starting (4) Has 4, 6, or 8 poles; (5) Is rated from 0.4 kW to 1600 kW at a frequency of 60 Hz; and (6) Conforms to sections 8.1, 8.2, and 8.3 of the IEC 60034–12 edition 2.1 (incorporated by reference, see § 431.15) requirements for starting torque, locked rotor apparent power, and starting. *Id.*

[13] ''Fire pump electric motor'' means an electric motor, including any IEC-equivalent motor, that meets the requirements of section 9.5 of NFPA 20. *Id.*

specifications to the existing IEC motor designs that are designated by the addition of ''Y'' (indicating a star-delta starter [14]). 85 FR 30878, 30881. As a result of these industry nomenclature updates, the IEC Design N and IEC Design H motor designations are augmented with the designations IEC Design NE, HE, NY, NEY, HY, and HEY. DOE stated that all six additional categories are described as electric motors that are variants of IEC Design N and IEC Design H electric motors that DOE currently regulates, with the only differences being the premium efficiency attribute (indicated by the letter ''E''), and starting configuration (star-delta starter indicated by the letter ''Y''). For induction motors, the starting configuration refers to the manner in which the three-phase input terminals are connected to each other, and the star configuration results in a lower line-to-line voltage than the delta configuration. See sections 2.62 and 2.64 of NEMA MG 1–2016 with 2018 Supplements for further detail. Accordingly, DOE requested comment as to whether these six IEC electric motor designs were equivalent to NEMA Designs A, B or C, and if so, information and data to support such a consideration.

Advanced Energy stated that IEC Design NE and HE motors are higher efficiency motors than their standard counterparts (IEC Design N and IEC Design H), and should be added to the regulatory definitions at 10 CFR 431.12 for clarity. (Advanced Energy, No. 4 at p. 2) NEMA stated that Design NE and Design HE motor designations do not warrant special treatment or the establishment of a separate product class or type. (NEMA, No. 2 at p. 4) Responding to the May 2020 RFI, NEMA commented that all six IEC designs are equivalent to NEMA Design A and C ''Premium'' efficient electric motor designs, and referenced a letter it sent to DOE on March 26, 2018, which requested that DOE consider IEC Design ''E'' motors. (Docket No. EERE–2020–BT–STD–0007, NEMA, No. 4 at p. 2, 11)

Accordingly, DOE proposes to revise 10 CFR 431.25 to reflect the inclusion of IEC Design NE, NEY, and NY motors as IEC Design N motors and to make a similar set of revisions to reflect the inclusion of IEC Design HE, HEY, and HY motors as IEC Design H motors. DOE clarifies that to the extent IEC Design N and IEC Design H motors are subject to the DOE regulations for electric motors, such coverage already includes IEC Design NE, NY, NEY, HE, HY and HEY motors. DOE also proposes to update the definitions for IEC Design N and H, and include new definitions for the IEC Design N and H ''E'' and ''Y'' designations; see section III.B.1for further discussion on proposed definitions.

DOE seeks comments on its proposed clarification of IEC Design NE, NY, NEY, HE, HY and HEY motors as variants of IEC Design N and IEC Design H motors, as applicable.

2. Single-Speed AC Induction Motors

CA IOUs commented that DOE should revisit the applicability of the test procedures for ''single-speed AC motors,'' as specified in 10 CFR 431.25(g). (CA IOUs, No. 3 at p. 2) CA IOUs stated that IEC 60034–30–1:2014 ''Rotating Electrical Machines—Part 30–1: Efficiency Classes Of Line Operated AC Motors (IE Code)'' (''IEC 60034–30–1:2014'') includes within its scope of ''single-speed AC motors'' electric motors that are capable of operation both by frequency converter and direct-on-line, in contrast to DOE's current scope of ''single-speed AC motors''. The CA IOUs suggested that DOE revisit the current interpretation to mirror that of the IEC standards. *Id.*

The existing test procedures for electric motors apply to electric motors that, in part, operate on polyphase alternating current 60-hertz sinusoidal power. 10 CFR 431.25(g)(4) This criterion includes motors capable of operating directly connected to the power supply (*i.e.,* ''direct-on-line''). In addition, the definitions of IEC Design N and H motors (which are within scope as specified in 10 CFR 431.25(g)) in 10 CFR 431.12 further specify that the electric motor is capable of direct-on-line starting. Therefore, motors that are capable of direct-on-line starting are already included within the current scope of DOE regulations.

Inverters (also called controls or converters, see section III.B.3) operate by changing the frequency and voltage of the power source to which an electric motor is connected. Inverter-only electric motors are currently exempt from the energy conservation standards.[15] 10 CFR 431.25(l)(5). However, DOE does not exempt inverter-capable electric motors that meet the scope criteria at 10 CFR 431.25(g); therefore, electric motors that are inverter-capable are already included within the current scope of DOE regulations. An ''inverter-capable electric motor'' is defined as an electric motor designed to be directly connected to polyphase, sinusoidal line power, but that is also capable of continuous operation on an inverter drive over a limited speed range and associated load. 10 CFR 431.12. An inverter-capable electric motor would be tested without the use of an inverter and would rely on the set-ups used when testing a general purpose electric motor. 78 FR 75962, 75972.

In this NOPR, DOE is proposing to establish test procedures for inverter-only electric motors, as described further in section III.A.7.

3. Air-Over Electric Motors

DOE defines an ''air-over electric motor'' as an electric motor rated to operate in and be cooled by the airstream of a fan or blower that is not supplied with the motor and whose primary purpose is providing airflow to an application other than the motor driving it. 10 CFR 431.12. These motors are currently exempt from the energy conservation standards. 10 CFR 431.25(l)(4). For air-over electric motors, DOE previously determined there was insufficient information at the time to support establishment of a test method. 78 FR 75962, 75974–75975.

In the July 2017 RFI, DOE noted that since the publication of the December 2013 Final Rule, NEMA had published a test standard for air-over motors in Section IV, ''Performance Standards Applying to All Machines'', Part 34 ''Air-Over Motor Efficiency Test Method'' of NEMA MG1–2016 with 2018 Supplements (''NEMA Air-over Motor Efficiency Test Method'').[16] 82 FR 35468, 35475. DOE also noted that section 8.2.1 of IEEE 114–2010 ''Test Procedure for Single-phase Motors'' (''IEEE 114–2010'') (and section 5 of CSA C747–09 (R2019) [17] ''Energy Efficiency Test Method for Small Motors'' (''CSA C747–09 (R2019)'') included provisions for testing air-over motors. *Id.*

In response to the July 2017 RFI, NEMA commented that DOE should not regulate air-over motors but instead regulate at the level of the finished product. NEMA also generally commented in support of maintaining all exemptions at 10 CFR 431.25(l) (Docket No. EERE–2017–BT–TP–0047,

[14] A ''star-delta starter'' refers to a reduced voltage starter system arranged by connecting the supply with the primary motor winding initially in star (wye) configuration, then reconnected in delta configuration for running operation.

[15] ''Inverter-only electric motor'' means an electric motor that is capable of rated operation solely with an inverter, and is not intended for operation when directly connected to polyphase, sinusoidal line power. 10 CFR 431.12.

[16] The air-over method was originally published as part of the 2017 NEMA MG–1 Supplements and is also included in the latest version of NEMA MG1–2016 with 2018 Supplements.

[17] CSA C747–09 was re-affirmed in 2014 and in 2019 (*i.e.,* no changes were adopted). The July 2017 RFI referenced CSA C747–09 (R2014) which is equivalent to CSA C747–09 (R2019).

NEMA, No. 24 at pp. 6–7) Similarly, Lennox commented that it did not support regulating air-over motors. (Docket No. EERE–2017–BT–TP–0047, Lennox, No. 22 at p. 3) The Joint Advocates supported including air-over motors in the scope of the test procedure. The Joint Advocates noted that some applications could use air-over or non-air-over motors interchangeably, and that consumers would benefit from being able to compare motor efficiency. (Docket No. EERE–2017–BT–TP–0047, Joint Advocates, No. 27 at p. 3)

In response to the June 2020 RFI, Advanced Energy commented that NEMA MG1–2016 with 2018 Supplements incorporates a test procedure for air-over motors. (Advanced Energy, No. 4 at p. 2) The CA IOUs, NEEA, NWPCC, and Efficiency Advocates recommended that DOE expand the scope of the test procedure to include air-over electric motors. (CA IOUs, No. 3 at p. 8–10; NEEA and NWPCC, No. 6 at p. 4; Efficiency Advocates, No. 5 at p. 3) These interested parties commented that since the last rulemaking, NEMA has published a test procedure for air-over electric motors and that DOE should consider the NEMA test procedure as the basis for the DOE test procedure. *Id.*

DOE reviewed NEMA MG1–2016, Part 34: Air-Over Motor Efficiency Test Method, as well as section 8.2.1 of IEEE 114–2010 and section 5 of CSA C747–09 (R2019), and has initially determined that sufficient information is now available to propose a test method for air-over electric motors. (See section III.D.1 for more details). Accordingly, DOE proposes to include air-over electric motors in the scope of the test procedure. See section III.B.4 for a discussion of the air-over electric motor definition and section III.D.1 for further details on the proposed test method. As noted, were DOE to include air-over electric motors within the scope of the test procedure, such electric motors would not be required to be tested using that test procedure until such time as DOE establishes energy conservation standards for air-over electric motors. If manufacturers voluntarily choose to make representations regarding the energy consumption or cost of energy of such electric motors, however, they would be required to test according to the DOE test procedure and sampling requirements.

DOE requests comments on its proposal to add air-over electric motors to the scope of the test procedure. To the extent available, DOE requests that comments be accompanied by supporting information and data.

4. Submersible Electric Motors

DOE defines a ''submersible electric motor'' as an electric motor that: (1) Is intended to operate continuously only while submerged in liquid; (2) is capable of operation while submerged in liquid for an indefinite period of time; and (3) has been sealed to prevent ingress of liquid from contacting the motor's internal parts. 10 CFR 431.12. These motors are currently exempt from the energy conservation standards. 10 CFR 431.25(l)(4). DOE previously did not adopt test procedures for submersible electric motors because no industry test procedures or potential modifications to the Federal test procedures could be used to consistently test (and reliably measure) a motor that relies on submersion in liquid for continuous duty operation. 78 FR 75962, 75988.

CA IOUs and Efficiency Advocates recommended that DOE expand the scope of the test procedures to include submersible electric motors, and develop a test procedure for such motors (CA IOUs, No. 3 at p. 8–10; Efficiency Advocates, No. 5 at p. 3) The CA IOUs commented that a similar procedure as the industry air-over test procedure could be used to test submersible motors because for both motors, cooling is provided by the material surrounding the motor (*e.g.,* air or water). (CA IOUs, No. 3 at p. 9) CA IOUs stated that submersible motors are a large portion of the motor market with significant energy savings potential [18] and that many submersible pumps already offer NEMA Premium Efficiency motors with the pump. (CA IOUs, No. 3 at p. 10) The Efficiency Advocates stated that the marketing of NEMA Premium Efficiency motors for submersible applications suggests that these motors could be tested with current test procedures. (Efficiency Advocates, No. 5 at p. 3) In response to the July 2017 RFI, Advanced Energy commented that it does not support regulating motors that are typically manufactured for highly specialized applications, including submersible motors, to the extent that their exemption would not create inconsistency in the regulations. Advanced Energy also stated that submersible motors should be treated similarly to other categories of covered electric motors for which test procedures are available, such as totally-enclosed non-ventilated (''TENV'') electric motors [19] and air-over electric motors, and that exempting submersible electric motors would not be justified if DOE were to propose establishing test procedures for air-over motors. (Docket No. EERE–2017–BT–TP–0047, Advanced Energy, No. 25 at p. 6)

In the December 2013 Final Rule, DOE determined at the time that no industry test procedures or potential modifications to the procedures then currently under 10 CFR 431.16 could be used to consistently test (and reliably measure the efficiency of) a motor that relies on submersion in liquid for continuous duty operation. 78 FR 75962, 75988. In addition, DOE confirmed that there were no testing facilities that were capable of testing a motor submerged in water. *Id.*

The primary concern in developing a test procedure for submersible electric motors is how to cool the motor to ensure it does not overheat during the load test. Since the December 2013 Final Rule, NEMA has published a test procedure for air-over motors (NEMA MG1–2016, Part 34: Air-Over Motor Efficiency Test Method). (See section III.D.1 for more details.) As discussed previously, air-over electric motors need to be cooled by the airstream of an external fan or blower to operate continuously at full load. Section 34.4 and Section 34.5 of NEMA MG1–2016 with the 2018 Supplements provide specifications to test air-over electric motors with and without the use of an external blower to cool the motor. DOE has initially determined that these test methods could be adapted as a test method for submersible electric motors either by using an external blower to cool the motor or without the need to submerge the motor in a liquid during testing to cool the motor. (See section III.I for more details). Accordingly, DOE proposes to specify test procedure provisions for submersible electric motors. As noted, were DOE to include submersible electric motors within the scope of the test procedure, such electric motors would not be required to test according to the DOE test procedure until such time as DOE establishes energy conservation standards for submersible electric motors. If manufacturers voluntarily make representations regarding the energy consumption or cost of energy of such

[18] CA IOUs suggested that submersible electric motors are present in both residential and non-residential settings: In a residential scenario, well pumps (which account for 23 percent of residential pumping energy) include submersible pumps and motors; in non-residential scenarios, submersible pumps and motors are used in potable water supply, drain water runoff, and wastewater and sewage applications, among other applications. (CA IOUs, No. 3 at p. 9)

[19] TENV electric motors are ''built in a frame-surface cooled, totally enclosed configuration that is designed and equipped to be cooled only by free convection.'' 10 CFR 431.12.

electric motors, however, they would be required to test according to the DOE test procedure and sampling requirements.

DOE requests comments on its proposal to add submersible electric motors to the scope of the test procedure.

5. AC Induction Electric Motors Greater Than 500 Horsepower

DOE currently specifies that the conservation standards for electric motors, and therefore the test procedures, are not applicable to motors that produce greater than 500 horsepower (373 kW). 10 CFR 431.25(g)(8); Appendix B, Note. Efficiency Advocates suggested that DOE extend its test procedure scope to motors with higher horsepower ratings (*i.e.,* greater than 500 hp). (Efficiency Advocates, No. 5 at p. 2)

In an energy conservation standards final rule published May 29, 2014 (''May 2014 Final Rule''), DOE stated that it may consider expanding the scope of its regulations to large motors in future updates to the rulemaking. 79 FR 30934, 30946. Based on a review of catalog offerings, DOE identified large induction motors rated up to 750 hp currently being sold in the market, and the majority of the models identified listed full load efficiencies even though DOE currently does not regulate electric motors greater than 500 hp. Based on discussions with a subject matter expert, DOE understands that most of these large motors rely on the alternative efficiency determination method (''AEDM'') permitted under 10 CFR 431.17 to determine full load efficiencies for regulated electric motors at and under 500 hp.[20] In addition, the current industry test procedures incorporated by reference in section 2 of appendix B do not apply an upper horsepower limit.

Accordingly, DOE proposes to expand the scope of the test procedure to include induction electric motors with a horsepower rating greater than 500 hp and up to 750 hp that otherwise meet the criteria provided in 10 CFR 431.25(g) and are not currently listed at 10 CFR 431.25(l)(2)–(4). As discussed previously, DOE's review of the market identified 750 hp as the upper limit for commercially available AC induction electric motors. Furthermore, as noted, were DOE to include the higher horsepower induction electric motors within the scope of the test procedure, such electric motors would not be required to be tested according to the DOE test procedure until such time as DOE establishes energy conservation standards for these electric motors. If manufacturers voluntarily make representations regarding the energy consumption or cost of energy of such electric motors, however, they would be required to test according to the DOE test procedure and sampling requirements.

DOE is also proposing test procedure provisions for certain non-induction motor topologies under a new category of ''synchronous electric motors,'' as discussed in section III.A.8 of this document.

DOE requests comments on its proposal to add electric motors greater than 500 hp (and up to 750 hp) that meet the criteria provided in 10 CFR 431.25(g) (except (8)) and are not listed at 10 CFR 431.25(l)(2)–(4) to the scope of the test procedure. DOE requests comment and supporting information on whether an upper limit of 750 hp is appropriate for the proposed expanded scope of motors greater than 500 hp—and if not, why not.

6. AC Induction Electric Motors Considered ''Small''

As discussed, this NOPR addresses motors that are defined as ''electric motors'' at 10 CFR 431.12. Also as noted, DOE separately regulates ''small electric motors.'' See 10 CFR part 431 subpart X. A ''small electric motor'' is a NEMA general purpose AC single-speed induction motor, built in a two-digit frame number series in accordance with NEMA Standards Publication MG1–1987, including IEC metric equivalent motors. 10 CFR 431.442. This section addresses electric motors that are not small electric motors as that term is defined in 10 CFR part 431, subpart X, but that are generally considered small by industry (*i.e.,* ''small, non-small-electric-motor electric motor, or SNEM''). In this section, DOE specifically discusses SNEMs that are induction motors. Non-induction motor topologies (specifically certain synchronous electric motors) are discussed in section III.A.8 of this document.

In the July 2017 RFI, DOE requested comment on whether DOE should consider establishing test procedures for SNEMs, as they are not currently subject to either the small electric motor or electric motor test procedures. 82 FR 35468, 35470. SNEMs may have similarities to motors that are currently regulated as small electric motors (such as horsepower) and may be used in similar applications. Accordingly, establishing test procedures for these motors would allow for standardized representations of efficiency of all motors used for similar functions. Table III.1 lists the SNEM motor configurations that DOE requested comment on in the July 2017 RFI. *Id*

TABLE III.1—SNEMS UNDER CONSIDERATION IN THE JULY 2017 RFI

Phase count	Horsepower	Frame size
Single	≥0.125 hp and ≤15 hp	All.
Polyphase	≥0.125 hp and ≤5 hp	*2-digit.
Polyphase	<1 hp	All.

*Polyphase enclosed motors ≥ 1 hp of the 56-frame size are not under consideration for revised test procedures, as certain enclosed 56-frame size polyphase motors were considered in the May 2014 Final Rule, and are regulated at 10 CFR 431.25.

DOE also presented a list of topologies that could be considered as part of this rulemaking: Permanent-split capacitor, polyphase induction, squirrel cage, capacitor-start, reluctance synchronous (also known as synchronous reluctance); shaded-pole; permanent magnet (or permanent magnet synchronous); line-start permanent magnet; switched reluctance; split-phase; and electronically commutated motors. 82 FR 35468, 35471. As previously mentioned, this section discusses only induction electric motors (direct-on-line, inverter-capable, or inverter-only). Non-induction motor topologies—including synchronous reluctance, permanent magnet, line-start permanent

[20] An AEDM may be used to determine the average full load efficiency of one or more of a manufacturer's basic models if the average full load efficiency of at least five of its other basic models is determined through testing. 10 CFR 431.17(a)(1). An AEDM applied to a basic model must be: (i) Derived from a mathematical model that represents the mechanical and electrical characteristics of that basic model, and (ii) based on engineering or statistical analysis, computer simulation or modeling, or other analytic evaluation of performance data. 10 CFR 431.17(a)(2).

magnet, switched reluctance, and electronically commutated motor) are discussed in section III.A.8 of this document.

In response to the July 2017 RFI, the CA IOUs supported establishing test procedures for additional categories of SNEMs. (Docket No. EERE–2017–BT–TP–0047, CA IOUs, No. 26 at p. 2). The Joint Advocates supported establishing test procedures for SNEMs as considered in the July 2017 RFI and with a focus on the topologies as identified in the July 2017 RFI (Docket No. EERE–2017–BT–TP–0047, Joint Advocates, No. 27 at pp. 2–3) Advanced Energy commented in support of including all topologies listed in the July 2017 RFI. (Docket No. EERE–2017–BT–TP–0047, Advanced Energy, No. 25 at p. 4) NEMA commented that DOE should not consider test procedures for additional motor topologies for which DOE test procedures do not currently exist. (Docket No. EERE–2017–BT–TP–0047, NEMA, No. 24 at p. 6)

Although DOE did not discuss the potential of including additional categories of electric motors within the scope of regulated electric motors in the June 2020 RFI, several interested parties addressed the issue of scope in their responses to the June 2020 RFI. The Efficiency Advocates and NEEA and NWPCC commented that DOE should expand its scope of coverage and establish test procedures for SNEMs as identified in the July 2017 RFI. (Efficiency Advocates, No. 5 at p. 2; NEEA and NWPCC, No. 6 at p. 3) Efficiency Advocates suggested that DOE rely on its authority to regulate ''other motors'' and consider test procedures for SNEMs. (Efficiency Advocates, No. 5 at p. 2)

NEEA and NWPCC commented that these ''small'' motors are installed in the same application as regulated motors and should be included in scope to allow for fair comparison across motor types and to provide consumers the information necessary to make an informed decision. (NEEA and NWPCC, No. 6 at p. 3) In addition, both the Efficiency Advocates and NEEA and NWPCC further commented that DOE should expand its test procedure scope to other small motor topologies presented in the July 2017 RFI, including permanent-split capacitor, shaded pole and split phase. (Efficiency Advocates, No. 5 at p. 2; NEEA and NWPCC, No. 6 at p. 2)

AHAM and AHRI opposed the development of test procedures, energy conservation standards, and/or certification requirements for any additional categories of small electric motors or electric motors that are component parts, and supported a finished-product approach to energy efficiency regulation. AHAM and AHRI commented that setting such standards could push finished product manufacturers to purchase more expensive motors and increase the cost of appliances and equipment, while not necessarily improving the energy performance of the finished product. AHAM and AHRI asserted that requiring finished product manufacturers to certify compliance with standards for component parts, including the testing, paperwork, and record-keeping requirements that accompany certification would significantly increase burden on manufacturers. AHAM and AHRI also asserted that more efficient motors within a particular topology are likely to be larger and heavier, that home appliances and HVACR equipment have space constraints preventing manufacturers from using larger motors, and that heavier or larger appliances would decrease consumer utility. (AHAM and AHRI, No. 21 at p. 2)

DOE is proposing to include test procedures for additional electric motors not covered under the current electric motors test procedure and that do not meet the definition of small electric motors in 10 CFR part 431, subpart X, but are nonetheless considered ''small'', *i.e.,* SNEMs. EPCA provides that ''other motors'' may be classified as covered equipment by the Secretary of Energy if the Secretary determines that such classification is necessary to carry out the purpose of the Energy Conservation Program for Certain Industrial Equipment *i.e.,* necessary to improve the efficiency of electric motors and pumps and certain other industrial equipment in order to conserve the energy resources of the Nation. (42 U.S.C. 6311(1)(L) and (2)(B)(xiii); 42 U.S.C. 6312(b)). However, in this NOPR, DOE is proposing to cover motors considered ''small'' by the industry under its ''electric motors'' authority (42 U.S.C. 6311(1)(A)).

As discussed in the May 2012 Final Rule, DOE believes that EPCA, as amended through EISA 2007, provides sufficient statutory authority for the regulation of such motors. 77 FR 26608, 26612—26613. Before the enactment of EISA 2007, EPCA defined the term ''electric motor'' as any motor that is a general purpose T-frame, single-speed, foot-mounting, polyphase squirrel-cage induction motor of the National Electrical Manufacturers Association, Design A and B, continuous rated, operating on 230/460 volts and constant 60 Hertz line power as defined in NEMA Standards Publication MG1–1987. (See 42 U.S.C. 6311(13)(A) (2006)) Section 313(a)(2) of EISA 2007 removed that definition and the prior limits that narrowly defined what types of motors would be considered as electric motors, and instead inserted a new ''Electric motors'' heading, and created two new subtypes of electric motors: General purpose electric motor (subtype I) and general purpose electric motor (subtype II). (42 U.S.C. 6311(13)(A)–(B)(2011)) In addition, section 313(b)(2) of EISA 2007 established energy conservation standards for four types of electric motors: General purpose electric motors (subtype I) (*i.e.,* subtype I motors) with a power rating of 1 to 200 horsepower; fire pump motors; general purpose electric motor (subtype II) (*i.e.,* subtype II motors) with a power rating of 1 to 200 horsepower; and NEMA Design B, general purpose electric motors with a power rating of more than 200 horsepower, but less than or equal to 500 horsepower. (42 U.S.C. 6313(b)(2)) The term ''electric motor'' (which frequently appears throughout EPCA, as amended by EISA 2007, and various subparts of 10 CFR part 431) was left undefined.

As described in the May 2012 Final Rule, DOE believed that a definition for ''electric motor'' was necessary, and therefore adopted the broad definition of ''electric motor'' currently found in 10 CFR 431.12. At this time, while the definition covers a large set of motors, only those for which energy conservation standards have been set are currently within the scope of the test procedures—*i.e.,* electric motors that meet the criteria specified at 10 CFR 431.25(g) and with the exemptions listed at 10 CFR 431.25(l). These categories of polyphase electric motors between 1 and 500 hp are NEMA Design A motors, NEMA Design B motors, NEMA Design C motors, IEC Design N motors, IEC Design H motors, and fire pump electric motors. In the May 2012 Final Rule, DOE noted that this approach would allow DOE to fill the definitional gap created by the EISA 2007 amendments while providing DOE with the flexibility to set energy conservation standards for other types of electric motors without having to continuously update the definition of ''electric motors'' each time DOE sets energy conservation standards for a new subset of electric motors.

In this NOPR, DOE proposes to establish test procedures for SNEMs. These motors have similarities to motors that are currently regulated as small electric motors at 10 CFR part 431 subpart X and electric motors at 10 CFR part 431 subpart B. However, DOE proposes to distinguish SNEMs by specifying combinations of frame sizes, rated motor horsepower, enclosure construction, and additional performance criteria that are not currently included in the existing electric motors and small electric motors regulations at 10 CFR part 431 subpart B and subpart X (*See* Table III.4 and Table III–3)). DOE notes that SNEMs are highly prevalent in the market and are used in similar applications as small electric motors regulated under 10 CFR part 431, subpart X. Accordingly, should DOE establish energy conservation standards for SNEMs in the future, establishing test procedures for these motors would allow for standardized representations of efficiency of all motors used for similar functions. Further, DOE proposes that existing industry test standards can be applicable to these SNEMs (*see* section III.D.2). To the extent DOE were to establish test procedures for a SNEMs prior to the establishment of an energy conservation standard, SNEM manufacturers would not be required to use the test procedure for certification or labeling purposes, until such time as a standard is established. However, any voluntary representations by manufacturers, distributors, retailers, or private labelers about the energy consumption or cost of energy for these motors must be based on the use of that test procedure beginning 180 days following publication of a final rule. DOE's proposal would not require manufacturers who do not currently make voluntary representations to then begin making public representations of efficiency. (42 U.S.C. 6314(d)(1)) Manufacturers would be required to test such motors in accordance with the DOE test procedure at such time as compliance is required with a labeling or energy conservation standard requirement should such a requirement be established. (42 U.S.C. 6315(b); 42 U.S.C. 6316(a); 42 U.S.C. 6295(s))

The following sections discuss each criteria DOE considered for describing the additional SNEMs that DOE proposes to include in the test procedures, as well as justifications. Additionally, exemptions for certain other motors are discussed in section III.A.9.

TABLE III–2—DESCRIPTION OF SINGLE PHASE INDUCTION MOTORS CURRENTLY SUBJECT TO ENERGY CONSERVATION STANDARDS AND TEST PROCEDURES

Motor enclosure construction	NEMA frame size	
	2-digit NEMA frame size	3-digit NEMA frame size or above
Open	NEMA general purpose capacitor-start induction run, capacitor-start capacitor run motors between 0.25 and 3 hp.	None.
Enclosed	None	None.

Note: This table provides a high-level description. Full description of motors currently subject to energy conservation standards and test procedures available at 10 CFR part 431 subpart B and subpart X.

TABLE III–3—DESCRIPTION OF POLYPHASE PHASE INDUCTION MOTORS CURRENTLY SUBJECT TO ENERGY CONSERVATION STANDARDS AND TEST PROCEDURES

Motor enclosure construction	NEMA frame size	
	2-digit NEMA frame size	3-digit NEMA frame size or above
Open	None	Between 1–500 hp.
Enclosed	NEMA 56-frame size only between 1—500 hp	Between 1–500 hp.

Note: This table provides a high-level description. Full description of motors currently subject to energy conservation standards and test procedures in available at 10 CFR part 431 subpart B and subpart X.

DOE addresses the regulation of electric motors that are component parts in section III.A.10. Furthermore, section III.D.2 provides description of applicable industry standards that provide for the testing of the electric motors that would be subject to the provisions proposed in this NOPR.

DOE proposes to include test procedure provisions for SNEMs, which are described by the criteria listed in Table III.4. These criteria would be specified as a new definition in section 1.2 of appendix B, titled ''Definitions.'' As noted, were DOE to include SNEMs within the scope of the test procedure, such electric motors would not be required to be tested according to the DOE test procedure until such time as DOE establishes energy conservation standards for SNEMs. If manufacturers voluntarily make representations regarding the energy consumption or cost of energy of such electric motors, however, they would be required to test according to the DOE test procedure and sampling requirements.

TABLE III.4—SNEMS PROPOSED IN SCOPE

Criteria number	Description
1	Are not small electric motors, as defined at 10 CFR 431.442 and are not dedicated pool pump motors as defined at 10 CFR 431.483.
2	Are single-speed induction motors.
3	Are rated for continuous duty (MG 1) operation or for duty type S1 (IEC).
4	Capable of operating on polyphase or single-phase alternating current 60-hertz (Hz) sinusoidal line power (with or without an inverter).
5	Are rated for 600 volts or less.

TABLE III.4—SNEMS PROPOSED IN SCOPE—Continued

Criteria number	Description
6	Are built in the following frame sizes: 1. Any frame sizes if the motor operates on single-phase power; 2. Any frame size if the motor operates on polyphase power, and has a rated motor horspower less than 1 horsepower (0.75 kW) 3. A two-digit NEMA frame size (or IEC metric equivalent), if the motor operates on polyphase power, has a rated motor horspower equal to or greater than 1 horsepower (0.75 kW), and is not an enclosed 56 NEMA frame size (or IEC metric equivalent).
7	Produce a rated motor horsepower greater than or equal to 0.25 horsepower (0.18 kW).

DOE requests comments on the proposal to include SNEMs, as specified in Table III.4, within the scope of the test procedure. Specifically, DOE requests feedback on each individual criteria listed in Table III.4. To the extent that these criteria should be revised, DOE seeks supporting information and justification for those revisions.

a. Single Speed

Motors can have different speed capabilities, including single, multi, or (continuously) variable speeds. Variable and multi-speed motors can be tested with existing industry standards at a variety of operating points, but no single metric currently exists to quantify the performance of a variable or multi-speed motor. Variable or multi-speed capability provides the ability to save energy by more closely matching motor output to a varying load. In the July 2017 RFI, DOE stated it was considering whether to consider all speed capabilities in setting any potential new test procedures. 82 FR 35468, 35472. As it relates to those ''SNEMs'' that DOE is proposing to cover under its test procedure, DOE is considering aligning its approach with the existing regulations for small electric motors and electric motors and include only single-speed ''SNEMs'' that are induction motors, and would not include AC induction multi-speed electric motors in the scope of the test procedure. Synchronous electric motors with variable-speed capability (at 0.25 hp and above) and comments received on this topic are discussed in section III.A.8 of this document. AC induction inverter-only electric motors that are variable speed are discussed in section III.A.7 of this document.

b. Duty Rating

Motors can be described by their duty type, using either NEMA or IEC nomenclature. Duty type describes the operating profile the motor is designed to handle. For example, a continuous duty motor can operate for long periods of time at a steady load, whereas intermittent-duty motors are operated non-continuously for shorter periods of time (*i.e.,* intermittently, or cyclically), and thus accumulate significantly fewer annual operating hours. In the July 2017 RFI, DOE stated that it was considered analyzing only continuous duty small motors for inclusion in the scope of the test procedure. 82 FR 35468, 35472.

In response to the July 2017 RFI, the Joint Advocates supported a focus on continuous duty motors (Docket No. EERE–2017–BT–TP–0047, Joint Advocates, No. 27 at p. 2) Advanced Energy commented that intermittent duty motors could be considered for inclusion in the scope of the test procedure. (Docket No. EERE–2017–BT–TP–0047; Advanced Energy, No. 25 at p. 3)

For continuous duty motors, NEMA MG 1–2016 defines a continuous rating as ''the load which can be carried for an indefinitely long period of time.'' *See* Paragraph 1.40.1. of NEMA MG 1–2016. Similarly, IEC 60034–1 describes an S1 duty rating in section 5.2.1 as ''A rating at which the machine may be operated for an unlimited period, while complying with the requirements of this standard.'' DOE considers these continuous duty ratings to be equivalent to each other. As described in the July 2017 RFI, DOE limited its consideration to continuous duty motors because they represent more operating hours and potential energy savings in comparison to non-continuous duty motors. 82 FR 35468, 35472. Electric motors and small electric motors currently subject to the test procedures and energy conservation standards in 10 CFR part 431 subpart B and subpart X are rated for continuous duty. Consistent with the electric motors currently within the scope of the DOE test procedure, DOE proposes to add only those ''SNEMs'' rated for continuous duty, as these motors may be used in similar applications to their electric motor counterparts. These criteria would be reflected in a new definition in section 1.2 by specifying motors that are rated for continuous duty (MG 1) operation or for duty type S1 (IEC).

c. Current Waveform

A motor can be designed to operate with an alternating current (AC) or direct current (DC) waveform. In the July 2017 RFI, DOE stated it was considering whether to analyze motors that operate while connected directly to an external DC power supply. 82 FR 35468, 35473.

Motors that connect directly to an external DC power source are primarily used in less common, specialty applications that are not served by AC motors (*e.g.,* applications requiring precise motion control or reversibility).[21] DOE research indicates that these motors have a low market share.[22] Electric motors currently subject to test procedures and energy conservation standards at 10 CFR part 431 subpart B are supplied by AC sinusoidal line power. DOE proposes to limit the scope of applicability of this test procedure to SNEMs that operate on AC sinusoidal line power (with or without an inverter). DOE notes that these motors include direct-on-line, inverter-capable, and inverter-only electric motors. The specification of AC sinusoidal line power would be reflected in a new definition in section 1.2 of appendix B. Motors that are inverter-only are further discussed in section III.A.7 of this document.

d. Input Frequency

AC motors are designed to operate at a particular frequency. In the United States, AC power is delivered at 60 Hz. In the July 2017 RFI, DOE discussed analyzing motors designed to operate with a sinusoidal input frequency of 60

[21] DOE notes that DC motors that operate while connected directly to an external DC power supply are different from more common motors that operate using a DC waveform that is supplied by a power converter placed between the motor and an external AC power source (*e.g.* as in an electronically commutated motor). Comments related to electronically communicated motors are discussed in section III.A.8.

[22] DOE reviewed information on the market share of DC motors for motors above 1 horsepower from the following market report: ''Low Voltage Motors, World Market report 2019'' November 2019 IHS Markit. DOE notes that this report did not include information related to motors below 1 horsepower.

Hz, but that may also be designed to operate at different frequencies. For example, some motors are marketed as being capable of operating at either 50 or 60 Hz, and are therefore designed to work while connected to line power in different regions (*e.g.,* Europe and North America). 82 FR 35468, 35473.

In response, Advanced Energy commented that 50 Hz motors could be connected to 60 Hz power supplies and therefore the scope of test procedures applicable to ''small motors'' should consider 50 Hz motors as well. Advanced Energy noted that NEMA MG1 included efficiency tables for 50 Hz motors. (Docket No. EERE–2017–BT–TP–0047; Advanced Energy, No. 25 at p. 3).

EPCA authorizes DOE to establish test procedures and energy conservation standards for covered equipment distributed in commerce within the United States. (42 U.S.C. 6316(a); 42 U.S.C. 6302(a); *see also* 42 U.S.C. 6300; 42 U.S.C. 6301) Within the United States, electricity is supplied at 60 Hz. Therefore, DOE proposes to limit the scope of applicability of this test procedure to SNEMs capable of operating using 60 Hz input power, including motors marketed as being capable of operating at frequencies in addition to 60 Hz (*e.g.,* motors designed to operate at either 60 or 50 Hz). In the January 2021 Final Rule, DOE also established the definition of rated frequency as ''60 Hz'' for small electric motors in 10 CFR 431.442. 86 FR 4, 14. Further, DOE is proposing to define rated frequency for electric motors similarly, as discussed in section III.G.1 of this document. Finally, the specification of 60 Hz would be reflected as a new definition in section 1.2 of appendix B.

e. Frame Size

Motors can be built in different frame sizes, which most commonly characterizes the distance between the centerline of the shaft and the bottom of the mounting feet, but can also describe a motor's axial length. Typically, as rated motor horsepower increases with a general motor design, so does frame size. NEMA frame sizes are described in 2-, 3-, and 4-digit naming conventions. In the July 2017 RFI, DOE indicated that it was considering not using frame size to describe motors under consideration for standards, other than to avoid overlap with other existing electric motor regulations in 10 CFR part 431 subpart B. 82 FR 35468, 35473.

In this NOPR, DOE proposes to differentiate the additional SNEMs proposed for inclusion in the scope of the test procedures from electric motors currently subject to test procedures at 10 CFR part 431 subpart B and from small electric motors currently subject to test procedures at 10 CFR part 431 subpart X by specifying combinations of frame sizes, rated motor horsepower, and enclosure construction that are not currently included in the existing electric motors and small electric motors regulations.

Subpart B of 10 CFR part 431 subjects certain NEMA 56-frame polyphase electric motors of enclosed construction and certain 3-digit or 4-digit polyphase electric motors to the test procedures, and currently does not cover two groups of motors: (1) Those motors with a rated motor horsepower less than one and; (2) polyphase motors of a 2-digit frame size (other than certain NEMA 56-frame size enclosed motors) with a rated motor horsepower greater than or equal to one.

Subpart X of 10 CFR part 431 subjects certain 2-digit NEMA frame single-phase and polyphase motors with a rated motor horsepower greater than or equal to 0.25 hp and less than or equal to 3 hp to those test procedures, and does not cover any 3-digit frame size motors or certain 2-digit NEMA frame single-phase motors that do not meet the definition of small electric motors.

Accordingly, DOE is proposing to specify the following frame-size criteria to describe the electric motors proposed for inclusion in scope under 10 CFR part 431 subpart B as SNEMs: 2-Digit frame size for polyphase electric motors greater than or equal to one horsepower, which are not of an enclosed 56 frame size and which are not a small electric motor as defined at 10 CFR 431.442. For single-phase SNEMs and polyphase SNEMs less than one horsepower that are not small electric motors, DOE is not proposing any frame size requirements. (See Table III.5). These criteria would be reflected in a new definition in section 1.2 of appendix B.

TABLE III.5—PROPOSED FRAME SIZE REQUIREMENTS FOR SNEMS PROPOSED FOR INCLUSION IN SCOPE UNDER 10 CFR PART 431 SUBPART B

Phase	Horsepower	Frame size
Single-phase	≥0.25 hp	All.
Polyphase	≥0.25 and <1 hp	All.
Polyphase	≥1 hp	2-digit except 56 enclosed.

f. Horsepower

A motor horsepower indicates the output power that a motor can deliver at full-load. In the July 2017 RFI, DOE discussed the horsepower range for motors under consideration in this rulemaking. 82 FR 35468, 35470. See Table III.1. DOE used the existing scope for small electric motors and electric motors as a starting point, and reviewed market data to determine whether to revise the limits. In the July 2017 RFI, DOE identified 0.125 hp as the lowest rated motor horsepower, with multiple manufacturers offering a wide range of motors that meet the other scope of applicability criteria considered in Table III.1. *Id.* In the July 2017 RFI, DOE also identified an upper limit to rated motor horsepower corresponding to motors that meet the other scope of applicability criteria considered in Table III.1. (*i.e.,* single-phase motors inclusive of all frame sizes with up to 15 hp and polyphase 2-digit NEMA frame size motors, excluding those currently regulated at 10 CFR 431.25, up to 5 hp). *Id.*

In response to the July 2017 RFI, Advanced Energy commented that the 15 hp and 5 hp upper limits for single-phase and polyphase motors in two-digit frames were reasonable. Advanced Energy also commented that some of the sub-fractional horsepower motors may not have an opportunity for significant savings and commented that the cost of testing such motors exceeds their purchase price. Advanced Energy asserted that although the burden of testing can be avoided or minimized through the use of AEDMs, not all manufacturers use AEDMs. (Docket No. EERE–2017–BT–TP–0047; Advanced Energy, No. 25 at p. 1) The CA IOUs commented in support of DOE expanding the scope of the small electric motor test procedure to 0.125 hp through 15 hp from the current scope of 0.5 hp to 3 hp. The CA IOUs commented that having greater information about the small motor market has many benefits, such as aiding in the development of new incentive programs. (Docket No. EERE–2017–BT–TP–0047; CA IOUs, No. 26 at p. 2) NEMA opposed any changes to the current horsepower range of regulated motors. NEMA commented that special and definite purpose motors (specifically between 0.125—3 hp) are predominantly used as components of other regulated products and that regulating these motors would increase consumer costs, add burden on manufacturers, and would not lead to energy savings. (Docket No. EERE–2017–BT–TP–0047; NEMA, No. 24 at pp. 1, 6)

NEEA and NWPCC commented that DOE should include in the electric motor test procedure all motors that directly compete against each other in the 1 to 15 hp range so that such motors can be fairly compared against other motor designs. NEEA and NWPCC commented that some of these motor types and designs are known for having low efficiencies but are commonly chosen by consumers and original equipment manufacturers because they are cheaper than other motors. NEEA and NWPCC commented that the lack of coverage by the electric motors test procedure and standard is giving competitive advantage to inefficient motor types and increasing operating costs for consumers. (NEEA and NWPCC, No. 6 at p. 3)

DOE proposes a lower limit of 0.25 hp for SNEMs proposed for inclusion in scope, which would be reflected in a new definition of ''SNEMs'' in section 1.2 of appendix B. The proposed lower horsepower limit corresponds to the scope of the small electric motor test procedure in subpart X and would ensure that the efficiency levels of competing motor topologies in the same horsepower range can be compared. DOE does not propose to specify an upper limit, as the criteria specified in the proposed definition of ''SNEMs'' inherently limits the range of horsepower sizes of equipment meeting this definition. Single-phase motors are inherently limited in horsepower due to the limitations of residential electrical power service.[23] The proposed frame size specification for polyphase motors (two-digit NEMA frame size or IEC metric equivalent) inherently provides a limitation on the physical size and rated horsepower of the motor, as described in the July 2017 RFI. 82 FR 35468, 35470. Based on a review of manufacturer catalog data, DOE found that single-phase motors, inclusive of all frame sizes, exist up to 15 hp. DOE also found that polyphase 2-digit NEMA frame size motors exist up to 5 hp. *Id.* The discussion regarding the potential regulation of ''SNEMs'' that are components of other regulated products is discussed in section III.A.10.

g. Enclosure Construction

In the July 2017 RFI, DOE discussed motor enclosure construction, which includes open and enclosed construction and certain subcategories such as open drip proof, totally enclosed non-ventilated, and totally enclosed air-over motors. 82 FR 35468, 35472. Enclosure construction characterizes both the level of ingress protection (*i.e.,* protection from dust or liquids) and the cooling method (such as active air cooling via an integral fan or passive cooling via natural convection). *Id.*

Similar to 10 CFR 431.25, DOE proposes to include SNEMs with open and enclosed constructions under electric motors; *i.e.,* without differentiating by enclosure type, except to exclude motors that are an enclosed 56 NEMA frame size (or IEC metric equivalent) to avoid overlapping with existing regulations at 10 CFR part 431 subpart B and subpart X. The exclusion of enclosed 56 NEMA frame size would be reflected in a new definition in section 1.2 of appendix B. In addition, liquid-cooled electric motors would be excluded from the scope of the test procedure, as described in section III.A.9. Furthermore, DOE proposes to include air-over electric motors as discussed in section III.A.3 of this document.

h. Topology

Section 340(13)(G) of EPCA, as amended by the Energy Independence and Security Act of 2007 (Pub. L. 110–140; EISA 2007) 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)) When DOE codified the EISA 2007 definition of ''small electric motor'' into the CFR, it added ''including IEC metric equivalent motors,'' clarifying and explicitly indicating that IEC equivalent motors meet the definition of small electric motor. 10 CFR 431.442 In a final rule published on March 9, 2010 (''March 2010 Final Rule''), DOE interpreted the term ''NEMA general purpose alternating current single-speed induction motor'' as referring to elements within paragraph MG 1–1.05 of NEMA MG 1–1987, which provides a list of characteristics for determining whether a particular motor is a general purpose alternating current motor (see Table III.6). 75 FR 10874, 10882–10886. On June 17, 2014, DOE issued a guidance document that clarifies DOE's interpretation of each of these characteristics.[24]

TABLE III.6—CHARACTERISTICS OF GENERAL PURPOSE MOTORS

General Purpose Motor Performance Requirements (paragraph MG 1–1.05 of NEMA MG 1–1987)
(1) Built with an open construction;
(2) Rated for continuous duty;
(3) Incorporates the service factor in MG 1–12.47 of MG 1–1987;
(4) Uses insulation that satisfies at least the minimum Class A insulation system temperature rise specifications detailed in MG 1–12.42 of MG 1–1987;
(5) Designed in standard ratings;
(6) Has standard operating characteristics;
(7) Has standard mechanical construction;
(8) Designed for use under usual service conditions; and
(9) Is not restricted to a particular application.

[23] Residential electric power service is typically provided at 100 to 200 amps total for the entire residence, with individual circuits typically sized at 15–30 amps, up to a maximum of around 60 amps for special use cases. A 60-amp circuit at 240V could theoretically accommodate a maximum motor size of around 15 hp.

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

In the March 2010 Final Rule, DOE identified six categories of AC single-speed induction motors: Split-phase, shaded-pole, capacitor-start (both capacitor-start induction-run (''CSIR'') and capacitor-start capacitor-run (''CSCR'')), permanent-split capacitor (''PSC''), and polyphase. 75 FR 10874, 10883. Table III.7 describes each of these motor types.

TABLE III.7—SINGLE-SPEED AC INDUCTION MOTOR TOPOLOGIES

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

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

Of these six motor types, DOE established that split-phase, shaded-pole, and PSC motors did not meet the definition of small electric motor (based on the performance requirements of general purpose motors as listed in Table III.6) and therefore were not addressed by the test procedure at 10 CFR 431.444. *Id.*

EPCA does not define ''electric motor,'' and DOE's authority to regulate this equipment, unlike that for small electric motors, is not restricted to general purpose motors as defined in NEMA MG–1 1987. (*See* 42 U.S.C. 6311(13)) DOE proposes to expand the applicability of the test procedure to include electric motors that are generally considered SNEMs but that do not meet the general purpose requirements of NEMA MG1–1987 specified in the definition of ''small electric motor.'' DOE is proposing that all six induction motor topologies described in Table III.7 would be included as SNEMs if they meet all other criteria (*e.g.,* duty, single-speed, etc.) as listed in Table III.4 (*i.e.,* DOE is not proposing to specifically specify these SNEM topologies in the ''Scope'' section of appendix B, but rather to specify coverage through other motor features and characteristics as listed in Table III.4). DOE notes that all motors in Table III.7 were presented in the July 2017 RFI as primary motor topologies for which DOE was considering standards and test procedures. 82 FR 35468, 35471.

In addition, by covering these six-topologies, the proposed test procedure would apply to general-purpose, definite-purpose, and special-purpose motors, as defined in NEMA MG 1–2016, paragraphs 1.11 and 1.15. (*See also* 42 U.S.C. 6311(13)(C)-(D) (defining the terms ''definite-purpose motor'' and ''special-purpose motor,'' respectively)) Definite- and special-purpose motors are designed for a particular application (*e.g.,* washdown duty motors) and incorporate features that are not included in general purpose motors (*e.g.,* contact seals). DOE notes that certain definite- and special-purpose motors would require additional testing instructions beyond what industry standards specify. Section III.L discusses these definite- and special-purpose motors and potential additional testing instructions.[25]

7. AC Induction Inverter-Only Electric Motors

The current electric motor test procedures apply to AC induction motors except for those AC induction motors that are ''inverter-only electric motors.'' [26] These motors are an exempted category of electric motors listed at 10 CFR 431.25(l)(5).[27] This section discusses inverter-only electric motors that are AC induction motors. Section III.A.8 discusses inverter-only electric motors that are not AC induction motors.

In the December 2013 Final Rule, DOE found that testing an inverter-only motor presented multiple difficulties. 78 FR 75962, 75988. Inverter-only motors can be operated at a continuum of speeds, with no established speed testing profile; and the motors may be optimized for different waveforms, which have no established testing standards. Further, without extensive study it would be difficult to generate meaningful test results for products that may be designed for a wide variety of operating inputs. Additionally, at the time, DOE established that the high frequency power signals may be difficult to measure accurately without specialized equipment that testing

[25] Both definite purpose electric motor and special purpose electric motors cannot be used in most general purpose applications. The main difference between definite purpose electric motor and special purpose electric motors is that definite purpose electric motor are designed to standard ratings with standard operating characteristics or standard mechanical construction (as specified in NEMA MG1–2016) while special purpose electric motor are designed with special operating characteristics or special mechanical construction. Section III.L discusses additional testing instructions for the following categories of electric motors: (1) Brake electric motors; (2) close-coupled pump electric motors and electric motors with single or double shaft extensions of non-standard dimensions or design; (3) electric motors with non-standard endshields or flanges; (4) electric motors with non-standard bases, feet or mounting configurations; (5) electric motors with a separately-powered blower; (6) immersible electric motors; (7) partial electric motors; and (8) vertical electric motors and electric motors with bearings incapable of horizontal operation.

[26] NEMA MG–1 2016, paragraph 30.2.1.5 defines the term ''control'' for motors receiving AC power, as ''devices that are also called inverters and converters. They are electronic devices that convert an input AC or DC power into a controlled output AC voltage or current''. Converters can also be found in motors that receive DC power and also include electronic devices that convert an input AC or DC power into a controlled output DC voltage or current. See section III.B.3 of this NOPR.

[27] DOE defines an ''inverter-only electric motor'' as an electric motor that is capable of rated operation solely with an inverter, and is not intended for operation when directly connected to polyphase, sinusoidal line power.'' 10 CFR 431.12 DOE notes that more generally, the requirement to operate with an inverter also means that that inverter-only motors are not intended for operation when directly connected to single-phase, sinusoidal line power or to DC power. See section III.B.3 of this NOPR.

laboratories may not possess. *Id.* Consequently, DOE provided an exemption for inverter-only electric motors from the energy conservation standards at 10 CFR 431.25 due to the absence of a reliable and repeatable method to test them for efficiency. 79 FR 30934, 30945.

Since the publication of the December 2013 Final Rule, the industry has developed several methods to test inverter-only motors, as discussed further in section III.D.3. Therefore, DOE proposes to include within the scope of the test procedure AC induction inverter-only electric motors that meet the criteria listed at 10 CFR 431.25(g) and in Table III.4 of this NOPR. As noted, were DOE to include induction inverter-only electric motors within the scope of the test procedure, such electric motors would not be required to be tested according to the DOE test procedure until such time as DOE establishes energy conservation standards for induction inverter-only electric motors. If manufacturers voluntarily make representations regarding the energy consumption or cost of energy of such electric motors, however, they would be required to test according to the DOE test procedure and sampling requirements.

DOE requests comments on its proposal to add test procedure provisions for AC induction inverter-only electric motors. DOE seeks supporting information and justification for including or excluding AC induction inverter-only electric motors in the scope of the test procedure.

8. Synchronous Electric Motors

The current electric motors test procedures apply only to induction electric motors. 10 CFR 431.25(g)(1), appendix B, Note.

The ''induction motor'' criteria exclude synchronous electric motors from the scope. A ''synchronous electric motor'' is an electric motor in which the average speed of the normal operation is exactly proportional to the frequency of power supply to which it is connected, regardless of load. [28] In contrast, in an induction electric motor, the average speed of the normal operation is not proportional to the frequency of the power supply to which it is connected.[29] For example, a 4-pole synchronous electric motor will rotate at 1800 rpm when connected to 60 Hz power even when the load varies; whereas a 4-pole induction electric motor in the same setup will slow down as load increases.

Synchronous electric motors can operate either direct-on-line (connected directly to the power supply) or as inverter-fed (connected to an inverter). Some inverter-fed electric motors require being connected to an inverter to operate (*i.e.,* inverter-only electric motors) while others are capable of operating both direct-on-line or connected to an inverter (*i.e.,* inverter-capable electric motors).

In the July 2017 RFI, DOE presented a list of motor topologies for which it was considering test procedures. Specifically, DOE identified the following inverter-fed synchronous electric motor topologies that are not included in the current test procedures for electric motors or small electric motors: Line start permanent magnet (''LSPM''); [30] permanent magnet AC (''PMAC,'' also known as permanent magnet synchronous motor (''PMSM'') or brushless AC); switched reluctance (''SR''); synchronous reluctance motors (''SynRMs''); and electronically commutated motor (''ECMs'').[31] 82 FR 35468, 35471 Typically, these motor technologies are used as higher efficiency replacements for single-speed induction motors.

LSPM motors can be connected directly to 60 Hz line power and started with a squirrel cage rotor (similar to an induction electric motor) but can also be paired with an inverter to start the motor or have variable-speed capability enabled by integrated electronic controls. SynRMs, SR motors, and PMAC motors are designed for variable-speed operation, and must be controlled by an inverter to be able to start the motor.

ECMs, also known as a brushless DC electric motor, are synchronous motors that operate on DC power via an inverter connected to an AC power supply. ECMs typically consist of an integrated permanent magnet DC motor and an integrated variable frequency drive (''VFD''), which provides speed control capability.

In response to the July 2017 RFI, the Joint Advocates recommended that the test procedures should be (1) applied to a broad range of motor technologies and categories to enable consumers to make fair comparisons; (2) be based on existing test methods where possible; and (3) reflect the relative power consumption over a range of points. The Joint Advocates commented that DOE should prioritize establishing test procedures for primary topologies based on sales, specifically DC motors. (Docket No. EERE–2017–BT–TP–0047, Joint Advocates, No. 27 at pp. 2–3)

The CA IOUs commented that DOE should establish test procedures for the additional motor categories considered in the July 2017 RFI. (CA IOUs, No. 3 at p. 3–5) Specifically, regarding advanced motor technologies, the CA IOUs commented in support of including motors using frequency converters that can be tested in accordance with IEC 60034–2–3:2020 ''Rotating electrical machines—Part 2–3: Specific test methods for determining losses and efficiency of converter-fed AC motors'' (''IEC 60034–2–3:2020''); IEC 61800–9–2:2017 ''Adjustable speed electrical power drive systems—Part 9–2: Ecodesign for power drive systems, motor starters, power electronics and their driven applications—Energy efficiency indicators for power drive systems and motor starters'' (IEC 61800–9–2:2017); and other industry test standards applicable to DC motors such as IEC 60034–2–1:2014. The CA IOUs commented that DOE should establish test procedures for advanced motor technologies that are interchangeable with electric motors currently subject to DOE test procedures. The CA IOUs commented that this would reduce market confusion by providing comparable ratings for substitutable motors and motor systems. The CA IOUs stated that including advanced motor technologies in the scope of the test procedure would ensure that end users are provided with ratings from a uniform test method that can be used to compare and select between electric motors of competing technologies that would ultimately be used in the same end-use applications. Specifically, the

[28] NEMA MG 1–2016 paragraph 1.17.3.4 defines a ''synchronous machine'', as an ''alternating-current machine in which the average speed of the normal operation is exactly proportional to the frequency of the system to which it is connected.''

[29] NEMA MG 1–2016 paragraph 1.17.3.3 defines an ''induction machine'', as an ''an asynchronous machine that comprises a magnetic circuit interlinked with two electric circuits or sets of circuits, rotating with respect to each other and in which power is transferred from one circuit to another by electromagnetic induction.''

[30] Advanced Energy noted that LSPM motors are synchronous motors. Though these motors have a squirrel cage, they do not operate on the principle of induction as is attributed to regular induction motors. The cage is simply for starting the motor and these motors are essentially synchronous motors. (Docket No. EERE–2017–BT–TP–0047; Advanced Energy, No. 25 at p. 2) This technology is described further in Chapter 3 of the technical support document accompanying the May 2014 Final Rule: During the motor transient start up, the squirrel cage in the rotor contributes to the production of enough torque to start the rotation of the rotor, albeit at an asynchronous speed. When the speed of the rotor approaches synchronous speed, the constant magnetic field of the permanent magnet locks to the rotating stator field, thereby pulling the rotor into synchronous operation. (Docket No. EERE–2010–BT–STD–0027–0108)

[31] All 5 topologies are referred to as ''advanced motor technologies'' and represent motor technologies that have been more recently introduced on the market and have variable speed capabilities.

CA IOUs commented that DOE should expand the scope of existing test procedure to include SR, SynRM, PMAC, PMSMs, and motors with an integrated VFD. The CA IOUs provided additional information to demonstrate the technical feasibility and market availability of these advanced motor technologies. (CA IOUs, No. 3 at p. 3–5)

The Efficiency Advocates and NEEA and NWPCC similarly commented that DOE should establish test procedures for the additional motor categories considered in the July 2017 RFI. In addition, the Efficiency Advocates and NEEA and NWPCC similarly urged DOE to consider test procedure modifications to account for electric motors with advanced motor technologies. NEEA and NWPCC commented that including a broad a range of motor technologies, designs, and categories in the test procedure enables consumers to make fair comparisons. The Efficiency Advocates added that the scope of the test procedure should enable any new motor technology to be rated on a fair basis with existing motor technologies. (Efficiency Advocates, No. 5 at pp. 2–3; NEEA and NWPCC, No. 6 at pp. 2–4)

DOE has identified new industry standards since its December 2013 Final Rule that apply to synchronous electric motors (see section III.D.3). Accordingly, DOE proposes to include within the scope of the test procedure synchronous electric motors with the characteristics listed in Table III.8. These criteria would be specified in a new definition in section 1.2 of appendix B, titled ''Definitions.''

TABLE III.8—SYNCHRONOUS ELECTRIC MOTORS PROPOSED FOR INCLUSION IN SCOPE

Criteria number	Description
1	Are not dedicated purpose pool pump motors as defined at 10 CFR 431.483.
2	Are synchronous electric motors;.
3	Are rated for continuous duty (MG 1) operation or for duty type S1 (IEC);.
4	Capable of operating on polyphase or single-phase alternating current 60-hertz (Hz); sinusoidal line power (with or without an inverter);.
5	Are rated 600 volts or less;.
6	Have a 2-, 4-, 6-, 8-, 10-, or 12-pole configuration.
7	Produce at least 0.25 horsepower (hp) (0.18 kilowatt (kW)) but not greater than 750 hp (373 kW).

Section III.D.3 discusses industry standards that DOE proposes to incorporate by reference and use to test synchronous electric motors.

DOE requests comments on its proposal to add synchronous electric motors to the scope of the test procedure. Specifically, DOE request comments on whether the criteria listed in Table III.8 accurately reflect DOE's intent to propose to include LSPM motors; PMAC motors; SR motors; SynRMs; and ECMs in the scope of the proposed test procedure. To the extent that the criteria listed in Table III.8 should be revised, DOE seeks supporting information and justification for the suggested revision.

9. Exemptions

DOE proposes to include within the scope of the test procedure previously exempted air-over electric motors, submersible electric motors and inverter-only electric motors at 10 CFR 431.25(l), as discussed in sections III.A.3, III.A.4 and III.A.7, respectively. However, in this NOPR, DOE proposes to continue to exempt (1) component sets of an electric motor; and (2) liquid-cooled electric motors. 10 CFR 431.25(l)(2) and (3).

a. Component Sets

Electric motors within the scope of the DOE test procedure typically incorporate a number of components that may include: A rotor, stator, stator windings, stator frame, endshields, bearings, and a shaft. Any combination of these parts that does not form an operable electric motor is considered a component set of an electric motor. An operable motor is engineered for performing in accordance with nameplate ratings. Motor component sets may be sold to third parties with the intention of mounting motor components inside equipment that would provide the necessary elements to allow the component set to operate similarly to a standalone electric motor. For example, a motor component set consisting of a rotor, stator, and stator windings may be purchased and installed inside equipment that provides the structural support and interfacing components necessary to allow performance consistent with that of a complete, operable motor. Third parties may also purchase component sets with the intention of assembling complete, operable motors, in which case the third party would be responsible for certifying that the assembled motor meets any applicable standards.

In the December 2013 Final Rule, DOE determined that the additional parts required to construct an operable motor from a component set may be costly, complex, and are often only provided by a motor manufacturer. 78 FR 75962, 75987. Subsequently, DOE determined that a single testing laboratory would have insurmountable difficulty machining motor parts, assembling the parts into an operable machine, and testing the motor in a way that would be manageable, consistent, and repeatable by other testing laboratories. *Id.* At this time, DOE is unaware of an industry test procedure or instructions that could facilitate the consistent testing of component sets. Therefore, DOE proposes to maintain the existing exemption for component sets of an electric motor at 10 CFR 431.25(l)(2).

DOE requests comment on maintaining the existing exemption of component sets of an electric motor from the scope of the test procedure.

b. Liquid-Cooled Electric Motors

Liquid-cooled motors use liquid (or liquid-filled components) to facilitate heat dissipation but are not submerged in liquid during operation. In the December 2013 Final Rule, DOE described a liquid-cooled electric motor as a motor that circulates one or a combination of several liquids into and around the motor and frame to dissipate heat. 78 FR 75962, 75987. This circulation of liquid for cooling could impact the operating temperature of the motor and, by extension, its efficiency. Further, DOE did not identify any standardized methodology for testing the energy efficiency of a liquid-cooled motor. *Id.* Consequently, in the May 2014 Final Rule, DOE exempted liquid-cooled electric motors from the energy conservation standards at 10 CFR 431.25(l)(3) due to the absence of a reliable and repeatable method to test them for efficiency. 79 FR 30933, 30945. DOE defines a ''liquid-cooled electric motor'' as a motor that is cooled by liquid circulated using a designated cooling apparatus such that the liquid or liquid-filled conductors come into direct contact with the parts of the motor. 10 CFR 431.12.

In response to the July 2017 RFI, Advanced Energy commented that it did not support regulating motors that are manufactured for highly specialized applications, such as liquid-cooled motors. (Advanced Energy, EERE–2017–BT–TP–0047, No. 25 at p. 6) DOE has preliminarily determined that the testing difficulties previously described for liquid-cooled motors, including lack of a repeatable and reliable test method, still exist. Therefore, DOE continues to propose to exempt liquid-cooled motors from the scope of applicability of this test procedure. However, to more clearly distinguish the exempted liquid-cooled electric motors from submersible electric motors (which DOE is proposing to include within scope, as discussed in section III.A.4), DOE proposes to update the definition for ''liquid-cooled electric motors,'' as described in section III.B.5.

DOE requests comment on maintaining the existing exemption of liquid-cooled electric motors from the scope of the test procedure.

10. Motor Used as a Component of a Covered Product or Equipment

EPCA provides that no standard prescribed for small electric motors (those regulated in 10 CFR part 431, subpart X) shall apply to any such motor that is a component of a covered product under EPCA or of covered equipment under EPCA. (42 U.S.C. 6317(b)(3)) EPCA does not establish any such prohibition for electric motors and suggests the opposite. See 42 U.S.C. 6313(b)(1) (providing that standards for electric motors be applied to electric motors manufactured ''alone or as a component of another piece of equipment'').

NEMA, McMillan Electric Company, Detech, and Lennox International indicated that they do not support regulating motors that are components of covered products or equipment, but instead support a finished-product approach to energy efficiency regulations.[32] (Docket No. EERE–2017–BT–TP–0047, NEMA, No. 24 at p. 1; McMillian Electric Company, No. 16 at p. 1; Detech, no. 18 at p. 1; Lennox, No. 22 at p. 1–2) In addition, AHAM and AHRI commented that they oppose DOE requiring testing of motors that only enter commerce as components of another product, including special and definite purpose motors. AHAM and AHRI commented that is too difficult to uniformly test such motors that are designed and destined for specific applications and that are vastly different from one-another. AHAM and AHRI asserted that developing such test procedures would be difficult, if not impossible, and that complying with them would be difficult and costly to manage. (Docket No. EERE–2017–BT–TP–0047, AHAM and AHRI, No. 21 at p. 5)

At this time, DOE is not proposing to exclude from its test procedure's scope those motors used as a component of a covered product or covered equipment. DOE notes that the current electric motors test procedure applies to definite purpose and special purpose electric motors, and DOE is not aware of any technical issues with testing such motors using the current DOE test procedure. Furthermore, DOE is proposing additional test instructions for the additional electric motors proposed in scope, including testing instructions for special and definite purpose motors. (See section III.L for further discussion).

DOE requests comment on whether any electric motors, when used as components of covered products or covered equipment, are unable to be tested under the DOE test procedure absent modification to the test procedure. If so, DOE requests information on what such modifications should be and why.

B. Definitions

DOE is proposing to modify 10 CFR 431.12 by either modifying or adding certain definitions applicable to electric motors.

1. Updating IEC Design N and H Motors Definitions and Including New Definitions for IEC Design N and H ''E'' and ''Y'' Designations

As discussed in section III.A.1, DOE proposes to clarify that IEC Design HE, HY, HEY, NE, NY, and NEY are already covered equipment. Accordingly, DOE proposes to add definitions for these designs in 10 CFR 431.12 based on the definitions of IEC Design H and N provided in 10 CFR 431.12, and the definitions for IEC Design HE, HY, HEY, NE, NY, and NEY provided in IEC 60034–12:2016. DOE proposes to include these ''E'' and/or ''Y'' variants in each instance where IEC Design N and H are currently referenced in 10 CFR 431.25. In addition, DOE proposes to amend the current definitions for IEC Design H and N (which currently reference and are based on IEC 60034–12 Edition 2.1 2007–09) to be consistent with the latest version of that industry standard—IEC 60034–12:2016.

In reviewing IEC 60034–12:2016, DOE identified the following updates as it relates to the definitions: (1) For IEC Design N and Design H motors, the lower end of the rated output power range was reduced from 0.4 kW (0.5 hp) to 0.12 kW (1⁄6 hp), and corresponding new limits for minimum values of torque and external moment of inertia were added to these power ratings; and (2) the limits for locked rotor apparent power for motors with protection type ''e'' were replaced by a reference to IEC 60079–7:2015 ''Explosive atmospheres—Part 7: Equipment protection by increased safety ''e'' '' (''IEC 60079–7:2015''). IEC protection type ''e'' denotes motors to be used in hazardous environments and minimizes air-gap sparking; see section III.C.1 for further description. DOE notes that the update to the lower end of the rated output power range would not affect the applicability of the energy conservation standards, as discussed in section III.C.1.

DOE proposes updating the definitions for IEC Design H and N, consistent with the updates in IEC 60034–12:2016, as follows:

IEC Design H motor means an electric motor that:

(1) Is an induction motor designed for use with three-phase power;

(2) Contains a cage rotor;

(3) Is capable of direct-on-line starting;

(4) Has 4, 6, or 8 poles;

(5) Is rated from 0.12 kW to 1600 kW at a frequency of 60 Hz; and

(6) Conforms to sections 9.1, 9.2, and 9.3 of the IEC 60034–12:2016 (incorporated by reference, see § 431.15) specifications for starting torque, locked rotor apparent power, and starting requirements, respectively.

IEC Design N motor means an electric motor that:

(1) Is an induction motor designed for use with three-phase power;

(2) Contains a cage rotor;

(3) Is capable of direct-on-line starting;

(4) Has 2, 4, 6, or 8 poles;

(5) Is rated from 0.12 kW to 1600 kW at a frequency of 60 Hz; and

(6) Conforms to sections 6.1, 6.2, and 6.3 of the IEC 60034–12:2016 (incorporated by reference, see § 431.15) specifications for torque characteristics, locked rotor apparent power, and starting requirements, respectively. If a motor has an increased safety designation of type 'e', the locked rotor apparent power shall be in accordance with the appropriate values specified in IEC 60079–7:2015. (incorporated by reference, see § 431.15)

[32] A finished-product approach would consider establishing energy conservation standards at the larger equipment level (*e.g.,* HVAC equipment) rather than at the component level (*e.g.,* the motor).

Furthermore, DOE proposes to add the following definitions to 10 CFR 431.12:

IEC Design HE means an electric motor that

(1) Is an induction motor designed for use with three-phase power;

(2) Contains a cage rotor;

(3) Is capable of direct-on-line starting;

(4) Has 4, 6, or 8 poles;

(5) Is rated from 0.12 kW to 1600 kW at a frequency of 60 Hz; and

(6) Conforms to section 9.1, Table 3, and section 9.3 of the IEC 60034–12:2016 (incorporated by reference, see § 431.15) specifications for starting torque, locked rotor apparent power, and starting requirements, respectively.

IEC Design HY means an electric motor that

(1) Is an induction motor designed for use with three-phase power;

(2) Contains a cage rotor;

(3) Is capable of direct-on-line starting;

(4) Has 4, 6, or 8 poles;

(5) Is rated from 0.12 kW to 1600 kW at a frequency of 60 Hz; and

(6) Conforms to section 5.7, section 9.2 and section 9.3 of the IEC 60034–12:2016 (incorporated by reference, see § 431.15) specifications for starting torque, locked rotor apparent power, and starting requirements, respectively.

IEC Design HEY means an electric motor that

(1) Is an induction motor designed for use with three-phase power;

(2) Contains a cage rotor;

(3) Is capable of direct-on-line starting;

(4) Has 4, 6, or 8 poles;

(5) Is rated from 0.12 kW to 1600 kW at a frequency of 60 Hz; and

(6) Conforms to section 5.7, Table 3 and section 9.3 of the IEC 60034–12:2016 (incorporated by reference, see § 431.15) specifications for starting torque, locked rotor apparent power, and starting requirements, respectively.

IEC Design NE means an electric motor that

(1) Is an induction motor designed for use with three-phase power;

(2) Contains a cage rotor;

(3) Is capable of direct-on-line starting;

(4) Has 2, 4, 6, or 8 poles;

(5) Is rated from 0.12 kW to 1600 kW at a frequency of 60 Hz; and

(6) Conforms to section 6.1, Table 3 and section 6.3 of the IEC 60034–12:2016 (incorporated by reference, see § 431.15) specifications for starting torque, locked rotor apparent power, and starting requirements, respectively.

IEC Design NY means an electric motor that

(1) Is an induction motor designed for use with three-phase power;

(2) Contains a cage rotor;

(3) Is capable of direct-on-line starting;

(4) Has 2, 4, 6, or 8 poles;

(5) Is rated from 0.12 kW to 1600 kW at a frequency of 60 Hz; and

(6) Conforms to section 5.4, section 6.2 and section 6.3 of the IEC 60034–12:2016 (incorporated by reference, see § 431.15) specifications for starting torque, locked rotor apparent power, and starting requirements, respectively.

IEC Design NEY means an electric motor that

(1) Is an induction motor designed for use with three-phase power;

(2) Contains a cage rotor;

(3) Is capable of direct-on-line starting;

(4) Has 2, 4, 6, or 8 poles;

(5) Is rated from 0.12 kW to 1600 kW at a frequency of 60 Hz; and

(6) Conforms to section 5.4, Table 3 and section 6.3 of the IEC 60034–12:2016 (incorporated by reference, see § 431.15) specifications for starting torque, locked rotor apparent power, and starting requirements, respectively.

DOE seeks comments on the proposed updates to the definitions for IEC Design H, and IEC Design N, and the proposed additional definitions for IEC Design HE, HY, HEY, NE, NY and NEY.

2. Updating Definitions to Reference NEMA MG1–2016 With 2018 Supplements

A number of definitions in 10 CFR 431.12 incorporate references to specific sections of NEMA MG 1–2009 to characterize the construction and operation of different categories of electric motors. DOE is proposing to revise these definitions to update the current NEMA MG 1 references to the most recent edition of that industry standard, NEMA MG 1–2016 with 2018 Supplements. These reference updates would align DOE's regulatory definitions with the current industry standard.

Among the definitions at 10 CFR 431.12 that reference NEMA MG 1–2009, the following definitions include references to sections of NEMA MG 1–2009 that have not changed between the 2009 and 2016 publications of the standard: ''electric motor with encapsulated windings,'' ''electric motor with moisture resistant windings,'' ''electric motor with sealed windings,'' ''general purpose electric motor (subtype I),'' and ''general purpose electric motor (subtype II).''

The following definitions reference provisions of NEMA MG 1–2009 that have changed between the 2009 and 2016 versions: ''definite purpose motor,'' ''definite purpose electric motor,'' ''general purpose electric motor,'' ''NEMA Design A Motor,'' ''NEMA Design B Motor,'' ''NEMA Design C motor,'' and ''nominal full-load efficiency.'' DOE has initially determined that the changes in NEMA MG 1–2016 with 2018 Supplements do not substantively change these definitions. DOE initially concludes that the updates to ''definite purpose motor'', ''definite purpose electric motor'', and ''general purpose electric motor'' would not affect the DOE test procedures or energy conservation standards for electric motors manufactured on or after June 1, 2016, because as of that date the energy conservation standards no longer differentiate between ''general purpose'' motors and ''definite purpose'' motors. 10 CFR 431.25(h) and (i).

The definitions for ''NEMA Design A motor,'' ''NEMA Design B motor,'' and ''NEMA Design C motor'' at 10 CFR 431.12 reference tables of locked-rotor current in sections 12.35.1 and 12.35.2 of NEMA MG 1–2009. NEMA MG 1–2016 with 2018 Supplements revise these tables by adding a column for ''Locked-Rotor kVA Code'' and a footnote regarding a tolerance that may be applied to the locked-rotor current values based on the associated Locked-Rotor kVA Code.[33] Section 10.37 of NEMA MG 1–2016 with 2018 Supplements provides the applicable range of kVA per horsepower for each locked-rotor kVA code that would be used to calculate the locked-rotor current tolerances required by the footnote. These definitions also reference other sections in NEMA MG 1–2009, each of which remains unchanged in NEMA MG 1–2016 with 2018 Supplements. The addition of the column for ''Locked-Rotor kVA Code'' is not expected to impact the applicability of test procedures or energy conservation standards for electric motors. DOE notes that the existing tolerance presented in section 10.37 of NEMA MG1–2009 remains unchanged in NEMA MG1–2016 with 2018 Supplements and its adoption by DOE would also not impact the scope of electric motors that are subject to energy

[33] The ''Locked-Rotor kVA Code'' is a letter that appears on the nameplate of an alternating-current motor to show its range of locked-rotor kilo-volt-ampere (kVA) per horsepower. The letter designations for locked rotor kVA per horsepower are given in Section 10.37 of NEMA MG 1–2016. For example, the letter ''N'' corresponds to a range of locked rotor kVA per horsepower between 11.2 and 12.5.

conservation standards and test procedures. See 85 FR 34111, 34114.

The definition for ''nominal full-load efficiency'' at 10 CFR 431.12 references Table 12–10 of NEMA MG 1–2009, which provides a list of nominal efficiencies and associated minimum motor efficiencies based on a 20 percent loss difference. Table 12–10 in NEMA MG 1–2009 lists nominal efficiency ratings ranging from 50.5 to 99.0, whereas Table 12–10 in NEMA MG 1–2016 with 2018 Supplements lists nominal efficiency ratings ranging from 34.5 to 99.0. The nominal efficiency ratings (and associated minimum efficiencies) in the range of 50.5 to 99.0 did not change between the two versions of the standard. The nominal full-load efficiency requirements specified by the energy conservation standards for electric motors at 10 CFR 431.25 are efficiency values ranging from 74.0 to 96.2; therefore, the addition of nominal efficiency ratings ranging from 34.5 to 50.5 in NEMA MG 1–2016 with 2018 Supplements does not impact the applicability of test procedures or energy conservation standards for electric motors. *Id.*

In response to the June 2020 RFI, NEMA commented in support of updating these definitions to NEMA MG1 2016 with 2018 Supplements and agreed that it would not cause an impact to testing burden or test results. (NEMA, No. 2 at p. 2) CA IOUs supported DOE's proposal to update the definitions. (CA IOUs, No. 3 at p. 1)

DOE tentatively concludes that updating the NEMA MG 1 references to NEMA MG 1–2016 with 2018 Supplements would not alter the measured efficiency of electric motors, and would not result in additional test burden. Therefore, DOE proposes to revise the definitions to update its NEMA MG 1 references to NEMA MG 1–2016 with 2018 Supplements.

DOE seeks comments on its assessment that updating the NEMA MG 1 references in the DOE definitions to NEMA MG 1–2016 with 2018 Supplements would not substantially change the definitions currently prescribed in 10 CFR 431.12. DOE also seeks comment on whether the proposed updates would alter the measured efficiency of electric motors.

3. Inverter, Inverter-Only, and Inverter-Capable

DOE defines an ''inverter-only electric motor'' as an electric motor that is capable of rated operation solely with an inverter, and is not intended for operation when directly connected to polyphase, sinusoidal line power.'' DOE also defines an ''inverter-capable electric motor'' as an ''electric motor designed to be directly connected to polyphase, sinusoidal line power, but that is also capable of continuous operation on an inverter drive over a limited speed range and associated load''. 10 CFR 431.12 Inverter-only and inverter-capable electric motors can be sold with or without an inverter.

In addition to not being designed for operation when directly connected to polyphase, sinusoidal power, inverter-only motors are also not designed for operation when directly connected to single-phase, sinusoidal line power or to DC power. To provide a more complete definition, DOE proposes to revise the definition of inverter-only electric motor as follows: ''as an electric motor that is capable of continuous operation solely with an inverter, and is not designed for operation when directly connected to AC sinusoidal or DC power supply.'' Similarly, DOE proposes to revise the definition of an inverter-capable electric motor as follows: ''an electric motor designed to be directly connected to AC sinusoidal or DC power, but that is also capable of continuous operation on an inverter drive over a limited speed range and associated load.''

As previously discussed, paragraph 30.2.1.5 of NEMA MG–1 2016 with 2018 Supplements defines the term ''control'' for motors receiving AC power, as ''devices that are also called inverters and converters. They are electronic devices that convert an input AC or DC power into a controlled output AC voltage or current''. Converters can also be found in motors that receive DC power and also include electronic devices that convert an input AC or DC power into a controlled output DC voltage or current. To support the definition of ''inverter-only motor,'' DOE proposes to define an inverter as ''an electronic device that converts an input AC or DC power into a controlled output AC or DC voltage or current. An inverter may also be called a converter.''

DOE seeks comments on the proposed definitions of ''inverter-only electric motor'' ''inverter-capable electric motor'' and ''inverter''. If these definitions should be revised, DOE requests supporting information and justification for these revisions.

4. Air-Over Electric Motors

As discussed in section III.A.3, DOE is proposing to include within the scope of the test procedure air-over electric motors. DOE defines the term ''air-over electric motor'' as: ''an electric motor rated to operate in and be cooled by the airstream of a fan or blower that is not supplied with the motor and whose primary purpose is providing airflow to an application other than the motor driving it.'' 10 CFR 431.12. In other words, air-over electric motors do not have a factory-attached fan and require a separate means of forcing air over the frame of the motor. The external cooling maintains internal motor winding temperatures within the permissible temperature rise for the motor's insulation class or to a maximum temperature value specified by the manufacturer.[34] Without an external means of cooling, an air-over electric motor would overheat during continuous operation. Air-over motors can be found in direct-drive axial fans, blowers, and several other applications; for example, single-phase air-over motors are widely used in residential and commercial HVAC systems, appliances, and equipment as well as in agricultural applications.

In the July 2017 RFI, DOE noted that the absence of a fan is not a differentiating feature specific to air-over electric motors and that a revised definition may be needed to distinguish such motors from similarly constructed electric motors that are subject to the DOE test procedure. 82 FR 35468, 35472–35473. For example, there is little difference between a totally enclosed fan-cooled electric motor (''TEFC'') and a totally enclosed air-over electric motor (''TEAO''). A user could remove the fan on a TEFC electric motor, and then place the motor in an airstream of the application to obtain an air-over electric motor configuration. Further, other motors categories such as TENV electric motors do not have internal fans or blowers and are similar in construction to TEAO electric motors.[35]

In the July 2017 RFI, DOE identified that what differentiates air-over motors from non-air-over motors is that they require external cooling by a free flow of air to prevent overheating during continuous operation.[36] *Id.* The risk of overheating can be verified by observing whether the motor's temperature continuously rises during a rated load temperature test instead of stabilizing at

[34] Sections 12.42 and 12.43 of NEMA MG1–2016 with 2018 Supplements specifies the maximum temperature rises corresponding to four insulation classes (A, B, F, and H). Each class represents the maximum allowable operating temperature rise at which the motor can operate without failure, or risk of reducing its lifetime.

[35] TENV electric motors are ''built in a frame-surface cooled, totally enclosed configuration that is designed and equipped to be cooled only by free convection'' 10 CFR 431.12.

[36] Without the application of free flowing air, the internal winding temperatures of an air-over electric motor would exceed the maximum permissible temperature (*i.e.,* the motor's insulation class' permissible temperature rise or a maximum temperature value specified by the manufacturer).

the permissible temperature rise of the motor's insulation class or to a maximum temperature value specified by the manufacturer. During a rated load temperature test, the motor is loaded at the rated full load using a dynamometer until it is thermally stable.[37] A rated load temperature test is a test during which the motor is loaded at rated full-load by means of a dynamometer until it is thermally stable. Its purpose is to determine the temperature rise of certain parts of the machine above the ambient temperature when running at rated load. The current industry standards referenced by the existing DOE electric motors test procedure each contain provisions for a rated load temperature test.[38]

DOE further provided in the July 2017 RFI that specifying that the external cooling is obtained by a free flow of air is needed to differentiate air-over motors from totally-enclosed pipe-ventilated (''TEPV'') motors. TEPV motors are a category of electric motor that requires external cooling to operate, and the external cooling is directed on the motor via a duct or a pipe rather than a free flow of air.[39] *Id.* Accordingly, in the July 2017 RFI, DOE stated it was considering defining an air-over motor based on its inability to thermally stabilize without the application of external cooling by a free flow of air during a rated load temperature test. *Id*

In response to the 2017 RFI, Lennox commented that the definition of air-over motors at 10 CFR 431.12 was appropriate. (Docket No. EERE–2017–BT–TP–0047, Lennox, No. 22 at p. 4) NEMA commented that air-over motors could not be identified by physical and technical features alone but did not provide alternative means to identify them. (Docket No. EERE–2017–BT–TP–0047, NEMA, No. 24 at p. 6)

Advanced Energy commented that it would be difficult to differentiate air-over motors from TENV motors in terms of physical and/or external features. Advanced Energy commented that air-over motors can be defined by their inability to achieve a stable temperature under standard test conditions. Advanced Energy stated that thermal equilibrium is defined in the referenced test standards, but that DOE could add a definition as part of the air-over motor definition. Advanced Energy commented that the term ''rated temperature test'' should be replaced with ''rated load temperature test.'' (Docket No. EERE–2017–BT–TP–0047, Advanced Energy, No. 25 at pp. 4–5)

Advanced Energy asserted that that the term ''external cooling by a free flow of air'' used in the July 2017 RFI was ambiguous and that DOE should specify by a ''device or equipment not mechanically attached to the motor'' or ''forced cooling from a fan or blower not connected to the motor.'' Advanced Energy explained that some TEFC motors have external fans and therefore, such distinction is necessary. Advanced Energy recommended the following definition for air-over motors: A motor that does not reach thermal equilibrium (also known as ''thermal stability'') during a rated load temperature test according to test standards incorporated by reference, without the application of forced cooling by a free flow of air from an external device not mechanically connected to the motor. Advanced Energy commented that thermal equilibrium is already defined in the referenced industry test standards, but that DOE could add a definition as part of the air-over electric motor definition (Docket No. EERE–2017–BT–TP–0047, Advanced Energy, No. 25 at pp. 4–5).

Based on the preceding discussion, to differentiate air-over electric motors from TEFC electric motors with external fans connected to the motor, DOE proposes to define the air-over electric motor definition as an electric motor that does not reach thermal equilibrium during a rated load temperature test without the application of forced cooling by a free flow of air from an external device not mechanically connected to the motor. In addition, DOE does not propose to define thermal equilibrium, as this term is defined in the industry test procedure incorporated by reference.[40] The referenced definition specifies that thermal equilibrium is characterized by a load temperature test according to section 2 of appendix B.

In summary, DOE proposes to define an air-over electric motor as: ''an electric motor that does not reach thermal equilibrium (*i.e.,* thermal stability) during a rated load temperature test according to section 2 of appendix B, without the application of forced cooling by a free flow of air from an external device not mechanically connected to the motor''.

DOE requests comments (*i.e.,* supporting information and technical justification) on the proposed definition for an air-over electric motor—including technical information and support on whether and why the definition should be modified.

5. Liquid-Cooled Electric Motors

DOE defines a ''liquid-cooled electric motor'' as a motor that is cooled by liquid circulated using a designated cooling apparatus such that the liquid or liquid-filled conductors come into direct contact with the parts of the motor. 10 CFR 431.12.

DOE proposes to include submersible electric motors within scope of the test procedure while continuing to exclude liquid-cooled electric motors. Accordingly, DOE reviewed the existing definitions to ensure that the definitions provide an appropriate distinction between liquid-cooled electric motors and submersible electric motors, because both type of motors use liquid for cooling purposes. DOE notes that the definition for submersible electric motors, as described in section III.A.4 of this document is based on the premise of the electric motor intended to operate only when submerged in a liquid. The current definition for ''liquid-cooled electric motor,'' however, does not specify whether the electric motor must be submerged in a liquid to operate.

The December 2013 Final Rule discussed the general differences between these categories of electric motors. Specifically, the December 2013 Final Rule described ''liquid-cooled motors'' as electric motors that use liquid (or liquid-filled components) to facilitate heat dissipation, but are not submerged in liquid during operation. 78 FR 75962, 75975. In order to appropriately distinguish ''liquid-cooled electric motors'' from ''submersible electric motors,'' DOE proposes to define ''liquid-cooled electric motors'' as follows: As a motor that is cooled by liquid circulated using a designated

[37] Thermal stability (or thermal equilibrium) is defined as the condition in which the motor temperature does not change by more than 1 °C over 30 minutes or 15 minutes depending on the motor category. See Section 5.9.45 of IEEE 112–2017, Section 3.1. of CSA C390–10; Section 10.3.1.3 of IEEE 114–2010; Section 3 of CSA C747–09 (R2019); and Section 6.1.3.2.1 of IEC 60034–2–1.

[38] See Section 7.1.3 of CSA 390–10; Section 6.4 of CSA C747–09 (R2019); 7.1.3.2.1 of IEC 60034–2–3:2014; Section 5.9 of IEEE 112–2017; and Section 10 of IEEE 114–2010.

[39] DOE did not find any pipe-ventilated motors in the proposed scope of applicability of this test procedure but is aware that some motors may exist in such configurations. TEPV motors are cooled by supply air which is piped into the motor and ducted out of the motor. They are typically used to overcome heat dissipation difficulties and when air surrounding the motor is not clean (*e.g.,* dust).

[40] A ''rated load temperature test'' is a test during which the motor is loaded at rated full-load by means of a dynamometer until it is thermally stable. See Section 7.1.3 of CSA 390–10; Section 6.4 of CSA C747–09 (R2019); 7.1.3.2.1 of IEC 60034–2–3:2014; Section 5.9 of IEEE 112–2017; and Section 10 of IEEE 114–2010. The term ''thermal equilibrium'' (*i.e.,* thermal stability) is defined as the condition where the motor temperature does not change by more than 1 °C over 30 min (See Section 5.9.45 of IEEE 112–2017, Section 3.1. of CSA C390–10; Section 10.3.1.3 of IEEE 114–2010; Section 3 of CSA C747–09 (R2019); and Section 6.1.3.2.1 of IEC 60034–2–1).

cooling apparatus such that the liquid or liquid-filled conductors come into direct contact with the parts of the motor, but is not submerged in a liquid during operation.

DOE requests comments (*i.e.,* supporting information and technical justification) on the proposed definition for a liquid-cooled electric motor—including technical information and support on whether and why the definition should be modified.

6. Basic Model and Equipment Class

DOE proposes to amend the definition of ''basic model'' in 10 CFR 431.12 to make it similar to the definitions used for other DOE-regulated products and equipment, and to eliminate an ambiguity found in the current definition. The definition currently specifies that basic models of electric motors are all units of a given type manufactured by the same manufacturer, which have the same rating, and have electrical characteristics that are essentially identical, and do not have any differing physical or functional characteristics that affect energy consumption or efficiency. (10 CFR 431.12) For the purposes of this definition, the term ''rating'' is specified to mean one of 113 combinations of horsepower, poles, and open or enclosed construction. (See *id.*) The reference to 113 combinations dates from the Department's implementation of the Energy Policy Act of 1992 (''EPACT 1992'') (Pub. L. 102–486), which set initial standards for motors based on that categorization. Since then, EISA 2007 and DOE's regulations have established standards for additional motor categories. See 10 CFR 431.25. To clarify that the concept of a ''basic model'' reflects the categorization in effect under the prevailing standard, as it stands today and as it may evolve in future rulemakings, DOE proposes to refer only to the combinations of horsepower (or standard kilowatt equivalent), number of poles, and open or enclosed construction for which 10 CFR 431.25 prescribes standards; and to drop the current reference to 113 such combinations.

As such, DOE proposes to replace the term ''rating'' with the term ''equipment class'' in the basic model definition. In addition, DOE proposes to define ''equipment class'' as one of the combinations of an electric motor's horsepower (or standard kilowatt equivalent), number of poles, and open or enclosed construction, with respect to a category of electric motor for which § 431.25 prescribes nominal full-load efficiency standards. This proposal would also limit confusion between the use of the term ''rating''

in this specific case and the use of the term as it applies to represented values of other individual characteristics of an electric motor, such as its rated horsepower, voltage, torque, or energy efficiency.

With the aforementioned change, DOE proposes that basic model means, with respect to an electric motor, all units of electric motors manufactured by a single manufacturer, that are within the same equipment class, have electrical characteristics that are essentially identical, and do not have any differing physical or functional characteristics that affect energy consumption or efficiency.

The proposed update to the basic model definition does not alter current representations or efficiencies.

C. Updates to Industry Standards Currently Incorporated by Reference

DOE has reviewed each of the industry standards that are currently incorporated by reference as test methods for determining the energy efficiency of electric motors, and identified updates for the following existing references: IEC 60034–12 Edition 2.1 2007–09 ''Rotating Electrical Machines, Part 12: Starting Performance of Single-Speed Three-Phase Cage Induction Motors'' (''IEC 60034–12:2007''); NFPA 20–2010 ''Standard for the Installation of Stationary Pumps for Fire Protection'' (''NFPA 20–2010''); and NEMA MG 1–2009. DOE also notes that CSA C390–10 has been reaffirmed. The revised and reaffirmed industry standards are listed in Table III.9.

TABLE III.9—UPDATED INDUSTRY STANDARDS CURRENTLY INCORPORATED BY REFERENCE

Existing reference	Updated version	Type of update
IEC 60034–12 Edition 2.1 200709	IEC 60034–12 Edition 3.0 2016	Revision.
NFPA 20–2010	NFPA 20–2019	Revision.
CSA C390–10	CSA C390–10 (R2019)	Reaffirmed.
NEMA MG 1–2009	NEMA MG 1–2016 with 2018 Supplements	Revision.

As discussed in section I.B, DOE incorporated by reference IEEE 112–2017 for both small electric motors and electric motors in the January 2021 Final Rule. 86 FR 4. Specifically, for electric motors, reference to IEEE 112–2017 Test Method B in the DOE test procedure replaces the prior reference to IEEE 112–2004 Test Method B. 86 FR 4, 10. DOE determined that reference to IEEE 112–2017 harmonizes the permitted test methods under subpart B of 10 CFR part 431 and aligns measurement and instrumentation requirements with recent industry practice. 86 FR 4, 10. DOE also incorporates by reference IEC 60034–2–1:2014 as an additional alternative test procedure for both small electric motors and electric motors. 86 FR 4, 10–13. Specifically for electric motors, DOE references IEC 60034–2–1:2014 Test Method 2–1–1B as an alternative to IEEE 112–2017 Test Method B and CSA C390–10. 86 FR 4, 12–13. DOE determined that reference to IEC 60034–2–1:2014 Test Method 2–1–1B further harmonizes DOE's test procedures with current industry practice and reduces manufacturer test burden while ensuring that the test procedure reflects the energy efficiency of the relevant motors during a representative average use cycle. 86 FR 4, 11–12. In response to the June 2020 RFI, the CA IOUs recommended that DOE update its test procedure to reference the latest version of key industry test procedures, citing the updates to IEEE 112–2004, CSA C390–10 and NEMA MG 1–2009. (CA IOUs, No. 3 at p. 12) NEMA suggested that DOE incorporate by reference the latest versions of IEEE 112–2017, CSA C390–2010 (R2019), and IEC 60034–2–1:2014. (NEMA, No. 2 at p. 5) DOE has updated its test procedures to reference IEEE 112–2017 and IEC 60034–2–1:2014, as previously discussed. The following sections provide a review of the proposed revisions related to industry test procedures.

1. IEC 60034–12

DOE references clauses 5.2, 5.4, 6, and 8, and Tables 1, 2, 3, 4, 5, 6, and 7 of IEC 60034–12:2007. 10 CFR 431.15(c)(4). The specified sections of IEC 60034–12 are referenced in the definitions for IEC Design H motor and IEC Design N motor in 10 CFR 431.12.

On November 23, 2016, IEC 60034–12:2007 was updated with the publication of IEC 60034–12:2016. As discussed, of the IEC 60034–12:2007 sections that are currently incorporated in the DOE test procedure, DOE identified the following updates in IEC 60034–12:2016: (1) For IEC Design N and Design H motors, the lower end of the rated output power range was reduced from 0.4 kW (0.5 hp) to 0.12 kW (1⁄6 hp), and corresponding new limits for minimum values of torque and external moment of inertia were added at these power ratings; (2) the limits for locked rotor apparent power for motors with type of protection ''e'' were replaced by a reference to IEC 60079–7:2015 ''Explosive atmospheres—Part 7: Equipment protection by increased safety ''e'' (''IEC 60079–7:2015''); and (3) an equation was added to clarify how to calculate the locked rotor current from the locked rotor apparent power.[41]

DOE notes that the horsepower range provided at 10 CFR 431.25(g)(8)[42] is controlling in regard to the scope of the energy conservation standards and therefore tentatively concludes that the update to horsepower range for IEC Design N and IEC Design H motors in IEC 60034–12:2016 would not impact the scope of the test procedure. In the December 2013 Final Rule, DOE discussed that the objective of defining IEC Design N and IEC Design H motors was only to define what characteristics and features comprise these type of motors, so that manufacturers designing to the IEC standards can determine whether their motor is subject to DOE's regulatory requirements. 78 FR 75962, 75970. At the time, DOE had concluded that although the specified range in terms of rated output power for IEC Design N and Design H in IEC 60034–12:2007 was broader than the DOE scope, there was no need to limit the definitions to the power ranges covered by DOE regulatory requirements. *Id.* DOE maintains the same conclusions for the update to horsepower range in IEC 60034–12:2016.

Regarding the reference to IEC 60079–7:2015, sections 5.2.7.3 and 5.2.8.2 of this industry standard describe the additional starting requirements of increased safety ''eb'' and ''ec'' motors. The ''eb'' and ''ec'' designations are the two levels of protection offered by the increased safety ''e'' designation, intended for use in explosive gas atmospheres, according to section 1 of IEC 60079–7:2015. Section 5.2.7.3 specifies the application of protective measures to prevent airgap sparking. Section 5.2.8.2 specifies the application of starting current requirements, and when a current-dependent safety device is required. Section 1 of IEC 60034–12:2007 stated that the standard applied to motors that ''are constructed to any degree of protection'', indicating that safety ''e'' motors are not excluded from IEC Design N or Design H motors. Similarly, Section 1 of IEC 60034–12:2016 states that the standard applies to motors that ''are constructed to any degree of protection and explosion protection.'' DOE tentatively concludes that the requirements specified in sections 5.2.7.3 and 5.2.8.2 of IEC 60079–7 would not impact the scope of the current DOE test procedure because motors with the ''increased safety ''e'' designation'' were previously eligible to be considered IEC Design N or H motors, and this remains unchanged with this update.

Regarding the addition of the new locked rotor current equation, DOE notes that the definitions for IEC Design H and IEC Design N in 10 CFR 431.12 do not specify conformance to any locked rotor current specification, but rather specify the starting torque, locked rotor apparent power and starting requirement. The new equation specifies how to calculate the locked rotor current from the locked rotor apparent power. IEC 60034–12:2016 does not provide any minimum or maximum values for locked rotor current. DOE tentatively concludes that the new locked rotor current equation does not change the scope of IEC Design H and Design N definitions, as defined in 10 CFR 431.12.

Based on DOE's review of the updates to IEC 60034–12:2016, DOE tentatively concludes updating the IEC 60034–12 reference in the CFR to the 2016 version would not alter the measured efficiency of electric motors, and would not be unduly burdensome to conduct. Therefore, DOE proposes to incorporate by reference the 2016 version of IEC 60034–12 and reference the most current test standards in use by industry. In addition, because IEC 60079–7:2015 is referenced within IEC 60034–12:2016 and is necessary for the test procedure, DOE also proposes incorporating by reference IEC 60079–7:2015.

DOE seeks comments on whether its assessment of the updates to IEC 60034–12:2016 is accurate and on its proposal to incorporate by reference the 2016 version of IEC 60034–12, including reference to IEC 60079–7:2015.

2. NFPA 20

DOE incorporates by reference section 9.5 of NFPA 20–2010 in the definition of ''fire pump electric motor.'' DOE defines fire pump electric motor as an electric motor, including any IEC-equivalent, that meets the requirements of section 9.5 of NFPA 20. 10 CFR 431.12.

On May 24, 2018, NFPA approved a 2019 edition of NFPA 20 (*i.e.,* NFPA 20–2019), which is the most recent version. Based on a review of NFPA 20–2019, DOE identified the following updates: (1) Addition of horsepower and locked rotor motor designations for three-phase NEMA Design B, 1–3 hp, 60 Hz, motors (Table 9.5.1.1(a)); (2) addition of horsepower and locked rotor current motor designations for single-phase NEMA Design N and L motors (Table 9.5.1.1(b)); (3) addition of horsepower and locked rotor current motor designations for three-phase NEMA Design B 50 Hz motors (Table 9.5.1.1(c)); (4) inclusion of a specification that single-phase motors are used only in across-the-line starting applications (section 9.5.1.1.1); (5) addition of a clause that IEC motors, where used, are to be listed for fire service (section 9.5.1.1.2); (6) further specifications for motors used with variable speed controllers (section 9.5.1.4); and (7) specification that the service factor used is to be marked on the motor but in no case is the factor to exceed 1.15 where the motor is used with a variable speed pressure limiting controller (section 9.5.2.2(2)).

The current energy conservation standard requirements for fire pump electric motors in Table 7 of Appendix B are for motors with horsepower ranging from 1 to 500 hp. NFPA 20–2010 accounted for NEMA Design B motors at rated horsepower between 5–500 hp. DOE notes that the addition of 1–3 hp motors in NFPA 20–2019 further aligns the NFPA 20 scope with the existing DOE fire pump electric motors scope.

As discussed in section III.A, DOE is proposing to expand scope of the DOE test procedure to include additional categories of motors, including SNEMs (*i.e.,* certain single-phase motors) and electric motors with synchronous technologies (*i.e.,* inverter-fed motor topologies). NFPA 20–2019 requirements regarding single-phase motors and motors used with variable speed controllers (as identified in Table 9.5.1.1(b); sections 9.5.1.1.1, 9.5.1.4 and 9.5.2.2(2) of NFPA 20–2019) could be applicable to the scope of the DOE test procedure proposed in this NOPR. In the May 2012 Final Rule, DOE referenced all of section 9.5 of NFPA 20–2010 in its definition of fire pump electric motor, including those sections that apply to motors that were not

[41] In addition, IEC 60034–12:2016 also includes new definitions for Design NE, NEY, HE and HEY and their corresponding starting requirements, as discussed further in section III.A.1.

[42] Produce at least one horsepower (0.746 kW) but not greater than 500 horsepower (373 kW).

subject to energy conservation standards. 77 FR 26608, 26618. Accordingly, DOE proposes to continue to reference all of section 9.5 of NFPA 20–2019 to align with the proposed expansion of scope.

As noted, the definition for fire pump electric motors in 10 CFR 431.12 includes any IEC-equivalent electric motors that meet the requirements of section 9.5 of NFPA 20. In the May 2012 Final Rule, DOE included IEC-equivalent electric motors within the definition because NFPA 20 did not explicitly recognize the use of IEC motors with fire pumps. 77 FR 26608, 26618. DOE notes that the addition of the IEC clause in NFPA 20–2019 aligns with the DOE definition for fire pump electric motors. In this NOPR, DOE proposes to maintain the specification within the fire pump electric motor definition that IEC-equivalent electric motors are included within the definition of fire pump electric motor.

Finally, the updated provisions regarding 50 Hz motors would not be applicable in the context of the test procedure as proposed, as DOE is proposing to limit the scope of the test procedure to electric motors with a rated frequency of 60 Hz (see section III.G.1 for further discussion on the definition for rated frequency).

Based on DOE's review of the updates to NFPA 20–2019, DOE proposes to incorporate by reference the 2019 version of NFPA 20 in order to reference the most current version of the industry standard. DOE has tentatively determined that referencing the most current version would not change the applicability of the definition of fire pump electric motor.

DOE seeks comments on whether its assessment of the updates to NFPA 20–2019 is accurate. In addition, DOE seeks comment on its proposal to reference section 9.5 of NFPA 20–2019, the most current test standard.

DOE seeks comment on whether the clause ''including any IEC-equivalent'' should be maintained in the fire pump electric motor definition, considering that section 9.5 of NFPA 20–2019 now includes this specification.

3. CSA C390

DOE incorporates by reference CSA C390–10 in 10 CFR 431.12; 431.19; and 431.20. 10 CFR 431.15(b)(1). CSA C390–10 was reaffirmed in 2019 (*i.e.,* no changes were adopted). Accordingly, DOE tentatively concludes that the proposed update to reference the reaffirmed version of CSA C390–10 would not impact the scope or substance of the DOE test procedure. Therefore, DOE proposes to incorporate by reference the 2019 reaffirmed version of CSA C390–10 (CSA C390–10 (R2019)) in order to reference the most current version of the industry standard.

4. NEMA MG1

DOE references certain sections of NEMA MG1–2009 in 10 CFR 431.12, 431.31, and appendix B. See 10 CFR 431.15(e)(1). DOE also references NEMA MG1–1967, Motors and Generators, (NEMA MG1–1967) in the definition of ''general purpose electric motor (subtype II).'' 10 CFR 431.12. This section of the NOPR provides a discussion of the updates to NEMA MG1 as applicable to appendix B only. See section III.D of the NOPR for discussion of the updates to NEMA MG1 as applicable to definitions in 10 CFR 431.12.

Efficiency and losses of electric motors are determined, in part, in accordance with NEMA MG1–2009, paragraph 12.58.1, ''Determination of Motor Efficiency and Losses.'' (Section 2 of Appendix B) Paragraph 12.58.1 of NEMA MG1–2009 specifies the use of IEEE 112–2004 and CSA C390–98 when measuring and determining the efficiency of an electric motor.[43]

Since publication of the January 2021 Final Rule, NEMA MG 1–2009 was updated to NEMA MG 1–2016 with 2018 Supplements.[44] NEMA MG 1–2016 with 2018 Supplements updates paragraph 12.58.1 to reference the most current versions IEEE 112 and CSA C390. NEMA MG1–2016 with 2018 Supplements does not specify a publication year when referencing industry test standards. Instead, it specifies that the latest revision or edition of the applicable publication should be referenced, which currently is IEEE 112–2017 and CSA C390–10 (R2019). The revised paragraph 12.58.1 also specifies IEC 60034–2–1 as an additional industry test standard for use when measuring and determining the efficiency of an electric motor. The latest revision of IEC 60034–2–1 is the 2014 version (*i.e.,* IEC 60034–2–1:2014).

DOE previously performed a side-by-side comparison of CSA C390–93 and CSA C390–98 and concluded that there were no substantive changes between these two versions that would affect the measurement and determination of efficiency of an electric motor. 73 FR 78220, 78229 (December 22, 2008). DOE also performed a comparison of CSA C390–93 and CSA C390–10 and similarly concluded that there were no substantive changes. 77 FR 26608, 26621 Therefore, DOE concludes that there are no substantive changes between CSA C390–98 and CSA C390–10 (R2019) that would affect the measurements and determination of the efficiency of an electric motor. Regarding the inclusion of the IEC 60034–2–1 in the revised paragraph 12.58.1 of NEMA MG1–2016 with 2018 Supplements, this modification aligns with the January 2021 Final Rule (see section III.B.2). Therefore, DOE proposes to incorporate by reference the 2016 version of NEMA MG1 to reference the most current test standards in use by industry. DOE has initially determined that this proposal would not affect the measurements and determination of the efficiency of an electric motor.

In addition, to ensure consistency in the versions of the referenced standards used when testing, DOE proposes to specify the publication year for each of the industry standards referenced by paragraph 12.58.1 of NEMA MG1–2016 with 2018 Supplements, as follows: IEEE 112–2017, CSA C390–10 (R2019), and IEC 60034–2–1:2014.

DOE seeks comments on whether its assessment of the updated paragraph 12.58.1 of NEMA MG1–2016 with 2018 Supplements is accurate. DOE also seeks comment on its proposal to incorporate IEEE 112–2017, CSA C390–10 (R2019), and IEC 60034–2–1:2014, and on its preliminary determination that updating these references to the latest version of each standard would not affect the measured efficiency of an electric motor currently subject to energy conservation standards at 10 CFR 431.25.

D. Industry Standards To Incorporate By Reference

This section discusses industry test standards that DOE proposes to incorporate by reference for testing the additional electric motors proposed for inclusion in the scope of the DOE test procedure.

As discussed in section I.A, EPCA provides for the establishment of a test procedure for covered equipment. (42 U.S.C. 6314(a)) The test procedure must be reasonably designed to produce results reflecting the energy efficiency, energy use, and estimated operating costs of the covered equipment during a representative average use cycle, and not be unduly burdensome to conduct. (42 U.S.C. 6314(a)(2)) Also as discussed,

[43] The version of CSA C390 (1998) was the most current at the time of publication of NEMA MG1–2009. This version is now obsolete and has been replaced by CSA C390–10 (R2019).

[44] NEMA MG1–2016 also includes 2018 updates published on March 22, 2019.These 2018 updates modified Part 7, paragraphs 12.35, 12.50, 12.59 and 12.60 of Part 12, Part 30, and Part 31 of NEMA MG1–2016 and did not include any edits to paragraph 12.58.1 of NEMA MG1–2016. See *https://www.nema.org/standards/view/motors-and-generators.*

EPCA provides that at least once every seven years DOE must conduct an evaluation of each class of covered equipment and determine whether amended test procedures would more accurately or fully comply with the requirements regarding representativeness and burden. (42 U.S.C. 6314(a)(1)(A)) In the following paragraphs, DOE evaluates certain industry test procedures for incorporation into the DOE test procedure for electric motors to provide for the testing of certain categories of electric motors not currently subject to the DOE test procedure.

In addition, EPCA includes specific test procedure-related requirements for electric motors subject to energy conservation standards under 42 U.S.C. 6313. The provisions in EPCA require that electric motors be tested in accordance with the test procedures specified in NEMA Standards Publication MG1–1987 and IEEE Standard 112 Test Method B for motor efficiency, as in effect on October 24, 1992 (See 42 U.S.C. 6314(a)(5)) As discussed in section III.C and III.C.4. both publications have been replaced with the more recent version IEEE 112–2017 and NEMA MG1–2016 with 2018 Supplements. The additional electric motors DOE proposes to add in the scope of the DOE test procedure are not included in the electric motors to which standards are currently applicable under section 6313. DOE notes that the industry test procedures proposed for air-over electric motors and for SNEMs are included in NEMA MG1–2016 with 2018 Supplements. *See* Section IV, Part 34: Air-Over Motor Efficiency Test Method and Section 12.30. Section 12.30 of NEMA MG1–2016 with 2018 Supplements specifies the use of IEEE 112 and IEEE 114 for all single-phase and polyphase motors.[45] As further discussed in section III.D.2, DOE is proposing to require testing of SNEMs other than inverter-only electric motors according to IEEE 112–2017 (or CSA C390–10 (R2019) or IEC 60034–2–1:2014, which are equivalent to IEEE 112–2017) and IEEE 114–2010 (or CSA C747–09 (R2019) or IEC 60034–2–1:2014, which are equivalent to IEEE 114–2010). This proposal would satisfy the test procedure requirements under 42 U.S.C. 6314(a)(5).

The methods listed in section 12.30 of NEMA MG–1 2016 with 2018 Supplements for testing AC motors are applicable only to AC induction motors that can be operated directly connected to the power supply (direct-on-line) and do not apply to electric motors that are inverter-only or to synchronous electric motors that are not AC induction motors. Therefore, for these additional electric motor types, DOE proposes to specify the use of different industry test procedures, as further discussed in section III.D.3.

1. Test Procedures for Air-Over Electric Motors

DOE proposes to include within the scope of the test procedure electric motors that are air-over electric motors (see section III.A.3) and establish test procedures for such motors. In support of the December 2013 Final Rule, DOE investigated possible methods to test air-over electric motors. 78 FR 75962, 75975. At the time, DOE determined that it did not have sufficient information to address the practical challenges associated with testing air-over electric motors, such as providing the tested unit with a standardized flow of cooling air at a specified constant velocity, defined ambient temperature, and barometric conditions. *Id.* Accordingly, DOE did not establish test methods for air-over electric motors. *Id.*

As described, the NEMA Air-over Motor Efficiency Test Method was published after publication of the December 2013 Final Rule, and was ANSI approved on June 1, 2018. The NEMA Air-over Motor Efficiency Test Method provides three alternative testing protocols for measuring the efficiency of single-phase and polyphase air-over electric motors and describes these three testing methods as equivalent. Each alternative test protocol specifies a rated load temperature test (*i.e.,* ''load test'') to be conducted before performing the efficiency test according to the applicable industry test standard (*i.e.,* IEEE 114, IEEE 112, CSA C390, CSA C747, or IEC 60034–2–1, depending on the motor phase and rated motor horsepower).[46] The specified load test is performed in place of the rated load temperature test portion of the industry test standard for non-air-over motors.

For electric motors generally, because of the effects of temperature on measured efficiency, the efficiency measurements are performed once the tested motor's windings are thermally stable.[47] This requires an initial rated load temperature test (''heat-run test'' or ''temperature test'') to be conducted in order for the motor winding to reach thermal stability.[48] For air-over electric motors, which require the use of an external fan for cooling, a modified temperature test as described in the NEMA Air-over Motor Efficiency Test Method (*e.g.,* the use of an external fan or other means of controlling the motor's winding temperature) is needed because air-over electric motors could otherwise overheat during the rated load temperature test, and the winding temperature would not achieve thermal stability.

The first alternative test method (see Section 34.3 of NEMA MG1–2016 with 2018 Supplements) specifies that the temperature test must be conducted by thermally stabilizing the motor at the rated full-load conditions using an external airflow according to the end user specifications in terms of air-velocity ratings in feet per minute. Once the motor winding temperature is stable (*i.e.,* the motor temperature does not change by more than 1 °C over 30 min), the efficiency test is conducted according to the applicable test method (*i.e.,* IEEE 114, IEEE 112, CSA C390, CSA C747, or IEC 600034–2–1, depending on the motor phase and horsepower) while maintaining the same airflow.

In the second alternative test method (see Section 34.4 of NEMA MG1–2016 with 2018 Supplements), the temperature test is also conducted with the use of an external blower. However, the amount of air flow is not specified. Instead, the amount of ventilation required during the temperature test must be such that the motor winding temperature reaches a target temperature, therefore removing the need to measure the airflow. Because the motor winding temperature is inversely correlated to efficiency, a target winding temperature range is specified to enable relative comparability of efficiency for air-over motors and to reflect the field operating conditions for air-over motor. The target temperature is established based on the motor's insulation class for polyphase motors (*i.e.,* between 75 °C and 130 °C, depending on the motor's insulation

[45] As previously mentioned, NEMA MG1–2016 with 2018 Supplements does not specify the publication year of the referenced test standards and instead specifies that the most recent version should be used.

[46] As previously mentioned, NEMA MG1–2016 with 2018 Supplements does not specify the publication year of the referenced test standards and instead specifies that the most recent version should be used.

[47] Temperature correlates inversely with efficiency; *i.e.,* a motor will demonstrate more efficient performance at a lower temperature compared to a higher temperature.

[48] A rated load temperature test is a test during which the motor is loaded at rated full load by means of a dynamometer until it is thermally stable. Thermal stability is defined as the condition where the motor temperature does not change by more than 1 °C over 30 min (See Section 5.9.45 of IEEE 112–2017, Section 3.1. of CSA C390–10; Section 10.3.1.3 of IEEE 114–2010; Section 3 of CSA C747–09 (R2019); and Section 6.1.3.2.1 of IEC 60034–2–1).

class),[49] and equal to 75 °C for single-phase motors. The second alternative method specifies iterative steps to adjust the airflow and achieve a stable motor winding temperature within 10 °C of the target temperature. Once the target temperature is reached at the rated load, a load test according to the applicable test method is conducted to measure the motor's efficiency (*i.e.,* IEEE 114, IEEE 112, CSA C390, CSA C747, or IEC 600034–2–1, depending on the motor phase and horsepower) while applying the same amount of airflow as in the temperature test. At the start of the load test, the average winding temperature must be within 10 °C of the target temperature. During the load test, there are no requirements to maintain the winding temperature within 10 °C of the target temperature; however, the same amount of airflow must be applied as in the temperature test.

In the third alternative test method (see Section 34.5 of NEMA MG1–2016 with 2018 Supplements), the temperature test is performed without the use of an external blower, and without loading the motor at its rated load. Instead, the motor is gradually loaded until the motor winding temperature reaches the required target temperature. As in the previous method, for polyphase motors, the target temperature is determined based on the motor's insulation class, while the target temperature of single-phase motors is set at 75 °C. The third alternative test method specifies iterative steps to achieve a stable motor winding temperature within 10 °C of the target temperature. Once the motor winding temperature is stable, the motor efficiency is measured according to the applicable test method (*i.e.,* IEEE 114, IEEE 112, CSA C390, CSA C747, or IEC 600034–2–1, depending on the motor phase and horsepower). During the load test, there are no requirements to maintain the winding temperature within 10 °C of the target temperature; and as the test is conducted without a blower, there are no specifications regarding airflow.

In the July 2017 RFI, DOE discussed its review of section 8.2.1 of IEEE 114–2010 (applicable to single-phase motors) and section 5 of CSA C747–09 (applicable to single-phase motors and polyphase motors below 1 hp), which include provisions for testing air-over motors. 82 FR 35468, 35475. Similar to the NEMA Air-over Motor Efficiency Test Method, both test standards require test measurements to be performed with sufficient ventilation to maintain a motor winding temperature within 70 °C–80 °C, therefore removing the need to measure airflow by specifying a temperature range for the motor's winding instead.

In the July 2017 RFI, DOE requested feedback on the various methods for testing air-over motors. *Id.* Specifically, DOE requested comment on whether a single target temperature should be used for polyphase motors in order to allow relative comparability of polyphase air-over motor efficiency across insulation classes. *Id.*

In response to the July 2017 RFI, the CA IOUs, NEEA, NWPCC, and Efficiency Advocates recommended that DOE consider the NEMA Air-over Motor Efficiency Test method as the basis for the DOE test procedure. (CA IOUs, No. 3 at p. 8–10; NEEA and NWPCC, No. 6 at p. 4; Efficiency Advocates, No. 5 at p. 3)

Advanced Energy commented that based on its testing experience, the use of external blower with a specified target temperature (as specified in CSA 747–09, IEEE 114–2010, and in Section 34.4 of NEMA MG1–2016 with 2018 Supplements) was a reasonable approach to test air-over motors. Advanced Energy further recommended that a single target temperature or temperature range be applied for both polyphase and single-phase air-over motors, as specified in CSA 747–09 and IEEE 114–2010. For single-phase motors, Advanced Energy noted that this was consistent with the target temperature of 75 °C in Section 34.4 of NEMA MG1–2016 with 2018 Supplements. For polyphase motors, Advanced Energy commented that temperature specifications in CSA 747–09 and IEEE 114–2010 deviate from the provisions in Sections 34.4 and 34.5 of NEMA MG1–2016 with 2018 Supplements, which specify different target temperatures for polyphase motors depending on the motor's insulation class. Advanced Energy stated that the fact that a particular motor was designed with a higher temperature insulation class (*e.g.,* insulation class C, 115 °C) than a second motor (*e.g.,* insulation class A, 75 °C) does not necessarily mean that the first motor would operate or is designed to operate at a higher temperature than the second motor. Advanced Energy asserted that instead, it means that the first motor is capable of running at the higher temperature associated with its insulation class (*e.g.,* 115 °C). Advanced Energy cited previous research work [50] showing that the temperature rise of motors across all speeds and insulation classes and across manufacturers varied without regard to the motor insulation class. Advanced Energy asserted that specifying different temperatures based on insulation class is unnecessary. (Docket No. EERE–2017–BT–TP–0047, Advanced Energy, No. 25 at pp. 10–11) With regards to the provisions in Section 34.3 of NEMA MG1–2016 with 2018 Supplements, Advanced Energy commented that testing air-over motors per customer air velocity specification should only be used by a manufacturer to provide information to a specific customer. (Docket No. EERE–2017–BT–TP–0047, Advanced Energy, No. 25 at p. 11)

DOE is not proposing to adopt the first alternative test method in Section 34.3 of NEMA MG1–2016 with 2018 Supplements. Not all customers use the same air velocity specifications, and customer requirements could vary for the same air-over motor. Testing with an external airflow according to the customer, as specified in the first alternative test method, could result in testing the same motor at different winding temperature during the test, which would impact the measurement of efficiency. Therefore, results from applying the first test method according to Section 34.3 of NEMA MG1–2016 with 2018 Supplements would not ensure relative comparability of efficiency for air-over electric motors.

DOE conducted a series of efficiency tests to compare the second and third alternate test methods (*i.e.,* Section 34.4 and 34.5 of NEMA MG1–2016 with 2018 Supplements). The NEMA Air-over Motor Efficiency Test method states that these two test procedures are equivalent and can be used interchangeably. DOE conducted testing to evaluate specifically whether these two methods provide equivalent results for air-over electric motors. DOE also investigated the repeatability of both test methods. DOE focused its review on the NEMA Air-over Motor Efficiency Test method, as it reflects the latest industry practice and because it provides methods applicable to all air-over motors proposed in scope.[51] DOE's test sample

[49] Insulation class is a letter designation (*i.e.,* A, B, F, and H), which has an associated temperature rise indicating the temperature range that the motor can withstand without failure (*i.e.,* 75, 95, 115, and 130 °C. respectively), and is commonly displayed in manufacturer literature and on motor nameplates.

[50] E.B. Agamloh ''A guide for the ranking and selection of induction motors,'' IEEE Pulp and Paper Conference, Atlanta, GA June 22–26, 2014.

[51] DOE also reviewed section 8.2.1 of IEEE 114–2010 (applicable to single-phase motors) and section 5 of CSA C747–09 (R2019) (applicable to single-phase motors and polyphase motors below 1 hp), which include provisions for testing air-over motors. Similar to the NEMA Air-over Motor Efficiency Test Method, both test standards require test measurements to be performed with sufficient ventilation to maintain a motor winding

included seven air-over motor models, which spanned a range of 0.25 to 20 hp and represented both single-phase and polyphase motors.

Table III.10 shows the difference in measured losses between the Section 34.4 and 34.5 of NEMA MG1–2016 with 2018 Supplements test methods (''Section 34.4 and 34.5''). Table III.11 shows the corresponding efficiency values resulting from the measured losses presented in Table III.10. DOE observed the percent difference in losses between Section 34.5 and 34.4 range from − 0.4 (on the lower end) to +10.9 (on the higher end). For the units at the higher end of the percent difference (units 1, 4 and 6), DOE notes that these three units spanned a wide range of hp ratings, and included both single-phase and polyphase motor types, indicating no clear or consistent trend that could be used to define criteria by which the two methods would produce equivalent results. DOE tentatively concludes that these two test methods do not produce equivalent test results in all cases.

TABLE III.10—DIFFERENCE IN MEASURED LOSSES BETWEEN SECTION 34.4 AND 34.5 TEST METHODS

Unit No.	HP	Phase	Section 34.4 measured losses (W)	Section 34.5 measured losses (W)	Percent difference section 34.5 vs. 34.4
1	.25	1	412.8	385.7	+6.6
2	.5	1	250.6	253.3	− 1.1
3	.75	3	180.7	180.0	+0.4
4	1	1	252.6	244.5	+3.2
5	10	3	984.1	988.0	− 0.4
6	14	3	1,479.6	1,318.5	+10.9
7	20	3	1,283.5	1,293.0	− 0.7

TABLE III.11—DIFFERENCE IN MEASURED EFFICIENCY BETWEEN SECTION 34.4 AND 34.5 TEST METHODS

Unit No.	HP	Phase	Section 34.4 tested efficiency (%)	Section 34.5 tested efficiency (%)
1	.25	1	31.1	32.6
2	.5	1	59.8	59.5
3	.75	3	75.6	75.7
4	1	1	74.7	75.3
5	10	3	88.3	88.3
6	14	3	87.6	88.8
7	20	3	92.1	92.0

Therefore, to determine which of the two test methods (Section 34.4 or 34.5) to propose for air-over electric motors, DOE tested a subset of the motors to evaluate the repeatability of each test methods. For this evaluation, DOE tested four models from its test sample that represented a range of motor output and phases. For each model, DOE performed a second replication of each test and compared the results to the first test (*i.e.,* the results presented in Table III.10 and Table III.11). Table III.12 shows the measured losses for both replications of the Sections 34.4 and 34.5 test methods. Table III.13 shows the corresponding efficiency values resulting from the measured losses presented in Table III.12.

The test results indicate that for three units (Units 1, 3, and 6), the Section 34.5 test method showed greater variation between subsequent tests compared to the Section 34.4 test method. However, for one unit, the Section 34.4 test method showed greater variation than the Section 34.5 test method. Based on these results, DOE tentatively concludes that Section 34.4 may provide more repeatability than Section 34.5 for air-over motors.

TABLE III.12—REPEATABILITY OF MEASURED LOSSES FOR SECTION 34.4 AND 34.5 TEST METHODS

Unit No.	Section 34.4—Measured Losses (W)			Section 34.5—Measured Losses (W)		
	Test 1	Test 2	% Difference	Test 1	Test 2	% Difference
1	412.8	410.3	− 0.62	385.7	379.0	− 1.75
3	180.7	184.3	+2.02	180.0	192.7	+7.04
4	252.6	238.4	− 5.64	244.5	239.5	− 1.75
6	1,479.6	1,519.5	+2.70	1318.5	1,399.4	+6.14

temperature within 70 °C–80 °C, therefore removing the need to measure airflow by specifying a temperature range for the motor's winding instead.

TABLE III.13—REPEATABILITY OF MEASURED EFFICIENCY FOR SECTION 34.4 AND 34.5 TEST METHODS

Unit No.	Section 34.4—Measured Efficiency (%)		Section 34.5—Measured Efficiency (%)	
	Test 1	Test 2	Test 1	Test 2
1	31.1	31.2	32.6	33.0
3	75.6	75.2	75.7	74.4
4	74.7	75.8	75.3	75.7
6	87.6	87.3	88.8	88.2

Based on these test results, and without further information to support considering these methods as equivalent, DOE is not proposing use of the methods in Sections 34.4 and 34.5 as equivalent alternatives for testing air-over electric motors. Instead, DOE proposes to apply the testing instructions as established in Section 34.4 to the air-over electric motors proposed for inclusion in scope of applicability of the proposed test procedure, with the modification of target temperature as discussed in the following paragraph. DOE notes that the use of an external fan to cool the motor during the load test is consistent with CSA C747–09 (R2019) Section 5.5 that states ''Air-over motors shall be supplied with sufficient ventilation during the test to maintain a winding temperature at full load below the rated temperature of the winding insulation.''

Section 34.4 specifies that polyphase air-over electric motors use a target temperature that depends on the motor's insulation class. This temperature target is then used as the temperature that the load test is conducted at. In contrast, for all single-phase motors, the target temperature is specified at 75 °C, regardless of insulation class. Measured efficiency is inversely correlated to temperature, so conducting testing at different temperatures may result in measured efficiency values that are not comparable across insulation classes. DOE conducted testing to understand how much the temperature target could affect measured efficiency for both Sections 34.4 and 34.5. The first test was conducted with the insulation-based target temperature as prescribed in Sections 34.4 and 34.5; and the second test was conducted with a 75 °C target temperature, regardless of insulation class.

Table III.14 shows the measured losses and the percent change in measured losses due to the different temperature targets. Table III.15 shows the corresponding efficiencies measured by these tests.

TABLE III.14—MEASURED LOSSES OF DIFFERENT TARGET TEMPERATURES FOR SECTION 34.4 AND SECTION 34.5

Unit No.	Insulation-based target temp. (°C)	Section 34.4			Section 34.5		
		Measured losses at insulation-based temp. (W)	Measured losses at 75 °C (W)	Percent difference in measured losses (%)	Measured losses at insulation-based temp. (W)	Measured losses at 75 °C (W)	Percent difference in measured losses (%)
3	95	184.3	184.2	−0.07	192.7	187.8	−2.56
6	115	1,519.5	1,389.1	−8.58	1399.4	1342.5	−4.07

TABLE III.15—MEASURED EFFICIENCY AT DIFFERENT TARGET TEMPERATURES FOR SECTION 34.4 AND SECTION 34.5

Unit No.	Insulation-based target temp. (°C)	Section 34.4		Section 34.5	
		Measured efficiency at 75 °C (%)	Measured efficiency at insulation-based temp. (%)	Measured efficiency at insulation-based temp. (%)	Measured efficiency at 75 °C (%)
3	95 °C	75.2	75.2	74.4	74.9
6	115 °C	87.3	88.3	88.2	88.6

In the Section 34.4 test, Unit 3 demonstrated results that could be considered equivalent at both temperatures, whereas Unit 6 showed a significant difference in measured losses between the two temperatures. These test results demonstrate that for some units, both Sections 34.4 and 34.5 test methods produce different measurements of efficiency at different test temperatures. As such, DOE tentatively concludes that defining a single test temperature, rather than using a target temperature that depends on the motor's insulation class, would produce measured efficiency values that are more comparable across insulation classes.

DOE is proposing to specify a single target temperature of 75 °C for all air-over electric motors (*i.e.,* polyphase and single-phase electric motors). The value of 75 °C was chosen for polyphase electric motors to be consistent with the temperature defined for single-phase electric motor, and because 75 °C corresponds to the target temperature defined for the lowest insulation class (*i.e.,* class A) of polyphase motors and can be safely achieved by all motor insulation classes without risk of damaging the motor.

DOE requests comment on its proposal to specify using Section 34.4, with modification, for measuring the efficiency of air-over electric motors.

DOE requests feedback on the proposal to specify a single target temperature 75 °C for polyphase motors.

DOE requests comment on its conclusion that Section 34.4 is less repeatable than Section 34.5.

DOE requests comment on its conclusion that measured efficiency correlates inversely with the temperature the motor is tested at.

DOE requests feedback and supporting data on the repeatability and level of accuracy of the methods included Section 34.4 and 34.5, and on whether these or other methods would lead to equivalent results when applied to the same motor.

DOE requests comment on whether some air-over electric motors could thermally stabilize at a temperature that is lower than the proposed target temperature of 75 °C. If yes, DOE requests comment on how these should be tested.

DOE requests comment on whether the proposed test procedure is applicable to all air-over electric motors in scope. If not, DOE is requesting information and feedback on which air-over electric motors cannot be tested in accordance with the proposed test procedure and on any revisions needed.

2. Test Procedures for SNEMs

As previously discussed, DOE proposes to include within the scope of DOE's test procedure for electric motors additional electric motors considered small by the industry (*i.e.,* SNEMs, see Section III.A.6). This section discusses proposed test procedures for additional SNEMs proposed in scope that are induction motors and that are not inverter-only electric motors, air-over motors, or submersible motors. Proposed test procedures for non-induction motor topologies (*i.e.,* synchronous electric motors) are discussed in section III.D.3 of this document. Proposed test procedures for SNEMs proposed to be included in scope that are inverter-only electric motors are discussed in section III.D.3 of this document. Proposed test procedures for SNEMs proposed to be included in scope that are air-over electric motors and submersible motors are discussed in section III.D.1 and section III.I respectively.

In the July 2017 RFI, DOE identified several industry test procedures applicable to small motors. 82 FR 35468, 35475–35476. The CA IOUs, NEEA and NWPCC commented that DOE should consider the test procedures identified by DOE in the July 2017 RFI. (CA IOUs, No. 3 at p. 6; NEEA and NWPCC, No. 6 at p. 5–6)

DOE is proposing to require testing of SNEMs (other than inverter-only, air-over, and submersible electric motors) according to the industry test methods identified in the July 2017 RFI. DOE has initially determined that polyphase motors at or above 1 hp can be tested with the same methods as would be applicable under this proposal to electric motors currently subject to the DOE test procedure (*i.e.,* IEEE 112–2017, CSA C390–10 (R2019), and IEC 60034–2–1:2014). See section 2 of appendix B. The referenced industry standards applicable to electric motors, IEEE 112–2017, CSA C390–10, and IEC 60034–2–1:2014, are also consistent with those referenced for small electric motors that are for polyphase motors greater than 1 hp. 10 CFR 431.444(b). For SNEMs that are polyphase motors with a horsepower less than 1 hp and for SNEMs that are single-phase motors, DOE has initially determined that, consistent with the DOE test method established for regulated small electric motors (which also include polyphase motors with rated motor horsepower less than 1 hp and single-phase motors), IEEE 114–2010, CSA C747–09 (R2019) and IEC 60034–2–1:2014 are appropriate test procedures. Additionally, DOE notes that Paragraph 12.58.1 of NEMA MG1–2016 with 2018 Supplements also lists IEEE 114 or CSA C747 as the selected industry standards for measuring and determining the efficiency of polyphase motors below with a horsepower less than 1 hp and single-phase motors.

DOE has initially determined that applying the proposed industry test procedures would result in representative results because the SNEMs proposed in scope are identical in design as currently regulated electric motors and small electric motors and can be used in the same applications. In addition, the proposed industry test methods reflect current industry practice, and DOE has tentatively determined that applying these test methods would not results in undue manufacturer burden.

DOE proposes to test these additional polyphase electric motors with a horsepower greater than or equal to 1 hp, that are not inverter-only electric motors, using the same methods as the ones proposed for currently regulated electric motors. For polyphase motors with a horsepower less than 1 hp and for single-phase motors, that are not inverter-only electric motors, consistent with the DOE test method established for regulated small electric motors, DOE proposes to incorporate by reference the same industry test methods as used when testing small electric motors of the same topologies and horsepower: IEEE 114–2010 and CSA C747–09 (R2019) (IEC 60034–2–1:2014 and IEEE 112–2017 are already incorporated by reference, see section III.C of this document). See Table III.16.

TABLE III.16—ADDITIONAL INDUSTRY TEST STANDARDS PROPOSED FOR INCORPORATION BY REFERENCE FOR SNEMS

Topology	Industry test standard incorporated by reference
Single-phase	IEEE 114–2010, CSA C747–09 (R2019), IEC 60034–2–1:2014.
Polyphase with rated horsepower less than 1 horsepower	IEEE 112–2017, CSA C747–09 (R2019), IEC 60034–2–1:2014.
Polyphase with rated horsepower equal to or greater than 1 horsepower.	IEEE 112–2017, CSA C390–10 (R2019), IEC 60034–2–1:2014.

DOE requests comment on the proposed test method for measuring the efficiency of additional SNEMs (not including inverter-only electric motors, air-over electric motors, or submersible electric motors).

3. Test Procedures for AC Induction Inverter-Only Electric Motors and Synchronous Electric Motors

This section discusses industry test methods applicable to AC inverter-only induction motors and to synchronous electric motors as described in Table III.8.

In the July 2017 RFI, DOE identified several industry test standards that may be applicable to synchronous electric motors. 82 FR 35468, 35476. These standards were IEC 60034–2–1:2014; CSA C747–09 (R2019); [52] IEEE 115–2009 ''IEEE Guide for Test Procedures for Synchronous Machines Part I—Acceptance and Performance Testing

[52] The July 2017 RFI referenced CSA C747–09 (R2014) which is equivalent to CSA C747–09 (R2019).

Part II—Test Procedures and Parameter Determination for Dynamic Analysis'' (''IEEE 115–2009''); and IEEE 1812–2014 ''IEEE Trial-Use Guide for Testing Permanent Magnet Machines'' (''IEEE 1812–2014''). *Id.* DOE requested comment on the applicability of these test procedures to synchronous motors, and specifically, on the applicability of IEEE 115–2009 to PMAC motors and SynRMs. *Id.*

Advanced Energy recommended using the input-output test method from CSA C747–09 to test synchronous electric motors. Advanced Energy commented that IEEE 115–2009 was applicable to larger size wound-field (*i.e.,* DC-excited) synchronous motors and not to permanent magnet motors, which are non-excited synchronous motors. Advanced Energy commented that IEEE 1812–2004 included provision for permanent magnet motors. (Docket No. EERE–2017–BT–TP–0047, Advanced Energy, No. 25 at p. 12) Advanced Energy commented that for electric motors with integrated controls,[53] testing should be performed without any recourse to, or manipulation of, the embedded control circuitry (*i.e.,* inclusive of the motor and inverter). Advanced Energy stated that if DOE is considering an efficiency metric that captures the efficiency of the motor only, the test procedure for electric motors that are intended to operate with controls that are not integrated with the motor[54] should allow manufacturers to certify the efficiency of the motors with their designated inverters as recommended in the catalogs. Advanced Energy stated that although most off-the-shelf inverters are capable of operating these motors, the best performance may not be achieved if a one-size-fits-all inverter is used across all motors. Advanced Energy also stated that the impact of the choice of the inverter could be minimized. Advanced Energy commented that computing the motor efficiency separately from the inverter is fairly straightforward, for the case where these are supplied as two separate components. Advanced Energy stated that the direct input-output method could be used in this case, as would be expected with these categories of motors. Advanced Energy commented that if DOE is considering an efficiency metric inclusive of the inverter (*i.e.,* combined motor and inverter efficiency), then the issue of the drive that is applied becomes more important. (Docket No. EERE–2017–BT–TP–0047, Advanced Energy, No. 25 at pp. 6–7)

NEMA recommended adding the CSA C838–2013 (R2018) ''Energy efficiency test methods for three-phase variable frequency drive systems'' (''CSA C838–2013'') industry test standard to the DOE test procedure for testing ''power drive systems'' (*i.e.,* the combination of a motor and inverter). (Docket No. EERE–2017–BT–TP–0047, NEMA, No. 24 at p. 2) NEMA also commented that electric motors with advanced motor technologies that are power drive systems should be tested per IEC 61800–9–2:2017 and commented in support of incorporating IEC 61800–9–2:2017 by reference. (Docket No. EERE–2017–BT–TP–0047, NEMA, No. 24 at pp. 1, 3, 8, 11) NEMA described IEC 61800–9–2:2017 as the only repeatable industry test standard for power drive systems. (Docket No. EERE–2017–BT–TP–0047, NEMA, No. 24 at pp. 13) Specifically, NEMA commented that while IEEE 115–2009 and IEEE 1812–2014 were acceptable design specification standards for synchronous electric motors, testing of PMAC motors and SynRMs should be performed based on IEC 61800–9–2:2017. NEMA further commented that the IEEE 1812–2014 standard was not finalized yet and was released for trial use. (Docket No. EERE–2017–BT–TP–0047, NEMA, No. 24 at p. 10) NEMA further commented that control and power conversion components are captured when conducting an energy efficiency test for power drive systems. (Docket No. EERE–2017–BT–TP–0047, NEMA, No. 24 at p. 7)

The CA IOUs recommended that DOE consider adopting appropriate test standards for motors using frequency converters, such as IEC 60034–2–3:2020, IEC 61800–9–2:2017, and other industry test standards applicable to AC and DC motors, such as IEC 60034–2–1:2014. (CA IOUs, No. 3 at pp. 2, 7–8)

Since the publication of the July 2017 RFI, DOE performed a review of the most recent standards available to test synchronous electric motors proposed for inclusion in scope of the DOE test procedure. Different industry test standards are applicable depending on whether the considered motor can operate directly connected to the power supply (*i.e.,* line-fed or direct-on-line such as LSPMs) or is operated connected to an inverter (*e.g.,* PMAC motor). DOE notes that the industry test standards for motors that operate connected to an inverter (*i.e.,* inverter-fed motors) are also applicable to inverter-only AC induction motors. Existing industry test standards for electric motors that operate with an inverter can be classified in two categories depending on the equipment tested: (1) Inverter-fed motors test standards, which consider the motor only (*i.e.,* the motor is tested while operating connected to an inverter, however the measured efficiency is the efficiency of the motor only and does not include the efficiency of the inverter); and (2) power drive systems (''PDS'' or ''PDSs'') test standards, which consider the motor and inverter combination (*i.e.,* motor is tested while operating connected to an inverter and the measured efficiency includes the motor and inverter efficiency). DOE notes that test procedures also exist for inverters only; specifically, ANSI ASHRAE 222–2018. However, DOE did not further investigate these standards, as the definition of electric motor does not cover an inverter as a single component.

DOE reviewed the industry test standards identified in the July 2017 RFI (*i.e.,* IEEE 115–2009, IEEE 1812–2014, CSA C747–09 (R2019), and IEC 60034–2–1:2014) as well as three additional industry test standards for electric motors that require an inverter to operate: IEC 60034–2–3:2020; IEC 61800–9–2:2017; and CSA C838–2013. DOE notes that some of these test standards are also applicable to AC induction inverter-only motors.

IEEE 115–2009 applies to wound-field (*i.e.,* DC-excited) synchronous motors and is not applicable to permanent magnet and reluctance synchronous motors, which are non-excited synchronous motors.[55] As commented by Advanced Energy, IEEE 115–2009 does not provide adequate instruction for all the synchronous electric motors discussed in section III.A.8, and therefore DOE did not further review IEEE 115–2009.

IEEE 1812–2014 applies to permanent magnet synchronous motors. However, as commented by NEMA, this standard is a trial-use standard and was effective only until December 2016. DOE did not further consider this standard for this test procedure.

CSA C747–09 (R2019) is equivalent to the 2009 version which is incorporated by reference as part of the small electric

[53] Integrated means that the drive and the motor are physically contained in a single unit.

[54] These would include inverter-capable electric motors with or without an inverter, and inverter-only electric motors with or without an inverter.

[55] Specifically, Section 4.1.1 of IEEE 115–2009 discusses the determination of field I^2R losses from field current and resistance, which is only applicable to wound-field synchronous motors. In wound-field synchronous motors, field poles are magnetized by direct current from an exciter, resulting in I^2R losses in the field windings. Additionally, section 1.3 of IEEE 1812 explains that it references IEEE 115–2009 for instructions that would be identical to wound-field synchronous motors, implying that IEEE 115–2009 is specifically for wound-field (*i.e.,* DC-excited) synchronous motors.

motors test procedure at 10 CFR 431.443 as a test method that may be used for testing single-phase small electric motors and polyphase small electric motors of less than or equal to 1 horsepower. Section 6 of CSA C747–09 (R2019) determines efficiency by measuring input power and output power, a method known as ''the direct measurement method'' or ''input-output'' method. CSA C747–09 (R2019) also specifies that this method is also applicable to certain inverter-fed motors and to certain synchronous electric motors proposed for inclusion in scope: section 1 specifies that the scope of CSA C747–09 (R2019) also applies to inverter-driven motors (also known as inverter-fed), ECMs, and to certain synchronous motors, namely reluctance (*i.e.,* SynRM and SR) and permanent magnet motors (PMAC, LSPM).[56] However, the scope of CSA C747–09 (R2019) is focused on motors of smaller size: section 1.2 states that the test standard is applicable to DC and polyphase AC motors with rated motor horsepower greater than or equal to 0.25 and less than 1 hp, and to single-phase motors with a rated motor horsepower greater than or equal to 0.25 hp. In addition, CSA C747–09 (R2019) does not provide test instructions regarding the selection of the inverter used for testing inverter-only motors that do not include an inverter (*i.e.,* electric motors that do not include an inverter and are unable to operate without an inverter), as are provided in IEC 60034–2–3:2020 (see description in the remainder of this section).

IEC 60034–2–1:2014 is incorporated by reference as part of the small electric motors test procedure at 10 CFR 431.443 and the electric motors test procedure at 10 CFR 431.15. IEC 60034–2–1:2014 includes methods for testing the efficiency of direct-on-line motors, including AC synchronous electric motors. The test methods[57] for AC synchronous electric motors are specified in Section 7, Tables 4 and 5 of IEC 60034–2–1:2014 and depend on the frame size and/or the rating of the motor under test. Methods also depend on whether the synchronous motors use electrical excitation or permanent magnets. For permanent magnet synchronous motors, the direct measurement input-output method is used. This is the same method specified in CSA C747–09 (R2019) for permanent magnet motors; however, IEC 60034–2–1 does not specify a limit on horsepower rating. For synchronous motors with electrical excitation, the test method depends on frame size and/or output power. For motors with a shaft height (distance from the center line of the shaft to the bottom of the feet) less than or equal to 180 mm (corresponding to NEMA frame sizes 284T and 286T), the input-output method is used, with additional test instructions to account for the exciter. For motors with a shaft height greater than 180 mm and with an output power less than or equal to 2 megawatts (equivalent to 2,682 hp), the loss segregation method is used, with additional test instructions to account for the exciter.[58] The third test method specified is for motors that are not in the proposed scope of applicability of this test procedure (*e.g.,* motors with an output power greater than 2 megawatts) and are therefore not relevant to this rulemaking.

IEC 60034–2–3:2020 specifies test methods for determining losses and efficiencies of inverter-fed motors. While the motor is operated with an inverter during the test, the measured efficiency is the efficiency of the motor only and does not include the efficiency of the inverter. Section 6.1 of IEC 60034–2–3:2020 describes four applicable methods for the determination of the efficiency of inverter-fed motors. In the first method, the motor can be tested with a specific inverter (*e.g.,* an inverter that is sold with the motor) or using an inverter as specified by the test procedure (*i.e.,* using a ''comparable converter'').[59] The motor is tested using the input-output method (*i.e.,* direct measurement of electrical input power to the motor and mechanical output power, in the form of torque and speed, from the motor) and calculates the efficiency as the ratio of these two values at different load points. In its introduction, IEC 60034–2–3:2020 states that the test method with the ''comparable converter'' is a standardized method intended to give comparable motor efficiency figures (excluding the inverter) at standardized test conditions, and that this method is not intended to determine the actual motor efficiency for operation with a specific inverter used in the final application. The second method relies on the indirect method (*i.e.,* summation of losses)[60] to determine the efficiency of the inverter-fed motor and is applicable only in combination with a specific inverter selected for the test. The other two methods include the description of an AEDM and of a calculation method for very large motors (above 2 megawatts). The AEDM provisions in section 6.1 of IEC 60034–2–3:2020 were not considered in this test procedure, as DOE establishes its own AEDM requirements; additionally, the calculation method for larger inverter-fed motors was not considered for this test procedure, as motors above 2 megawatts are not in the proposed scope of this test procedure. IEC 60034–2–3:2020 also specifies procedures to determine motor losses at any load point based on the determination of efficiency at seven standardized load points.[61] Although the measurements are made at seven points, the motor's performance is evaluated at a single point (90 percent rated speed and 100 percent rated torque)[62] for the purposes of comparing its performance with other motors and determining its ''IE efficiency class''.[63]

IEC 61800–9–2:2017 specifies test methods for determining losses of inverters (or complete drive module, ''CDM'')[64] and of motor and inverter combinations, (*i.e.,* PDSs).[65] The motor

[56] Section 4 of CSA C747–09 (R2019) includes additional instructions for motors that include an inverter and specifies that when a motor requires an inverter to operate on alternating current, the motor and inverter shall be tested together.

[57] In addition, IEC 60034–2–1:2014 includes other methods that may be used for customer-specific acceptance tests, field tests or routine tests which were not considered by DOE.

[58] In the loss segregation method, the input power of the motor is not directly measured. Instead, it is calculated as the sum of the motor output power and the losses of the motor. Under this approach, the losses of the motor are measured separately by category (*i.e.,* constant losses, stator losses, excitation losses, and load losses). The efficiency is calculated as the output power of the motor divided by the input power of the motor. See Section 7.1.3. of IEC 600034–2–1:2014.

[59] The comparable converter (inverter) represents a typical set-up. The purpose of the comparable inverter set-up is to establish comparable test conditions for motors that operate with inverters. The requirements of the comparable inverter are described in section 5.2.2. of IEC 60034–2–3:2020.

[60] Also known as ''segregation of losses'' method. In this method, the different components of the motor losses are determined separately and added to calculate the total motor losses and efficiency. The different loss components are iron loss (core losses); windage and friction losses; the stator and rotor copper losses; and additional load losses (stray losses).

[61] Seven speed/torque points at (90/100), (50/100), (25/100), (90/50), (50/50), (50/25), and (25/25) percent of motor rated speed/torque.

[62] Rated torque and rated speeds are the torque and speed values corresponding to the motor's rated load. See III.F.2.

[63] IEC TS 60034–30–2:2016 ''Rotating electrical machines—Part 30–2: Efficiency classes of variable speed AC motors (IE-code)'' establishes efficiency classes for converter-fed motors (IE classes from IE1 to IE5).

[64] IEC 61800–9–2:2017 defines a CDM, or drive, or drive controller as a '' drive module consisting of the electronic power converter connected between the electric supply and a motor as well as extension such as protection devices, transformers and auxiliaries.''

[65] IEC 60034–9–2:2017 also provides a mathematical model to determine the losses of a reference CDM, reference motor and reference PDS which are then used as the basis for comparing other CDMs, motors, and PDSs and establishing

Continued

is tested with its inverter (either integrated or non-integrated), and the measured losses includes the losses of the motor and of the inverter. Section 7.3 of IEC 61800–9–2:2017 describes two options for determining the losses of a PDS: the input-output method (direct measurement method) and the loss calculation method. In the loss calculation method, the losses of the PDS are established by adding the losses of the inverter, the motor, and the auxiliary equipment [66] included in the PDS (which are determined by calculation, input-output measurement, or by calorimetric measurement depending on the component considered). Section 7.2 of IEC 61800–9–2:2017 prescribes that the losses of the CDM can be determined using either calculations,[67] input-output measurement, or by calorimetric measurement.[68] IEC 61800–9–2:2017 does not provide standardized methods to determine the losses of the auxiliary equipment. Instead, Annex B (informative) provides a description of the possible sources of losses. IEC 61800–9–2:2017 also specifies procedures to determine PDS losses at any load point based on determination of losses at eight standardized load points.[69] Although the loss measurements are made at eight points, the PDS performance is evaluated at a single point (100 percent rated frequency and 100 percent rated torque) for the purposes of comparing its performance with other PDSs and determining its ''IE efficiency class''.[70]

CSA C838–13 (R2018) provides energy efficiency test methods for motors with three-phase variable frequency drive (*i.e.,* variable frequency drives that output polyphase power). CSA C838–13 (R2018) applies to certain inverters for AC squirrel cage induction motors and other inverters commonly used with PMAC motors and reluctance motors (SR motors and SynRM). The test method relies on the input-output method with options to determine the efficiency of the inverter, motor, or combination of both. The measurements are performed at twenty load points defined by a percentage of rated frequency and torque. [71]

After reviewing these industry testing standards and stakeholder comments, DOE proposes to require testing through reference to industry test standards as detailed in the remainder of this section. DOE proposes to require testing synchronous electric motors that are direct-on-line, or inverter-capable using the methods in section 7.1 of IEC 60034–2–1:2014 and requirements in section 5 of IEC 60034–2–1:2014. As noted previously, inverter-capable electric motors subject to current test procedures are currently required to be tested without the use of an inverter, and rely on the set-ups used when testing a general purpose electric motor. *See* 78 FR 75962, 75972. Similarly, DOE proposes to require inverter-capable synchronous electric motors to be tested without the use of an inverter. DOE notes that it identified LSPMs as the only synchronous electric motor that is inverter-capable. All other synchronous electric motors proposed for inclusion in scope require an inverter to operate (*i.e.,* inverter-only). DOE notes that the proposal to not include the inverter when testing inverter-capable motors is consistent with how the efficiency classification of inverter-capable motors is established in accordance with IEC 60034–30–1:2014.[72] DOE believes such a proposal provides representative measurements without imposing undue test burden on manufacturers.

DOE proposes to require testing inverter-only synchronous electric motors that include an inverter, and inverter-only AC induction motors that include an inverter, in accordance with section 7.7.2 of IEC 61800–9–2:2017, and using the test provisions specified in section 7.7.3.5 and testing conditions specified in section 7.10. DOE notes that this category includes electric motors with integrated inverters such as ECMs which cannot be physically separated from the inverter and cannot be tested without the inverter. Inverter-only electric motors sold with an inverter require the inverter to operate in the field. DOE has initially determined that the proposal to measure the combined motor and inverter efficiency provides representative measurements without imposing undue test burden on manufacturers, specifically in the case of a motor with an integrated inverter.

DOE proposes to test inverter-only synchronous electric motors that do not include an inverter, and AC induction inverter-only motors that do not include an inverter, in accordance with IEC 61800–9–2:2017 [73] and to specify that testing must be performed using an inverter as recommended in the manufacturer's catalogs or offered for sale with the electric motor. If more than one inverter is available in manufacturer's catalogs or offered for sale with the electric motor, DOE is considering requiring to test using the least efficient inverter. Requiring the measurement of the combined motor and inverter efficiency would provide representative measurements without imposing undue test burden on manufacturers, in that the proposed method would not require an inverter-only motor to be tested both with and without the inverter.

Table III.17 summarizes the additional industry test standards proposed for incorporation by reference for electric motors with advanced motor technologies and AC induction inverter-only motors.

efficiency classes (IES classes). PDS shall be classified as ''IES 0'' if its losses are more than 20% higher than the value specified for a reference PDS. See section 6.4 of IEC 61800–9–2:2017.

[66] For example: output filters and motor cables.

[67] The CDM loss calculation method relies on a mathematical model and does not require testing. (Section 7.5).

[68] The calorimetric determination method of the power losses is based on the calorimetric measurement of the dissipated power losses (*i.e.,* heat). Measurements must be made at thermal equilibrium, and the component to be measured must be thermally isolated to guarantee conduction of the dissipated power losses by the cooling medium (air or water).

[69] Eight frequency/torque producing current points for CDM defined as follows: (0/25), (0/50), (0/100), (50/25), (50/50), (50/100), (90/50), and (90/100); and eight speed/torque points for PDS defined as follows: (0/25), (0/50), (0/100), (50/25), (50/50), (50/100), (100/50), and (100/100) percent motor rated frequency and rated torque.

[70] IEC 61800–9–2:2017 establishes efficiency classes for PDSs (IES classes).

[71] Twenty frequency/torque points as follows: (100/100), (100/75), (100/50), (100/25), (100/10), (75/100), (75/75), (75/50), (75/25), (75/10), (50/100), (50/75), (50/50), (50/25), (50/10), (25/100), (25/75), (25/50), (25/25), and (25/10) percent motor rated frequency and rated torque.

[72] Although not noted in IEC 60034–30–1:2014, Section 4.1 of IEC TS 60034–30–2:2016 specifies that motors that are capable of both direct-on-line operation and can also be inverter-fed (such as LSPMs) must be rated in accordance with IEC 60034–30–1:2014, which specifies testing in accordance with IEC 60034–2–1:2014 (which excludes the inverter).

[73] Specifically, in accordance with section 7.7.2 of IEC 61800–9–2:2017, and using the test provisions specified in section 7.7.3.5 and testing conditions specified in section 7.10.

TABLE III.17—INDUSTRY TEST STANDARDS PROPOSED FOR INCORPORATION BY REFERENCE FOR SYNCHRONOUS ELECTRIC MOTORS AND AC INDUCTION INVERTER-ONLY MOTORS

Motor configuration	Equipment tested	Industry test standard incorporated by reference
Direct-on-line or inverter-capable	Motor	IEC 60034–2–1:2014.
Inverter-only	Motor + Inverter	IEC 61800–9–2:2017.

For inverter-only synchronous electric motors that do not include an inverter and AC induction inverter-only motors that do not include an inverter, DOE is also considering in the alternate whether such electric motors should be tested using the method in section 6.2 of IEC 60034–2–3:2020, with a ''comparable inverter'' in accordance with section 5 of IEC 60034–2–3:2020. However, with this approach, an inverter-only motor would be subject to different test procedures depending on whether it was sold with or without an inverter. Inverter-only electric motor sold with an inverter would be tested with the accompanying inverter in accordance with IEC 61800–9–2:2017 as a motor and inverter combination (*i.e.,* the measured efficiency would include the efficiency of the motor and inverter); whereas inverter-only electric motors sold without an inverter would be tested using a ''comparable inverter,'' and the efficiency of only the motor would be determined under IEC 60034–2–3:2020. As inverter only motors require an inverter to operate, measurement of the motor efficiency independent of the inverter would not be as representative of performance in the field as measurement of the combined motor and inverter efficiency. As indicated by Advanced Energy, inverter-only electric motors that do not include an inverter could be tested with a ''representative'' inverter, with the measured energy efficiency representing the efficiency of the electric motor combined with an inverter specified for use in testing. Such an approach would require adding provisions specifying which inverter characteristics to use for the test. As proposed inverter-only motors that do not include an inverter would be tested with an inverter as recommended in the manufacturer's catalogs or offered for sale with the electric motor. DOE notes that CSA C838–13 and CSA C747–09 (R2019) also provide methods that could be used to test inverter-fed motors that include an inverter and for direct-on-line synchronous electric motors. DOE is proposing to specify the IEC methods instead, which are used internationally. DOE also notes that, as mentioned previously, CSA C747–09 (R2019) does not cover DC and polyphase motors with a horsepower greater than 1hp.

DOE requests feedback on the proposed test methods for synchronous electric motors and AC induction inverter-only electric motors. Specifically, DOE requests feedback on the proposal to test direct-on-line synchronous motors and inverter-capable electric motors in accordance with IEC 60034–2–1:2014. In addition, DOE requests feedback on the proposal to test inverter-only electric motors in accordance with IEC 61800–9–2:2017 and specifying, for inverter-only motors that do not include an inverter, that testing must be conducted using an inverter as recommended in the manufacturer's catalogs or offered for sale with the electric motor.

DOE requests feedback how inverter-only electric motors sold with or without an inverter are typically tested (*i.e.,* inclusive of the inverter or not, and on whether the test measurements include the inverter). DOE requests feedback and supporting information on whether there would be any benefits to considering a test method that measures the combined efficiency of the motor and inverter for inverter-capable electric motors (with and without inverters).

For inverter-only electric motors without inverters, DOE requests comment on the proposal to conduct the test using an inverter as recommended in the manufacturer's catalogs or offered for sale with the electric motor to determine a combined motor and inverter efficiency. DOE also requests feedback on which inverter should be selected for testing in the case where more than one inverter is recommended in the manufacturer's catalogs or offered for sale with the electric motor. To the extent other approaches should be considered, DOE requests feedback and supporting information.

For inverter-only electric motors sold without inverters, DOE requests comment on whether these motors should be tested using the method in section 6.2 of IEC 60034–2–3:2020, with a ''comparable inverter'' in accordance with section 5 of IEC 60034–2–3:2020.

E. Metric

The represented value of nominal full-load efficiency is used to make representations of efficiency for electric motors currently subject to standards in subpart B of part 431 and are based on the full-load efficiency metric as measured in accordance with the provisions at 10 CFR 431.17.

The CA IOUs, the Efficiency Advocates, and NEEA and NWPCC commented that the electric motors test procedure should be modified to include efficiency or input power at multiple load points in order to be more representative of typical motor operation and capture the energy-saving benefits of speed control. (CA IOUs, No. 3 at p. 8; Efficiency Advocates, No. 5 at p. 4; NEEA and NWPCC, No. 6 at pp. 4–5)

Specifically, the Efficiency Advocates suggested using the average of the efficiency at 25 percent, 50 percent, 75 percent, and 100 percent of full load as the metric for electric motors. (Efficiency Advocates, No. 5 at p. 4) The CA IOUs referenced the European Commission Regulation (''EU'') 2019/1781 of October 1, 2019 specifying requirements for electric motors and variable speed drives [74] and stated that the EU standard relied on rated efficiency measured at the 50, 75 and 100 percent of full load. (CA IOUs, No. 3 at p. 8)

NEEA and NWPCC recommended a metric based on input power at a variety of load points and incorporating information on representative load profiles for motors (*i.e.,* load point and percentage of time spent at that load point). NEEA and NWPCC further stated that the IEC 60034–2–3:2020 ''Specific test methods for determining losses and efficiency of converter-fed AC induction motors'' test standard applies to converter-fed motors and accounts for 7 standardized test points. (NEEA and NWPCC, No. 6 at p. 4–5)

The CA IOUs commented that DOE should consider motors that are single speed and motors that are variable speed separately, similar to the approach taken by the IEC test standards (*i.e.,* IEC 60034–2–1:2014, IEC 60034–2–3:2020, IEC 61800–9–2:2017) and associated efficiency classification standards (IEC 60034–30–1:2014; IEC

[74] See *https://eur-lex.europa.eu/eli/reg/2019/1781/oj.*

TS 60034–30–2:2016 ; and IEC 61800–9–2:2017) The CA IOUs stated that this approach is similar to how the pump energy conservation standards sets separate requirements for constant load pumps and variable-load pumps at 10 CFR part 431, subpart Y. (CA IOUs, No. 3 at p. 7–8)

The Joint Advocates commented that the test procedures should account for efficiency at multiple load points and the benefits of variable speed control. (Docket No. EERE–2017–BT–TP–0047; Joint Advocates, No. 27 at p. 3)

As discussed, EPCA requires the test procedures for electric motors that are subject to standards be the test procedures specified in NEMA Standards Publication MG1–1987 and IEEE Standard 112 Test Method B for motor efficiency, or the successor standards, unless DOE determined by rule, published in the **Federal Register** and supported by clear and convincing evidence, that to do so would not meet the statutory requirements for test procedures to produce results that are representative of an average use cycle and not be unduly burdensome to conduct. (42 U.S.C. 6314(a)(5)(A) and (B)).

Regarding the IEC test standards and efficiency classification, DOE notes that although the IEC test standards include testing at standardized part-load points, the IEC efficiency classification standards are based on the performance at full load (or close to full load, as noted in the remainder of this section). Specifically, for direct-on-line and inverter-capable motors, although the IEC 60034–2–1:2014 test standards for direct-on-line motors includes testing at part load (see discussion in section 6.1.3.2.3), IEC 60034–30–1:2014 establishes efficiency classes (*e.g.,* IE3) for direct-on-line motors based on the motor full load efficiency. For inverter-only motors (motor only), although the IEC 60034–2–3:2020 test standard includes seven standardized test points, the IEC efficiency classification is based on the performance at a unique point close to full load (*i.e.,* 90 percent rated speed and 100 percent rated torque).[75] See section 4.2 of IEC 60034–30–2:2016. For motor and inverter combination, although the IEC 61800–9–2:2017 test standard includes eight standardized test points, the IEC efficiency classification is based on the performance at a unique point at full load (100 percent rated speed and 100 percent rated torque). See section 6 of IEC 61800–9–2.

DOE reviewed the European Commission Regulation (EU) 2019/1781, which sets efficiency requirements expressed in terms of International Energy efficiency class (''IE'').[76] Section 2 of Annex I of EU 2019/1781 describes the energy efficiency and product information requirements for electric motors subject to this regulation. Although section 2 of Annex I (''Product Information Requirements for Motors'') specifies that the efficiency of the motor at the full, 75 percent and 50 percent rated load must be displayed, the efficiency requirements are defined based on the full load efficiency of the motor. Section 1 of Annex I (''Energy Efficiency Requirement for Motors'') specifies that the IE class of a motor is determined at rated output power (*i.e.,* at full load).

Motor efficiency varies depending on the motor's operating load, however for three-phase, single-speed, AC induction motors included in the scope of the proposed test procedure, this efficiency curve is relatively flat within the range of operation (typically between 50 and 75 percent).[77] Therefore, an electric motor with a tested full-load efficiency will typically perform better than another electric motor with a lower tested full-load efficiency within its typical range of operation in the field. Accordingly, the tested efficiency at full-load is representative of motor performance at the typical range of operation. In addition, although manufacturers are currently only required to certify the nominal full-load efficiency of the least efficient basic model, the DOE test procedure requires performing a load test at 6 load points,[78] and this information is typically provided in online catalogs. Given the relationship between efficiency at part load and full load, and the difficulty in identifying a representative motor load profile,[79] DOE does not propose to change the load point at which the efficiency metric is measured for electric motors that are currently regulated at 10 CFR 431.25. DOE intends to maintain use of the nominal full-load efficiency for electric motors currently subject to standards at 10 CFR 431.25.

For the expanded scope being proposed in this NOPR, different test procedure instructions are proposed depending on the motor's configuration: (1) Direct-on-line (motor only) or (2) inverter-fed. All test procedures rely on the efficiency metric to determine the motor's performance, which is the ratio of the input power (to the motor, or to the motor and inverter combination) divided by the output power (of the motor). In all cases, the efficiency is measured at different load points.

DOE proposes to use the full-load efficiency as the metric for measuring the performance of the additional electric motors proposed for inclusion within the scope of these test procedures, as described in the following discussion. DOE proposes to evaluate the efficiency of the motor with or without the inclusion of the inverter depending on the motor configuration. For each motor configuration, DOE proposes to evaluate the efficiency at full load as follows:

- For additional electric motors proposed for inclusion within the scope of these test procedures that do not require an inverter to operate (*i.e.,* are direct-on-line or inverter-capable), DOE proposes to determine the efficiency of the motor at full-load (*i.e.,* measure the full-load efficiency), consistent with how electric motors currently subject to standards at 10 CFR 431.25 are evaluated and consistent with the efficiency classification of these motors in IEC 60034–30–1:2014.
- For additional electric motors proposed for inclusion within the scope of these test procedures that are inverter-only, DOE proposes to evaluate the efficiency of the motor and inverter combination at 100 percent rated speed and rated torque (*i.e.,* measure the full load efficiency). DOE notes that for inverter-only electric motors that include an inverter, this approach is consistent with the specifications in IEC 61800–9–2:2017.

DOE proposes to use a single load point at full-load for the efficiency metric. Currently regulated electric motors and the additional electric motors proposed for inclusion in scope

[75] The IEC TS 60034–30–2:2016 notes that the requirement to test at 90 percent of rated speed (instead of 100 percent) ensures that the motor is operated at full magnetic flux (full voltage) regardless of the voltage drop in the internal electronic switches of the frequency converter.

[76] An IE class is a table of full load efficiency ratings provided at different motor rated power and poles. For example, the IE class ''IE3'' is considered largely equivalent to the current energy conservation standards in Table 5 at 10 CFR 431.25.

[77] See U.S. Department of Energy Motor Challenge Fact Sheet, ''Determining Electric Motor Load and Efficiency.'' Available at *https://www.energy.gov/sites/prod/files/2014/04/f15/10097517.pdf.* Last accessed September 14, 2020.

[78] The load test portion of the test procedure include measurements at four load points approximately equally spaced between not less than 25 percent and up to and including 100 percent load, and two load points suitably chosen above 100 percent load, but not exceeding 150 percent load. See section 5.7.1 of IEEE 112–2017, Section 7.1.4 of CSA C390–10, Section 6.1.3.2.3 of IEC 60034–2–1:2014.

[79] Electric motors serve a variety of applications (*e.g.,* pumps, fans, material handling, material processing, air compressors, refrigeration compressors) in different sectors (*e.g.,* residential, commercial, industrial), which makes identifying a single representative load profile challenging.

are not restricted to a single application and can be used in a variety of applications and sectors with different load profiles (*i.e.,* collection of load points weighted based on the duration of operation at a given load point). Given the large number of possible electric motor end-use applications, DOE does not find it practical to establish a unique load profile that would be representative of all applications. Instead, for all motors in the proposed for inclusion in scope (including electric motors currently subject to standards at 10 CFR 431.25), DOE proposes that the represented values of nominal full-load efficiency or of average full-load efficiency be used to make representations. As stated, for the electric motors proposed for inclusion in the scope of the test procedure, such motors would not be required to be tested according the proposed test procedure, if finalized, until such time as DOE were to establish corresponding energy conservation standards. If manufacturers voluntarily make representations regarding the energy consumption or cost of energy of such electric motors, however, they would be required to test according to the DOE test procedure and sampling requirements. DOE may consider requiring manufacturers to disclose the part load performance efficiency of the additional motors proposed for inclusion within the scope of this test procedure as part of any future energy conservation standard related to these electric motors.

In addition, similar to currently regulated electric motors, for the additional electric motors proposed for inclusion within the scope of these test procedures, DOE proposes sampling requirements to calculate the average full-load efficiency of a basic model and provisions to determine a nominal full-load efficiency. (*See* section III.O)

The test procedure as proposed does not account for the impacts of variable speed controls. However, the proposal to determine efficiency at a single load point would allow consumers to compare motors of the same configuration against each other (see Table III.18 for the description of the motor configurations). In addition, the proposed test procedures also require the part-load efficiency to be measured, and consumers typically have access to part-load motor performance information to assess the benefits of applying controls in their specific application and load profile.

TABLE III.18—PROPOSED LOAD POINTS AND INDUSTRY TEST STANDARDS FOR ADDITIONAL ELECTRIC MOTORS PROPOSED IN SCOPE

Motor configuration	Equipment tested	Load point	Industry test standard incorporated by reference
Direct-on-line or inverter-capable	Motor	100 percent of rated load, 100 percent of rated torque.	IEEE 114–2010, CSA C747–09 (R2019), IEEE 112–2017, CSA C390–10 (R2019), IEC 60034–2–1:2014.*
Inverter-only	Motor + Inverter	100 percent of rated speed, 100 percent rated torque.	IEC 61800–9–2:2017.

* The choice of the industry test standards depends on the motor topology and horsepower. See section III.B.3 and III.D.3 of this NOPR.

DOE requests comments on its proposal to use full-load efficiency as the metric for measuring the performance of the additional electric motors proposed in scope. Specifically, DOE requests comment on the proposed load points associated with each electric motor category. If any different load points or metric should be considered, DOE requests information and data to support those load points and any alternate metric.

DOE requests comments whether it should consider an efficiency metric inclusive of the inverter efficiency for inverter-capable electric motors and inverter-only electric motors sold with or without inverters.

F. Rated Output Power and Breakdown Torque of Electric Motors

The current regulations for electric motors specify that the metric for energy conservation standards, nominal full-load efficiency, is defined as a representative value of efficiency selected from the ''nominal efficiency'' column of Table 12–10 of NEMA MG1–2009, that is not greater than the average full-load efficiency of a population of motors of the same design. *See* 10 CFR 431.12. The ''average full-load efficiency'' is defined as ''. . . the ratio (expressed as a percentage) of the motor's useful power output to its total power input when the motor is operated at its full rated load, rated voltage, and rated frequency.'' *Id.* The industry testing standards referenced in the DOE electric motor test procedure do not provide a method for determining the full rated load of the tested unit; rather they rely on the manufacturer-specified output power listed on a motor's nameplate (*i.e.,* the rated motor horsepower). The industry standards do not define rated output power; rather, the output power is a manufacturer declaration.

As explained in the June 2020 RFI, rated motor output power (which is synonymous to rated motor horsepower) is generally not an intrinsic, observable property, and motors are usually capable of operating both above and below the rated motor output power. 85 FR 34111, 34116. NEMA MG1–2016 with 2018 Supplements directs that the rated motor output power be established by identifying the horsepower that corresponds to the appropriate value of breakdown torque, established in section 12.37 and section 12.39 of NEMA MG1–2016 with 2018 Supplements, for general-purpose polyphase 2-digit frame (*e.g.,* 56-frame) size electric motors and Design A, B, and C polyphase 3- and 4-digit frame size electric motors, respectively (*e.g.,* 215-frame). In the June 2020 RFI, DOE stated that it was considering applying the definition in section 12.37 of NEMA MG1–2016 to all 2-digit frame size electric motors within DOE scope, such that DOE could define rated motor output power based on breakdown torque, as defined in NEMA MG 1–2016. 85 FR 34111, 34116.

In concept, the breakdown torque describes the maximum torque the motor can develop without slowing down and stalling. Breakdown torque corresponds to a local maximum torque (on a plot of torque versus speed) that is nearest to the rated torque and does not represent the maximum torque over the entire speed range. 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 section 12.39 of NEMA MG1–2016 with 2018 Supplements for single-speed polyphase squirrel-cage NEMA Design A, B and C medium motors.[80] Section 12.37 of NEMA MG1–

[80] NEMA MG1–2016 with 2018 Supplements, section 1.4.1 states that a medium electric machine Continued

2016 with 2018 Supplements specifies that the breakdown torque of a general-purpose polyphase squirrel-cage small motor,[81] with rated voltage and frequency applied, 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.

DOE requested comment in the June 2020 RFI as to how industry currently determines rated motor output power and the feasibility of establishing a definition based on breakdown torque. DOE also requested comment on how to determine the rated motor output power for motors not expressly characterized by Table 10–5 of NEMA MG 1–2016. 85 FR 34111, 34116.

The Efficiency Advocates stated that DOE must define ''rated horsepower'' to ensure motors are tested and rated in a fair and consistent manner. They supported the use of breakdown torque on the basis that it aligns with the proposed small electric motor test procedure. (Efficiency Advocates, No. 5 at p. 4) NEMA commented that defining rated motor horsepower based on breakdown torque is unnecessary, stating that sections 12.37 and 12.39 in NEMA MG1–2016 provide sufficient guidance for determining rated motor horsepower, and that these methods are commonly used by industry. (NEMA, No. 2 at p. 4–5).

CA IOUs submitted comments prepared by Dr. Emmanuel Agamloh of Baylor University. (CA IOUs, No. 3 at p. 11) Dr. Agamloh stated that it is not necessary to establish the rated motor horsepower in order to determine motor efficiency. (*Id.*) Further, Dr. Agamloh stated that a breakdown torque measurement is less reliable than an efficiency measurement, and that measuring breakdown torque requires operating the motor at the upper end of equipment capacity and testing facilities and is therefore unrealistic for larger motors (>250 hp) within DOE's scope. *Id.* Dr. Agamloh cited a 2017 paper that he stated illustrates his concern that the current methods for determining breakdown torque may be inaccurate.[82] *Id.* The cited paper states that as motors get larger in size and approach the size limitations of testing equipment, manufacturers tend to test electric motors at lower voltages and use parabolic fitting to estimate the breakdown torque of motors. *Id.* Dr. Agamloh asserted that the process for determining a motor horsepower for a motor that has no declared rating is a series of lengthy and burdensome heat run tests to produce a stable temperature that does not exceed the rated temperature of the insulation. (CA IOUs, No. 3 at p. 11–12).

In the January 2021 Final Rule, DOE established definitions for ''rated output power'' and ''breakdown torque'' as they relate to small electric motors. 86 FR 4, 13–14; see 10 CFR 431.442. DOE discussed that defining rated output power and breakdown torque based on NEMA MG 1–2016 provides additional detail that allows for the accurate comparison of small electric motors. *Id.* In this NOPR, DOE is proposing a definition for ''breakdown torque,'' and proposing to further specify ''rated output power'' for air-over electric motors, electric motors subject to energy conservation standards at 431.25, electric motors above 500 horsepower, and SNEMs.

DOE's review of NEMA MG1–2016 with 2018 Supplements indicates some of the difficulties identified by CA IOUs in specifying rated output power for electric motors using the same definition of ''breakdown torque'' as it relates to small electric motors, as defined by the January 2021 Final Rule. 86 FR 4, 13–14. Namely, the rated output power of small electric motors is defined based on breakdown torque in NEMA MG1–2016 with 2018 Supplements, Table 10–5. Table 10–5 specifies a range of breakdown torques for each motor horsepower, such that given a motor synchronous speed and frequency, the breakdown torque will uniquely identify the rated output power.

This is different from the electric motors covered under 10 CFR 431.25. The motor requirements for a NEMA Design A, B or C motor at NEMA MG1–2016 with 2018 Supplements, section 12.39 specify the minimum breakdown torque as a percentage of full load torque. Therefore, the breakdown torque can describe the largest possible rated output power but cannot uniquely identify a rated output power.

Manufacturers typically determine the rated output power of an electric motor through assessment of a combination of motor performance characteristics (pull-up torque, breakdown torque, and locked-rotor current described in NEMA MG1–2016 with 2018 Supplements sections 12.40, 12.39, and 12.35, respectively), along with the temperature rise limits of the motor's rated insulation class. These limits determine the maximum rated output power, but do not inherently prevent a manufacturer from rating a motor with a lower output power than the maximum; *i.e.,* ''down-rating''. Based on discussion with a subject matter expert, DOE understands that rating a motor at a lower horsepower than the maximum would result in a motor with excess active and inactive material. The added cost of excess material in the oversized motor would result in a motor that is not cost-competitive with motors at the lower horsepower. DOE understands that the economics of motor manufacturing prevent manufacturers from down-rating the output power of motors; however, NEMA MG1–2016 with 2018 Supplements does not inherently eliminate that possibility. If a manufacturer intentionally ''down-rated'' a motor, a less stringent energy conservation standard could apply, since lower efficiency standards generally apply to lower horsepower ratings. *See* 10 CFR 431.25 Table 7. However, as discussed, manufacturers are disincentivized to down-rate motors because of the implications of cost-competitiveness.

In this NOPR, DOE proposes to specify in proposed section 2.1 of appendix B (applicable to electric motors subject to energy conservation standards at 431.25 and electric motors above 500 horsepower) that for the purposes of this section and electric motors at or below 500 horsepower, rated output power means ''the mechanical output power that corresponds to the electric motor's breakdown torque as specified in section 12.37 and 12.39 of NEMA MG 1–2016 with 2018 Supplements.''

DOE also proposes to specify in proposed sections 2.2 (applicable to air-over electric motors) and 2.4 of Appendix B (applicable to SNEMs) that for the purposes of those sections, rated output power means (1) for 2-digit frame sizes, the mechanical output power that corresponds to the electric motor's breakdown torque as specified in Table 10–5 of NEMA MG 1–2016 with 2018 Supplements for single-phase motors, or 140 percent of the breakdown torque values specified in Table 10–5 of NEMA MG 1–2016 with 2018 Supplements for polyphase motors; (2) For 3-digit frame sizes, the mechanical output power that corresponds to the electric motor's breakdown torque specified in section 12.37 and 12.39 of NEMA MG 1–2016 with 2018 Supplements.

DOE is proposing to define ''breakdown torque'' as ''the maximum torque that an induction motor will develop with rated voltage and frequency applied without an abrupt

is a machine built in a 3- or 4-digit frame size, and has a continuous rating up to and including 500 HP.

[81] NEMA MG1–2016 with 2018 Supplements, section 1.3 states that small machines are machines built in a 2-digit frame size.

[82] E.B. Agamloh, A. Cavagnino, S. Vaschetto ''Accurate determination of induction machine torque and current speed characteristics'', *IEEE Transactions on Industry Applications, vol 53, no. 4, July/Aug 2017.*

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.'' [83] The phrase ''abrupt drop in speed'' references the intrinsic behaviour of motors, in which a motor will slow down or stall if the load applied to the motor exceed the breakdown torque, and indicates that minor reductions in speed observed due to measurement sensitivities are not considered. DOE is not proposing to require manufacturers to test or report the value of breakdown torque used to establish a rated motor horsepower. Rather, DOE is proposing to define ''breakdown torque,'' through reference to the industry standard NEMA MG1–2016, in order to specify the ''rated output power'' in sections 2.1, 2.2, and 2.4 of 10 CFR 431 Appendix B.

DOE requests comment on its proposal to specify rated output power for induction motors based on frame size requirements in NEMA MG–2016 with 2018 Supplements. Specifically, DOE requests comment on whether the proposed specification of rated output power for sections 2.1, 2.2, and 2.4 of appendix B accurately describe how manufacturers are currently determining the rated output power for electric motors.

DOE seeks comment on how rated output power and breakdown torque are determined for the additional motors proposed to be added to scope (specifically synchronous electric motors); whether breakdown torque needs to be defined; and if so, how.

G. Rated Values Specified for Testing

1. Rated Frequency

Electricity is supplied at sinusoidal frequency of 60 Hz in the United States, whereas in other regions of the world (*e.g.,* Europe), electricity is provided at a frequency of 50 Hz. The frequency supplied to a motor inherently affects its performance. ''Rated frequency'' is a term commonly used by industry standards for testing electric motors (*e.g.,* section 6.1 in IEEE 112–2004, and section 6.1 in CSA C390–10 (R2019)), and refers to the frequency at which the motor is designed to operate. These motor's rated frequency is typically provided by manufacturers on the electric motor nameplate. Multiple rated frequencies are sometimes provided if a manufacturer intends to sell a particular model in all parts of the world. In the case where an electric motor is designated to operate at either 60 or 50 Hz, the current test procedure does not explicitly specify the value at which an electric motor is tested.

In the June 2020 RFI, DOE stated that because the test procedures and energy conservation standards established under EPCA apply to motors distributed in commerce within the United Stated, DOE was considering defining the term ''rated frequency'' as 60 Hz to expressly specify the test requirement. DOE requested comment on specifying the ''rated frequency'' as 60 Hz. 85 FR 34111, 34116.

The CA IOUs commented that defining rated voltage as 60 Hz was good but not necessary since there was no clear advantage to testing at a different frequency. (CA IOUs, No. 3 at p. 12) The Efficiency Advocates commented that such a definition would remove ambiguity and reflect the true operating frequency. (Efficiency Advocates, No. 5 at p.4–5) NEMA commented that the definition presented in the June 2020 RFI was adequate, and if adopted, would not impact current test procedure results. (NEMA, No. 2 at p. 5) NEMA also suggested that rated frequency should be required to appear on the nameplates for electric motors. *Id.*

DOE did not receive any comments opposing the definition. For the reasons discussed above and in the June 2020 RFI, DOE is proposing to amend 10 CFR 431.12 to add the term ''rated frequency,'' which would be defined as ''60 hertz.''

2. Rated Load

''Rated load'' [84] is a term used in industry standards to specify a loading point at which to test a motor (*e.g.,* sections 5.7 and 6.4.2.4 in IEEE 112–2017, and section 6.1 in CSA C390–10 (R2019)). Typically, a rated load represents a power output expected from the motor (*e.g.,* a horsepower value on the nameplate). The rated load has a corresponding rated speed and rated torque. In the June 2020 RFI, DOE stated that it was considering defining the term ''rated load'' as ''the rated motor horsepower of an electric motor''. 85 FR 34111, 34116–34117.

The Efficiency Advocates and NEEA supported this definition, stating that the definition is necessary to ensure the test procedures are applied consistently. (Efficiency Advocates, No. 5 at p. 5) (NEEA, No. 6 at p. 4) NEMA commented that the definition presented in the June 2020 RFI was adequate, and if adopted, would not impact current test procedure results. (NEMA, No. 2 at p. 5) NEMA also suggested that rated load should be required to appear on the nameplates for electric motors. *Id.* DOE did not receive any comments opposing the definition.

In the January 2021 Final Rule, DOE defined rated load as the ''the rated output power of a small electric motor.'' 86 FR 4, 13–14; see 10 CFR 431.442. DOE notes that rated output power is synonymous to the term rated horsepower. To keep consistent with the January 2021 Final Rule, DOE is proposing to establish the definition of ''rated load'' as ''the rated output power of an electric motor.'' DOE also proposes 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 electric motors.

3. Rated Voltage

The term ''rated voltage'' is used in industry standards to specify the voltage supplied to the motor under test (*e.g.,* section 6.1 in IEEE 112–2004, and section 6.1 in CSA C390–10 (R2019)). The industry standards referenced in appendix B direct motors to be tested at the rated voltage, without specifying how to test when multiple voltages are provided on the nameplate and marketing material. DOE has found that some motor nameplates are labeled with a voltage rating including a range of values, such as ''208–230/460 volts,'' or other qualifiers, such as ''230/460V, usable at 208V.'' Currently under the DOE test procedure, manufacturers select the input voltage for testing.

In the June 2020 RFI, DOE stated that it was considering specifying the input voltages required for testing motors rated for use at multiple voltages. 85 FR 34111, 34117. DOE identified several options, including specifying testing only at the lowest rated voltage, testing at only the highest rated voltage, testing at all rated voltages, or aligning with the small electric motor test procedure by allowing manufacturers to test and certify motors at any rated voltage, provided that the tested input voltage setting is listed on the certification report. *Id.*

NEMA commented that the input voltage settings are defined in IEEE 112 and should be applied as appropriate per that industry standard. (NEMA, No. 2 at p. 5) Advanced Energy hypothesized that testing a motor at 208V would have a slightly lower efficiency that testing a motor at 230V. Advanced Energy supported this hypothesis with test data from two motors that showed an average 0.45% decrease in efficiency when operating 208V as compared to 230V. (Advanced

[83] 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.

[84] Also referred to as ''rated full-load,'' ''full rated load,'' or ''full-load'' interchangeably.

Energy, No. 4 at p. 5–6) Regarding comparison of other voltages, while Advanced Energy did provide results that indicate a slight decrease in efficiency when operating at 208V as compared to 230V; there is no indication that the values currently selected by manufacturers are not representative of average use.

The Efficiency Advocates commented that electric motors should be tested at all nameplate voltages and should meet efficiency standards across all nameplate voltages. (Efficiency Advocates, No. 5 at p. 5) They expressed concern that allowing manufacturers to test at different voltages would allow manufacturers to test at a more favorable voltage even if that voltage was not a likely operating voltage. Further, efficiency ratings would not be comparable across manufacturers because one manufacturer might test at the least efficient voltage, while another might test at the most efficient voltage. *Id*

CA IOU's comments prepared by Dr. Emmanuel Agamloh stated that for dual rated motors such as ''230 V/460 V,'' there is generally no difference in efficiency; for motors specified as ''208–230 V/460 V,'' the motor should meet efficiency at the specified voltages; and for motors specified as ''230 V/460 V, usable at 208 V,'' the motors are not rated at 208 V and it would be unfair to test them as such. Accordingly, CA IOUs commented that specifying a test voltage is not necessary and would create undue burden; but, if one is specified, it should be the lowest rated voltage. (CA IOUs, No. 3 at p. 12) DOE understands that the lowest rated voltage for motors specified as ''230 V/460 V, usable at 208 V'' would be 230V, not 208V.

Advanced Energy commented that a test procedure for ECMs may need to specify an input voltage range for testing, as these motors sometimes provide an input voltage range instead of a single nominal voltage. Advanced Energy stated that in such a case, there may be sensitivity to applied voltage that may result in variations in efficiency across the range. In addition, Advanced Energy commented that these motors may be variable speed with different efficiency at various speeds. (Advanced Energy, No. 25 at p. 12) DOE did not receive data concerning the sensitivity of efficiency to applied voltage as it relates to ECMs.

DOE tested two electric motor models at the two rated voltages of 230V and 460V to determine how voltage affects efficiency. In both cases, the tests at the higher voltage rating (460V) resulted in fewer losses than at 230V. The difference in losses between the two voltage test cases were minimal, approximately 0.5 percent and 1.2 percent. These results are shown in Table III.19and Table III.20.

TABLE III.19—MEASURED LOSSES OF POLYPHASE MOTORS AT DIFFERENT INPUT VOLTAGES

HP	Pole count	Measured losses (W)		Percent difference
		230V input voltage	460V input voltage	
5	2	507.3	505.0	−0.5
5	4	411.7	406.8	−1.2

TABLE III.20—MEASURED EFFICIENCY OF POLYPHASE MOTORS AT DIFFERENT INPUT VOLTAGES

HP	Pole count	Measured Efficiency (%)	
		230V input voltage	460V input voltage
5	2	88.0	88.1
5	4	90.1	90.2

In addition, for polyphase electric motors, DOE notes that section 12.50 of NEMA MG1–2016 with 2018 Supplements states that ''When a small or medium polyphase motor is marked with a single (*e.g.,* 230 V), dual (*e.g.,* 230/460) or broad range (*e.g.,* 208–230/460) voltage in the Rated Voltage field, the motor shall meet all performance requirements of NEMA MG 1–2016 with 2018 Supplements at the rated voltage(s). When a voltage is shown in a field other than the Rated Voltage field (*e.g.,* 'Usable at 208 Volts' or 'Usable at 200 Volts', per 14.35.2) this is for reference only and the motor is not required to meet all performance requirements of this standard (*e.g.,* torques and nameplate nominal efficiency) at this reference voltage.'' Therefore, current practice is that a manufacturer can select the voltage for testing; however, the electric motor must meet all performance requirements of NEMA MG1–2016 with 2018 Supplements at all rated voltages.

Therefore, after considering the comments and testing regarding how efficiency varies with input voltage, and the specifications provided in NEMA MG 1–2016 with 2018 Supplements, DOE proposes to allow testing electric motors at any nameplate voltage. This includes electric motors currently in scope, and expanded scope being considered in this NOPR. However, to address issues regarding comparability, consistent with the requirements in NEMA MG1–2016 with 2018 Supplements, DOE further clarifies that this proposed definition for ''rated voltage'' would also require that a motor would have to meet all performance requirements at any voltage listed on its nameplate. Therefore, a manufacturer would not be permitted to make representations regarding other voltages at which an electric motor could operate but at which the electric motor did not meet the performance standards. Accordingly, DOE proposes to define ''rated voltage'' as ''any of the nameplate input voltages of an electric motor or inverter, including the voltage selected by the motor's manufacturer to be used for testing the motor's efficiency.''

DOE clarifies that this definition would apply to all motors within the proposed scope of this test procedure. Alternatively, DOE could consider separate definitions or test instructions for ''rated voltage'' for motors currently within the scope of the test procedure and newly covered motors under the proposed expanded scope, if needed. DOE requests comment on this topic.

The proposed definition diverges from the rated voltage definition finalized in the January 2021 Final Rule for small electric motors. See 10 CFR 431.442. DOE notes that the definition is consistent with what NEMA and CA IOUs commented is the current practice in industry (*i.e.,* electric motors are tested at one of the voltages at which manufacturer representations are made). DOE seeks comments on its proposed definitions for ''rated frequency'' and ''rated load.''

DOE seeks comment on the proposed definition for ''rated voltage'' for electric motors currently in scope and expanded scope motors.

DOE seeks comment on its proposal to allow 'Usable at' voltages on the nameplate to be selected for testing, and how these 'Usable at' voltages differ from a ''rated voltage'' as currently labeled on certain electric motor nameplates.

DOE seeks comment on if ''rated voltage'' should be defined differently for currently in scope motors and newly included motors in the proposed expanded scope.

H. Temperature Rise Measurement Location

In the June 2020 RFI, DOE requested comment on whether the test instructions in IEEE 112–2004 Test Method B and IEEE 112–2017 Test Method B provided sufficient detail regarding placement of temperature measurement devices for establishing thermal equilibrium in the heat-run test. 85 FR 34111, 34115. Specifically, DOE requested comment regarding potential locations for measurement to establish thermal equilibrium. *Id.*

In response, NEMA and the CA IOUs commented that the current provisions in IEEE 112–2004 Test Method B and IEEE 112–2017 Test Method B were adequate and did not require further clarification. The CA IOUs comments prepared by Dr. Agamloh stated that the absolute value of the temperature captured was not important to establish thermal equilibrium. The CA IOUs' comments stated that instead, capturing the variations in temperature (regardless of where the temperature measurement devices are placed) is the critical information needed to establish thermal equilibrium. The CA IOUs stated that the placement of the temperature device to indicate the thermal condition of the machine is not critical and that additional instructions were not needed in the DOE test procedure. (NEMA, No. 2 at p. 4; CA IOUs, No. 3 at p. 13)

Advanced Energy provided a description of the typical locations for measurement to establish thermal equilibrium, and stated that some represent a higher test burden than others. (Advanced Energy, No. 4 at p. 4–5) Advanced Energy did not make any recommendations on whether additional instructions were needed in the DOE test procedure.

DOE agrees that the critical information to establish thermal equilibrium does not depend on the placement of temperature measurement devices, but rather on the variations in temperature, regardless of where the temperature measurement devices are placed. Therefore, DOE does not propose any modifications to the current instructions regarding the placement of temperature measurement devices for establishing thermal equilibrium in the heat-run test.

I. Submersible Electric Motors Testing

DOE proposes to include within the scope of the test procedure electric motors that are submersible electric motors and establish test procedures for such motors. In response to the June 2020 RFI, the Efficiency Advocates stated that the marketing of NEMA Premium Efficiency motors for submersible applications suggests that these motors could be tested with current test procedures. (Efficiency Advocates, No. 5 at p. 3) Further, CA IOUs commented that a similar procedure as the industry air-over test procedure could be used to test submersible motors because for both motors, cooling is provided by the material surrounding the motor (*e.g.,* air or water). (CA IOUs, No. 3 at p. 9)

Accordingly, DOE conducted investigative testing on four submersible electric motors to evaluate the feasibility of adapting Section 34.4 and Section 34.5 of NEMA MG1–2016 with its 2018 Supplements (the NEMA Air-over test method) to measure the efficiency of a submersible electric motor. DOE tested two single-phase submersible motors and two polyphase submersible motors ranging from 0.5 hp to 5 hp. For more details on Section 34.4 and Section 34.5, see section III.D.1. of this document.

As part of the investigative testing for submersible electric motors, DOE did not consider any liquid medium for cooling the motor because of the added test burden associated with testing using a liquid medium. Both air-over and submersible electric motors rely on an external cooling medium to not overheat during operation, and they differ in what that cooling medium is. For a typical self-cooled electric motor with an internal fan, the initial temperature test has the motor run at full load until its temperature rise above ambient does not change by 1 °C over a thirty-minute period according to Section 5.9.4.5 of IEEE 112–2017. In contrast, temperature stabilization is not required for Section 34.4 and Section 34.5 of NEMA MG1–2016 with its 2018 Supplements; instead, the motor is required to remain within a ±10 °C range of a 75 °C target temperature during the load test. For polyphase motors, this temperature target increases based on the insulation class of the motor. Since temperature stabilization is not required, a cooling medium of air (which is less conducive to heat transfer than most liquids) can be used to test submersible motors even if the motor is not intended to operate continuously in air.

Accordingly, to adapt Sections 34.4 and 34.5 to test submersible electric motors, DOE considered updates to the following test specifications: (1) Thermocouple placement, and (2) target temperature. Regarding thermocouple placement, according to Sections 34.4 and 34.5, the thermocouple should be placed on either the stator windings or if the windings are inaccessible, the stator iron. Since submersible motors are hermetically sealed and often have an oil inside the case to cool the windings, placing the thermocouple in either of these locations is possible without significant modification to the motor. Without any instruction from the industry standard on thermocouple placement in this case, DOE proposes to add instructions to the test procedure to place thermocouples on the case of the motor during testing.

Regarding target temperature, Sections 34.4 and 34.5 do not require the motor to be thermally stable during the load test, but instead, require the motor to be within a 20 °C range of the target temperature (if the thermocouple is on the stator iron, this tolerance is –10 °C to –40 °C). For all single-phase motors, this target temperature is 75 °C, and for polyphase motors this target temperature varies with insulation class of the motor. For the same reasons discussed in section III.D.1, DOE proposes the target temperature to be 75 °C for all motors, regardless of insulation class.

DOE found that tests according to Section 34.5 would heat the motor beyond the allowable temperature range multiple times during the load test, forcing the motor to be shutoff to cool down before measuring remaining load points. These repeated shutdowns are not desirable as they increase variability and reduce the amount of time the test lab has to take accurate measurements. Section 34.4 did not have this issue of rapid overheating because of the blower forcing air over the motor during the tests. As such, DOE tentatively concludes that Section 34.5 is not a feasible test procedure to measure the efficiency of submersible electric motors.

After ruling out Section 34.5 as a potential test procedure, DOE conducted testing to evaluate the repeatability of Section 34.4 as a submersible test procedure. For this testing, DOE tested two motors and observed a maximum change in measured losses of 1.2% between repeated tests. Table III.21, Section 34.4, Measured Losses shows the results of this testing.

TABLE III.2—SECTION 34.4 MEASURED LOSSES

HP	Phase	Section 34.4—Measured Losses (W)		
		Test 1	Test 2	Difference
1	1	630.9	631.9	−0.16
5	3	1039.4	1051.6	−1.16

DOE notes that as motor rated horsepower increased, the blower had to increase in power to keep the motor from heating beyond the permissible temperature range too quickly. Based on the testing results, DOE initially determines that Section 34.4 is a repeatable test method and proposes to use Section 34.4, with modifications discussed above, as the test procedure for submersible motors.

DOE seeks comment on the proposed test procedure for submersible electric motors based on Section 34.4 of NEMA MG1–2016 with its 2018 Supplements.

DOE also seeks comment on the proposed modifications to Section 34.4 of NEMA MG1–2016 with its 2018 Supplements, and if further modifications are warranted for use with submersible electric motors.

DOE seeks comment and supporting data on if the submersible test procedure should only apply to a certain range of horsepower rating, or if it should apply to all submersible electric motors, regardless of rated horsepower.

J. Vertical Electric Motors Testing

Current testing requirements for vertical electric motors, located in section 3.8 of appendix B require testing in the vertical or horizontal configuration depending on several factors. Those factors include IEEE 112 Method B instructions, test facility capabilities, and construction of the motor. Section 3.8 of appendix B. In its June 2020 RFI, DOE did not seek comment specifically regarding testing of vertical motors.

In response to the June 2020 RFI, NEMA commented regarding testing of vertical motors. NEMA's comment applied specifically to provisions of the current vertical motor test instructions that apply only to vertical motors with hollow shafts, which state ''Finally, if the unit under test contains a hollow shaft, a solid shaft shall be inserted, bolted to the non-drive end of the motor and welded on the drive end. Enough clearance shall be maintained such that attachment to a dynamometer is possible.'' Section 3.8 of appendix B. (NEMA, No. 6 at p. 3) NEMA argued that the requirements of the cited provisions should be revised because they both (1) do not improve test procedure accuracy or consistency and (2) may increase testing burden. (NEMA, No. 6 at p. 3) NEMA commented that, although current requirements direct welding of a solid shaft to the motor's drive end, it is common practice within industry to use a disconnectable coupling or adapter to connect hollow motor shafts to dynamometers. NEMA commented that using an adaptor or coupling causes no loss of testing accuracy, but carries the advantage of easy reversibility; whereas welding may permanently alter the motor. *Id*

In addition, NEMA stated that the CFR's reference to the drive end of the motor was confusing because depending on motor design, the dynamometer-connected end may vary. Accordingly, NEMA offered potential replacement language as follows: ''If necessary, a coupling or other adaptor can be utilized for connection of the unit under test to the dynamometer.'' (NEMA, No. 6 at p. 3)

NEMA's proposed language effectively would provide additional flexibility in the permitted methods of connecting a motor under test to a dynamometer. Provided the coupling is sufficiently rigid, it would be unlikely to significantly alter dynamometer measurements. As such, it would be unlikely that use of a coupling would reduce test procedure repeatability. Permitted use of a coupling could reduce burden, as removal of such a connector may be less laborious than reversing a welding process.

As a result, DOE is proposing to adopt NEMA's suggestion with two modifications: (1) The addition of a lower bound on coupling's torsional rigidity, and (2) consolidation of ''coupling or other adaptor'' to simply ''coupling''. DOE is not proposing to require measurement of torsional rigidity, but rather to require that it exceed that of the motor shaft so that the coupling is unlikely to significantly deform or oscillate in response to applied torque. Deformations or oscillations in the mechanical connection between the motor and the dynamometer, if significant, could introduce measurement error. Also, DOE expects than any adaptor used could be described as a ''coupling'' and, thus, for clarity proposes to use only the latter term. Accordingly, DOE's proposed language is as follows:

''If necessary, the unit under test may be connected to the dynamometer using a coupling of torsional rigidity greater than or equal to that of the motor shaft.''

DOE requests comment on the proposed changes to the testing requirement for certain vertical electric motors.

DOE requests comment on whether it should be specified in the test method that the coupling torsional rigidity exceed the rigidity of the motor shaft it is connected to.

K. Contact Seals Requirement

Current testing requirements for immersible electric motors, located in Section 3.6 of Appendix B, specify testing with all contact seals removed but with no other modifications to the motor. No such provision currently exists for other varieties of electric motors. For other motors, unless otherwise provided for, motors are to be tested unmodified. In the June 2020 RFI, DOE did not seek comment specifically regarding testing of motors with contact seals.

In response to the June 2020 RFI, Advanced Energy stated that DOE had previously permitted removal of dust seals prior to testing, but not permitted removal of oil seals. (Advanced Energy, No. 4 at p. 7) Advanced Energy commented that oil seals can greatly affect efficiency and typically require motor disassembly to remove. Advanced Energy requested clarification regarding which seals may be removed prior to testing. *Id*

The current regulations at section 3.6 of appendix B do not distinguish between seals designed to prevent ingress of dust, oil, or any other contaminant. Seal removal is determined solely based on whether the seal in question is a contact seal. If a motor under test both (1) has contact seals and (2) is an immersible electric motor, then the contact seal is removed during testing. If a motor under test has contact seals but is not an immersible electric motor, the seals remain installed during testing.

Advanced Energy's comment suggests that some confusion exists within the electric motor industry regarding which seals may be removed and under what conditions. To provide more explicit instruction, DOE proposes to add the following additional specification to section 3.9 of appendix B:

''Electric motor shaft seals of any variety shall remain installed during testing unless the motor under test is an immersible electric motor, in which case the seals shall be removed for testing only if they are contact seals.''

DOE requests comment on the proposed language clarifying testing of electric motors with shaft seals.

L. Additional Testing Instructions for Additional Electric Motors Proposed for Inclusion in the Scope of the Test Procedure

For the NOPR, DOE conducted research and reviewed feedback from testing laboratories and subject matter experts as well as information from the December 2013 Final Rule to determine whether instruction in addition to the proposed referenced industry test procedures would be needed for testing the additional electric motors proposed for inclusion within the scope of these test procedures. In the July 2017 RFI, DOE indicated that it was considering reviewing the test instructions in section 3 of appendix B to subpart B of part 431. 82 FR 35468, 35475.

Advanced Energy commented that testing instructions similar to those found in appendix B to subpart B of part 431 may be needed in some cases for the expanded scope that was considered in the July 2017 RFI. (Docket No. EERE–2017–BT–TP–0047, Advanced Energy, No. 25 at p. 10)

Sections 3.1 through 3.8 of appendix B provide additional testing instructions for electric motors that are (1) brake electric motors; (2) close-coupled pump electric motors and electric motors with single or double shaft extensions of non-standard dimensions or design; (3) electric motors with non-standard endshields or flanges; (4) electric motors with non-standard bases, feet or mounting configurations; (5) electric motors with a separately-powered blower; (6) immersible electric motors; (7) partial electric motors; and (8) vertical electric motors and electric motors with bearings incapable of horizontal operation. DOE reviewed the testing instructions and found that these would also be applicable to the additional motors proposed for inclusion in scope, to the extent that the additional motors are also covered by one of these eight certain types of electric motors listed in sections 3.1–3.8 of appendix B.

For partial electric motors and vertical motors, the existing testing instructions reference the specification of a ''standard bearing'' described as ''a 6000 series, either open or grease-lubricated double-shielded, single row, deep groove, radial ball bearings.'' (*See* section 3 of appendix B to subpart B of part 431) DOE proposes to retain similar testing instructions. However, because the categories of bearings contained in motors within the proposed scope of applicability of this test procedure could have smaller shafts compared to those discussed in the December 2013 Final Rule, DOE proposes to define standard bearings as follows: a 600 or 6000 series, either open or grease-lubricated double-shielded, single-row, deep groove, radial ball bearing. 600 series bearings have smaller bore diameters than 6000 series bearings and can accommodate the motors with smaller shafts considered in this rulemaking. 600 series bearings also may have different load and speed ratings, but DOE understands that they are suitable to use as standard bearings as specified in these testing instructions.

DOE requests comments on the proposed application of the additional testing instructions in sections 3.1 through 3.8 of appendix B to the additional electric motors proposed for inclusion in scope of the test procedure. To the extent that revisions to the additional instructions other than those discussed are needed, DOE requests supporting information and justification for these revisions.

M. Transition to 10 CFR Part 429

DOE proposes to amend and move the portions of the existing electric motor regulations that pertain to certification testing and to the determination of represented values from 10 CFR part 431 to 10 CFR part 429. In addition, DOE proposes to amend other sections of 10 CFR part 431, subpart B, to ensure the regulatory structure comprising 10 CFR part 431, subpart B, and 10 CFR part 429 remains coherent. DOE also proposes to make changes to the general provisions in 10 CFR part 429 to reflect the proposed addition of electric motor provisions related to certification testing and to the determination of represented values.

In this rule, DOE proposes to largely retain the procedures for recognition and withdrawal of recognition of accreditation bodies and certification programs as it exists at 10 CFR 431.21 with one proposed change to the current provisions at 10 CFR 431.21(g) to clarify the timeline and process of withdrawal of recognition by DOE. DOE proposes that if the certification program is failing to meet the criteria of paragraph (b) of § 429.73 or 429.74, DOE will issue a Notice of Withdrawal (''Notice'') stating which criteria the entity has failed to meet. The Notice will request that the entity take appropriate corrective action(s) specified in the Notice. The entity must take corrective action within 180 days from the date of the Notice of Withdrawal or dispute DOE's allegations within 30 days from the issuance of the Notice. If after 180 days DOE finds that satisfactory corrective action has not been made, DOE will withdraw its recognition from the entity. DOE proposes to add these requirements to the procedures for recognition and withdrawal of recognition because it believes this timeframe is an important clarification.

TABLE III.22—ELECTRIC MOTORS CERTIFICATION, COMPLIANCE, AND ENFORCEMENT CFR TRANSITIONS

Subpart B—electric motors [85]	Proposed location
10 CFR 431.14 Sources for information and guidance	Moved to 10 CFR 429.3.
10 CFR 431.17 Determination of efficiency	Moved to 10 CFR 429.64 and 10 CFR 429.70 as relevant, edits to general provisions in 10 CFR part 429 as needed.
10 CFR 431.18 Testing laboratories	Retained and added additional provisions at 10 CFR 429.64.

TABLE III.22—ELECTRIC MOTORS CERTIFICATION, COMPLIANCE, AND ENFORCEMENT CFR TRANSITIONS—Continued

Subpart B—electric motors [85]	Proposed location
10 CFR 431.19 Department of Energy recognition of accreditation bodies.	Moved to 10 CFR 429.74.
10 CFR 431.20 Department of Energy recognition of nationally recognized certification programs.	Moved to 10 CFR 429.73.
10 CFR 431.21 Procedures for recognition and withdrawal of recognition of accreditation bodies and certification programs.	Moved to 10 CFR 429.75.

N. Certification of Electric Motors

In addition to physical testing of electric motors, DOE allows manufacturers to certify basic models using an alternative efficiency determination method (AEDM). AEDMs must be derived from a mathematical model that represents the mechanical and electrical characteristics of that basic model, and is based on analytic evaluation of performance data and has been substantiated according to DOE's requirements. *See* 10 CFR 431.17. NEMA commented that the use of AEDMs is gaining support and that DOE should continue to allow their use. (NEMA, No. 2 at p. 2) NEMA stated that AEDMs reduce the test burden on manufacturers. (NEMA, No. 2 at p. 6) DOE does not propose any significant changes to the AEDM provisions in the test procedure (*See* section III.O.4) and continues to provide for its use as a method for reducing the testing burden on manufacturers. As noted in section III.O, DOE is proposing to continue to allow the use of an AEDM for electric motors currently included in the scope of the DOE test procedure. DOE also proposes to allow use of an AEDM for the additional motors proposed for inclusion under the scope of the test procedure. *See* section III.O.

For electric motors currently subject to standards at § 431.25, DOE also provides the option for manufacturers to use a nationally recognized certification program to certify the nominal full load efficiency of a basic model and issue a certificate of conformity for the motor. 10 CFR 431.17(a)(5). NEMA requested that the IEC System of Conformity Assessment Schemes for Electrotechnical Equipment and Components Global Motor Energy Efficiency program be recognized as a nationally certified program. (NEMA, No. 2 at p. 2) DOE notes that for any entity seeking recognition, the procedures for recognition of certification programs are currently provided at 10 CFR 431.21.

Manufacturers must certify electric motors as compliant with the applicable standard through the use of an ''independent testing or certification program nationally recognized in the United States.'' (42 U.S.C. 6316(c)) DOE proposes changes to the provisions related to certification testing to ensure consistency with the statutory language found in 42 U.S.C. 6316(c). These proposals are described in section III.N.1 and section III.N.2.

1. Independent Testing

DOE codified at 10 CFR 431.17(a)(5) the statutory requirement prescribing that manufacturers must certify electric motors as compliant with the applicable standard through the use of an ''independent testing or certification program nationally recognized in the United States.'' (42 U.S.C. 6316(c)) In its October 1999 final rule establishing certification, labeling and test procedures for electric motors, DOE explained that testing conducted in a laboratory accredited by a body such as National Institute of Standards and Technology (NIST)/National Voluntary Laboratory Accreditation Program (NVLAP) would satisfy the ''independent testing'' requirement under the statute. 64 FR 54124.[86] The accreditation requirements applicable to testing laboratories for electric motors are at 10 CFR 431.18, and the specific provisions for DOE recognition of accreditation bodies are at 10 CFR 431.19. An organization can petition DOE to be classified as a nationally recognized certification program. The petition process, criteria for evaluation, and withdrawal are described at 10 CFR 431.20–21.

In the existing regulations, DOE addresses the requirement to use an independent testing program nationally recognized in the United States by requiring that testing laboratories be accredited by NIST/NVLAP, a laboratory accreditation program having a mutual recognition program with NIST/NVLAP, or an organization classified by DOE as an accreditation body. 10 CFR 431.18. The term ''accredited laboratory'' is used to designate a testing laboratory to which accreditation has been granted. (10 CFR 431.12).

When a certification program is not used, DOE proposes that for certification of a new basic model pursuant to 10 CFR 431.36(e), required prior to 180 days following the publication of this final rule, testing must continue to be conducted in an accredited laboratory that meets the requirements of § 431.18. However, for certification of a new basic model pursuant to 10 CFR 431.36(e), required on or after 180 days following the publication of this final rule, DOE proposes that testing must be conducted by a nationally recognized testing program as further described in the remainder of this section. DOE proposes to replace the use of the term ''accredited laboratory'' (currently defined at 10 CFR 431.12) by the term ''nationally recognized testing program'' to better reflect the requirements to use a testing program nationally recognized in the United States. (42 U.S.C. 6316(c))

In addition, DOE proposes to add a definition of ''independent'' at 10 CFR 429.2 as a more appropriate interpretation of the statutory language found in 42 U.S.C. 6316(c) than the agency's prior application of this provision. The October 1999 Final rule assumed that a laboratory could be meaningfully independent, in a way that would satisfy the statutory criterion, while being owned by a manufacturer, so long as the laboratory was NIST/NVLAP certified. In light of experience since that time, DOE is concerned that this premise is not justified. NIST/NVLAP accreditation ensures the proficiency of test

[85] As it appeared at 10 CFR part 431, subpart B, in the 10 CFR parts 200 to 499 edition revised as of January 1, 2020.

[86] Laboratories accredited by NIST/NVLAP are governed by the NVLAP ''Procedures and General Requirements'' NIST Handbook 150–10 (February 2007) and Lab Bulletin LB–42–009. (See 10 CFR 431.18(b).) NIST Handbook 150–10 (via incorporation by reference of ''Procedures and General Requirements'' NIST Handbook 150 (February 2006)) describes the level of independence that a laboratory must have in relation to the organization for which it is conducting testing. The requirements include organizational arrangements that are necessary for in-house laboratories and additional levels of independence that must be demonstrated for third-party laboratories.

laboratories in the accurate determination of the efficiency of motors, however, DOE does not consider laboratory accreditation a sufficient assurance of ''independence''. Testing at a manufacturer's own laboratory allows the opportunity for a manufacturer to gain a competitive advantage by administering the testing in such a manner that could yield better results. It also further exacerbates the differential treatment between those businesses that are financially able to own their own test facilities and small businesses that may not have the capital to afford such large investments.. Therefore, DOE proposes a definition for ''independent'' that would pertain to the nationally recognized testing program, the certification program evaluation criteria, and the accreditation body evaluation. The term, ''independent,'' would refer to an entity that is not controlled by, or under common control with, electric motor manufacturers, importers, private labelers, or vendors. ''Independent'' would also mean that the testing laboratory has no affiliation or financial ties or contractual agreements (other than contractual agreements for testing pursuant to DOE test procedures), apparently or otherwise, with such entities that would: (1) Hinder the ability of the laboratory to evaluate fully or report the measured or calculated energy efficiency of any electric motor, or (2) create any potential or actual conflict of interest that would undermine the validity of said evaluation. This definition was largely based on the descriptions of independence currently in 10 CFR 431.19(b)(2), 431.19(c)(2), 431.20(b)(2) and 431.20(c)(2) and replace these descriptions.

DOE notes that the proposed definition of ''independence'' excludes any contractual agreements that would create a conflict of interest. Therefore, an independent laboratory providing certification testing services to a manufacturer would not be allowed to perform design and engineering consulting services to the same client for that same product.

In addition, DOE notes that its proposal would still allow for the option of testing in a manufacturer's own laboratory if the manufacturer uses a third-party certification program, as described in section III.N.2. DOE believes this combination of the three options explained in section III.N.2 to certify electric motors provides manufacturers with the most flexibility while satisfying the statute. DOE recognizes that the concerns expressed in the rulemaking that culminated in the October 1999 final rule may still apply. See, *e.g.,* 61 FR 60455–60456 (November 27, 1996). At that time, DOE noted that there were few test facilities that could meet this level of independence and noted the concerns of commenters that test facilities could not handle the necessary volume of testing given the potential for ''thousands'' of basic models. Nonetheless, DOE believes that the proposed change should have little practical impact on manufacturers' current practices due to the volume of motors rated using AEDMs and/or through participation in certification programs. DOE understands that most models are rated based on modeling and thus will be subject to the AEDM provisions, which are largely unchanged by this proposal. In addition, as noted previously, DOE proposes that the requirement to test in an independent testing program would only apply when certifying a new basic model on or after 180 days following the publication of this final rule. As such, previously certified basic models would not need to be re-tested.

DOE requests comments in the proposed definition of independent as it pertains to nationally recognized testing programs, certification programs, and accreditation bodies.

2. Certification Process for Electric Motors

As mentioned previously, DOE codified at 10 CFR 431.17(a)(5) the statutory requirement prescribing that manufacturers must certify electric motors as compliant with the applicable standard through the use of an ''independent testing or certification program nationally recognized in the United States.'' (42 U.S.C. 6316(c)) Consistent with the requirements of 42 U.S.C. 6316(c), DOE proposes to continue to offer the option of using independent testing (via an independent nationally recognized testing program as discussed in section III.N.1) or a nationally recognized certification program and to further specify which parties can test electric motors and certify compliance with the applicable energy conservation standards to DOE. DOE proposes that these provisions be required on and after the compliance date for any amended standards for electric motors published after January 1, 2021, as this is the date of the most recent print edition of the Code of Federal Regulations.

DOE proposes three options in this regard: (1) A manufacturer can have the electric motor tested using a nationally recognized testing program that is (as described in the proposed § 429.64(d)) and then certify on its own behalf or have a third party submit the manufacturer's certification report; (2) a manufacturer can test the electric motor at a testing laboratory other than a nationally recognized testing program (as described in the proposed § 429.64(d)) and then have a nationally recognized certification program (as described in the proposed § 429.73) certify the efficiency of the electric motor; or (3) a manufacturer can use an alternative efficiency determination method (''AEDM,'' as described in the proposed § 429.70) and then have a third-party nationally recognized certification program certify the efficiency of the electric motor. Under the proposed regulatory structure, a manufacturer cannot both test in its own laboratories and directly submit the certification of compliance to DOE for its own electric motors. See § 429.64(d) as proposed.

As explained previously, DOE does not consider a laboratory accreditation to be an assurance of ''independence''. Therefore, DOE believes that when testing in a facility that is not performed using an independent nationally recognized testing program, the results of the test must be certified by a third party nationally recognized certification program under § 429.73 of this proposal.

Further, DOE does not consider that the requirements of an AEDM would satisfy the statutory requirement of ''independence''. Therefore, DOE believes that when using an AEDM, the results of the AEDM must be certified by a third party certification program that is nationally recognized in the United States under the proposed § 429.73.

DOE requests comments on the three proposed options through which manufacturers must certify electric motors as compliant.

O. Determination of Represented Value

For electric motors subject to standards, DOE has established sampling requirements applicable to the determination of the nominal full-load efficiency. 10 CFR 431.17. The purpose of these sampling plans is to provide uniform statistical methods for determining compliance with any prescribed energy conservation standards and for making representations of energy consumption and energy efficiency on labels and in other locations such as marketing materials. The current regulations require that each basic model must either be tested or rated using an AEDM. 10 CFR 431.17(a). Section 431.17 specifies the requirements for use of an AEDM, including requirements for substantiation (*i.e.,* the initial validation) and verification of an AEDM. 10 CFR 431.17(a)(2)–(4).

AHAM and AHRI commented that any test procedures DOE develops should not be mandatory (including for representations) until or unless energy conservation standards are required. AHAM and AHRI opposed developing test procedures for products that DOE has not yet determined, through notice and comment rulemaking, that it will regulate. (Docket No. EERE–201 -BT–TP–0047, AHAM and AHRI, No. 21 at p. 3) Additional motors proposed for inclusion under the scope of the test procedure would not be required to be tested according to the test procedure as proposed, if made final, until such time as DOE were to establish energy conservation standards for such electric motor. If the proposed scope of applicability and test procedure were finalized, a manufacturer would only be required to use the DOE test procedure if that manufacturer voluntarily makes representations regarding the energy consumption or cost of energy of an electric motor. (42 U.S.C. 6314(d)(1))

The current sampling requirements for electric motors were established through the October 1999 final rule. 64 FR 54129 (October 1999). The current regulations require that each basic model must either be tested or rated using an AEDM. 10 CFR 431.17(a) For basic models that are not rated with an AEDM, the current regulations allow a manufacturer to choose between either testing in a non-accredited laboratory and having a nationally recognized certification program certify a basic model's nominal full-load efficiency or conducting testing in an accredited laboratory.[87] 10 CFR 431.17(a)(5)

As discussed in the remainder of the section, DOE proposes several edits to the current regulatory language to revise the existing requirements that manufacturers will be required to follow when determining the represented value of nominal full-load efficiency of a basic model. The revised provisions regarding the determination of the represented value of nominal full-load efficiency, enforcement provisions, and the validation and verification of an AEDM, consistent with DOE's overall approach for consolidating the locations of its certification and compliance provisions, would be placed in 10 CFR 429.64, and 429.70. In addition, DOE proposes that these revised provisions regarding the determination of the represented value of nominal full-load efficiency, enforcement provisions, and the validation and verification of an AEDM would apply to the additional electric motors proposed for inclusion in the scope of the test procedure, when a manufacturer of such motors would be required to use the DOE test procedure. These proposals are discussed in more detail in sections III.O.1 through III.O.4.

1. Nominal Full-Load Efficiency

DOE defines nominal full-load efficiency as a representative value of efficiency selected from the ''nominal efficiency'' column of Table 12–10, NEMA MG1–2009, that is not greater than the average full-load efficiency of a population of motors of the same design. (10 CFR 431.12) DOE is not proposing changes to this definition other than updating the reference to the latest version of NEMA MG1 as discussed in section III.C.4. Starting on and after the compliance date for any new or amended standards for electric motors published after January 1, 2021, DOE proposes to specify how manufacturers must apply this definition by adding revised language to the sampling provisions. Specifically, the nominal full-load efficiency of a basic model must be less than or equal to the average full-load efficiency of that basic model determined through testing. DOE discusses how to determine the average full-load efficiency of a basic model in the following sections. See 429.64(e) as proposed.

In addition, DOE proposes to clarify that the nominal full-load efficiency of a basic model must be less than or equal to the simulated full-load efficiency of that basic model determined through the application of an AEDM.

DOE seeks comments on its proposal to specify how to determine the nominal full load efficiency of a basic model of electric motors when the average full-load efficiency of that basic model is known.

Manufacturers currently rely on the nominal full-load efficiency to represent the performance of electric motor basic models. Starting on and after the compliance date for any new or amended standards for electric motors published after January 1, 2021, DOE proposes to allow manufacturers to alternatively use the average full-load efficiency of a basic model of electric motor as the represented efficiency (instead of the nominal full-load efficiency) provided that the manufacturer uses the average full-load efficiency consistently on all marketing materials, and as the value on the nameplate. Note that the energy conservation standard would remain based on the nominal full-load efficiency; DOE's proposal is only to permit representations in terms of average full-load efficiency as described in more detail in the following section. See 429.64(e) as proposed.

DOE requests comment on its proposal to allow using average full-load efficiency values as alternative represented values for electric motors.

2. Testing: Use of a Nationally Recognized Testing Program

Manufacturers who test basic models in an accredited laboratory must follow the criteria for selecting units for testing, including a minimum sample size of 5 units in most cases, as specified at 10 CFR 431.17(b)(2).[88]

The sample of units must be large enough to account for reasonable manufacturing variability among individual units of the basic model or variability in the test methodology such that the test results for the overall sample will be reasonably representative of the average full-load efficiency of the whole population of production units of that basic model. DOE notes that the current regulations do not limit the sample size and manufacturers can increase their sample size to narrow the margin of error. Prior to the compliance date for any new or amended standards for electric motors published after January 1, 2021, DOE proposes that manufacturers continue to follow the current provisions in 10 CFR 431.17 related to the determination of the represented value. However, DOE proposes to move these provisions in the newly proposed §§ 429.64(b) and 429.64(c).

On or after the compliance date for any new or amended standards for electric motors published after January 1, 2021, DOE proposes to require that manufacturers determine the represented values of a basic model in accordance with the provisions in the newly proposed § 429.64(e) and discussed in the remainder of this section.

DOE proposes to specify that the average full-load efficiency of a basic model is the arithmetic mean of tested efficiencies. That is, the average full-load efficiency of a basic model is determined using the definition of ''average full-load efficiency'' *i.e.,* the arithmetic mean of the full-load efficiencies of a population of electric motors of duplicate design. 10 CFR 431.12.

The terms ''population'' and ''sample'' are standard statistical concepts. A population of objects consists of all the objects that are

[87] As noted above, DOE proposes to replace the use of the term ''accredited laboratory'' with ''nationally recognized testing program''. See III.N.1.

[88] DOE proposes to replace the use of the term ''accredited laboratory'' with ''nationally recognized testing program''. See III.N.1.

relevant in a particular study.[89] A sample refers to a subset of the population containing the characteristics of the larger population. Samples are used in statistical analyses when population sizes are too large for the analysis to include all objects in the population, so that one can make inferences from the sample to the population. ''A population of electric motors of duplicate design'' consists of all the electric motors produced for a basic model. Testing all the units of a basic model to determine the arithmetic mean of the full-load efficiency of the total population is not practical. DOE only requires manufacturers to test a representative sample of the population in order to make inferences about the basic model's population. DOE proposes to add regulatory text to implement the definition such that, when conducting testing at a nationally recognized testing program, the average full-load efficiency of a basic model is calculated as the arithmetic mean of the full-load efficiencies of a sample of electric motors selected in accordance with the sampling requirements at 10 CFR 431.17(b)(2). In addition, DOE proposes to remove the equations at 10 CFR 431.17(b)(2)(i)–(ii).

Further, to improve clarity, DOE proposes to replace the current requirement that ''the sample size shall be not fewer than five units, except that when fewer than five units of a basic model would be produced over a reasonable period of time (approximately 180 days)'' by the following: ''the minimum sample size is five units. If fewer units than the minimum sample size are produced, each unit produced must be tested and the test results must demonstrate that the basic model performs at or better than the applicable standard(s). If one or more units of the basic model are manufactured subsequently, compliance with the default sampling and representations provisions is required''.

Finally, to ensure a high level of quality control and consistency of performance within the basic model, DOE proposes to add a requirement to verify that no motor tested has losses exceeding 15 percent of those permitted by the applicable energy conservation standard, similar to the prescribed margin applied when conducting verifications as proposed in § 429.134.

DOE requests comment on its proposal to require that, on or after the compliance date for any new or amended standards for electric motors published after January 1, 2021, manufacturers must calculate the average full-load efficiency of a basic model as the arithmetic mean of the full-load efficiencies of a sample of electric motors and on the proposal to add a requirement that no electric motor tested in the sample has losses exceeding 15 percent of those permitted by the applicable energy conservation standard.

3. Testing: Use of a Nationally Recognized Certification Program

For manufacturers using a nationally recognized certification program as described in § 431.17(a)(5), the selection and sampling requirements are typically specified in the certification program's operational documents, however these are not always described in detail. DOE proposes to impose additional requirements to ensure that the certification program follow the provisions proposed in § 429.64, as well as the AEDM validation procedures, and periodic AEDM verification procedures proposed in § 429.70(i). DOE believes these proposals would ensure consistency between basic model ratings obtained with and without the use of a certification program and would have no impact on how nationally certification programs operate.

In addition, after any updates to DOE's electric motors regulations, DOE proposes that, within one year of publication of the final rule, all certification programs must either submit a letter to DOE certifying that no change to their program is needed, or submit a letter describing the measures implemented to ensure the criteria in the proposed § 429.73(b) are met. If a certification program submits a letter describing updates to their program, DOE proposes that the current certification program would still be recognized until DOE evaluates any newly implemented measures and decides otherwise.

DOE requests comment on the proposal to add a requirement to specify that nationally recognized certification programs for electric motors must follow provisions as proposed in §§ 429.64 and 429.70(i).

DOE requests comment on its proposal to require that within one year of publication of a test procedures or certification, compliance and enforcement final rule pertaining to electric motors, all certification programs must either submit a letter to DOE certifying that no change to their program is needed or submit a letter describing the measures implemented to ensure the criteria in the proposed § 429.73(b) are still met. If a certification program submits a letter describing updates, DOE requests comment on its proposal to maintain the program's recognition until DOE reviews the measures implemented.

4. Use of an AEDM

Section 431.17 also specifies the requirements for use of an AEDM (10 CFR 431.17(a)(2)), including requirements for substantiation (*i.e.,* the initial validation) (10 CFR 431.17(a)(3), 10 CFR 431.17(b)(3)) and subsequent verification of an AEDM (10 CFR 431.17(a)(4)). Those requirements ensure the accuracy and reliability of the AEDM both prior to use and then through ongoing verification checks on the estimated efficiency.

DOE proposes to replace the term ''substantiation'' with the term ''validation'' to better align the relevant terminology with the AEDM provisions in 10 CFR 429.70. DOE also proposes to modify one of the requirements for AEDM validation. Currently, the provisions in 10 CFR 431.17(a)(3)(ii) require that the simulated full-load losses for each basic model selected for AEDM validation testing, must be within plus or minus ten percent of the average full-load losses determined from the testing of that basic model.[90] DOE proposes to change that language to a one-sided 10 percent tolerance to allow flexibility for manufacturers to choose to rely on a more conservative AEDM (*i.e.,* the simulated full-load losses for each basic model selected for AEDM validation testing, calculated by applying the AEDM, must be greater or equal to 90 percent of the average full-load losses determined from the testing of that basic model). This proposal would not require manufacturers to update their AEDMs and basic model ratings.

In addition, as previously discussed in III.O.1, DOE proposes to specify how to obtain the nominal full-load efficiency of a basic model using the simulated full-load efficiency of that basic model determined through the application of an AEDM: The nominal full-load efficiency of a basic model must be less than or equal to the simulated full-load efficiency of that basic model determined through the application of an AEDM.

Paragraph (b) of 10 CFR 431.17 provides further clarity regarding testing

[89] Wilcox, Rand R. *Basic Statistics: Understanding Conventional Methods and Modern Insights.* New York: Oxford UP, 2009: 4. Print.

[90] The output of the AEDM is the average full-load efficiency of the basic model. The represented value of nominal full-load efficiency is obtained by applying the provisions discussed in section I.A.1. The average full load losses predicted by the AEDM can be calculated as hp × (1/Eff-1) where hp is the motor horsepower and Eff is the average full-load efficiency predicted by the AEDM.

if a certification program is not used. Basic models used to validate an AEDM must be selected for testing in accordance with paragraph (b)(1), and units of each such basic model must be tested in accordance with paragraph (b)(2). 10 CFR 431.17(b)(3) Paragraph (b)(1) explains the criteria for selecting a minimum of 5 basic models for certification testing (in an accredited laboratory) in order to validate an AEDM. Paragraph (b)(2) provides the criteria for selecting units for testing including a minimum sample size of 5 units in most cases.[91] For manufacturers using AEDMs, paragraph (b)(2) applies to those basic models selected for validating the AEDM. Paragraph (b)(3) also explains that the motors tested to validate an AEDM must either be in a certification program or must have been tested in an accredited laboratory. 10 CFR 431.17(b)(2)–(3)

DOE proposes to revise the current regulatory language to specify that, when manufacturers use an accredited laboratory or a nationally recognized testing program for testing the basic models used to validate the AEDM, the selection criteria and sampling requirements as described in paragraph (b)(2) apply, including the requirement to select a minimum of 5 basic models that must be compliant with the energy conservation standards at 10 CFR 431.25 (if any exist) . In addition, when using an accredited laboratory or nationally recognized testing program for testing, DOE proposes that the average full-load efficiency of each basic model selected to validate the AEDM must be determined based on the provisions discussed in section III.O.1. Further, in order to reduce testing burden, DOE proposes to replace the requirement in paragraph (b)(1) that two of the basic models must be among the five basic models with the highest unit volumes of production by the manufacturer in the prior year by in the prior 5 years. The extension from 1 to 5 year would reduce testing burden in the case of a year to year variation in the basic models with the highest unit volumes of production and would not impact basic model ratings.

Currently, the periodic verification of an AEDM can be achieved in one of three ways: through participation in a certification program; by additional, periodic testing in an accredited lab; or by verification by a professional engineer. When using periodic testing in an accredited lab, a sample of units must be tested in accordance with the DOE test procedure and § 431.17(b)(2). 10 CFR 431.17(a)(4)(A)

The regulatory text does not specify how often the periodic testing must be conducted. DOE proposes to add that manufacturers must perform a sufficient number of periodic verification tests to ensure the AEDM maintains its accuracy and reliability. Paragraph (b)(2) provides the criteria for selecting units for testing (in a nationally recognized testing program) when conducting periodic AEDM verification, including a minimum sample size of 5 units in most cases. DOE proposes to revise the 5 unit minimum requirement on the sample size and to replace it by requiring that manufacturers test at least one unit of each basic model. DOE believes that at least one unit is a sufficient criteria on the sample size when conducting an AEDM verification and would reduce testing burden. Paragraphs (b)(2) also includes the equations to use when conducting periodic AEDM verification. 10 CFR 431.17(b)(2)(i)–(ii) The equations in paragraph (b)(2) are used after the represented value of the basic model has already been determined (*e.g.,* by AEDM)[92] ''in a test of compliance with a represented average or nominal efficiency''. The equations are applied to verify that the average full-load efficiency of the sample and the minimum full-load efficiency of the sample of the basic model, are within a prescribed margin of the represented value as provided by applying the AEDM (*i.e.,* a test of compliance with a represented average or nominal efficiency). In addition, the equations in paragraph (b)(2) also imply that the represented value of the basic model has already been determined (*e.g.,* by AEDM). As previously noted, DOE proposes to revise the current regulatory test to remove the equations currently located in § 431.17(b)(2)(i)–(ii). Instead, for manufacturers conducting periodic AEDM verification using testing, DOE proposes that manufacturers rely on the same criteria used for the AEDM validation at 10 CFR 429.70(i)(2)(iv) and compare the average of the measured full-load losses of the basic model[93] to the simulated full-load losses of the basic model as predicted by the AEDM.

If using a certification program to conduct the AEDM verification, the provisions at 10 CFR 431.17(a)(4)(i)(B) specify that a manufacturer must periodically select basic models to which it has applied the AEDM and have a nationally recognized certification program certify its nominal full-load efficiency. The provision does not specify what criteria to use when comparing the output of the AEDM of the tested and certified values of nominal full-load efficiency. DOE is considering three options to further specify how the manufacturer must conduct the AEDM verification when using a certification program. DOE is considering proposing: (1) That manufacturers rely on the same 10 percent tolerance used for the AEDM validation at 10 CFR 429.70(i)(2)(iv) and compare the losses corresponding to the tested and certified nominal full-load efficiency of the basic model to the nominal full-load efficiency of the basic model as predicted by the AEDM;[94] (2) that manufacturers rely on a higher tolerance (*e.g.,* a 15 percent tolerance rather than 10 percent) than used for the AEDM validation at 10 CFR 429.70(i)(2)(iv) and compare the losses corresponding to the tested and certified nominal full-load efficiency of the basic model to the nominal full-load efficiency of the basic model as predicted by the AEDM; or (3) to continue to not specify any requirements but require that certification programs provide a detailed description of the method used to verify the AEDM.

DOE further proposes to remove the options to rely on a professional engineer to conduct AEDM verification because this is not an option that is used by manufacturers.

Finally, DOE proposes that the AEDM provisions as proposed would also apply to the additional electric motors proposed for inclusion in the scope of the test procedure, when a manufacturer of such motors would be required to use the DOE test procedure.

DOE requests comments on the proposed requirements for validation and subsequent verification of an AEDM.

[91] As discussed previously and in the remainder of this section, the provisions for selecting units within a basic model and minimum sample size described in paragraph (b)(2) apply to three different situations: when (1) testing at an accredited laboratory; (2) using an AEDM and selecting units for substantiating the AEDM; and (3) using a AEDM and selecting units for periodic verification testing.

[92] The AEDM output is the simulated full-load efficiency. The represented value of nominal full-load efficiency as predicted by the AEDM is obtained by applying the provisions discussed in section I.A.1.

[93] The sample could include a single unit, in which case the average measured full-load losses of the basic model are the measured full-load losses of the unit.

[94] The AEDM output is the average full-load efficiency. The represented value of nominal full-load efficiency as predicted by the AEDM is obtained by applying the provisions discussed in section I.A.1.

P. Certification, Sampling Plans, and AEDM Provisions for Dedicated-Purpose Pool Pump Motors

As discussed, on July 29, 2021, DOE published a final rule to establish test procedures for dedicated purpose pool pump motors, a type of electric motor. 86 FR 40765 (''July 2021 Final Rule''). Specifically, the test procedure requires manufacturers to use CSA C747–09 (R2014), ''Energy Efficiency Test Methods for Small Motors'' for testing the full-load efficiency of DPPP motors and did not establish any certification, sampling plans, or AEDM requirements. *Id.* The new test procedure is currently located in subpart Z. DOE did not establish certification, sampling, or AEDM provisions in the July 2021 Final Rule.

In this NOPR, DOE is proposing to include certification, sampling plan, and AEDM provisions for DPPP motors subject to the requirements in subpart Z of 10 CFR part 431. Manufacturers would be required to test such motors at such time as compliance is required with a labeling or energy conservation standard requirement should such a requirement be established. (42 U.S.C. 6315(b); 42 U.S.C. 6316(a); 42 U.S.C. 6295(s)) To the extent DOE were to establish certification, sampling plan, and AEDM provisions for DPPP motors, any voluntary representations by manufacturers, distributors, retailers, or private labelers about the energy consumption or cost of energy for these motors must be based on the use of that test procedure beginning 180 days following publication of a final rule. DOE's proposal would not require manufacturers who do not currently make voluntary representations to then begin making public representations of efficiency. (42 U.S.C. 6314(d)(1))

The proposed certification, sampling plan, and AEDM provisions would apply to representations of energy efficiency made by manufacturers, including representations for certification of compliance. Because DPPP motors are a subset of electric motors, DOE proposes to apply the same certification, sampling provisions and AEDM provisions for consistency. Accordingly, DOE proposes to allow the use of ''nominal full-load efficiency'' as an alternative represented value for DPPP motors. DOE proposes to add these provisions in a new section 10 CFR 429.66 and 429.70(j), and to specifically reference DPPP motors in 10 CFR 429.73 and 429.74 as proposed.

Q. Reporting

Manufacturers, including importers, must use product-specific certification templates to certify compliance to DOE. For electric motors, the certification template reflects the general certification requirements specified at 10 CFR 429.12 and the product-specific requirements specified at 10 CFR 431.35.[95] One of the reporting requirements for the compliance certification is the nominal full load efficiency, determined pursuant to 10 CFR 431.16 and 431.17, of the least efficient basic model within that rating. 10 CFR 431.35(a)(2)(i).

R. Test Procedure Costs and Harmonization

1. Test Procedure Costs and Impact

In this NOPR, DOE proposes to revise the current scope of the test procedures to add additional electric motors and subsequent updates needed for supporting definitions and metric requirements as a result of this expanded scope; incorporate by reference the most recent versions of the referenced industry standards; incorporate by reference additional industry standards used to test additional electric motors proposed in scope; clarify the scope and test instructions by adding definitions for specific terms; revise the current vertical motor testing instructions to reduce manufacturer test burden; clarify that the current test procedure permits removal of contact seals for immersible electric motors only; revise the provisions pertaining to certification testing and determination of represented values; and add provisions pertaining to certification testing and determination of represented values for DPPP motors.

Regarding the proposals to amend the provisions pertaining to certification testing and determination of represented values: (1) The proposed updates that are effective 180 days after the publication of the final rule, include moving and largely retaining the provisions related to AEDMs (see section III.O.4), as well as moving and largely retaining the procedures for recognition and withdrawal of recognition of accreditation bodies and certification programs (see section III.O.2 and III.O.3) from 10 CFR part 431 to 10 CFR part 429 and therefore, DOE does not anticipate any added test burden; (2) other proposed updates requiring that testing be conducted in an independent nationally recognized testing program (see section III.N.1) would only be required for certification of a new basic model pursuant to 10 CFR 431.36(e), required on or after 180 days following the publication of this final rule; previously certified basic models would not need to be re-tested and DOE anticipates that there would be no added costs associated with this proposed update as it would apply to certification of new basic models only, which does not add any new test burden to manufacturers compared to the current requirements; (3) finally, for the other proposed provisions (*i.e.,* requiring to certify using three options as discussed in section III.N.2, revising the provisions pertaining to the determination of the represented value as discussed in section III.O.1 and III.O.2) whose proposed compliance date would be on or after the effective date of the final rule adopting new or amended energy conservation standards for electric motors, DOE will be discussing the associated costs in the energy conservation standards rulemaking instead.

Of the remaining proposed amendments, DOE has tentatively determined that the following proposals would impact testing costs: (1) The proposal to expand scope to include other motor categories and the proposal to include certification, sampling plan, and AEDM provisions for DPPP motors; and (2) the proposal to update vertical motor testing. These proposals are discussed in the following paragraph.

a. Voluntary Representations

DOE proposes to add certain categories of electric motors to the scope of the test procedure. Specifically (1) air-over electric motors; (2) submersible electric motors; (3) certain electric motors greater than 500 hp; (4) electric motors considered small; (5) inverter-only electric motors; and (5) certain synchronous motor technologies. In addition, DOE proposes to incorporate by reference additional test methods. Finally, DOE proposes to add provisions pertaining to certification testing and determination of represented values for DPPP motors.

As stated, were DOE to include additional electric motors within the scope of the DOE test procedure, such motors would not be required to test to the DOE test procedure until such time as energy efficiency standards were established. If manufacturers voluntarily make representations regarding the energy consumption or cost of energy of such electric motors, they would be required to test according to the DOE test procedure. (42 U.S.C. 6314(d)(1)) DOE has initially determined that the proposed inclusion of additional motors within the scope of the test procedure and the proposal pertaining to certification testing and determination

[95] *https://www.regulations.doe.gov/ccms/templates.*

of represented values for DPPP motors, if finalized, would result in added costs to motor manufacturers if manufacturers choose to make efficiency representations.

Based on a market review, DOE notes that approximately 50 percent of the basic models that would be covered under the proposed test procedure currently make voluntary representations. Consistent with the conclusions from the January 2021 Final Rule that only a fraction of basic models are physically tested (the remainder have efficiency determined through an alternative efficiency determination method (''AEDM'')), DOE estimates that 10 percent of these motors would be physically tested. 86 FR 4, 17. This proposal, if finalized, would require at least five units be tested per basic model. 10 CFR 431.17(b)(2) However, considering DOE is harmonizing with current industry standards, DOE assumes that manufacturers have already tested at least one unit for all the expanded scope electric motor basic models. Therefore, DOE estimates that manufacturers could have to conduct up to four additional tests per expanded scope electric motor basic models.

DOE identified that the testing requirements can be summarized broadly with the following three groups: (1) Motors tested according to CSA C747–09 (R2019), (2) motors tested according to IEC 61800–9–2:2017, and (3) motors tested according to Section 34.4 of the NEMA Air-over Motor Efficiency Test Method. Consistent with the conclusions from the January 2021 Final Rule that only a fraction of electric motor basic models that are physically tested are tested at a third-party test facility (the remainder are physically tested at in-house testing facilities), DOE estimated that 90 percent of the physical tests for these electric motors would be conducted at in-house test facilities, and the remaining 10 percent of the physical tests would be conducted at third-party test facilities. DOE assumed that the per-unit test costs differs between conducting testing at in-house test facilities versus testing at third-party test facilities. Table III.23 lists the estimated in-house and third-party single unit test cost incurred by the manufacturer for each industry standard.

TABLE III.23—ELECTRIC MOTOR PER UNIT TEST COST ESTIMATES

Industry standard	Tested at in-house facility	Tested at third-party facility
	Per unit test cost	Per unit test cost
CSA C747–09 (R2019)	$571	$2,000
IEC 61800–9–2:2017	728	3,000
Section 34.4 of NEMA Air-over Motor Efficiency Test Method	612	2,000

To estimate in-house testing cost, DOE assumed testing a single electric motor unit to CSA C747–09 (R2019) requires approximately nine hours of a mechanical engineer technician time and three hours from a mechanical engineer. DOE assumed testing a single electric motor-drive combination unit to IEC 61800–9–2:2017 requires approximately twelve hours of a mechanical engineer technician time and three and a half hours of time from a mechanical engineer. DOE assumed testing a single electric motor unit to Section 34.4 of NEMA Air-over Motor Efficiency Test Method requires ten hours of mechanical engineer technician time and three hours of time from a mechanical engineer. Based on data from the Bureau of Labor Statistics' (''BLS's'') Occupational Employment and Wage Statistics, the mean hourly wage for a mechanical engineer technician is $29.27 and the mean hourly wage for a mechanical engineer is $45.94.[96] Additionally, DOE used data from BLS's Employer Costs for Employee Compensation to estimate the percent that wages comprise the total compensation for an employee. DOE estimates that wages make up 70.3 percent of the total compensation for an employee.[97] Therefore, DOE estimated that the total hourly compensation (including all fringe benefits) of an employee is $41.64 for a mechanical engineering technician and $65.35 for a mechanical engineer.[98]

Using these labor rates and time estimates, DOE estimates that it would cost electric motor manufacturers approximately $571 to conduct a single test for motors tested according to CSA C747–09 (R2019); approximately $728 to conduct a single test for motors tested according to IEC 61800–9–2:2017; and approximately $612 to conduct a single test for motors tested according to Section 34.4 of the NEMA Air-over Motor Efficiency Test Method, if these test were conducted by the electric motor manufacturers in-house.

To estimate third-party lab costs, DOE received quotes from test labs on the price of conducting each industry standard. DOE then averaged these prices to arrive at an estimate of what the manufacturers would have to spend to test their product using a third-party test lab. Using these quotes, DOE estimates that it would cost electric motor manufacturers approximately $2,000 to conduct a single test for motors tested according to CSA C747–09 (R2019); approximately $3,000 to conduct a single test for motors tested according to IEC 61800–9–2:2017; and approximately $2,000 to conduct a single test for motors tested according to Section 34.4 of the NEMA Air-over Motor Efficiency Test Method, if these tests were conducted by a third-party test facility.

DOE requests comment on its estimate that 50 percent of the current market of the proposed expanded scope electric motors and DPPP motors make voluntary representations.

DOE requests comment on the in-house and third-party single unit test costs.

b. Updating Vertical Motor Testing Requirements

DOE proposes to update the testing requirements for vertical motors with hollow shafts to not require welding of

[96] DOE used the May 2020 Occupation Profiles of ''17–3027 Mechanical Engineering Technologists and Technicians'' to estimate the hourly wage rate of a mechanical technician (See *www.bls.gov/oes/current/oes173027.htm*) and ''17–2141 Mechanical Engineers'' to estimate the hourly wage rate of a mechanical engineer (See *www.bls.gov/oes/current/oes172141.htm*).

[97] DOE used the December 2020 ''Employer Costs for Employee Compensation'' to estimate that for ''Private Industry'' ''Wages and Salaries'' are 70.3 percent of total employee compensation (See *www.bls.gov/news.release/archives/ecec_03182021.pdf*).

[98] Mechanical Engineering Technician: $29.27/0.703 = $41.64. Mechanical Engineer: $45.94/0.703 = $65.35.

a solid shaft to the drive end, and instead permit connection of electric motors to a dynamometer without restriction on the motor end and using a coupling of torsional rigidity greater than or equal to that of the motor shaft.

DOE has initially determined that the proposed amendment would not require changes to the designs of electric motors, and that the proposed amendments would not impact the utility of such electric motors or impact the availability of available electric motor options. DOE has also initially determined that the proposed amendments would not impact the representations of electric motor energy efficiency/energy use based on the initial determination that manufacturers would be able to rely on data generated under the current test procedure should the proposed amendments be finalized. As such, retesting of electric motors would not be required solely as a result of DOE's adoption of this proposed amendment to the test procedure.

Although the proposed amendments are initially determined not to add cost, under specific circumstances they may reduce testing cost. NEMA commented that the existing requirement to weld may prevent a motor from being used in its intended application (NEMA, No. 6 at p. 3). In such instances, testing cost could include the cost of scrapping an otherwise useable motor. This scrap cost may be avoided if welding is not required by Appendix B, in which case the test cost savings could equal the value of the motor.

To estimate these cost savings DOE determined approximately how many tests of these motors are conducted per year. To do this, DOE reviewed product catalogs from 2006 and compared these to catalogs from 2018 to determine how many new vertical hollow shaft models have been produced in that time. DOE annualized this count to estimate how many new vertical hollow shaft motors are listed per year and would need to be certified as compliant with 10 CFR 431.25. Using the 2018 catalog, DOE found the average price of a vertical hollow shaft motor and assumed a markup of 100 percent to estimate the manufacturer's production cost. Next, DOE requires at least five units to be tested per basic model. 10 CFR 431.17(b)(2) Finally, DOE estimated that 10 percent of these new vertical hollow shaft motors are certified via physical testing, based on the observation that most manufacturers use an AEDM to certify an electric motor as required under 10 CFR 431.36. Using this methodology, DOE estimates that annual cost savings to industry due to the proposed amendments may approach $9,410 per year.

DOE requests comment on its estimation of reduction in testing cost due to the proposed requirements for testing of vertical electric motors.

2. Harmonization With Industry Standards

DOE's established practice is to adopt relevant industry standards as DOE test procedures unless such methodology would be unduly burdensome to conduct or would not produce test results that reflect the energy efficiency, energy use, water use (as specified in EPCA) or estimated operating costs of that product during a representative average use cycle. 10 CFR 431.4; Section 8(c) of appendix A of 10 CFR part 430 subpart C. In cases where the industry standard does not meet EPCA statutory criteria for test procedures, DOE will make modifications through the rulemaking process to these standards as the DOE test procedure. With regard to electric motors subject to standards, EPCA requires the test procedures to be the test procedures specified in NEMA Standards Publication MG1–1987 and IEEE Standard 112 Test Method B for motor efficiency, or the successor standards, unless DOE determined by rule, published in the **Federal Register** and supported by clear and convincing evidence, that to do so would not meet the statutory requirements for test procedures to produce results that are representative of an average use cycle and not be unduly burdensome to conduct. (42 U.S.C. 6314(a)(5)(A) and (B)). DOE established the current test procedures for electric motors at appendix B based on the provisions of NEMA MG1–2009, CSA C390–10, IEC 60034–2–1:2014, IEEE 112–2017, which are incorporated by reference and all of which contain methods for measuring the energy efficiency and losses of electric motors. These referenced standards specify test methods for polyphase induction electric motors above 1 horsepower which can operate directly connected to a power supply. DOE reviewed each of the industry standards and proposes to update its incorporation by reference to IEC 60034–12:2016, CSA C390–10 (R2019), and NEMA MG 1–2016 with 2018 Supplements to align with the latest revised and reaffirmed versions of these standards.

In addition, certain additional motors proposed for incorporation in scope of the test procedure cannot be tested using the industry standards incorporated by reference for currently regulated electric motors because they require modifications to the test procedure to account for: Requiring to be connected to an inverter to be able to operate (*i.e.,* inverter-only motors); and differences in electrical design (*i.e.,* single-phase induction electric motors included as SNEMs, and synchronous electric motors). For these additional motors proposed for inclusion in scope, DOE proposes to incorporate by reference the following additional industry standards: IEEE 114–2010, CSA C747–09 (R2019), IEC 60034–2–1:2014, and IEC 61800–9–2:2017. IEEE 114–2010, CSA C747–09 (R2019), and IEC 60034–2–1:2014 specify methods for measuring the efficiency and losses of single-phase induction electric motors. IEC 61800–9–2:2017 specifies methods for measuring the efficiency and losses of induction and synchronous inverter-only electric motors.

The test procedures proposed for air-over electric motors and for SNEMs are included in NEMA MG1–2016 with 2018 Supplements. *See* Section IV, Part 34: Air-Over Motor Efficiency Test Method and Section 12.30. Section 12.30 specifies the use of IEEE 112 and IEEE 114 for all single-phase and polyphase motors.[99] As further discussed in section III.D.2, DOE is proposing to require testing of SNEMs other than inverter-only electric motors according to IEEE 112–2017, (or CSA C390–10 (R2019) or IEC 60034–2–1:2014, which are equivalent to IEEE 112–2017; see discussion in section III.D.2) and IEEE 114–2010 (or CSA C747–09 (R2019) or IEC 60034–2–1:2014, which are equivalent to IEEE 114–2010; see discussion in III.D.2). This proposal would satisfy the test procedure requirements under 42 U.S.C. 6314(a)(5).

The methods listed in section 12.30 of NEMA MG–1 2016 with 2018 Supplements for testing AC motors are applicable only to AC induction motors that can be operated directly connected to the power supply (direct-on-line) and do not apply to electric motors that are inverter-only or to synchronous electric motors that are not AC induction motors. Therefore, for these additional electric motors, DOE proposes to specify the use of different industry test procedures, as previously noted.

DOE requests comments on the benefits and burdens of the proposed updates and additions to industry standards referenced in the test procedure for electric motors.

DOE notes that with regard to the industry standards currently

[99] As previously mentioned, NEMA MG1–2016 with 2018 Supplements does not specify the publication year of the referenced test standards and instead specifies that the most recent version should be used.

incorporated into the DOE test procedure, DOE is only proposing to update the versions referenced to the latest version of the industry standards.

S. Compliance Date

EPCA prescribes that, if DOE amends a test procedure, all representations of energy efficiency and energy use of an electric motor subject to the test procedure, including those made on marketing materials and product labels, must be made in accordance with that amended test procedure, beginning 180 days after publication of such a test procedure final rule in the **Federal Register**. (42 U.S.C. 6314(d)(1)) To the extent DOE were to establish test procedures for electric motors not currently subject to an energy conservation standard, manufacturers would only need to use the testing set-up instructions, testing procedures, and rating procedures if a manufacturer elected to make voluntary representations of energy-efficiency or energy costs of his or her basic models beginning 180 days following publication of a final rule. DOE's proposal would not require manufacturers who do not currently make voluntary representations to then begin making public representations of efficiency. (42 U.S.C. 6314(d)(1)) Manufacturers would be required to test such motors at such time as compliance is required with a labeling or energy conservation standard requirement should such a requirement be established. (42 U.S.C. 6315(b); 42 U.S.C. 6316(a); 42 U.S.C. 6295(s))

If DOE were to publish an amended test procedure EPCA provides an allowance for individual manufacturers to petition DOE for an extension of the 180-day period if the manufacturer may experience undue hardship in meeting the deadline. (42 U.S.C. 6314(d)(2) To receive such an extension, petitions must be filed with DOE no later than 60 days before the end of the 180-day period and must detail how the manufacturer will experience undue hardship. (*Id.*)

IV. Procedural Issues and Regulatory Review

A. Review Under Executive 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 the Regulatory Flexibility Act

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

1. Description of Reasons Why Action Is Being Considered

DOE is proposing to amend the existing DOE test procedures for electric motors. EPCA, pursuant to amendments made by the Energy Policy Act of 1992, Public Law 102–486 (Oct. 24, 1992), specifies that the test procedures for electric motors subject to standards are those specified in National Electrical Manufacturers Association (''NEMA'') Standards Publication MG1–1987 and Institute of Electrical and Electronics Engineers (''IEEE'') Standard 112 Test Method B, as in effect on October 24, 1992. (42 U.S.C. 6314(a)(5)(A)). If these test procedures are amended, DOE must amend its test procedures to conform to such amended test procedure requirements, unless DOE determines by rule, published in the **Federal Register** and supported by clear and convincing evidence, that to do so would not meet the statutory requirements related to the test procedure representativeness and burden. (42 U.S.C. 6314(a)(5)(B))

EPCA also requires that, at least once every 7 years, DOE evaluate test procedures for each type of covered equipment, including 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 energy efficiency, energy use, and estimated operating costs during a representative average use cycle. (42 U.S.C. 6314(a)(1)) In addition, if the Secretary determines that a test procedure amendment is warranted, the Secretary must publish proposed test procedures in the **Federal Register**, and afford interested persons an opportunity (of not less than 45 days' duration) to present oral and written data, views, and arguments on the proposed test procedures. (42 U.S.C. 6314(b)) If DOE determines that test procedure revisions are not appropriate, DOE must publish its determination not to amend the test procedures.

DOE is publishing this NOPR in satisfaction of the requirements specified in EPCA.

2. Objective of, and Legal Basis for, Rule

As noted above, DOE is publishing this NOPR in satisfaction of the requirements specified in EPCA that DOE amend the test procedure for electric motors whenever the relevant industry standards are amended, but at minimum every 7 years, to ensure that the DOE test procedure produces test results which reflect energy efficiency, energy use, and estimated operating costs of a type of industrial equipment (or class thereof) during a representative average use cycle. 42 U.S.C. 6314(a).

3. Description and Estimate of Small Entities Regulated

For manufacturers of electric motors, the Small Business Administration (''SBA'') has set a size threshold, which defines those entities classified as ''small businesses'' for the purposes of the statute. DOE used the SBA's small business size standards to determine whether any small entities would be subject to the requirements of the rule. See 13 CFR part 121. The size standards are listed by North American Industry Classification System (''NAICS'') code and industry description available at: *www.sba.gov/document/support--table-size-standards.* Electric motor manufacturing is classified under NAICS code 335312, ''motor and generator manufacturing.'' The SBA sets a threshold of 1,250 employees or less for an entity to be considered as a small business for this category.

In this NOPR, DOE proposes to revise the current scope of the test procedures to add additional electric motors and subsequent updates needed for supporting definitions and metric requirements as a result of this expanded scope; incorporate by reference the most recent versions of the referenced industry standards; incorporate by reference additional industry standards used to test additional electric motors proposed in scope; clarify the scope and test instructions by adding definitions for specific terms; revise the current vertical motor testing instructions to reduce manufacturer test burden; clarify that the current test procedure permits removal of contact seals for immersible electric motors only; revise the provisions pertaining to certification testing and determination of represented values; and add provisions pertaining to certification testing and determination of represented values for DPPP motors.

As previously stated in section III.R.1, DOE estimates that some electric motor manufacturers would experience a cost savings from the proposed test procedure amendment, if finalized, regarding the proposal to update the testing requirements for vertical motors with hollow shafts. Additionally, this test procedure proposes to expand the scope of electric motors and proposes certification, sampling plan, and AEDM provisions for DPPP motors.

While manufacturers making these expanded scope electric motors and DPPP motors would not be required to test according to the DOE test procedure until energy efficiency standards were established, manufacturers voluntarily make representations regarding the energy consumption or cost of energy of such electric motors, they would be required to test according to the DOE test procedure, if finalized. DOE identified up to 12 potential small businesses manufacturing these expanded scope electric motors or DPPP motors.

DOE estimates that all other proposed test procedure amendments would not results in any electric motor manufacturer, large or small, to incur any additional costs due to the proposed test procedure amendments in this NOPR, if finalized.

4. Description and Estimate of Compliance Requirements

DOE estimated the per unit testing cost for these expanded scope electric motors and DPPP motors in section III.R.1. These estimated per unit testing costs are presented in Table IV.1.

TABLE IV.1—ELECTRIC MOTOR PER UNIT TEST COST ESTIMATES

Industry standard	Tested at in-house facility	Tested at third-party facility
	Per unit test cost	Per unit test cost
CSA C747–09 (R2019)	$571	$2,000
IEC 61800–9–2:2017	728	3,000
Section 34.4 of NEMA Air-over Motor Efficiency Test Method	612	2,000

As previously discussed, these expanded scope electric motors and DPPP motors would not be required to test according to the DOE test procedure until energy efficiency standards were established. However, if manufacturers voluntarily make representations regarding the energy consumption or cost of energy of such electric motors, they would be required to test according to the DOE test procedure, if finalized. DOE is unable to estimate the number of electric motor models that small business manufacturers would decide to make voluntary representations about the efficiency of their electric motors. Therefore, DOE is unable to estimate the total cost each small business would incur to test their electric motors in accordance with the proposed DOE test procedure.

Due to the uncertainty of the potential costs to small businesses, DOE is not able to conclude that the impacts of the test procedure amendments proposed in this NOPR would not have a ''significant economic impact on a substantial number of small entities.''

DOE requests comment on the number of small businesses DOE identified and the number of potential electric motor models that small business manufacturers would make voluntary representations regarding the energy consumption or cost of energy of such electric motors. DOE also requests comment on any other potential costs small businesses may incur due to the proposed amended test procedures, if finalized.

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

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

6. Significant Alternatives to the Rule

As previously stated in this section, DOE is required to review existing DOE test procedures for all covered equipment every 7 years. Additionally, DOE shall amend test procedures with respect to any covered equipment, if the Secretary determines that amended test procedures would more accurately produce test results which measure energy efficiency, energy use, or estimated annual operating cost of a covered equipment during a representative average use cycle or period of use. (42 U.S.C. 6314(a)(1)) DOE has initially determined that the proposed test procedure would more accurately produce test results to measure the energy efficiency of electric motors.

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

Additional compliance flexibilities may be available through other means. EPCA provides that a manufacturer whose annual gross revenue from all of its operations does not exceed $8 million may apply for an exemption from all or part of an energy conservation standard for a period not longer than 24 months after the effective date of a final rule establishing the standard. (42 U.S.C. 6295(t)) Additionally, section 504 of the Department of Energy Organization Act, 42 U.S.C. 7194, provides authority for the Secretary to adjust a rule issued under EPCA in order to prevent ''special hardship, inequity, or unfair distribution of burdens'' that may be imposed on that manufacturer as a result of such rule. Manufacturers should refer to 10 CFR part 430, subpart E, and part 1003 for additional details.

C. Review Under the Paperwork Reduction Act of 1995

Manufacturers of electric motors must certify to DOE that their products comply with any applicable energy conservation standards. To certify compliance, manufacturers must first obtain test data for their products according to the DOE test procedures, including any amendments adopted for those test procedures. DOE has established regulations for the certification and recordkeeping requirements for all covered consumer products and commercial equipment, including electric motors. (*See generally* 10 CFR part 429.) The collection-of-information requirement for the certification and recordkeeping is subject to review and approval by OMB under the Paperwork Reduction Act (''PRA''). DOE's current reporting requirements have 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, certifying compliance, 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.

1. Description of the Requirements

In this NOPR, DOE is proposing to require that within one year of publication of any final rule updating or amending DOE's electric motors regulations, all nationally recognized certification programs must reassess the evaluation criteria necessary for a certification program to be classified by DOE as nationally recognized and either submit a letter to DOE certifying that no change to their program is needed, or submit a letter describing the measures implemented to ensure the evaluation criteria in the proposed paragraph 10 CFR 429.73(b) are met. DOE is proposing to revise the collection of information approval under OMB Control Number 1910–1400 to account for the paperwork burden associated with submitting this letter, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

2. Method of Collection

DOE is proposing nationally recognized certification programs must submit a letter within one year after any final rule is published updating or amending DOE's electric motor regulations.

3. Data

There are three nationally recognized certification programs for electric motors. DOE estimated that drafting and submitting a letter to DOE certifying that no change to their program is needed or drafting and submitting a letter describing the measures implemented to ensure the criteria in the proposed paragraph 429.73(b) are met would require approximately 10 hours for each nationally recognized certification program. Therefore, DOE estimated that the three nationally recognized certification programs would spend approximately 30 hours to draft and submit these letters to DOE. DOE's February 2021 ''Supporting Statement for Certification Reports, Compliance Statements, Application for a Test Procedure Waiver, and Recording keeping for Consumer Products and Commercial Equipment Subject to Energy or Water Conservation Standards'' estimated a fully loaded (burdened) average wage rate of $67 per hour for manufacturer reporting and recordkeeping.[100] (86 FR 9916) DOE used this wage rate to estimate the burden on the certification programs. Therefore, DOE estimates that the total burden to the industry is approximately $2,010.[101] DOE requests comment on the number of respondents and burden requirements for collecting information for submission of a letter by nationally-recognized certification programs.

OMB Control Number: 1910–1400.

Form Number: DOE F 220.7.

Type of Review: Regular submission.

Affected Public: Nationally recognized certification programs.

Estimated Number of Respondents: 3.

Estimated Time per Response: 10 hours.

Estimated Total Annual Burden Hours: 30 hours.

Estimated Total Annual Cost to the Manufacturers: $2,010 in recordkeeping/reporting costs.

4. Conclusion

DOE has tentatively determined that the cost of these proposed amendments would not impose a material burden on nationally recognized certification programs. It is the responsibility of nationally recognized certification programs to have a complete understanding of applicable regulations for electric motors given their role as a certification body, and accordingly, DOE has tentatively concluded that the anticipated cost of $670 per program to submit a letter upon finalization of any updated or amended electric motors regulations is a reasonable burden for such a program. Public comment is sought on the number of respondents and burden requirements for collecting information for nationally recognized certification programs within a year after electric motor regulations are updated or amended. Send comments on these or any other aspects of the collection of information to the email address listed in the **ADDRESSES** section and to the OMB Desk Officer by email to *Sofie.E.Miller@omp.eop.gov.*

[100] *www.reginfo.gov/public/do/PRAViewDocument?ref_nbr=202102-1910-002.*

[101] 3 certification programs × 10 hours × $67 = $2,010.

D. Review Under the National Environmental Policy Act of 1969

In this proposed rule, DOE proposes test procedure amendments that it expects will be used to develop and implement future energy conservation standards for electric motors. DOE has determined that this rule falls into a class of actions that are categorically excluded from review under the National Environmental Policy Act of 1969 (42 U.S.C. *et seq.*) and DOE's implementing regulations at 10 CFR part 1021. Specifically, DOE has determined that adopting test procedures for measuring energy efficiency of consumer products and industrial equipment is consistent with activities identified in 10 CFR part 1021, appendix A to subpart D, A5 and A6. Accordingly, neither an environmental assessment nor an environmental impact statement is required.

E. Review Under Executive Order 13132

Executive Order 13132, ''Federalism,'' 64 FR 43255 (Aug. 4, 1999) imposes certain requirements on agencies formulating and implementing policies or regulations that preempt State law or that have federalism implications. The Executive order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. DOE has examined this proposed rule and has determined that it would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the products that are the subject of this proposed rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297(d)) No further action is required by Executive Order 13132.

F. Review Under Executive Order 12988

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

G. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (''UMRA'') requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Public Law 104–4, sec. 201 (codified at 2 U.S.C. 1531). For a proposed regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed ''significant intergovernmental mandate,'' and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect small governments. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820; also available at *http://energy.gov/gc/office-general-counsel.* DOE examined this proposed rule according to UMRA and its statement of policy and determined that the rule contains neither an intergovernmental mandate, nor a mandate that may result in the expenditure of $100 million or more in any year, so these requirements do not apply.

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

Section 654 of the Treasury and General Government Appropriations Act, 1999 (Pub. L. 105–277) requires Federal agencies to issue a Family Policymaking Assessment for any rule that may affect family well-being. This proposed rule would not have any impact on the autonomy or integrity of the family as an institution. Accordingly, DOE has concluded that it is not necessary to prepare a Family Policymaking Assessment.

I. Review Under Executive Order 12630

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

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

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516 note) provides for agencies to review most disseminations of information to the public under guidelines established by each agency pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). Pursuant to OMB Memorandum M–19–15, Improving Implementation of the Information Quality Act (April 24, 2019), DOE published updated guidelines which are available at *https://www.energy.gov/sites/prod/files/2019/12/f70/DOE%20Final%20Updated%20IQA%20Guidelines%20Dec%202019.pdf.* DOE has reviewed this proposed rule under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

K. Review Under Executive Order 13211

Executive Order 13211, ''Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use,'' 66 FR 28355 (May 22, 2001), requires Federal agencies to prepare and submit to OMB, a Statement of Energy Effects for any proposed significant energy action. A ''significant energy action'' is defined as any action by an agency that promulgated or is expected to lead to promulgation of a final rule, and that (1) is a significant regulatory action under Executive Order 12866, or any successor order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (3) is designated by the Administrator of OIRA as a significant energy action. For any proposed significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use should the proposal be implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

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

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

Under section 301 of the Department of Energy Organization Act (Pub. L. 95–91; 42 U.S.C. 7101), DOE must comply with section 32 of the Federal Energy Administration Act of 1974, as amended by the Federal Energy Administration Authorization Act of 1977. (15 U.S.C. 788; ''FEAA'') Section 32 essentially provides in relevant part that, where a proposed rule authorizes or requires use of commercial standards, the notice of proposed rulemaking must inform the public of the use and background of such standards. In addition, section 32(c) requires DOE to consult with the Attorney General and the Chairman of the Federal Trade Commission (''FTC'') concerning the impact of the commercial or industry standards on competition.

The proposed modifications to the test procedure for electric motors would reference testing methods contained in certain sections of the following commercial standards, which DOE is proposing to incorporate by reference: CSA C390–10 (R2019), IEC 60034–12:2016, IEC 60079–7:2015, IEC 61800–9–2:2017, NEMA MG 1–2016 with 2018 Supplements and NFPA 20–2019. DOE has evaluated these standards and is unable to conclude whether it fully complies with the requirements of section 32(b) of the FEAA (*i.e.,* whether it was developed in a manner that fully provides for public participation, comment, and review.) DOE will consult with both the Attorney General and the Chairman of the FTC concerning the impact of these test procedures on competition, prior to prescribing a final rule.

M. Description of Materials Incorporated by Reference

In this NOPR, DOE proposes to incorporate by reference the test standards published by CSA, IEC, IEEE, NEMA and NFPA.

CSA C390–10 (R2019) specifies test methods, marking requirements, and energy efficiency levels for three-phase induction motors.

CSA C747–09 (R2019) specifies test methods for single-phase electric motors and polyphase electric motors below 1 hp.

IEC 60034–1:2010 provides standardized performance and ratings, including test methods for electric motors.

IEC 60034–2–1:2014 specifies test methods for single phase and polyphase induction motors and synchronous motors.

IEC 60034–12:2016 specifies the parameters for eight designs (IEC Design N, Design NE, Design NY, Design NEY, IEC Design H, Design HE, Design HY, Design HEY) of starting performance of single-speed three-phase 50 Hz or 60 Hz cage induction motors.

IEC 60050–411 provides definitions related to electric motors.

IEC 60051–1:2016 specifies definitions and general requirements for electrical measuring instruments.

IEC 60072–1 specifies fixing dimensions, shaft extension dimensions and output powers, as well as permissible torques for continuous duty electric motors.

IEC 60079–7:2015 is referenced within IEC 60034–12:2016 and specifies the requirements for the design, construction, testing and marking of electrical equipment and Ex Components with type of protection increased safety ''e'' intended for use in explosive gas atmospheres.

IEC 61800–9–2:2017 specifies test methods for inverter-fed electric motors that include an inverter.

IEEE 112–2017 specifies test methods for polyphase electric motors.

IEEE 114–2010 specifies test methods for single-phase electric motors.

NEMA MG1–2016 with 2018 Supplements provides test methods to determine motor efficiency and losses, including for air-over electric motors, and establishes several industry definitions.

NFPA 20–2019 provides specifications for fire-pump motors.

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

• 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.*

• 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.*

• 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.*

• NEMA, 1300 North 17th Street, Suite 900, Arlington, Virginia 22209, +1 (703) 841 3200, or by visiting *https://www.nema.org.*

• National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169, +1 800 344 3555, or by visiting *https://www.nfpa.org.*

V. Public Participation

A. Participation in the Webinar

The time and date of the public meeting held via webinar are listed in the **DATES** section at the beginning of this document. If no participants register for the webinar, it will be cancelled. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's website: *www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=6&action=viewlive.* Participants are responsible for ensuring their systems are compatible with the webinar software.

B. Procedure for Submitting Prepared General Statements for Distribution

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

C. Conduct of the Webinar

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

A transcript of the webinar will be included in the docket, which can be viewed as described in the *Docket* section at the beginning of this NOPR. In addition, any person may buy a copy of the transcript from the transcribing reporter.

D. Submission of Comments

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

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

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

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

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

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

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

Include contact information each time you submit comments, data, documents, and other information to DOE. No faxes will be accepted.

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

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

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

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

E. Issues on Which DOE Seeks Comment

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

(1) DOE seeks comments on its proposed clarification of IEC Design NE, NY, NEY, HE, HY and HEY motors as variants of IEC Design N and IEC Design H motors, as applicable.

(2) DOE requests comments on its proposal to add air-over electric motors to the scope of the test procedure. To the extent available, DOE requests that comments be accompanied by supporting information and data.

(3) DOE requests comments on its proposal to add submersible electric motors to the scope of the test procedure.

(4) DOE requests comments on its proposal to add electric motors greater than 500 hp (and up to 750 hp) that meet the criteria provided in 10 CFR 431.25(g) (except (8)) and are not listed at 10 CFR 431.25(l)(2)–(4) to the scope of the test procedure. DOE requests comment and supporting information on whether an upper limit of 750 hp is appropriate for the proposed expanded scope of motors greater than 500 hp—and if not, why not.

(5) DOE requests comments on the proposal to include SNEMs, as specified in Table III.4, within the scope of the test procedure. Specifically, DOE requests feedback on each individual criteria listed in Table III.4. To the extent that these criteria should be revised, DOE seeks supporting information and justification for those revisions.

(6) DOE requests comments on its proposal to add test procedure provisions for AC induction inverter-only electric motors. DOE seeks supporting information and justification for including or excluding AC induction inverter-only electric motors in the scope of the test procedure.

(7) DOE requests comments on its proposal to add synchronous electric motors to the scope of the test procedure. Specifically, DOE request comments on whether the criteria listed in Table III.8 accurately reflect DOE's intent to propose to include LSPM motors; PMAC motors; SR motors; SynRMs; and ECMs in the scope of the proposed test procedure. To the extent that the criteria listed in Table III.8 should be revised, DOE seeks supporting information and justification for the suggested revision.

(8) DOE requests comment on maintaining the existing exemption of component sets of an electric motor from the scope of the test procedure.

(9) DOE requests comment on maintaining the existing exemption of liquid-cooled electric motors from the scope of the test procedure.

(10) DOE requests comment on whether any electric motors, when used as components of covered products or covered equipment, are unable to be tested under the DOE test procedure absent modification to the test procedure. If so, DOE requests information on what such modifications should be and why.

(11) DOE seeks comments on the proposed updates to the definitions for IEC Design H, and IEC Design N, and the proposed additional definitions for IEC Design HE, HY, HEY, NE, NY and NEY.

(12) DOE seeks comments on its assessment that updating the NEMA MG 1 references in the DOE definitions to

NEMA MG 1–2016 with 2018 Supplements would not substantially change the definitions currently prescribed in 10 CFR 431.12. DOE also seeks comment on whether the proposed updates would alter the measured efficiency of electric motors.

(13) DOE seeks comments on the proposed definitions of ''inverter-only electric motor'' ''inverter-capable electric motor'' and ''inverter''. If these definitions should be revised, DOE requests supporting information and justification for these revisions.

(14) DOE requests comments (*i.e.,* supporting information and technical justification) on the proposed definition for an air-over electric motor—including technical information and support on whether and why the definition should be modified.

(15) DOE requests comments (*i.e.,* supporting information and technical justification) on the proposed definition for a liquid-cooled electric motor—including technical information and support on whether and why the definition should be modified.

(16) DOE seeks comments on whether its assessment of the updates to IEC 60034–12:2016 is accurate and on its proposal to incorporate by reference the 2016 version of IEC 60034–12, including reference to IEC 60079–7:2015.

(17) DOE seeks comments on whether its assessment of the updates to NFPA 20–2019 is accurate. In addition, DOE seeks comment on its proposal to reference section 9.5 of NFPA 20–2019, the most current test standard.

(18) DOE seeks comment on whether the clause ''including any IEC-equivalent'' should be maintained in the fire pump electric motor definition, considering that section 9.5 of NFPA 20–2019 now includes this specification.

(19) DOE seeks comments on whether its assessment of the updated paragraph 12.58.1 of NEMA MG1–2016 with 2018 Supplements is accurate. DOE also seeks comment on its proposal to incorporate IEEE 112–2017, CSA C390–10 (R2019), and IEC 60034–2–1:2014, and on its preliminary determination that updating these references to the latest version of each standard would not affect the measured efficiency of an electric motor currently subject to energy conservation standards at 10 CFR 431.25.

(20) DOE requests comment on its proposal to specify using Section 34.4, with modification, for measuring the efficiency of air-over electric motors. DOE requests feedback on the proposal to specify a single target temperature 75 °C for polyphase motors.

(21) DOE requests comment on its conclusion that Section 34.4 is less repeatable than Section 34.5.

(22) DOE requests comment on its conclusion that measured efficiency correlates inversely with the temperature the motor is tested at.

(23) DOE requests feedback and supporting data on the repeatability and level of accuracy of the methods included Section 34.4 and 34.5, and on whether these or other methods would lead to equivalent results when applied to the same motor.

(24) DOE requests comment on whether some air-over electric motors could thermally stabilize at a temperature that is lower than the proposed target temperature of 75 °C. If yes, DOE requests comment on how these should be tested.

(25) DOE requests comment on whether the proposed test procedure is applicable to all air-over electric motors in scope. If not, DOE is requesting information and feedback on which air-over electric motors cannot be tested in accordance with the proposed test procedure and on any revisions needed.

(26) DOE requests comment on the proposed test method for measuring the efficiency of additional SNEMs (not including inverter-only electric motors, air-over electric motors, or submersible electric motors).

(27) DOE requests feedback on the proposed test methods for synchronous electric motors and AC induction inverter-only electric motors. Specifically, DOE requests feedback on the proposal to test direct-on-line synchronous motors and inverter-capable electric motors in accordance with IEC 60034–2–1:2014. In addition, DOE requests feedback on the proposal to test inverter-only electric motors in accordance with IEC 61800–9–2:2017 and specifying, for inverter-only motors that do not include an inverter, that testing must be conducted using an inverter as recommended in the manufacturer's catalogs or offered for sale with the electric motor.

(28) DOE requests feedback how inverter-only electric motors sold with or without an inverter are typically tested (*i.e.,* inclusive of the inverter or not, and on whether the test measurements include the inverter). DOE requests feedback and supporting information on whether there would be any benefits to considering a test method that measures the combined efficiency of the motor and inverter for inverter-capable electric motors (with and without inverters).

(29) For inverter-only electric motors without inverters, DOE requests comment on the proposal to conduct the test using an inverter as recommended in the manufacturer's catalogs or offered for sale with the electric motor to determine a combined motor and inverter efficiency. DOE also requests feedback on which inverter should be selected for testing in the case where more than one inverter is recommended in the manufacturer's catalogs or offered for sale with the electric motor. To the extent other approaches should be considered, DOE requests feedback and supporting information.

(30) For inverter-only electric motors sold without inverters, DOE requests comment on whether these motors should be tested using the method in section 6.2 of IEC 60034–2–3:2020, with a ''comparable inverter'' in accordance with section 5 of IEC 60034–2–3:2020.

(31) DOE requests comments on its proposal to use full-load efficiency as the metric for measuring the performance of the additional electric motors proposed in scope. Specifically, DOE requests comment on the proposed load points associated with each electric motor category. If any different load points or metric should be considered, DOE requests information and data to support those load points and any alternate metric.

(32) DOE requests comments whether it should consider an efficiency metric inclusive of the inverter efficiency for inverter-capable electric motors and inverter-only electric motors sold with or without inverters.

(33) DOE requests comment on its proposal to specify rated output power for induction motors based on frame size requirements in NEMA MG–2016 with 2018 Supplements. Specifically, DOE requests comment on whether the proposed specification of rated output power for sections 2.1, 2.2, and 2.4 of Appendix B accurately describe how manufacturers are currently determining the rated output power for electric motors.

(34) DOE seeks comment on how rated output power and breakdown torque are determined for the additional motors proposed to be added to scope (specifically synchronous electric motors); whether breakdown torque needs to be defined; and if so, how.

(35) DOE seeks comment on the proposed definition for ''rated voltage'' for electric motors currently in scope and expanded scope motors.

(36) DOE seeks comment on its proposal to allow 'Usable at' voltages on the nameplate to be selected for testing, and how these 'Usable at' voltages differ from a ''rated voltage'' as currently labeled on certain electric motor nameplates.

(37) DOE seeks comment on if ''rated voltage'' should be defined differently for currently in scope motors and newly included motors in the proposed expanded scope.

(38) DOE seeks comment on the proposed test procedure for submersible electric motors based on Section 34.4 of NEMA MG1–2016 with its 2018 Supplements.

(39) DOE also seeks comment on the proposed modifications to Section 34.4 of NEMA MG1–2016 with its 2018 Supplements, and if further modifications are warranted for use with submersible electric motors.

(40) DOE seeks comment and supporting data on if the submersible test procedure should only apply to a certain range of horsepower rating, or if it should apply to all submersible electric motors, regardless of rated horsepower.

(41) DOE requests comment on the proposed changes to the testing requirement for certain vertical electric motors.

(42) DOE requests comment on whether it should be specified in the test method that the coupling torsional rigidity exceed the rigidity of the motor shaft it is connected to.

(43) DOE requests comment on the proposed language clarifying testing of electric motors with shaft seals.

(44) DOE requests comments on the proposed application of the additional testing instructions in Sections 3.1 through 3.8 of appendix B to the additional electric motors proposed for inclusion in scope of the test procedure. To the extent that revisions to the additional instructions other than those discussed are needed, DOE requests supporting information and justification for these revisions.

(45) DOE requests comments in the proposed definition of independent as it pertains to nationally recognized testing programs, certification programs, and accreditation bodies.

(46) DOE requests comments on the three proposed options through which manufacturers must certify electric motors as compliant.

(47) DOE seeks comments on its proposal to specify how to determine the nominal full load efficiency of a basic model of electric motors when the average full-load efficiency of that basic model is known.

(48) DOE requests comment on its proposal to allow using average full-load efficiency values as alternative represented values for electric motors.

(49) DOE requests comment on its proposal to require that, on or after the compliance date for any new or amended standards for electric motors published after January 1, 2021, manufacturers must calculate the average full-load efficiency of a basic model as the arithmetic mean of the full-load efficiencies of a sample of electric motors and on the proposal to add a requirement that no electric motor tested in the sample has losses exceeding 15 percent of those permitted by the applicable energy conservation standard.

(50) DOE requests comment on the proposal to add a requirement to specify that nationally recognized certification programs for electric motors must follow provisions as proposed in §§ 429.64 and 429.70(i).

(51) DOE requests comment on its proposal to require that within one year of publication of a test procedures or certification, compliance and enforcement final rule pertaining to electric motors, all certification programs must either submit a letter to DOE certifying that no change to their program is needed or submit a letter describing the measures implemented to ensure the criteria in the proposed § 429.73(b) are still met. If a certification program submits a letter describing updates, DOE requests comment on its proposal to maintain the program's recognition until DOE reviews the measures implemented.

(52) DOE requests comments on the proposed requirements for validation and subsequent verification of an AEDM.

(53) DOE requests comment on its estimate that 50 percent of the current market of the proposed expanded scope electric motors and DPPP motors make voluntary representations.

(54) DOE requests comment on the in-house and third-party single unit test costs.

(55) DOE requests comment on its estimation of reduction in testing cost due to the proposed requirements for testing of vertical electric motors.

(56) DOE requests comments on the benefits and burdens of the proposed updates and additions to industry standards referenced in the test procedure for electric motors.

(57) DOE requests comment on the number of small businesses DOE identified and the number of potential electric motor models that small business manufacturers would make voluntary representations regarding the energy consumption or cost of energy of such electric motors. DOE also requests comment on any other potential costs small businesses may incur due to the proposed amended test procedures, if finalized.

VI. Approval of the Office of the Secretary

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

List of Subjects

10 CFR Part 429

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

10 CFR Part 431

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

Signing Authority

This document of the Department of Energy was signed on November 17, 2021, by Kelly Speakes-Backman, Principal Deputy Assistant Secretary for Energy Efficiency and Renewable Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the **Federal Register**.

Signed in Washington, DC, on November 19, 2021.

Treena V. Garrett,

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

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

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

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

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

■ 2. Revise § 429.1 to read as follows:

§ 429.1 Purpose and scope.

This part sets forth the procedures for certification, determination and enforcement of compliance of covered products and covered equipment with the applicable energy conservation standards set forth in parts 430 and 431 of this subchapter.

■ 3. Amend § 429.2 by:

■ a. Revising paragraph (a); and

■ b. Adding in alphabetical order, the definition for ''independent''.

The revision and addition read as follows:

§ 429.2 Definitions.

(a) The definitions found in 10 CFR parts 430 and 431 apply for purposes of this part.

* * * * *

Independent means, in the context of a nationally recognized testing program, certification program, or accreditation program for electric motors, an entity that is not controlled by, or under common control with, electric motor manufacturers, importers, private labelers, or vendors, and that has no affiliation, financial ties, or contractual agreements, apparently or otherwise, with such entities that would:

(1) Hinder the ability of the program to evaluate fully or report the measured or calculated energy efficiency of any electric motor, or

(2) Create any potential or actual conflict of interest that would undermine the validity of said evaluation. For purposes of this definition, financial ties or contractual agreements between an electric motor manufacturer, importer, private labeler or vendor and a nationally recognized testing program, certification program, or accreditation program exclusively for testing, certification, or accreditation services does not negate an otherwise independent relationship.

* * * * *

■ 4. Add § 429.3 to read as follows:

§ 429.3 Sources for information and guidance.

(a) *General.* The standards listed in this paragraph are referred to in §§ 429.73 and 429.74 and are not incorporated by reference. These sources are provided here for information and guidance only.

(b) *ISO/IEC.* International Organization for Standardization (ISO), 1, ch. de la Voie-Creuse, CP 56, CH–1211 Geneva 20, Switzerland/International Electrotechnical Commission, 3, rue de Varembé, P.O. Box 131, CH–1211 Geneva 20, Switzerland.

(1) International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC), (''ISO/IEC'') Guide 25, ''General requirements for the competence of calibration and testing laboratories'', December 1, 1990.

(2) International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC), (''ISO/IEC'') Guide 27, ''Guidelines for corrective action to be taken by a certification body in the event of misuse of its mark of conformity'', March 1, 1983.

(3) International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC), (''ISO/IEC'') Guide 28, ''Conformity assessment—Guidance on a third-party certification system for products,'' October 1, 2004.

(4) International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC), (''ISO/IEC '') Guide 58, ''Calibration and testing laboratory accreditation systems—General requirements for operation and recognition,'' February 11, 1993.

(5) International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC), (''ISO/IEC '') Guide 65, ''General requirements for bodies operating product certification systems,'' June 27, 1996.

(c) *NVLAP.* National Voluntary Laboratory Accreditation Program, National Institute of Standards and Technology, 100 Bureau Drive, M/S 2140, Gaithersburg, MD 20899–2140, 301–975–4016, or go to *www.nist.gov/nvlap/*. Also see *http://www.nist.gov/nvlap/nvlap-handbooks.cfm.*

(1) National Institute of Standards and Technology (NIST) Handbook 150, ''NVLAP Procedures and General Requirements,'' 2006 edition, February 2006.

(2) National Institute of Standards and Technology (NIST) Handbook 150–10, ''Efficiency of Electric Motors,'' 2007 edition, February 2007.

■ 5. Revise § 429.11 to read as follows:

§ 429.11 General sampling requirements for selecting units to be tested.

(a) When testing of covered products or covered equipment is required to comply with section 323(c) of the Act, or to comply with rules prescribed under sections 324, 325, 342, 344, 345 or 346 of the Act, a sample comprised of production units (or units representative of production units) of the basic model being tested must be selected at random and tested and must meet the criteria found in §§ 429.14 through 429.66. Any represented values of measures of energy efficiency, water efficiency, energy consumption, or water consumption for all individual models represented by a given basic model must be the same; and

(b) The minimum number of units tested must be no less than two, unless otherwise specified. A different minimum number of units may be specified for certain products in §§ 429.14 through 429.66. If fewer than the number of units required for testing is manufactured, each unit must be tested.

■ 6. Add § 429.64 to read as follows:

§ 429.64 Electric motors.

(a) *Applicability.* When a party determines the energy efficiency of an electric motor in order to comply with an obligation imposed on it by or pursuant to Part C of Title III of EPCA, 42 U.S.C. 6311–6316, this section applies. This section does not apply to enforcement testing conducted pursuant to § 431.192 of this chapter. This section applies to electric motors that are subject to requirements in subpart B of part 431 of this chapter and does not apply to dedicated-purpose pool pump motors subject to requirements in subpart Z of part 431.

(1) Prior to the date described in paragraph (a)(2) of this section, manufacturers of electric motors subject to energy conservation standards in subpart B of part 431 must make representations of energy efficiency, including representations for certification of compliance, in accordance with paragraphs (b) and (c) of this section.

(2) On and after the compliance date for any new or amended standards for electric motors published after January 1, 2021, manufacturers of electric motors subject to energy conservation standards in subpart B of part 431 of this chapter must make representations of energy efficiency, including representations for certification of compliance, in accordance with paragraphs (d) through (f) this section.

(b)(1) *General requirements.* The represented value of nominal full-load efficiency of each basic model of electric motor must be determined either by testing in accordance with § 431.16 of this chapter, or by application of an alternative efficiency determination method (AEDM) that meets the requirements of paragraph (b)(2) of this section.

(2) *Alternative efficiency determination method.* In lieu of testing, the represented value of nominal full-load efficiency for a basic model of electric motor must be determined through the application of an AEDM pursuant to the requirements of

§ 429.70(i) of this part and the provisions of paragraphs (b) and (c) of this section, where:

(i) The average full-load efficiency of any basic model used to validate an AEDM must be calculated under paragraph (c) of this section.

(ii) The represented value is the nominal full-load efficiency of a basic model of electric motor and is to be used in marketing materials and all public representations, as the certified value of efficiency, and on the nameplate. (See § 431.31(a) of this chapter.) Determine the nominal full-load efficiency by selecting a value from the ''Nominal Full-Load Efficiency'' Table in appendix B to subpart B of this part that is no greater than the simulated full-load efficiency predicted by the AEDM for the basic model.

(3) *Use of a certification program or accredited laboratory.* (i) A manufacturer may have a certification program, that DOE has classified as nationally recognized under § 429.73, certify the nominal full-load efficiency of a basic model of electric motor, and issue a certificate of conformity for the motor.

(ii) For each basic model for which a certification program is not used as described in paragraph (b)(3)(i) of this section, any testing of the motor pursuant to paragraphs (b)(1) or (2) of this section to determine its energy efficiency must be carried out:

(A) For certification of a new basic model pursuant to § 431.36(e) of this chapter required prior to [DATE 180 DAYS FOLLOWING PUBLICATION OF FINAL RULE], in accordance with paragraph (c) of this section in an accredited laboratory that meets the requirements of § 431.18 of this chapter;

(B) For certification of a new basic model pursuant to § 431.36(e) of this chapter required on or after [DATE 180 DAYS FOLLOWING PUBLICATION OF FINAL RULE], in a nationally recognized testing program that meets the requirements of paragraph (f) of this section.

(c) *Additional testing requirements applicable when a certification program is not used*—(1) *Selection of units for testing.* For each basic model selected for testing, a sample of units shall be selected at random and tested. Components of similar design may be substituted without requiring additional testing if the represented measures of energy consumption continue to satisfy the applicable sampling provision.

(2) *Sampling requirements.* The sample shall be comprised of production units of the basic model, or units that are representative of such production units. The sample size shall be not fewer than five units, except that when fewer than five units of a basic model would be produced over a reasonable period of time (approximately 180 days), then each unit shall be tested. In a test of compliance with a represented average or nominal efficiency:

(i) The average full-load efficiency of the sample $\bar{x}$, which is defined by:

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

where x_i is the measured full-load efficiency of unit *i* and n is the number of units tested, shall satisfy the condition:

$$\bar{x} = \frac{100}{1 + 1.05(\frac{100}{RE} - 1)}$$

where RE is the represented nominal full-load efficiency, and

(ii) The lowest full-load efficiency in the sample x_{min} , which is defined by:

$x_{min} = \min(x_i =)$

shall satisfy the condition:

$$x_{min} \geq \frac{100}{1 + 1.15(\frac{100}{RE} - 1)}$$

(d) *Compliance certification.* A manufacturer may not certify the compliance of an electric motor pursuant to § 429.12 unless:

(1) Testing of the electric motor basic model was conducted using a nationally recognized testing program that meets the requirements of paragraph (f) of this section;

(2) Testing was conducted using a laboratory other than a nationally recognized testing program that meets the requirements of paragraph (f) of this section, or the nominal full-load efficiency of the electric motor basic model was determined through the application of an AEDM pursuant to the requirements of § 429.70(i), and a third-party certification organization that is nationally recognized in the United States under § 429.73 has certified the nominal full-load efficiency of the electric motor basic model through issuance of a certificate of conformity for the basic model.

(e) *Determination of represented value.* A manufacturer must determine the represented value of nominal full-load efficiency (inclusive of the inverter for inverter-only electric motors) for each basic model of electric motor either by testing in conjunction with the applicable sampling provisions or by applying an AEDM as set forth in this section and in § 429.70(i).

(1) *Testing*—(i) *Units to be tested.* If the represented value for a given basic model is determined through testing, the requirements of § 429.11 apply except that, for electric motors, the minimum sample size is five units. If fewer units than the minimum sample size are produced, each unit produced must be tested and the test results must demonstrate that the basic model performs at or better than the applicable standard(s). If one or more units of the basic model are manufactured subsequently, compliance with the default sampling and representations provisions is required.

(ii) *Average Full-load Efficiency:* Determine the average full-load efficiency for the basic model $\bar{x}$, for the units in the sample as follows:

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

Where x_i is the measured full-load efficiency of unit i and n is the number of units tested.

(iii) *Represented value.* The represented value is the nominal full-load efficiency of a basic model of electric motor and is to be used in marketing materials and all public representations, as the certified value of efficiency, and on the nameplate. (*See* § 431.31(a) of this chapter.) Determine the nominal full-load efficiency by selecting an efficiency from the ''Nominal Full-load Efficiency'' Table in Appendix B that is no greater than the average full-load efficiency of the basic model as calculated in § 429.64(e)(1)(ii). Alternatively, a manufacturer may make representations of the represented value of the average full-load efficiency of a basic model of electric motor provided that the manufacturer uses the average full-load efficiency consistently on all marketing materials, public representations and as the value on the nameplate (*See* § 431.31(a) of this chapter). The represented value must be clearly identified as either Avg Eff. (if using average full-load efficiency) or as specified in § 431.31(a)(2) of this chapter (if using nominal full-load efficiency).

(iv) *Minimum full-load efficiency:* To ensure a high level of quality control and consistency of performance within the basic model, the lowest full-load efficiency in the sample x_{min}, must satisfy the condition:

$$x_{min} \geq \frac{100}{1 + 1.15(\frac{100}{Std} - 1)}$$

where *Std* is the value of the applicable energy conservation standard.

If the lowest measured full-load efficiency of a motor in the tested sample does not satisfy the condition in this section, then the basic model cannot be certified as compliant with the applicable standard.

(2) *Alternative efficiency determination methods.* In lieu of testing, the represented value of nominal full-load efficiency for a basic model of electric motor must be determined through the application of an AEDM pursuant to the requirements of § 429.70(i) and the provisions of this section, where:

(i) The average full-load efficiency of any basic model used to validate an AEDM must be calculated under paragraph (e)(1)(ii) of this section; and

(ii) The represented value is the nominal full-load efficiency of a basic model of electric motor and is to be used in marketing materials and all public representations, as the certified value of efficiency, and on the nameplate. (See § 431.31(a) of this chapter) Determine the nominal full-load efficiency by selecting a value from the ''Nominal Full-Load Efficiency'' Table in appendix B to subpart B of this part, that is no greater than the simulated full-load efficiency predicted by the AEDM for the basic model.

(f) *Nationally recognized testing program.* (1) Testing pursuant to paragraphs (b)(3)(ii)(B) and (d)(1) of this section must be conducted in an independent (as defined at 10 CFR 431.12) nationally recognized testing program for which the accreditation body was:

(i) The National Institute of Standards and Technology/National Voluntary Laboratory Accreditation Program (NIST/NVLAP); or

(ii) A laboratory accreditation body having a mutual recognition arrangement with NIST/NVLAP; or

(iii) An organization classified by the Department, pursuant to § 429.74, as an accreditation body.

(2) NIST/NVLAP is under the auspices of the National Institute of Standards and Technology (NIST)/ National Voluntary Laboratory Accreditation Program (NVLAP), which is part of the U.S. Department of Commerce. NIST/NVLAP accreditation is granted on the basis of conformance with criteria published in 15 CFR part 285. The National Voluntary Laboratory Accreditation Program, ''Procedures and General Requirements,'' NIST Handbook 150–10, February 2007, and Lab Bulletin LB–42–2009, Efficiency of Electric Motors Program, (referenced for guidance only, see § 429.3) present the technical requirements of NVLAP for the Efficiency of Electric Motors field of accreditation. This handbook supplements NIST Handbook 150, National Voluntary Laboratory Accreditation Program ''Procedures and General Requirements,'' which contains 15 CFR part 285 plus all general NIST/ NVLAP procedures, criteria, and policies. Information regarding NIST/ NVLAP and its Efficiency of Electric Motors Program (EEM) can be obtained from NIST/NVLAP, 100 Bureau Drive, Mail Stop 2140, Gaithersburg, MD 20899–2140, (301) 975–4016 (telephone), or (301) 926–2884 (fax).

■ 7. Add § 429.65 to read as follows:

§ 429.65 Dedicated-purpose pool pump motors.

(a) *Applicability.* This section applies to dedicated purpose motors that are subject to requirements in subpart Z of part 431 of this chapter. Starting on the compliance date for any standards for dedicated-purpose pool pump motors published after January 1, 2021, manufacturers of dedicated-purpose pool pump motors subject to such standards must make representations of energy efficiency, including representations for certification of compliance, in accordance with this section.

(b) *Compliance certification.* A manufacturer may not certify the compliance of a dedicated-purpose pool pump motor pursuant to 10 CFR 429.12 unless:

(1) Testing of the dedicated-purpose pool pump motor basic model was conducted using a nationally recognized testing program that meets the requirements of paragraph (d) of this section;

(2) Testing was conducted using a laboratory other than a nationally recognized testing program that meets the requirements of paragraph (d) of this section, or the full-load efficiency of the dedicated-purpose pool pump motor basic model was determined through the application of an AEDM pursuant to the requirements of § 429.70(j), and a third-party certification organization that is nationally recognized in the United States under § 429.73 has certified the full-load efficiency of the dedicated-purpose pool pump motor basic model through issuance of a certificate of conformity for the basic model.

(c) *Determination of represented value.* A manufacturer must determine the represented value of full-load efficiency (inclusive of the drive, if the dedicated-purpose pool pump motor basic model is placed into commerce with a drive, or is unable to operate without the presence of a drive) for each basic model of dedicated-purpose pool pump motor either by testing in conjunction with the applicable sampling provisions or by applying an AEDM as set forth in this section and in § 429.70(j).

(1) *Testing*—(i) *Units to be tested.* If the represented value for a given basic model is determined through testing, the requirements of § 429.11 apply except that, for dedicated-purpose pool pump motors, the minimum sample size is five units. If fewer units than the minimum sample size are produced, each unit produced must be tested and the test results must demonstrate that the basic model performs at or better than the applicable standard(s). If one or more units of the basic model are manufactured subsequently, compliance with the default sampling and representations provisions is required.

(ii) *Full-load efficiency.* Any value of full-load efficiency must be lower than or equal to the average of the sample X_{min}, calculated as follows:

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

Where x_i is the measured full-load efficiency of unit i and n is the number of units tested in the sample.

(iii) *Represented value.* The represented value is the full-load efficiency of a basic model of dedicated-purpose pool pump motor and is to be used in marketing materials and all public representations, as the certified value of efficiency, and on the nameplate. (See § 431.486 of this chapter). Alternatively, a manufacturer may make representations using the nominal full-load efficiency of a basic model of dedicated-purpose pool pump motor provided that the manufacturer uses the nominal full-load efficiency consistently on all marketing materials, and as the value on the nameplate. Determine the nominal full-load efficiency by selecting an efficiency from the ''Nominal Full-load Efficiency'' Table in appendix B to subpart B of this part, that is no greater than the full-load efficiency of the basic model as calculated in § 429.65(c)(1)(ii).

(iv) *Minimum full-load efficiency:* To ensure quality control and consistency of performance within the basic model, the lowest full-load efficiency in the sample , must satisfy the condition:

$$x_{min} \geq \frac{100}{1 + 1.15(\frac{100}{Std} - 1)}$$

where *Std* is the value of any applicable energy conservation standard.

If the lowest measured full-load efficiency of a motor in the tested sample does not satisfy the condition in this section, then the basic model cannot be certified as compliant with the applicable standard.

(v) *Dedicated-purpose pool pump motor total horsepower.* The represented value of the total horsepower of a basic model of dedicated-purpose pool pump motor must be the mean of the dedicated-purpose pool pump motor total horsepower for each tested unit in the sample.

(2) *Alternative efficiency determination methods.* In lieu of testing, the represented value of full-load efficiency for a basic model of dedicated-purpose pool pump motor must be determined through the application of an AEDM pursuant to the requirements of § 429.70(j) and the provisions of this section, where:

(i) The full-load efficiency of any basic model used to validate an AEDM must be calculated under paragraph (c)(1)(ii) of this section; and

(ii) The represented value is the full-load efficiency of a basic model of dedicated-purpose pool pump motor and is to be used in marketing materials and all public representations, as the certified value of efficiency, and on the nameplate. (*See* § 431.485 of this chapter). Alternatively, a manufacturer may make representations using the nominal full-load efficiency of a basic model of dedicated-purpose pool pump motor provided that the manufacturer uses the nominal full-load efficiency consistently on all marketing materials, and as the value on the nameplate. Determine the nominal full-load efficiency by selecting an efficiency from the ''Nominal Full-load Efficiency'' Table in appendix B to subpart B of this part, that is no greater than the full-load efficiency of the basic model as calculated in § 429.65(c)(1)(ii).

(d) *Nationally recognized testing program.* (1) Testing pursuant to paragraph (b) of this section must be conducted in an independent (as defined at 10 CFR 431.12 of this chapter) nationally recognized testing program for which the accreditation body was:

(i) The National Institute of Standards and Technology/National Voluntary Laboratory Accreditation Program (NIST/NVLAP); or

(ii) A laboratory accreditation body having a mutual recognition arrangement with NIST/NVLAP; or

(iii) An organization classified by the Department, pursuant to § 429.74, as an accreditation body.

(2) NIST/NVLAP is under the auspices of the National Institute of Standards and Technology (NIST)/National Voluntary Laboratory Accreditation Program (NVLAP), which is part of the U.S. Department of Commerce. NIST/NVLAP accreditation is granted on the basis of conformance with criteria published in 15 CFR part 285. The National Voluntary Laboratory Accreditation Program, ''Procedures and General Requirements,'' NIST Handbook 150–10, February 2007, and Lab Bulletin LB–42–2009, Efficiency of Electric Motors Program, (referenced for guidance only, see § 429.3) present the technical requirements of NVLAP for the Efficiency of Electric Motors field of accreditation. This handbook supplements NIST Handbook 150, National Voluntary Laboratory Accreditation Program ''Procedures and General Requirements,'' which contains 15 CFR part 285 plus all general NIST/NVLAP procedures, criteria, and policies. Information regarding NIST/NVLAP and its Efficiency of Electric Motors Program (EEM) can be obtained from NIST/NVLAP, 100 Bureau Drive, Mail Stop 2140, Gaithersburg, MD 20899–2140, (301) 975–4016 (telephone), or (301) 926–2884 (fax).

■ 8. Amend § 429.70 by:
■ a. Revising paragraph (a); and
■ b. Adding paragraphs (i) and (j).

The revision and additions read as follows:

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

(a) *General.* A manufacturer of covered products or covered equipment explicitly authorized to use an AEDM in §§ 429.14 through 429.65 may not distribute any basic model of such product or equipment in commerce unless the manufacturer has determined the energy consumption or energy efficiency of the basic model, either from testing the basic model in conjunction with DOE's certification sampling plans and statistics or from applying an alternative method for determining energy efficiency or energy use (*i.e.,* AEDM) to the basic model, in accordance with the requirements of this section. In instances where a manufacturer has tested a basic model to validate the AEDM, the represented value of energy consumption or efficiency of that basic model must be determined and certified according to results from actual testing in conjunction with 10 CFR part 429, subpart B certification sampling plans and statistics. In addition, a manufacturer may not knowingly use an AEDM to overrate the efficiency of a basic model.

* * * * *

(i) *Alternative efficiency determination method (AEDM) for electric motors subject to requirements in subpart B of part 431 of this chapter*—(1) *Criteria an AEDM must satisfy.* A manufacturer is not permitted to apply an AEDM to a basic model of electric motor to determine its efficiency pursuant to this section unless:

(i) The AEDM is derived from a mathematical model that estimates the energy efficiency characteristics and losses of the basic model as measured by the applicable DOE test procedure and accurately represents the mechanical and electrical characteristics of that basic model, and

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

(iii) The manufacturer has validated the AEDM in accordance with paragraph (i)(2) of this section with basic models that meet the current Federal energy conservation standards (if any).

(2) *Validation of an AEDM.* Before using an AEDM, the manufacturer must validate the AEDM's accuracy and reliability by comparing the simulated full-load losses to tested average full-load losses as follows.

(i) *Select basic models.* A manufacturer must select at least five basic models compliant with the energy conservation standards at § 431.25 of this chapter (if any), in accordance with the following criteria:

(A) Two of the basic models must be among the five basic models with the highest unit volumes of production by the manufacturer in the prior 5 years.

(B) No two basic models may have the same horsepower rating;

(C) No two basic models may have the same frame number series; and

(D) Each basic model must have the lowest average full-load efficiency among the basic models within the same equipment class.

(E) In any instance where it is impossible for a manufacturer to select basic models for testing in accordance with all of these criteria, prioritize the criteria in the order in which they are listed. Within the limits imposed by the criteria, select basic models randomly.

(F) A basic model with a sample size of fewer than five units may not be selected to validate an AEDM.

(ii) *Apply the AEDM to the selected basic models.* Using the AEDM, calculate the simulated full-load losses for each of the selected basic models as follows: Hp × (1/simulated full-load efficiency − 1), where hp is the horsepower of the basic model.

(iii) *Test at least five units of each of the selected basic models in accordance with § 431.16 of this chapter.* Use the measured full-load losses for each of the tested units to determine the average of the measured full-load losses for each of the selected basic models.

(iv) *Compare.* The simulated full-load losses for each basic model (paragraph (i)(2)(ii) of this section) must be greater than or equal to 90 percent of the average of the measured full-load losses (paragraph (i)(2)(iii) of this section) (*i.e.,* 0.90× average of the measured full-load losses ≤ simulated full-load losses).

(3) *Verification of an AEDM.* (i) Each manufacturer must periodically select basic models representative of those to which it has applied an AEDM. The manufacturer must select a sufficient number of basic models to ensure the AEDM maintains its accuracy and reliability. For each basic model selected for verification:

(A) Subject at least one unit to testing in accordance with § 431.16 of this chapter by a nationally recognized testing program that meets the requirements of § 429.74. The simulated full-load losses for each unit must be greater than or equal to 90 percent of the measured full-load losses (*i.e.,* 0.90× average of the measured full-load losses ≤ simulated full-load losses); or

(B) Have a certification body recognized under § 429.73 certify the results of the AEDM accurately represent the basic model's average full-load efficiency.

(ii) Each manufacturer that has used an AEDM under this section must have available for inspection by the Department of Energy records showing:

(A) The method or methods used to develop the AEDM;

(B) The mathematical model, the engineering or statistical analysis, computer simulation or modeling, and other analytic evaluation of performance data on which the AEDM is based;

(C) Complete test data, product information, and related information that the manufacturer has generated or acquired pursuant to paragraphs (i)(2) and (3) of this section; and

(D) The calculations used to determine the simulated full-load efficiency of each basic model to which the AEDM was applied.

(iii) If requested by the Department, the manufacturer must:

(A) Conduct simulations to predict the performance of particular basic models of electric motors specified by the Department;

(B) Provide analyses of previous simulations conducted by the manufacturer; and/or

(C) Conduct testing of basic models selected by the Department.

(j) *Alternative efficiency determination method (AEDM) for dedicated-purpose pool pump motors subject to requirements in subpart Z of part 431 of this chapter.*

(1) *Criteria an AEDM must satisfy.* A manufacturer is not permitted to apply an AEDM to a basic model of dedicated-purpose pool pump motors, to determine its efficiency pursuant to this section unless:

(i) The AEDM is derived from a mathematical model that estimates the energy efficiency characteristics and losses of the basic model as measured by the applicable DOE test procedure and accurately represents the mechanical and electrical characteristics of that basic model, and

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

(iii) The manufacturer has validated the AEDM in accordance with paragraph (i)(2) of this section with basic models that meet the current Federal energy conservation standards (if any).

(2) *Validation of an AEDM.* Before using an AEDM, the manufacturer must validate the AEDM's accuracy and reliability by comparing the simulated full-load losses to tested full-load losses as follows.

(i) *Select basic models.* A manufacturer must select at least five basic models compliant with any energy conservation standards at § 431.485 of this chapter (if any), in accordance with the following criteria:

(A) Two of the basic models must be among the five basic models with the highest unit volumes of production by the manufacturer in the prior 5 years.

(B) No two basic models may have the same total horsepower rating;

(C) No two basic models may have the same speed configuration; and

(D) Each basic model must have the lowest full-load efficiency among the basic models within the same equipment class.

(E) In any instance where it is impossible for a manufacturer to select basic models for testing in accordance with all of these criteria, prioritize the criteria in the order in which they are listed. Within the limits imposed by the criteria, select basic models randomly.

(F) A basic model with a sample size of fewer than five units may not be selected to validate an AEDM.

(ii) *Apply the AEDM* to the selected basic models. Using the AEDM, calculate the simulated full-load losses for each of the selected basic models as follows: THP × (1/simulated full-load efficiency − 1), where THP is the total horsepower of the basic model.

(iii) Test at least five units of each of the selected basic models in accordance with § 431.483 of this chapter. Use the measured full-load losses for each of the tested units to determine the average of the measured full-load losses for each of the selected basic models.

(iv) *Compare.* The simulated full-load losses for each basic model (paragraph (i)(2)(ii) of this section) must be greater than or equal to 90 percent of the average of the measured full-load losses (paragraph (i)(2)(iii) of this section) (*i.e.,* 0.90× average of the measured full-load losses ≤ simulated full-load losses).

(3) *Verification of an AEDM.* (i) Each manufacturer must periodically select basic models representative of those to which it has applied an AEDM. The manufacturer must select a sufficient number of basic models to ensure the AEDM maintains its accuracy and reliability. For each basic model selected for verification:

(A) Subject at least one unit to testing in accordance with § 431.483 of this chapter by a nationally recognized testing program that meets the requirements of § 429.74. The simulated full-load losses for each unit must be greater than or equal to 90 percent of the measured full-load losses (*i.e.,* 0.90× average of the measured full-load losses ≤ simulated full-load losses); or

(B) Have a certification body recognized under § 429.73 certify the results of the AEDM accurately represent the basic model's full-load efficiency.

(ii) Each manufacturer that has used an AEDM under this section must have available for inspection by the Department of Energy records showing:

(A) The method or methods used to develop the AEDM;

(B) The mathematical model, the engineering or statistical analysis, computer simulation or modeling, and other analytic evaluation of performance data on which the AEDM is based;

(C) Complete test data, product information, and related information that the manufacturer has generated or acquired pursuant to paragraphs (i)(2) and (3) of this section; and

(D) The calculations used to determine the simulated full-load efficiency of each basic model to which the AEDM was applied.

(iii) If requested by the Department, the manufacturer must:

(A) Conduct simulations to predict the performance of particular basic models of dedicated-purpose pool pump motors specified by the Department;

(B) Provide analyses of previous simulations conducted by the manufacturer; and/or

(C) Conduct testing of basic models selected by the Department.

■ 9. Add § 429.73 to subpart B to read as follows:

§ 429.73 Department of Energy recognition of nationally recognized certification programs for electric motors, including dedicated purpose pool pump motors.

(a) *Petition.* For a certification program to be classified by the Department of Energy as being nationally recognized in the United States for the purposes of section 345(c) of EPCA (''nationally recognized''), the organization operating the program must submit a petition to the Department requesting such classification, in accordance with paragraph (c) of this section and § 429.75. The petition must demonstrate that the program meets the criteria in paragraph (b) of this section.

(b) *Evaluation criteria.* For a certification program to be classified by the Department as nationally recognized, it must meet the following criteria:

(1) It must have satisfactory standards and procedures for conducting and administering a certification system, including periodic follow up activities to assure that basic models of electric motors continue to conform to the efficiency levels for which they were certified, and for granting a certificate of conformity.

(2) For certification of electric motors including dedicated-purpose pool pump motors, it must be independent (as defined at § 429.2) of electric motor, including dedicated-purpose pool pump motor, manufacturers, importers, distributors, private labelers or vendors for which it is providing certification.

(3) It must be qualified to operate a certification system in a highly competent manner.

(4) Electric motors subject to requirements in subpart B of part 431 of this chapter. The certification program has expertise in the content and application of the test procedures at § 431.16 of this chapter and must apply the provisions at §§ 429.64 and 429.70(i).

(5) Dedicated-purpose pool pump motors subject to requirements in subpart Z of part 431 of this chapter. The certification program has expertise in the content and application of the test procedures at § 431.484 of this chapter and must apply the provisions at §§ 429.65 and 429.70(j).

(c) *Petition format.* Each petition requesting classification as a nationally recognized certification program must contain a narrative statement as to why the program meets the criteria listed in paragraph (b) of this section, must be signed on behalf of the organization operating the program by an authorized representative, and must be accompanied by documentation that supports the narrative statement. The following provides additional guidance as to the specific criteria:

(1) *Standards and procedures.* A copy of the standards and procedures for operating a certification system and for granting a certificate of conformity should accompany the petition.

(2) *Independent status.* The petitioning organization must describe how it is independent (as defined at § 429.2) from electric motor, including dedicated-purpose pool pump motor manufacturers, importers, distributors, private labelers, vendors, and trade associations.

(3) *Qualifications to operate a certification system.* Experience in operating a certification system should be described and substantiated by supporting documents within the petition. Of particular relevance would be documentary evidence that establishes experience in the application of guidelines contained in the ISO/IEC Guide 65, ''General requirements for bodies operating product certification systems'' (referenced for guidance only, see § 429.3), ISO/IEC Guide 27, ''Guidelines for corrective action to be taken by a certification body in the event of either misapplication of its mark of conformity to a product, or products which bear the mark of the certification body being found to subject persons or property to risk'' (referenced for guidance only, see § 429.3), and ISO/IEC Guide 28, ''General rules for a model third-party certification system for products'' (referenced for guidance only, see § 429.3), as well as experience in overseeing compliance with the guidelines contained in the ISO/IEC Guide 25, ''General requirements for the competence of calibration and testing laboratories'' (referenced for guidance only, see § 429.3).

(4) *Expertise in test procedures*—(i) *General.* 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 § 429.3), and with energy efficiency testing of the equipment to be certified.

(ii) *Electric motors subject to requirements in Subpart B of part 431 of this chapter.* The petition should set forth the program's experience with the test procedures detailed in § 431.16 of this chapter and the provisions in §§ 429.64 and 429.70(i).

(iii) *Dedicated-purpose pool pump motors subject to requirements in Subpart Z of part 431 of this chapter.* The petition should set forth the program's experience with the test procedures detailed in § 431.484 of this chapter and the provisions in §§ 429.65 and 429.70(j).

(d) *Disposition.* The Department will evaluate the petition in accordance with § 429.75, and will determine whether the applicant meets the criteria in paragraph (b) of this section for classification as a nationally recognized certification program.

(e) *Periodic evaluation.* Within one year after publication of any final rule regarding electric motors, a nationally recognized certification program must evaluate whether they meet the criteria in paragraph (b) of this section and must either submit a letter to DOE certifying that no change to its program is needed to continue to meet the criteria in paragraph (b) of this section or submit letter describing the measures implemented to ensure the criteria in paragraph (b) of this section are met. A certification program will continue to be classified by the Department of Energy as being nationally recognized in the United States until DOE concludes otherwise.

■ 10. Add § 429.74 to subpart B to read as follows:

§ 429.74 Department of Energy recognition of accreditation bodies for electric motors, including dedicated-purpose pool pump motors.

(a) *Petition.* To be classified by the Department of Energy as an accreditation body, an organization must submit a petition to the Department requesting such classification, in accordance with paragraph (c) of this section and § 429.75. The petition must demonstrate that the organization meets the criteria in paragraph (b) of this section.

(b) *Evaluation criteria.* To be classified as an accreditation body by the Department, the organization must meet the following criteria:

(1) It must have satisfactory standards and procedures for conducting and administering an accreditation system and for granting accreditation. This must include provisions for periodic audits to verify that the laboratories receiving its accreditation continue to conform to the criteria by which they were initially accredited, and for withdrawal of accreditation where such conformance does not occur, including failure to provide accurate test results.

(2) It must be independent (as defined at § 429.2) of electric motor manufacturers, importers, distributors, private labelers or vendors for which it is providing accreditation.

(3) It must be qualified to perform the accrediting function in a highly competent manner.

(4)(i) Electric Motors subject to requirements in subpart B of part 431 of this chapter. It must be an expert in the content and application of the test procedures and methodologies at § 431.16 of this chapter and § 429.64.

(ii) Dedicated-purpose pool pump motors subject to requirements in subpart Z of part 431 of this chapter. It must be an expert in the content and application of the test procedures and methodologies at § 431.484 of this chapter and § 429.65.

(c) *Petition format.* Each petition requesting classification as an accreditation body must contain a narrative statement as to why the program meets the criteria set forth in paragraph (b) of this section, must be signed on behalf of the organization operating the program by an authorized representative, and must be accompanied by documentation that supports the narrative statement. The following provides additional guidance:

(1) *Standards and procedures.* A copy of the organization's standards and procedures for operating an accreditation system and for granting accreditation should accompany the petition.

(2) *Independent status.* The petitioning organization must describe how it is independent (as defined at § 429.2) from electric motor manufacturers, importers, distributors, private labelers, vendors, and trade associations.

(3) *Qualifications to operate a testing program.* Experience in accrediting should be discussed and substantiated by supporting documents. Of particular relevance would be documentary evidence that establishes experience in the application of guidelines contained in the ISO/IEC Guide 58, ''Calibration and testing laboratory accreditation systems—General requirements for operation and recognition'' (referenced for guidance only, see § 429.3), as well as experience in overseeing compliance with the guidelines contained in the ISO/IEC Guide 25, ''General Requirements for the Competence of Calibration and Testing Laboratories'' (referenced for guidance only, see § 429.3).

(4) *Expertise in test procedures.* The petition should set forth the organization's experience with the test procedures and methodologies test procedures and methodologies at § 431.16 of this chapter and § 429.64. 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 § 429.3) to energy efficiency testing for electric motors.

(d*) Disposition.* The Department will evaluate the petition in accordance with § 429.75, and will determine whether the applicant meets the criteria in paragraph (b) of this section for classification as an accrediting body.

■ 11. Add § 429.75 to read as follows:

§ 429.75 Procedures for recognition and withdrawal of recognition of accreditation bodies or certification programs.

(a) *Filing of petition.* Any petition submitted to the Department pursuant to § 429.73(a) or 429.74(a), shall be entitled ''Petition for Recognition'' (''Petition'') and must be submitted to the Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Office, Appliance and Equipment Standards Program, EE–5B, 1000 Independence Avenue SW, Washington, DC, 20585–0121, or via email (preferred submittal method) to *AS_Motor_Petitions@ee.doe.gov.* In accordance with the provisions set forth in 10 CFR 1004.11, any request for confidential treatment of any information contained in such a Petition or in supporting documentation must be accompanied by a copy of the Petition or supporting documentation from which the information claimed to be confidential has been deleted.

(b) *Public notice and solicitation of comments.* DOE shall publish in the **Federal Register** the Petition from which confidential information, as determined by DOE, has been deleted in accordance with 10 CFR 1004.11 and shall solicit comments, data and information on whether the Petition should be granted. The Department shall also make available for inspection and copying the Petition's supporting documentation from which confidential information, as determined by DOE, has been deleted in accordance with 10 CFR 1004.11. Any person submitting written comments to DOE with respect to a Petition shall also send a copy of such comments to the petitioner.

(c) *Responsive statement by the petitioner.* A petitioner may, within 10 working days of receipt of a copy of any comments submitted in accordance with paragraph (b) of this section, respond to such comments in a written statement submitted to the Assistant Secretary for Energy Efficiency and Renewable Energy. A petitioner may address more than one set of comments in a single responsive statement.

(d) *Public announcement of interim determination and solicitation of comments.* The Assistant Secretary for Energy Efficiency and Renewable Energy shall issue an interim determination on the Petition as soon as is practicable following receipt and review of the Petition and other applicable documents, including, but not limited to, comments and responses to comments. The petitioner shall be notified in writing of the interim determination. DOE shall also publish in the **Federal Register** the interim determination and shall solicit comments, data, and information with respect to that interim determination. Written comments and responsive statements may be submitted as provided in paragraphs (b) and (c) of this section.

(e) *Public announcement of final determination.* The Assistant Secretary for Energy Efficiency and Renewable Energy shall as soon as practicable, following receipt and review of comments and responsive statements on the interim determination, publish in the **Federal Register** a notice of final determination on the Petition.

(f) *Additional information.* The Department may, at any time during the recognition process, request additional relevant information or conduct an investigation concerning the Petition. The Department's determination on a Petition may be based solely on the Petition and supporting documents, or may also be based on such additional information as the Department deems appropriate.

(g) *Withdrawal of recognition*—(1) *Withdrawal by the Department.* If DOE believes that an accreditation body or certification program that has been recognized under § 429.73 or 429.74, respectively, is failing to meet the criteria of paragraph (b) of the section under which it is recognized, or if the certification program fails to meet the provisions at § 429.73(e), the Department will issue a Notice of Withdrawal (''Notice'') to inform such entity and request that it take appropriate corrective action(s) specified in the Notice. The Department will give the entity an opportunity to respond. In no case shall the time allowed for corrective action exceed 180 days from the date of the notice (inclusive of the 30 days allowed for disputing the bases for DOE's notification of withdrawal). If the entity wishes to dispute any bases identified in the Notice, the entity must respond to DOE within 30 days of receipt of the Notice. If after receiving such response, or no response, the Department believes satisfactory correction has not been made, the Department will withdraw its recognition from that entity.

(2) *Voluntary withdrawal.* An accreditation body or certification program may withdraw itself from recognition by the Department by advising the Department in writing of such withdrawal. It must also advise those that use it (for an accreditation body, the testing laboratories, and for a certification organization, the manufacturers) of such withdrawal.

(3) *Notice of withdrawal of recognition.* The Department will publish in the **Federal Register** a notice of any withdrawal of recognition that occurs pursuant to this paragraph.

■ 12. Add appendix B to subpart B of part 429 to read as follows:

Appendix B to Subpart B of Part 429—Nominal Full-Load Efficiency Table for Electric Motors

99.0	96.5	88.5	68	36.5
98.9	96.2	87.5	66	34.5
98.8	95.8	86.5	64	
98.7	95.4	85.5	62	
98.6	95	84	59.5	
98.5	94.5	82.5	57.5	
98.4	94.1	81.5	55	
98.2	93.6	80	52.5	
98	93	78.5	50.5	
97.8	92.4	77	48	
97.6	91.7	75.5	46	
97.4	91	74	43.5	
97.1	90.2	72	41	
96.8	89.5	70	38.5	

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

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

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

■ 14. Section 431.12 is amended by:

■ a. Revising the definitions of: ''Air-over electric motor'', ''Basic model'', ''Definite purpose motor'', ''Definite purpose electric motor'', ''Electric motor with encapsulated windings'', ''Electric motor with moisture resistant windings'', ''Electric motor with sealed windings'', ''General purpose electric motor'', ''General purpose electric motor (subtype I)'', ''General purpose electric motor (subtype II)'', ''IEC Design H motor'', ''IEC Design N motor'', ''Inverter-capable electric motor'', ''Inverter-only electric motor'', ''Liquid-cooled electric motor'', ''NEMA Design A motor'', ''NEMA Design B motor'', ''NEMA Design C motor'', and ''Nominal full-load efficiency'';

■ b. Adding in alphabetical order definitions for: ''Breakdown torque'', ''Equipment class'', ''IEC Design HE'', ''IEC Design HEY'', ''IEC Design HY'', ''IEC Design NE'', ''IEC Design NEY'', ''IEC Design NY'', ''Inverter'', ''Rated frequency'', ''Rated load'', and ''Rated voltage''.

The revisions and additions read as follows:

§ 431.12 Definitions.

* * * * *

Air-over electric motor means an electric motor that does not reach thermal equilibrium (or thermal stability) during a rated load temperature test according to section 2 of appendix B, without the application of forced cooling by a free flow of air from an external device not mechanically connected to the motor.

* * * * *

Basic model means all units of electric motors manufactured by a single manufacturer, that are within the same equipment class, have electrical characteristics that are essentially identical, and do not have any differing physical or functional characteristics that affect energy consumption or efficiency.

* * * * *

Breakdown torque means the maximum torque that an electric 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.

* * * * *

Definite purpose motor means any electric motor that cannot be used in most general purpose applications and is designed either:

(1) To standard ratings with standard operating characteristics or standard mechanical construction for use under service conditions other than usual, such as those specified in NEMA MG1–2016 with 2018 Supplements, paragraph 14.3, ''Unusual Service Conditions,'' (incorporated by reference, see § 431.15); or

(2) For use on a particular type of application.

Definite purpose electric motor means any electric motor that cannot be used in most general purpose applications and is designed either:

(1) To standard ratings with standard operating characteristics or standard mechanical construction for use under service conditions other than usual, such as those specified in NEMA MG1–2016 with 2018 Supplements, paragraph 14.3, ''Unusual Service Conditions,'' (incorporated by reference, see § 431.15); or

(2) For use on a particular type of application.

* * * * *

Electric motor with encapsulated windings means an electric motor capable of passing the conformance test for water resistance described in NEMA MG 1–2016 with 2018 Supplements, paragraph 12.62 (incorporated by reference, see § 431.15).

Electric motor with moisture resistant windings means an electric motor that is capable of passing the conformance test for moisture resistance generally described in NEMA MG 1–2016 with 2018 Supplements, paragraph 12.63 (incorporated by reference, see § 431.15).

Electric motor with sealed windings means an electric motor capable of passing the conformance test for water resistance described in NEMA MG 1–2016 with 2018 Supplements, paragraph 12.62 (incorporated by reference, see § 431.15).

* * * * *

Equipment class means one of the combinations of an electric motor's horsepower (or standard kilowatt equivalent), number of poles, and open or enclosed construction, with respect to a category of electric motor for which § 431.25 prescribes nominal full-load efficiency standards.

* * * * *

General purpose electric motor means any electric motor that is designed in standard ratings with either:

(1) Standard operating characteristics and mechanical construction for use under usual service conditions, such as those specified in NEMA MG1–2016 with 2018 Supplements, paragraph 14.2, ''Usual Service Conditions,'' (incorporated by reference, see § 431.15) and without restriction to a particular application or type of application; or

(2) Standard operating characteristics or standard mechanical construction for use under unusual service conditions, such as those specified in NEMA MG1–2016 with 2018 Supplements, paragraph 14.3, ''Unusual Service Conditions,'' (incorporated by reference, see § 431.15) or for a particular type of application, and which can be used in most general purpose applications.

General purpose electric motor (subtype I) means a general purpose electric motor that:

(1) Is a single-speed, induction motor;

(2) Is rated for continuous duty (MG1) operation or for duty type S1 (IEC);

(3) Contains a squirrel-cage (MG1) or cage (IEC) rotor;

(4) Has foot-mounting that may include foot-mounting with flanges or detachable feet;

(5) Is built in accordance with NEMA T-frame dimensions or their IEC metric equivalents, including a frame size that is between two consecutive NEMA frame sizes or their IEC metric equivalents;

(6) Has performance in accordance with NEMA Design A (MG1) or B (MG1) characteristics or equivalent designs such as IEC Design N (IEC);

(7) Operates on polyphase alternating current 60-hertz sinusoidal power, and:

(i) Is rated at 230 or 460 volts (or both) including motors rated at multiple voltages that include 230 or 460 volts (or both), or

(ii) Can be operated on 230 or 460 volts (or both); and

(8) Includes, but is not limited to, explosion-proof construction.

Note to definition of General purpose electric motor (subtype I): References to ''MG1'' above refer to NEMA Standards Publication MG1–2016 with 2018 Supplements (incorporated by reference in § 431.15). References to ''IEC'' above refer to IEC 60034–1, 60034–12:2016, 60050–411, and 60072–1 (incorporated by reference in § 431.15), as applicable.

General purpose electric motor (subtype II) means any general purpose electric motor that incorporates design elements of a general purpose electric motor (subtype I) but, unlike a general purpose electric motor (subtype I), is configured in one or more of the following ways:

(1) Is built in accordance with NEMA U-frame dimensions as described in NEMA MG1–1967 (incorporated by reference, see § 431.15) or in accordance with the IEC metric equivalents, including a frame size that is between two consecutive NEMA frame sizes or their IEC metric equivalents;

(2) Has performance in accordance with NEMA Design C characteristics as described in MG1 or an equivalent IEC design(s) such as IEC Design H;

(3) Is a close-coupled pump motor;

(4) Is a footless motor;

(5) Is a vertical solid shaft normal thrust motor (as tested in a horizontal configuration) built and designed in a manner consistent with MG1;

(6) Is an eight-pole motor (900 rpm); or

(7) Is a polyphase motor with a voltage rating of not more than 600 volts, is not rated at 230 or 460 volts (or both), and cannot be operated on 230 or 460 volts (or both).

Note to definition of General purpose electric motor (subtype II): With the exception of the NEMA Motor Standards MG1–1967 (incorporated by reference in § 431.15), references to ''MG1'' above refer to NEMA MG1–2016 with 2018 Supplements (incorporated by reference in § 431.15). References to ''IEC'' above refer to IEC 60034–1, 60034–12, 60050–411, and 60072–1 (incorporated by reference in § 431.15), as applicable.

* * * * *

IEC Design H motor means an electric motor that:

(1) Is an induction motor designed for use with three-phase power;

(2) Contains a cage rotor;

(3) Is capable of direct-on-line starting

(4) Has 4, 6, or 8 poles;

(5) Is rated from 0.12 kW to 1,600 kW at a frequency of 60 Hz; and

(6) Conforms to sections 9.1, 9.2, and 9.3 of the IEC 60034–12:2016 (incorporated by reference, see § 431.15) specifications for starting torque, locked rotor apparent power, and starting requirements, respectively.

IEC Design HE means an electric motor that:

(1) Is an induction motor designed for use with three-phase power;

(2) Contains a cage rotor;

(3) Is capable of direct-on-line starting

(4) Has 4, 6, or 8 poles;

(5) Is rated from 0.12 kW to 1,600 kW at a frequency of 60 Hz; and

(6) Conforms to section 9.1, Table 3, and section 9.3 of the IEC 60034–12:2016 (incorporated by reference, see § 431.15) specifications for starting torque, locked rotor apparent power, and starting requirements, respectively.

IEC Design HEY means an electric motor that:

(1) Is an induction motor designed for use with three-phase power;

(2) Contains a cage rotor;

(3) Is capable of direct-on-line starting

(4) Has 4, 6, or 8 poles;

(5) Is rated from 0.12 kW to 1,600 kW at a frequency of 60 Hz; and

(6) Conforms to section 5.7, Table 3 and section 9.3 of the IEC 60034–12:2016 (incorporated by reference, see § 431.15) specifications for starting torque, locked rotor apparent power, and starting requirements, respectively.

IEC Design HY means an electric motor that:

(1) Is an induction motor designed for use with three-phase power;

(2) Contains a cage rotor;

(3) Is capable of direct-on-line starting

(4) Has 4, 6, or 8 poles;

(5) Is rated from 0.12 kW to 1,600 kW at a frequency of 60 Hz; and

(6) Conforms to section 5.7, section 9.2 and section 9.3 of the IEC 60034–12:2016 (incorporated by reference, see § 431.15) specifications for starting torque, locked rotor apparent power, and starting requirements, respectively.

IEC Design N motor means an electric motor that:

(1) Is an induction motor designed for use with three-phase power;

(2) Contains a cage rotor;

(3) Is capable of direct-on-line starting;

(4) Has 2, 4, 6, or 8 poles;

(5) Is rated from 0.12 kW to 1,600 kW at a frequency of 60 Hz; and

(6) Conforms to sections 6.1, 6.2, and 6.3 of the IEC 60034–12:2016 (incorporated by reference, see § 431.15)

specifications for torque characteristics, locked rotor apparent power, and starting requirements, respectively. If a motor has an increased safety designation of type 'e', the locked rotor apparent power shall be in accordance with the appropriate values specified in IEC 60079–7:2015 (incorporated by reference, see § 431.15).

IEC Design NE means an electric motor that:

(1) Is an induction motor designed for use with three-phase power;

(2) Contains a cage rotor;

(3) Is capable of direct-on-line starting

(4) Has 2, 4, 6, or 8 poles;

(5) Is rated from 0.12 kW to 1,600 kW at a frequency of 60 Hz; and

(6) Conforms to section 6.1, Table 3 and section 6.3 of the IEC 60034–12:2016 (incorporated by reference, see § 431.15) specifications for starting torque, locked rotor apparent power, and starting requirements, respectively.

IEC Design NEY means an electric motor that:

(1) Is an induction motor designed for use with three-phase power;

(2) Contains a cage rotor;

(3) Is capable of direct-on-line starting

(4) Has 2, 4, 6, or 8 poles;

(5) Is rated from 0.12 kW to 1,600 kW at a frequency of 60 Hz; and

(6) Conforms to section 5.4, Table 3 and section 6.3 of the IEC 60034–12:2016 (incorporated by reference, see § 431.15) specifications for starting torque, locked rotor apparent power, and starting requirements, respectively.

IEC Design NY means an electric motor that:

(1) Is an induction motor designed for use with three-phase power;

(2) Contains a cage rotor;

(3) Is capable of direct-on-line starting

(4) Has 2, 4, 6, or 8 poles;

(5) Is rated from 0.12 kW to 1,600 kW at a frequency of 60 Hz; and

(6) Conforms to section 5.4, section 6.2 and section 6.3 of the IEC 60034–12:2016 (incorporated by reference, see § 431.15) specifications for starting torque, locked rotor apparent power, and starting requirements, respectively.

* * * * *

Inverter means an electronic device that converts an input AC or DC power into a controlled output AC or DC voltage or current. An inverter may also be called a converter.

Inverter-capable electric motor means an electric motor designed to be directly connected to AC sinusoidal or DC power, but that is also capable of continuous operation on an inverter drive over a limited speed range and associated load.

Inverter-only electric motor means an electric motor that is capable of continuous operation solely with an inverter, and is not designed for operation when directly connected to AC sinusoidal or DC power supply.

* * * * *

Liquid-cooled electric motor means a motor that is cooled by liquid circulated using a designated cooling apparatus such that the liquid or liquid-filled conductors come into direct contact with the parts of the motor, but is not submerged in a liquid during operation.

* * * * *

NEMA Design A motor means a squirrel-cage motor that:

(1) Is designed to withstand full-voltage starting and developing locked-rotor torque as shown in NEMA MG 1–2016 with 2018 Supplements, paragraph 12.38.1 (incorporated by reference, see § 431.15);

(2) Has pull-up torque not less than the values shown in NEMA MG 1–2016 with 2018 Supplements, paragraph 12.40.1;

(3) Has breakdown torque not less than the values shown in NEMA MG 1–2016 with 2018 Supplements, paragraph 12.39.1;

(4) Has a locked-rotor current higher than the values shown in NEMA MG 1–2016 with 2018 Supplements, paragraph 12.35.1 for 60 hertz and NEMA MG 1–2016 with 2018 Supplements, paragraph 12.35.2 for 50 hertz; and

(5) Has a slip at rated load of less than 5 percent for motors with fewer than 10 poles.

NEMA Design B motor means a squirrel-cage motor that is:

(1) Designed to withstand full-voltage starting;

(2) Develops locked-rotor, breakdown, and pull-up torques adequate for general application as specified in sections 12.38, 12.39 and 12.40 of NEMA MG 1–2016 with 2018 Supplements (incorporated by reference, see § 431.15);

(3) Draws locked-rotor current not to exceed the values shown in section 12.35.1 for 60 hertz and 12.35.2 for 50 hertz of NEMA MG 1–2016 with 2018 Supplements; and

(4) Has a slip at rated load of less than 5 percent for motors with fewer than 10 poles.

NEMA Design C motor means a squirrel-cage motor that:

(1) Is Designed to withstand full-voltage starting and developing locked-rotor torque for high-torque applications up to the values shown in NEMA MG 1–2016 with 2018 Supplements, paragraph 12.38.2 (incorporated by reference, see § 431.15);

(2) Has pull-up torque not less than the values shown in NEMA MG 1–2016 with 2018 Supplements, paragraph 12.40.2;

(3) Has breakdown torque not less than the values shown in NEMA MG 1–2016 with 2018 Supplements, paragraph 12.39.2;

(4) Has a locked-rotor current not to exceed the values shown in NEMA MG 1–2016 with 2018 Supplements, paragraphs 12.35.1 for 60 hertz and 12.35.2 for 50 hertz; and

(5) Has a slip at rated load of less than 5 percent.

Nominal full-load efficiency means, with respect to an electric motor, a representative value of efficiency selected from the ''nominal efficiency'' column of Table 12–10, NEMA MG 1–2016 with 2018 Supplements, (incorporated by reference, see § 431.15), that is not greater than the average full-load efficiency of a population of motors of the same design.

* * * * *

Rated frequency means 60 Hz.

Rated load (or *full load, full rated load,* or *rated full load)* means the rated output power of an electric motor.

Rated voltage means the input voltage of a motor or inverter used when making representations of the performance characteristics of a given electric motor and selected by the motor's manufacturer to be used for testing the motor's efficiency.

* * * * *

■ 15. Section 431.15 is amended by:

■ a. In paragraph (a), removing the text ''*fedreg.legal@nara.gov*'' and adding, in its place, the text ''*fr.inspection@nara.gov*'';

■ b. Revising paragraph (b)(1) and adding paragraph (b)(2);

■ c. Revising paragraphs (c)(3) and (4) and adding paragraphs (c)(8) and (9);

■ d. Revising paragraph (d)(1) and adding paragraph (d)(2);

e. Revising paragraph (e)(1); and

■ f. Revising paragraph (f)(1);

The revisions and additions read as follows:

§ 431.15 Materials incorporated by reference.

* * * * *

(b) * * *

(1) CSA C390–10 (R2019), (''CSA C390–10''), ''Test methods, marking requirements, and energy efficiency levels for three-phase induction motors'', March 2010, IBR approved for appendix B to this subpart.

(2) CSA C747–09 (R2019), (''CSA C747–09''), ''Energy efficiency test methods for small motors'', October 2009, IBR approved for appendix B to this subpart.

(c) * * *

(3) 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), Edition 2.0 2014–06, IBR approved for § 431.12 and appendix B to this subpart.

(4) IEC 60034–12:2016, Rotating Electrical Machines, Part 12: Starting Performance of Single-Speed Three-Phase Cage Induction Motors, Edition 3.0 2016–11, IBR approved for § 431.12.

* * * * *

(8) IEC 60079–7:2015, Explosive atmospheres—Part 7: Equipment protection by increased safety ''e'', Edition 5.0 2015–06, IBR approved for § 431.12.

(9) IEC 61800–9–2:2017, ''Adjustable speed electrical power drive systems—Part 9–2: Ecodesign for power drive systems, motor starters, power electronics and their driven applications—Energy efficiency indicators for power drive systems and motor starters'', Edition 1.0, March 2017, IBR approved for appendix B to this subpart.

(d) * * *

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

(2) IEEE 114–2010, ''Test Procedure for Single-Phase Induction Motors'' approved September 30, 2010, IBR approved for appendix B to this subpart.

(e) * * *

(1) NEMA Standards Publication MG 1–2016, (''NEMA MG 1–2016 with 2018 Supplements'') American National Standard for Motors and Generators, ANSI approved June 1, 2018. IBR approved for § 431.12 and appendix B to this subpart.

* * * * *

(f) * * *

(1) NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection, 2019 Edition, ANSI-approved May 24, 2018. IBR approved for § 431.12.

* * * * *

§§ 431.14 and 431.17 [Removed and Reserved]

■ 16. Remove and reserve §§ 431.14 and 431.17.

§§ 431.19—431.21 [Removed]

■ 17. Remove §§ 431.19 through 431.21.

■ 18. Section 431.25 is amended by:

■ a. Revising the introductory text for paragraphs (a), (c), and (d);

■ b. Revising paragraph (g)(9);

■ c. Revising the introductory text for paragraph (h) and Table 5 heading; and

■ d. Revising the introductory text for paragraph (i) and Table 6 heading.

The revisions read as follows:

§ 431.25 Energy conservation standards and effective dates.

(a) Except as provided for fire pump electric motors in paragraph (b) of this section, each general purpose electric motor (subtype I) with a power rating of 1 horsepower or greater, but not greater than 200 horsepower, including a NEMA Design B or an equivalent IEC Design N, NE, NEY, or NY motor that is a general purpose electric motor (subtype I), manufactured (alone or as a component of another piece of equipment) on or after December 19, 2010, but before June 1, 2016, shall have a nominal full-load efficiency that is not less than the following:

* * * * *

(c) Except as provided for fire pump electric motors in paragraph (b) of this section, each general purpose electric motor (subtype II) with a power rating of 1 horsepower or greater, but not greater than 200 horsepower, including a NEMA Design B or an equivalent IEC Design N, NE, NEY, or NY motor that is a general purpose electric motor (subtype II), manufactured (alone or as a component of another piece of equipment) on or after December 19, 2010, but before June 1, 2016, shall have a nominal full-load efficiency that is not less than the following:

* * * * *

(d) Each NEMA Design B or an equivalent IEC Design N, NE, NEY, or NY motor that is a general purpose electric motor (subtype I) or general purpose electric motor (subtype II), excluding fire pump electric motors, with a power rating of more than 200 horsepower, but not greater than 500 horsepower, manufactured (alone or as a component of another piece of equipment) on or after December 19, 2010, but before June 1, 2016 shall have a nominal full-load efficiency that is not less than the following:

* * * * *

(g) * * *

(9) Meet all of the performance requirements of one of the following motor types: A NEMA Design A, B, or C motor or an IEC Design N, NE, NEY, NY or H, HE, HEY, HY motor.

* * * * *

(h) Starting on June 1, 2016, each NEMA Design A motor, NEMA Design B motor, and IEC Design N, NE, NEY, or NY motor that is an electric motor meeting the criteria in paragraph (g) of this section and with a power rating from 1 horsepower through 500 horsepower, but excluding fire pump electric motors, manufactured (alone or as a component of another piece of equipment) shall have a nominal full-load efficiency of not less than the following:

Table 5—Nominal Full-Load Efficiencies of NEMA Design A, NEMA Design B and IEC Design N, NE, NEY or NY Motors (Excluding Fire Pump Electric Motors) at 60 Hz

* * * * *

(i) Starting on June 1, 2016, each NEMA Design C motor and IEC Design H, HE, HEY, or HY motor that is an electric motor meeting the criteria in paragraph (g) of this section and with a power rating from 1 horsepower through 200 horsepower manufactured (alone or as a component of another piece of equipment) shall have a nominal full-load efficiency that is not less than the following:

Table 6—Nominal Full-Load Efficiencies of NEMA Design C and IEC Design H, HE, HEY or HY Motors at 60 Hz

* * * * *

■ 19. Amend § 431.31 by revising paragraph (a)(1)(i) to read as follows:

§ 431.31 Labeling requirements.

(a) * * *

(1) * * *

(i) The motor's nominal full-load efficiency (as of the date of manufacture), derived from the motor's average full-load efficiency as determined pursuant to this subpart or the motor's average full-load efficiency; and

* * * * *

■ 20. Appendix B to subpart B of part 431 is revised to read as follows:

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

Note: For manufacturers conducting tests of motors for which energy conservation standards are provided at 10 CFR 431.25, manufacturers must conduct such test in accordance with this appendix.

For any other electric motor type that is not currently covered by the energy conservation standards at 10 CFR 431.25, manufacturers of this equipment will need to test in accordance with this appendix 180 days after the effective date of the final rule adopting energy conservation standards for such motor.

0. Incorporation by Reference

In § 431.15, DOE incorporated by reference the entire standard for CSA C390–10, CSA C747–09, IEC 60034–2–1:2014, IEC 60034–1:2010, IEC 60051–1:2016, IEC 61800–9–2:2017, IEEE 112–2017, IEE 114–2010, and NEMA MG 1–

2016 with 2018 Supplements; however, only enumerated provisions of those documents are applicable as follows:

0.1. CSA C390–10

0.1.1. Section 1.3 ''Scope,'' as specified in section 2.1.1 and 2.4.3.2 of this appendix;
0.1.2. Section 3.1 ''Definitions,'' as specified in section 2.1.1 and 2.4.3.2 of this appendix;
0.1.3. Section 5 ''General test requirements—Measurements,'' as specified in section 2(1) of this appendix;
0.1.4. Section 7 ''Test method,'' as specified in section 2.1.1 and 2.4.3.2 of this appendix;
0.1.5. Table 1 ''Resistance measurement time delay,'' as specified in section 2.1.1 and 2.4.3.2 of this appendix;
0.1.6. Annex B ''Linear regression analysis,'' as specified in section 2.1.1 and 2.4.3.2 of this appendix; and
0.1.7. Annex C ''Procedure for correction of dynamometer torque readings'' as specified in section 2.1.1 and 2.4.3.2 of this appendix.

0.2. CSA C747–09

0.2.1 Section 1.6 ''Scope'' as specified in section 2.4.1.2 and 2.4.2.2 of this appendix;
0.2.2. Section 3 ''Definitions'' as specified in section 2.4.1.2 and 2.4.2.2 of this appendix;
0.2.3. Section 5 ''General test requirements'' as specified in section 2.4.1.2 and 2.4.2.2 of this appendix; and
0.2.4. Section 6 ''Test method'' as specified in section 2.4.1.2 and 2.4.2.2 of this appendix.

0.3. IEC 60034–2–1:2014

0.3.1. Method 2–1–1A as specified in section 2.4.1.3 and 2.4.2.3 of this appendix;
0.3.2. Method 2–1–1B as specified in section 2.1.2 and 2.4.3.3 of this appendix;
0.3.3. Section 3 ''Terms and definitions'' as specified in sections 2.1.2, 2.4.1.3, 2.4.2.3, 2.4.3.3, and 2.5.1 of this appendix;
0.3.4. Section 4 ''Symbols and abbreviations'' as specified in sections 2.1.2, 2.4.1.3, 2.4.2.3, 2.4.3.3 and 2.5.1 of this appendix;
0.3.5. Section 5 ''Basic requirements'' as specified in sections 2.1.2, 2.4.1.3, 2.4.2.3, 2.4.3.3, and 2.5.1 of this appendix;
0.3.6. 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 section 2.4.1.3 and 2.4.2.3 of this appendix;
0.3.7. Section 6.1.3 ''Method 2–1–1B—Summations of losses, additional load losses according to the method of residual losses'' as specified in section 2.1.2 and 2.4.3.3 of this appendix; and
0.3.8. Section 7.1. ''Preferred Testing Methods'' as specified in section 2.5.1 of this appendix;
0.3.9. Annex D, ''Test report template for 2–1–1B'' as specified in section 2.1.2 and 2.4.3.3 of this appendix.

0.4. IEC 61800–9–2:2017

0.4.1. Section 3 ''Terms, definitions, symbols, and abbreviated terms'' as specified in section 2.5.3 of this appendix;
0.4.2. Section 7.7.2, ''Input-output measurement of PDS losses'' as specified in section 2.5.3 of this appendix;
0.4.3. Section 7.7.3.1, ''General'' as specified in section 2.5.3 of this appendix;
0.4.4. Section 7.7.3.2. ''Power analyser and transducers'' as specified in section 2.5.3 of this appendix;
0.4.5. Section 7.7.3.3, ''Mechanical Output of the motor'' as specified in section 2.5.3 of this appendix;
0.4.6. Section 7.7.3.5, ''PDS loss determination according to input-output method'' as specified in section 2.5.3 of this appendix;
0.4.7. Section 7.10 ''Testing Conditions for PDS testing'' as specified in section 2.5.3 of this appendix.

0.5. IEC 60034–1:2010

0.5.1. Section 7.2 as specified in section 2.1.2, 2.4.1.3, 2.4.2.3, and 2.4.3.3 of this appendix;
0.5.2. Section 8.6.2.3.3 as specified in section 2.1.2, 2.4.1.3, 2.4.2.3, and 2.4.3.3 of this appendix; and
0.5.3. Table 5 as specified in section 2.1.2, 2.4.1.3, 2.4.2.3, and 2.4.3.3 of this appendix.

0.6. IEC 60051–1:2016

0.6.1. Section 5.2 as specified in sections 2.1.2, 2.4.1.3, 2.4.2.3, and 2.4.3.3 of this appendix; and
0.6.2. [Reserved].

0.7. IEEE 112–2017

0.7.1. Test Method A as specified in section 2.4.2.1 of this appendix;
0.7.2. Test Method B as specified in section 2.1.3, 2.4.3.1, and section 3.8 of this appendix;
0.7.3. Section 3, ''General'' as specified in section 2.1.3, 2.4.2.1, and 2.4.3.1 of this appendix;
0.7.4. Section 4, ''Measurements'' as specified in section 2.1.3, 2.4.2.1, and 2.4.3.1 of this appendix;
0.7.5. Section 5, ''Machine losses and tests for losses'' as specified in section 2.1.3, 2.4.2.1, and 2.4.3.1 of this appendix;
0.7.6. Section 6.1, ''General'' as specified in section 2.1.3 2.4.2.1, and 2.4.3.1 of this appendix;
0.7.7. Section 6.3, ''Efficiency test method A—Input-output'' as specified in section 2.4.2.1 of this appendix;
0.7.8. Section 6.4, ''Efficiency test method B—Input-output'' as specified in section 2.1.3 and 2.4.3.1 of this appendix;
0.7.9. Section 9.2, ''Form A—Method A'' as specified in section 2.4.2.1 of this appendix;
0.7.10. Section 9.3, ''Form A2—Method A calculations'' as specified in section 2.4.2.1 of this appendix;
0.7.11. Section 9.4, ''Form B—Method B'' as specified in section 2.1.3, and 2.4.3.1 of this appendix; and
0.7.12. Section 9.5, ''Form B2—Method B calculations'' as specified in section 2.1.3 and 2.4.3.1 of this appendix.

0.8. IEEE 114–2010

0.8.1 Section 3.2, ''Test with load'' as specified in section 2.4.1.1 of this appendix;
0.8.2. Section 4, ''Testing Facilities as specified in section 2.4.1.1 of this appendix;
0.8.3. Section 5, ''Measurements'' as specified in section 2.4.1.1 of this appendix;
0.8.4. Section 6, ''General'' as specified in section 2.4.1.1 of this appendix;
0.8.5. Section 7, ''Type of loss'' as specified in section 2.4.1.1 of this appendix;
0.8.6. Section 8, ''Efficiency and Power Factor'' as specified in section 2.4.1.1 of this appendix;
0.8.7. Section 10 ''Temperature Tests'' as specified in section 2.4.1.1 of this appendix;
0.8.8. Annex A, Section A.3 ''Determination of Motor Efficiency'' as specified in section 2.4.1.1 of this appendix; and
0.8.9. Annex A, Section A.4 ''Explanatory notes for form 3, test data'' as specified in section 2.4.1.1 of this appendix.

0.9. NEMA MG 1–2016 With 2018 Supplements

0.9.1. Paragraph 12.58.1, ''Determination of Motor Efficiency and Losses'' as specified in the introductory paragraph to section 2.1 of this appendix, and
0.9.2. Paragraph 34.1, ''Applicable Motor Efficiency Test Methods'' as specified in section 2.2 of this appendix;
0.9.3. Paragraph 34.2.2 ''AO Temperature Test Procedure 2—Target Temperature with Air Flow'' as specified in section 2.2 of this appendix;

0.9.4. Paragraph 34.4, ''AO Temperature Test Procedure 2—Target Temperature with Air Flow'' as specified in section 2.2 of this appendix.

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

1. Scope and Definitions

1.1 *Scope.* The test procedure applies to the following categories of electric motors:

Electric motors that meet the criteria listed at § 431.25(g) and are not listed at § 431.25(l)(2)–(3).; Electric motors above 500 horsepower; Small non-small-electric-motor electric motor; and Electric motors that are synchronous motors.

1.2 *Definitions.* Definitions contained in §§ 431.2 and 431.12 are applicable to this appendix, in addition to the following terms:

Electric motor above 500 horsepower is defined as an electric motor having a rated horsepower above 500 and up to 750 hp that meets the criteria listed at § 431.25(g), with the exception of criteria § 431.25(g)(8), and are not listed at § 431.25(l)(2)–(3).

Small non-small-electric-motor electric motor (''*SNEMs*''*)* means an electric motor that:

(a) Is not a small electric motor, as defined § 431.442 and is not dedicated pool pump motors as defined at § 431.483;

(b) Is rated for continuous duty (MG 1) operation or for duty type S1 (IEC);

(c) Is capable of Operating on polyphase or single-phase alternating current 60-hertz (Hz) sinusoidal line power (with or without an inverter);

(d) Is rated for 600 volts or less;

(e) Is a single-speed induction motor;

(f) Produces a rated motor horsepower greater than or equal to 0.25 horsepower (0.18 kW); and

(g) Is built in the following frame sizes: Any frame sizes if the motor operates on single-phase power; any frame size if the motor operates on polyphase power, and has a rated motor horsepower less than 1 horsepower (0.75 kW); or a two-digit NEMA frame size (or IEC metric equivalent), if the motor operates on polyphase power, has a rated motor horsepower equal to or greater than 1 horsepower (0.75 kW), and is not an enclosed 56 NEMA frame size (or IEC metric equivalent).

Electric Motors that are Synchronous Motors:

(a) Is not dedicated pool pump motors as defined at § 431.483;

(b) Is a synchronous electric motors;

(c) Is capable of operating on polyphase or single-phase alternating current 60-hertz (Hz); sinusoidal line power (with or without an inverter);

(d) Is rated 600 volts or less;

(e) Has a 2-, 4-, 6-, 8-, 10-, or 12-pole configuration;

(f) Produces at least 0.25 hp (0.18 kW) but not greater than 750 hp (559 kW).

2. Test Procedures

2.1. Test Procedures for Electric Motors that meet the criteria listed at § 431.25(g) and are not listed at § 431.25(l)(2)–(3), and electric motors above 500 horsepower.

For the purposes of this section and electric motors at or below 500 horsepower, rated output power means the mechanical output power that corresponds to the electric motor's breakdown torque, as specified in Section 12.37 and 12.39 of NEMA MG 1–2016 with 2018 Supplements. Air-over electric motors must be tested in accordance with Section 2.2. Submersible electric motors must be tested in accordance with Section 2.3. Inverter-only electric motors must be tested in accordance with 2.5.

Efficiency and losses must be determined in accordance with NEMA MG 1–2016, paragraph 12.58.1, ''Determination of Motor Efficiency and Losses,'' or one of the following testing methods:

2.1.1. 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.''

2.1.2. 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, or

2.1.3. IEEE 112–2017, 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.''

2.2. Test Procedures for Air-Over Electric Motors

For the purposes of this section, rated output power means, for 2-digit frame sizes, the mechanical output power that corresponds to the electric motor's breakdown torque as specified in Table 10–5 of NEMA MG 1–2016 with 2018 Supplements for single-phase motors, or 140 percent of the breakdown torque values specified in Table 10–5 of NEMA MG 1–2016 with 2018 Supplements for polyphase motors. For 3-digit frame sizes, rated output power means the mechanical output power that corresponds to the electric motor's breakdown torque specified in Section 12.37 and 12.39 of NEMA MG 1–2016 with 2018 Supplements. Except noted otherwise in section 2.2.1 and 2.2.2 of this appendix, efficiency and losses of air-over electric motors must be determined in accordance with NEMA MG 1–2016 with 2018 Supplements, paragraph 34.1, ''Applicable Motor Efficiency Test Methods'', paragraph 34.2.2 ''AO Temperature Test Procedure 2—Target Temperature with Air Flow'', paragraph 34.4, ''AO Temperature Test Procedure 2—Target Temperature with Air Flow''.

2.2.1 The provisions in paragraph 34.4.1.a.1 NEMA MG 1–2016 with 2018 Supplements related to the determination of the target temperature for polyphase motors must be replaced by a single target temperature of 75 °C for all insulation classes.

2.2.2 The industry standards listed in paragraph 34.1, ''Applicable Motor Efficiency Test Methods'' must correspond to the versions incorporated by reference at § 431.15: IEEE 112–2017, IEEE 114–2010, CSA C390–10, CSA C747–09, and IEC 60034–2–1:2014. In addition, when testing in accordance with IEC 60034–2–1:2014, the additional testing instructions in section 2.1.2 of this appendix apply.

2.3. Test Procedures for Submersible Electric Motors

Except noted otherwise in sections 2.3.1, 2.3.2, and 2.3.3 of this appendix, efficiency and losses of submersible electric motors must be determined in accordance with NEMA MG 1–2016 with 2018 Supplements, paragraph 34.1, ''Applicable Motor Efficiency Test Methods'', paragraph 34.2.2 ''AO Temperature Test Procedure 2—Target Temperature with Air Flow'', paragraph 34.4, ''AO Temperature Test Procedure 2—Target Temperature with Air Flow''.

2.3.1 The provisions in paragraph 34.4.1.a.1 NEMA MG 1–2016 with 2018 Supplements related to the determination of the target temperature for polyphase motors must be replaced by a single target temperature of 75 °C for all insulation classes.

2.3.2 The provisions in paragraph 34.4.2 NEMA MG 1–2016 with 2018 Supplements related to temperature detector placement must add ''If both the windings and the stator iron are inaccessible, then install temperature detector(s) on the case of the motor.''

2.3.3 The industry standards listed in paragraph 34.1, ''Applicable Motor Efficiency Test Methods'' must correspond to the versions incorporated by reference at § 431.15: IEEE 112–2017, IEEE 114–2010, CSA C390–10, CSA C747–09, and IEC 60034–2–1:2014. In addition, when testing in accordance with IEC 60034–2–1:2014, the additional testing instructions in section 2.1.2 of this appendix apply.

2.4. Test Procedures for SNEMs

For the purposes of this section, rated output power means, for 2-digit frame sizes, the mechanical output power that corresponds to the 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 3-digit frame sizes, rated output power means the mechanical output power that corresponds to the electric motor's breakdown torque specified in Section 12.37 and 12.39 of NEMA MG 1–2016. Air-over electric motors must be tested in accordance with section 2.2. Submersible electric motors must be tested in accordance with section 2.3. Inverter-only electric motors must be tested in accordance with section 2.5.

2.4.1 The efficiencies and losses of single-phase SNEMs that are not air-over electric motors, submersible electric motors, or inverter-only electric motors, are determined using one of the following methods:

2.4.1.1. 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'';

2.4.1.2. CSA C747–09, Section 1.6 ''Scope'', Section 3 ''Definitions'', Section 5, ''General test requirements'', and Section 6 ''Test method'';

2.4.1.3. 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.

2.4.1.3.1. *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;

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

2.4.2 The efficiencies and losses of polyphase electric motors considered with rated horsepower less than 1 that are not air-over electric motors, submersible electric motors, or inverter-only electric motors are determined using one of the following methods:

2.4.2.1. 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'';

2.4.2.2. CSA C747–09, Section 1.6 ''Scope'', Section 3 ''Definitions'', Section 5, ''General test requirements'', and Section 6 ''Test method'';

2.4.2.3. 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.

2.4.2.3.1. *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;

2.4.2.3.2. 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.

2.4.3. The efficiencies and losses of polyphase SNEMs with rated horsepower equal to or greater than 1 that are not air-over electric motors, submersible electric motors, or inverter-only electric motors are determined using one of the following methods:

2.4.3.1. 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

2.4.3.2. 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

2.4.3.3. 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.

2.5. Test Procedures for Electric Motors That Are Synchronous Motors and Inverter-Only Electric Motors

These methods apply to electric motors that are synchronous motors as specified in section 1.2. of this appendix. These methods also apply to electric motors as specified in section 1.1 of this appendix that are inverter-only electric motor and do not include an inverter.

2.5.1. The efficiencies and losses of electric motors that are synchronous motors that do not require an inverter to operate, are determined in accordance with section IEC 60034–2–1:2014, Section 3 ''Terms and definitions'', Section 4 ''Symbols and abbreviations'', Section 5 ''Basic requirements'', and Section 7.1. ''Preferred Testing Methods''.

2.5.2. The efficiencies and losses of electric motors (inclusive of the inverter) that are that are inverter-only and do not include an inverter, are determined in accordance with IEC 61800–9–2:2017, Section 3 ''Terms, definitions, symbols, and abbreviated terms'', Section 7.7.2, ''Input-output measurement of PDS losses'', Section 7.7.3.1, ''General'', Section 7.7.3.2. ''Power analyser and transducers'', Section 7.7.3.3, ''Mechanical Output of the motor'', Section 7.7.3.5, ''PDS loss determination according to input-output method'', and Section 7.10 ''Testing Conditions for PDS testing''. Test must be conducted using an inverter as specified in the manufacturer catalogs or offered for sale with the electric motor.

2.5.3. The efficiencies and losses of electric motors (inclusive of the inverter) that are inverter-only and include an inverter are determined in accordance with IEC 61800–9–2:2017, Section 3 ''Terms, definitions, symbols, and abbreviated terms'', Section 7.7.2, ''Input-output measurement of PDS losses'', Section 7.7.3.1, ''General'', Section 7.7.3.2. ''Power analyser and transducers'', Section 7.7.3.3, ''Mechanical Output of the motor'', Section 7.7.3.5, ''PDS loss determination according to input-output method'', and Section 7.10 ''Testing Conditions for PDS testing''.

3. Procedures for the Testing of Certain Electric Motor Categories

Prior to testing according to section 2 of this appendix, each basic model of the electric motor categories 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 600 or 6000 series, either open or grease-lubricated double-shielded, single-row, deep groove, radial ball bearing.

3.1 Brake Electric Motors

Brake electric motors shall be tested with the brake component powered separately from the motor such that it does not activate during testing. Additionally, for any 10-minute period during the test and while the brake is being powered such that it remains disengaged from the motor shaft, record the power consumed (*i.e.,* watts). Only power used to drive the motor is to be included in the efficiency calculation; power supplied to prevent the brake from engaging is not included in this calculation. In lieu of powering the brake separately, the brake may be disengaged mechanically, if such a mechanism exists and if the use of this mechanism does not yield a different efficiency value than separately powering the brake electrically.

3.2 Close-Coupled Pump Electric Motors and Electric Motors With Single or Double Shaft Extensions of Non-Standard Dimensions or Design

To attach the unit under test to a dynamometer, close-coupled pump electric motors and electric motors with single or double shaft extensions of non-standard dimensions or design must be tested using a special coupling adapter.

3.3 Electric Motors With Non-Standard Endshields or Flanges

If it is not possible to connect the electric motor to a dynamometer with the non-standard endshield or flange in place, the testing laboratory shall replace the non-standard endshield or flange with an endshield or flange meeting NEMA or IEC specifications. The replacement component should be obtained from the manufacturer or, if the manufacturer chooses, machined by the testing laboratory after consulting with the manufacturer regarding the critical characteristics of the endshield.

3.4 Electric Motors With Non-Standard Bases, Feet or Mounting Configurations

An electric motor with a non-standard base, feet, or mounting configuration may be mounted on the test equipment using adaptive fixtures for testing as long as the mounting or use of adaptive mounting fixtures does not have an adverse impact on the performance of the electric motor, particularly on the cooling of the motor.

3.5 Electric Motors With a Separately-Powered Blower

For electric motors furnished with a separately-powered blower, the losses from the blower's motor should not be included in any efficiency calculation. This can be done either by powering the blower's motor by a source separate from the source powering the electric motor under test or by connecting leads such that they only measure the power of the motor under test.

3.6 Immersible Electric Motors

Immersible electric motors shall be tested with all contact seals removed but be otherwise unmodified.

3.7 Partial Electric Motors

Partial electric motors shall be disconnected from their mated piece of equipment. After disconnection from the equipment, standard bearings and/or endshields shall be added to the motor, such that it is capable of operation. If an endshield is necessary, an endshield meeting NEMA or IEC specifications should be obtained from the manufacturer or, if the manufacturer chooses, machined by the testing laboratory after consulting with the manufacturer regarding the critical characteristics of the endshield.

3.8 Vertical Electric Motors and Electric Motors With Bearings Incapable of Horizontal Operation

Vertical electric motors and electric motors with thrust bearings shall be tested in a horizontal or vertical configuration in accordance with the applicable test procedure under section 2 through section 2.5.3 of this appendix, depending on the testing facility's capabilities and construction of the motor, except if the motor is a vertical solid shaft normal thrust general purpose electric motor (subtype II), in which case it shall be tested in a horizontal configuration in accordance with the applicable test procedure under section 2 through section 2.5.3 of this appendix. Preference shall be given to testing a motor in its native orientation. If the unit under test cannot be reoriented horizontally due to its bearing construction, the electric motor's bearing(s) shall be removed and replaced with standard bearings. If the unit under test contains oil-lubricated bearings, its bearings shall be removed and replaced with standard bearings. If necessary, the unit under test may be connected to the dynamometer using a coupling of torsional rigidity greater than or equal to that of the motor shaft.

3.9 Electric Motors With Shaft Seals

Electric motor shaft seals of any variety shall remain installed during testing unless the motor under test is an immersible electric motor, in which case the seals shall be removed for testing only if they are contact seals (see section 3.6 of this appendix).

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