



[6450-01-P]

DEPARTMENT OF ENERGY

10 CFR Parts 429 and 430

[EERE-2017-BT-TP-0005]

RIN 1904-AD67

Energy Conservation Program: Test Procedure for Fluorescent Lamp Ballasts

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

ACTION: Final rule.

SUMMARY: On March 18, 2019, the U.S. Department of Energy (“DOE”) published a notice of proposed rulemaking (“NOPR”) to amend the test procedure for fluorescent lamp ballasts. That proposed rulemaking serves as the basis for the final rule. Specifically, in this final rule, DOE updates references to industry standards; clarifies the selection of reference lamps; removes extraneous requirements in the stabilization procedure; provides a second stabilization option for measuring ballast luminous efficiency; and revises the test procedure for measuring standby mode energy consumption.

DATES: The effective date of this rule is **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**. The final rule changes will be mandatory for product testing starting **[INSERT DATE 180 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**. The incorporation by reference of certain publications listed

in this rulemaking is approved by the Director of the Federal Register on **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**. The incorporation by reference of certain other publications listed in this rulemaking was approved by the Director of the Federal Register on June 3, 2011.

ADDRESSES: The docket, which includes *Federal Register* notices, comments, and other supporting documents/materials, is available for review at <http://www.regulations.gov>. All documents in the docket are listed in the <http://www.regulations.gov> index. However, some documents listed in the index, such as those containing information that is exempt from public disclosure, may not be publicly available.

A link to the docket web page can be found at <https://www.regulations.gov/docket?D=EERE-2017-BT-TP-0005>. The docket web page contains instructions on how to access all documents, including public comments, in the docket.

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

ApplianceStandardsQuestions@ee.doe.gov.

FOR FURTHER INFORMATION CONTACT: Ms. Lucy deButts, 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) 287-1604. Email: *ApplianceStandardsQuestions@ee.doe.gov*.

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SUPPLEMENTARY INFORMATION: DOE maintains previously approved incorporation by references and incorporates by reference the following industry standards into 10 CFR part 430: ANSI C78.81, (“ANSI C78.81-2016”), American National Standard for Electric Lamps – Double-Capped Fluorescent Lamps – Dimensional and Electrical Characteristics, approved June 29, 2016.

ANSI C78.375A-2014, (“ANSI C78.375A”), American National Standard for Electric Lamps - Fluorescent Lamps – Guide for Electrical Measures, approved August 28, 2014.

ANSI/NEMA C78.901-2016, (“ANSI C78.901-2016”), American National Standard for Electric Lamps – Single-Based Fluorescent Lamps – Dimensional and Electrical Characteristics, ANSI approved August 23, 2016.

ANSI C82.1-2004 (R2008, R2015), (“ANSI C82.1”), American National Standard for Lamp Ballasts—Line Frequency Fluorescent Lamp Ballast, approved November, 20, 2015.

ANSI C82.2-2002 (R2007, R2016), (“ANSI C82.2”), American National Standard for Lamp Ballasts—Method of Measurement of Fluorescent Lamp Ballasts, approved July 12, 2016.

ANSI C82.3-2016, (“ANSI C82.3”), American National Standard for Lamp Ballasts – Reference Ballasts for Fluorescent Lamps, approved April 8, 2016.

ANSI/NEMA C82.11-2017, (“ANSI C82.11”), American National Standard for Lamp Ballasts – High-frequency Fluorescent Lamp Ballasts, approved January 23, 2017.

ANSI C82.13-2002, (“ANSI C82.13”), American National Standard for Lamp Ballasts—Definitions for Fluorescent Lamps and Ballasts, approved July 23, 2002.

ANSI C82.77-2002, (“ANSI C82.77”), Harmonic Emission Limits—Related Power Quality Requirements for Lighting Equipment, approved January 17, 2002.

Copies of ANSI C78.81-2016, ANSI C78.375A, ANSI C78.901-2016, ANSI C82.1, ANSI C82.2, ANSI C82.3, ANSI C82.11, ANSI C82.13, and ANSI C82.77, are available at <http://www.ansi.org> or <http://www.nema.org>.

International Electrotechnical Commission (“IEC”) Standard 60081, (“IEC 60081”), Double-capped fluorescent lamps – Performance specifications (Amendment 6, Edition 5.0, August 2017).

IEC 62301:2011, (“IEC 62301”), Household electrical appliances – Measurement of standby power, (Edition 2.0, 2011-01).

Copies of IEC 60081 and IEC 62301 are available on IEC’s website at <https://webstore.iec.ch/home>.

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

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I. Authority and Background

Fluorescent lamp ballasts are included in the list of “covered products” for which DOE is authorized to establish and amend energy conservation standards and test procedures. (42 U.S.C. 6292(a)(13)) DOE’s energy conservation standards and test procedures for fluorescent lamp ballasts are currently prescribed in the Code of Federal Regulations (“CFR”) at 10 CFR 430.32(m) and 10 CFR 430.23(q), respectively. The following sections discuss DOE’s authority to establish test procedures for fluorescent lamp ballasts and relevant background information regarding DOE’s consideration of test procedures for these products.

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 B² of EPCA established the Energy Conservation Program for Consumer Products Other Than Automobiles, which sets forth a variety of provisions designed to improve energy efficiency. These consumer products include fluorescent lamp ballasts, the subject of this document. (42 U.S.C. 6292(a)(13))

The energy conservation program under EPCA consists essentially of four parts: (1) testing, (2) labeling, (3) Federal energy conservation standards, and (4) certification and enforcement procedures. Relevant provisions of EPCA specifically include definitions (42 U.S.C. 6291), test procedures (42 U.S.C. 6293), labeling provisions (42 U.S.C. 6294), energy

¹ All references to EPCA in this document refer to the statute as amended through America’s Water Infrastructure Act of 2018, Public Law 115–270 (October 23, 2018).

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

conservation standards (42 U.S.C. 6295), and the authority to require information and reports from manufacturers (42 U.S.C. 6296).

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

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

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

In addition, EPCA requires that DOE amend its test procedures for all covered products to integrate measures of standby mode and off mode energy consumption into the overall energy efficiency, energy consumption, or other energy descriptor, unless the current test procedure already incorporates the standby mode and off mode energy consumption, or if such integration is technically infeasible. (42 U.S.C. 6295(gg)(2)(A)) If an integrated test procedure is technically infeasible, DOE must prescribe separate standby mode and off mode energy use test procedures for the covered product, if a separate test is technically feasible. (*Id.*) Any such amendment must consider the most current versions of the International Electrotechnical Commission (“IEC”) Standard 62301 (“IEC 62301”)³ and IEC Standard 62087⁴ as applicable. (42 U.S.C. 6295(gg)(2)(A))

If DOE determines that a test procedure amendment is warranted, it must publish a proposed test procedure and offer the public an opportunity to present oral and written comments on it. (42 U.S.C. 6293(b)(2))

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

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

⁴ IEC Standard 62087, *Methods of measurement for the power consumption of audio, video, and related equipment* (Edition 3.0, 2011-04).

the Secretary determines, on his own behalf or in response to a petition by any interested person, that a test procedure should be prescribed or amended, the Secretary shall promptly publish in the *Federal Register* proposed test procedures and afford interested persons an opportunity to present oral and written data, views, and arguments with respect to such procedures. The comment period on a proposed rule to amend a test procedure shall be at least 60 days and may not exceed 270 days. In prescribing or amending a test procedure, the Secretary shall take into account such information as the Secretary determines relevant to such procedure, including technological developments relating to energy use or energy efficiency of the type (or class) of covered products involved. (42 U.S.C. 6293(b)(2)) If DOE determines that test procedure revisions are not appropriate, DOE must publish its determination not to amend the test procedures. DOE is publishing this final rule in satisfaction of the 7-year review requirement specified in EPCA. (42 U.S.C. 6293(b)(1)(A))

DOE's test procedure for fluorescent lamp ballasts appears at 10 CFR part 430, subpart B, appendix Q ("appendix Q"). DOE's energy conservation standards for fluorescent lamp ballasts can be found at 10 CFR 430.32(m) and require a minimum power factor and minimum ballast luminous efficiency ("BLE"). In this final rule, DOE updates references to industry standards; clarifies the selection of reference lamps; provides a second stabilization option for measuring ballast luminous efficiency; and revises the test procedure for measuring standby mode energy consumption.

B. Background

DOE published a final rule establishing an active mode test procedure for fluorescent lamp ballasts on April 24, 1991. 56 FR 18677. DOE last completed a full review of the active

mode test procedure for fluorescent lamp ballasts on May 4, 2011. 76 FR 25211. Some of the key amendments in that test procedure final rule included updates to industry standards, adopting BLE as the metric for measuring energy efficiency of fluorescent lamp ballasts, and expanding the test procedure to apply to additional products.

DOE published a final rule establishing a standby mode energy consumption test procedure for fluorescent lamp ballasts on October 22, 2009. 74 FR 54445. DOE determined that, according to EPCA's definition of standby mode,⁵ fluorescent lamp ballasts capable of standby mode operation are designed to operate in, or function as, a lighting control system where auxiliary control devices send signals to the ballast; and at zero light output, the ballast is standing by, connected to a main power source without being disconnected by an on-off switch or other type of relay. Further, DOE determined that it is not possible for fluorescent lamp ballasts to meet EPCA's definition of "off mode,"⁶ because there is no condition in which the ballast is connected to the main power source and is not in a mode already accounted for in either active mode or standby mode. 74 FR 54445, 54448.

DOE published final rules establishing and amending energy conservation standards for fluorescent lamp ballasts on September 19, 2000, and November 14, 2011, respectively. 65 FR 56740; 76 FR 70547. DOE also published final rules on February 4, 2015, June 5, 2015, and

⁵ EPCA defines "standby mode" as the condition in which an energy-using product—(1) is connected to a main power source; and (2) offers 1 or more of the following user-oriented or protective functions: (i) To facilitate the activation or deactivation of other functions (including active mode) by remote switch (including remote control), internal sensor, or timer. (ii) Continuous functions, including information or status displays (including clocks) or sensor-based functions. (42 U.S.C. 6295(gg)(1)(A)(iii))

⁶ EPCA defines "off mode" as "the condition in which an energy-using product—(I) is connected to a main power source; and (II) is not providing any standby or active mode function." (42 U.S.C. 6295(gg)(1)(A)(ii))

April 29, 2016, to correct and clarify certain requirements and specifications in the CFR relating to energy conservation standards and test procedures. 80 FR 5896; 80 FR 31971; 81 FR 25595. On June 23, 2015, DOE initiated a rulemaking to review energy conservation standards for fluorescent lamp ballasts by publishing a *Federal Register* notice announcing a public meeting and availability of the framework document (“June 2015 framework document”). 80 FR 35886. On October 22, 2019, DOE published a notice of proposed determination (“NOPD”) initially determining that energy conservation standards for fluorescent lamp ballasts do not need to be amended. 84 FR 56540 (“October 2019 NOPD”). DOE held a webinar open to the public on October 30, 2019, during which it described the analyses and results from the October 2019 NOPD and requested comments.⁷

On March 18, 2019, DOE published in the *Federal Register* a NOPR proposing amendments to the fluorescent lamp ballast (“FLB”) test procedure. 84 FR 9910 (“March 2019 NOPR”). This document addresses information and comments received in response to the March 2019 NOPR and details the amendments to the test procedure adopted in this final rule.

DOE received six written comments in response to the March 2019 NOPR from the interested parties listed in Table I.1 of this document.

Table I.1 Written Comments Received in Response to March 2019 NOPR

Organization(s)	Reference in this NOPR	Organization Type
Appliance Standards Awareness Project, American Council for an Energy-Efficient Economy	ASAP/ACEEE	Efficiency Organizations
National Electrical Manufacturers Association	NEMA	Trade Association
Eaton Electronics Co.	Eaton	Manufacturer

⁷ A transcript of the public webinar and supporting documents are available in the docket for this proposed determination at <https://www.regulations.gov/docket?D=EERE-2015-BT-STD-0006>.

Signify North America Corporation	Signify	Manufacturer
California Energy Commission	CEC	State Commission
Pacific Gas and Electric Company, San Diego Gas and Electric, and Southern California Edison; collectively California Investor Owned Utilities	CA IOUs	Utilities

II. Synopsis of the Final Rule

In this final rule, DOE amends 10 CFR 430.3, 10 CFR 430.23(q), and appendix Q as follows: (1) updates references to industry standards; (2) clarifies the selection of reference lamps; (3) removes extraneous requirements in the stabilization procedure; (4) provides a second stabilization option for measuring BLE; and (5) revises the test procedure for measuring standby mode energy consumption.

The amendments adopted for appendix Q are summarized in Table II.1 compared to the current test procedure as well as the reason for the adopted change.

Table II.1 Summary of Changes in the Amended Test Procedure

Current DOE Test Procedure	Amended Test Procedure	Attribution
References the 2002 version of ANSI C82.11 for testing high frequency ballasts.	Adds checks on inrush current and references lamp datasheets in ANSI C78.81 and ANSI C78.901 for appropriate maximum glow current.	Industry update to ANSI C82.11.
References lamp datasheets in ANSI C78.81 to specify the appropriate reference lamp to use when testing a particular ballast.	The 2016 version of ANSI C78.81 updates the high frequency characteristics of three lamps currently referenced in Table A.	Industry update to ANSI C78.81.

Current DOE Test Procedure	Amended Test Procedure	Attribution
References lamp datasheets in IEC 60081 Amendment 4 to specify the appropriate reference lamp to use when testing a particular ballast.	Amendment 6 of IEC 60081 updates the high frequency characteristics of two lamps currently referenced in Table A.	Industry update to IEC 60081.
Does not provide detail to determine which lamp to use for testing when ballasts can operate lamps of more than one base type.	Adds direction for how to select a reference lamp to use for testing fluorescent lamp ballasts designed and marketed to operate lamps of multiple base types.	Improve representativeness of test results.
Measures lamp arc voltage, current, and power once per second during stabilization.	Measures lamp arc voltage, current, and power once per minute during stabilization.	Reduce test burden while maintaining representative results.
Operates ballast for no longer than one hour until stable operating conditions are met.	No maximum operating time until stable operating conditions are met.	Reduce test burden while maintaining representative results.
Has one method of stabilization where lamp arc voltage, current, and power are measured once per second until the difference between the maximum and minimum values do not exceed one percent over a four minute moving window.	Allows a second stabilization option where an oven is used to heat the ballasts prior to testing and lamp arc voltage, current, and power are measured once per minute.	Reduce test burden while maintaining representative results.
Measures standby mode power by referencing ANSI C82.2.	References IEC 62301 to measure standby mode power.	Improve the repeatability and reproducibility of test results.
Ballast connects to reference lamp while measuring standby mode power.	Reference lamps are not required when measuring standby mode power.	Reduce test burden while maintaining representative results.
Standby power test conditions are based on conditions defined in ANSI C82.2, which do not include instructions specifying input voltage.	Standby power test conditions are based on conditions defined in appendix Q for the active mode measurement, which include specifications for which input voltage to operate ballasts designed and marketed to operate at multiple input voltages.	Improve representativeness, repeatability, and reproducibility of test results.

DOE is also amending the reporting requirements under 10 CFR 429.26 to require reporting average total lamp arc power, a value that is already determined in appendix Q; specify rounding requirements for average total lamp arc power; and remove references to values no longer required.

DOE has determined that the amendments described in section III of this document and adopted in this final rule will not alter the measured efficiency of fluorescent lamp ballasts, and that the test procedure will not be unduly burdensome to conduct. Discussion of DOE's actions are addressed in detail in section III of this document.

The effective date for the amended test procedure adopted in this final rule is **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**. Representations of energy use or energy efficiency must be based on testing in accordance with the amended test procedures beginning **[INSERT DATE 180 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**.

III. Discussion

A. Scope of Applicability

This rulemaking applies to fluorescent lamp ballasts, which are devices that can start and operate fluorescent lamps by providing a starting voltage and current and limiting the current during normal operation. 10 CFR 430.2. DOE defines a fluorescent lamp as a lamp of certain shapes, lengths, bases, and wattages⁸ that is a low pressure mercury electric-discharge source in

⁸ See definition of "fluorescent lamps" in 10 CFR 430.2 for the specific lamps defined as fluorescent lamps.

which a fluorescing coating transforms some of the ultraviolet energy generated by the mercury discharge into light. 10 CFR 430.2.

DOE received comments regarding potential amendments to FLB energy conservation standards. NEMA commented that the market for fluorescent lamps and fluorescent lamp ballasts (particularly, dimming ballasts) is decreasing substantially due to the transition to solid-state lighting (“SSL”). (NEMA, No. 3 at p. 2)⁹ NEMA stated that manufacturers are not currently investing, nor are expected to invest, material resources in fluorescent lamp ballasts. *Id.* NEMA added there have been no technological changes since the adoption of the current FLB standards and amending these standards will not result in new investment but rather discontinuance of products. *Id.* ASAP/ACEEE stated it could take many years for existing fluorescent systems to transition to SSL, and fluorescent lighting is still competitive on a lifecycle cost basis. (ASAP/ACEEE, No. 8 at p. 1)

Lutron asserted that amended FLB standards are not technologically feasible due to lack of any technological breakthrough in FLB technology and are not economically justified due to the FLB market decline. (Lutron, No. 6 at p. 2) Lutron added that amended FLB standards are unlikely to meet the energy savings threshold envisioned in the Process Rule. *Id.*

⁹ A notation in the form “NEMA, No. 3 at p. 2” identifies a written comment: (1) made by NEMA; (2) recorded in document number 3 that, unless otherwise specified, is filed in the docket of this test procedure rulemaking (Docket No. EERE-2017-BT-TP-0005-0003) and available for review at <http://www.regulations.gov>; and (3) which appears on page 2 of document number 3.

As discussed, DOE issued the October 2019 NOPD in which it initially determined that energy conservation standards for fluorescent lamp ballasts do not need to be amended. 84 FR 56540. DOE will address potential amendments to the energy conservation standards under that separate review.

Lutron stated DOE should adopt a “No-Rule Rule” and not amend FLB test procedures for the following reasons: (1) no technological breakthroughs or investments in fluorescent lamp ballasts since the last rulemaking, (2) decline in FLB sales due to adoption of light emitting diode (“LED”) technology, (3) ballasts are highly efficient, and dimming ballasts already save significant energy over standard non-dimming ballasts, and (4) updating test procedures may result in a significant regulatory burden for manufacturers without achieving energy savings. (Lutron, No. 6 at p. 2)

NEMA stated that, while it was appropriate to update the FLB test procedure as proposed, compliance to the changes should not be effective until amendments to FLB standards are justified in accordance with EPCA. NEMA asserted that some manufacturers may incur higher test cost burdens which should only be imposed if amended FLB standards are justified. (NEMA, No. 3 at pp. 2-3) Lutron stated that, if a “No-Rule-Rule” is not possible, it agreed with NEMA’s suggestion of aligning the compliance date of amended FLB test procedures and amended FLB standards. (Lutron, No. 6 at pp. 2-3)

In the March 2019 NOPR, DOE preliminarily determined that the proposed amendments to its FLB test procedure would not change measured values; and therefore, would not require

manufacturers to retest fluorescent lamp ballasts previously tested and certified under the previous test procedure. The amendments being adopted in this final rule further align the DOE test procedure with industry standards and best practices and clarify existing test methods. As described, DOE has determined that the amendments adopted in this final rule will not alter the measured efficiency of fluorescent lamp ballasts; hence, there is no need to delay the compliance date of the amendments. Additionally, DOE has determined the amendments being adopted in this final rule do not add regulatory burden (see section III.I of this document).

ASAP/ACEEE commented that DOE should address the issue resulting from the statutory exclusion from the definition of general service fluorescent lamps (“GSFLs”) those lamps with a color rendering index (“CRI”) of 87 or greater (“high CRI”). They stated that the exclusion has allowed large numbers of inexpensive T12¹⁰ linear fluorescent lamps with high CRI to be sold and that these lamps are significantly less efficient than standards-compliant GSFLs. ASAP/ACEEE stated that the sale of high CRI T12 lamps has allowed a continued market for T12 ballasts, and thereby inefficient T12 fluorescent lighting systems.¹¹

(ASAP/ACEEE, No. 8 at p. 3)

As noted, this rulemaking addresses the test procedure for fluorescent lamp ballasts and does not address GSFLs. The amendments to the test procedure adopted in this final rule are

¹⁰ T indicates the tubular shape of the lamp and the 12 is the diameter in eighths of an inch (*i.e.*, 12/8 inches).

¹¹ DOE’s findings in previous rulemakings of GSFL energy conservation standards have shown that T8 lamps have a higher lamp efficacy (lumens per watt) than comparable T12 lamps. See documents from previous rulemaking at <https://www.regulations.gov/docket?D=EERE-2011-BT-STD-0006>.

updates to industry standard references and clarifications to the test methods and do not impact the sale of fluorescent lamp ballasts or associated products such as fluorescent lamps.

B. Updates to Industry Standards

The FLB test procedure references several industry standards. Industry periodically updates its testing standards to account for changes in technology and/or developments in test methodology and/or test instruments. In the March 2019 NOPR, DOE identified updated versions of the referenced industry standards incorporated by reference for appendix Q as shown in Table III.1 of this document. 84 FR 9910, 9913.

Table III.1 Industry Standards Referenced in Appendix Q with Updated Versions Adopted in Final Rule

Industry Standard Currently Referenced in Appendix Q	Updated Versions Adopted in this Final Rule*
ANSI C82.11 ¹² version 2002 (sections 2.1 and 2.4.1 of appendix Q)	ANSI C82.11 ¹³ version 2017
ANSI C82.1 ¹⁴ version 2004 (sections 2.1, 2.3.1, and 2.4.1 of appendix Q)	ANSI C82.1 ¹⁵ version 2015
ANSI C82.2 ¹⁶ version 2002 (sections 2.1, 2.2.1, 2.2.2, 2.2.3, 2.4.1, 2.4.3, 2.5.1.6, 2.5.1.7, 2.5.1.8, 3.2.1, 3.3.1, and 3.3.3 of appendix Q)	ANSI C82.2 ¹⁷ version 2016
ANSI C82.3 ¹⁸ version 2002 (section 2.4.1 of appendix Q)	ANSI C82.3 ¹⁹ version 2016

¹² ANSI Standard C82.11, *American National Standard For Lamp Ballasts—High-frequency Fluorescent Lamp Ballasts—Supplements* (approved January 17, 2002).

¹³ ANSI Standard C82.11, *American National Standard For Lamp Ballasts—High-frequency Fluorescent Lamp Ballasts* (approved January 23, 2017).

¹⁴ ANSI Standard C82.1, *American National Standard For Lamp Ballasts—Line Frequency Fluorescent Lamp Ballast* (approved November, 19, 2004).

¹⁵ ANSI Standard C82.1, *American National Standard For Lamp Ballasts—Line Frequency Fluorescent Lamp Ballast* (approved November, 20, 2015).

¹⁶ ANSI Standard C82.2, *American National Standard for Lamp Ballasts—Method of Measurement of Fluorescent Lamp Ballasts* (approved June 6, 2002).

¹⁷ ANSI Standard C82.2, *American National Standard for Lamp Ballasts—Method of Measurement of Fluorescent Lamp Ballasts* (approved July 12, 2016).

¹⁸ ANSI Standard C82.3, *American National Standard for Lamp Ballasts – Reference Ballasts for Fluorescent Lamps* (approved September 4, 2002).

Industry Standard Currently Referenced in Appendix Q	Updated Versions Adopted in this Final Rule*
ANSI C78.375 ²⁰ version 1997 (section 2.4.2 of appendix Q)	ANSI C78.375A ²¹ version 2014
ANSI C78.901 ²² version 2005 (Table A of appendix Q)	ANSI C78.901 ²³ version 2016
ANSI C78.81 ²⁴ version 2010 (sections 1.6, 1.7, 1.8, 2.1, 2.3.1, 2.4.1, and Table A of appendix Q)	ANSI C78.81 ²⁵ version 2016
IEC 60081 Amendment 4, Edition 5, 2010 ²⁶ (Table A of appendix Q)	IEC 60081 Amendment 6, Edition 5, 2017 ²⁷

*Note: Additionally, this final rule incorporates by reference ANSI C82.77-2002 and IEC 62301 Edition 2.0 in appendix Q.

In the March 2019 NOPR, DOE compared updated and current versions to determine, as directed by EPCA, whether incorporating by reference the latest industry standards would alter measured energy efficiency. (42 U.S.C. 6293(e)(1)) For ANSI C82.2, DOE identified no substantial changes in the 2016 version compared to the 2002 version. For ANSI C82.1, DOE identified no substantial changes in the 2015 version compared to the 2004 version. For ANSI C78.375A, DOE identified no changes in the 2014 version compared to the 1997 version in the

¹⁹ ANSI Standard C82.3, *American National Standard for Lamp Ballasts – Reference Ballasts for Fluorescent Lamps* (approved April 8, 2016).

²⁰ ANSI Standard C78.375, *American National Standard For Fluorescent Lamps—Guide for Electrical Measures* (approved September, 25, 1997).

²¹ ANSI Standard C78.375A, *American National Standard For Fluorescent Lamps—Guide for Electrical Measures* (approved August, 28, 2014).

²² ANSI Standard C78.901, *American National Standards for Electric Lamps – Single-Based Fluorescent Lamps – Dimensional and Electrical Characteristics* (approved March 23, 2005).

²³ ANSI Standard C78.901, *American National Standards for Electric Lamps – Single-Based Fluorescent Lamps – Dimensional and Electrical Characteristics* (approved August 23, 2016).

²⁴ ANSI Standard C78.81, *American National Standard For Electric Lamps—Double-Capped Fluorescent Lamps—Dimensional and Electrical Characteristics* (approved January, 14, 2010).

²⁵ ANSI Standard C78.81, *American National Standard For Electric Lamps—Double-Capped Fluorescent Lamps—Dimensional and Electrical Characteristics* (approved June 29, 2016).

²⁶ IEC Standard - *Double-capped fluorescent lamps – Performance specifications*, (Amendment 4, Edition 5.0) (approved February 2010).

²⁷ IEC Standard - *Double Capped Fluorescent Lamps – Performance specifications*, (Amendment 6, Edition 5.0) (approved August 2017)."

ambient conditions or electrical instruments instructions, for which the industry standard is referenced. 84 FR 9910, 9914-9916.

For ANSI C82.11, DOE identified several key changes in the 2017 version compared to the 2002 version. For ANSI C82.3, DOE identified several key changes in the 2016 version compared to the 2002 version. In the March 2019 NOPR DOE tentatively determined these changes would not result in changes to measured values of BLE because the differences do not result in substantive changes to test setup or methodology. 84 FR 9910, 9916.

ANSI C78.81, ANSI C78.901, and IEC 60081 consist of lamp datasheets referenced by Table A of the DOE FLB test procedure to specify the appropriate reference lamp to use when testing a particular ballast. In the March 2019 NOPR, DOE tentatively determined changes to the values of reference lamp characteristics in the latest 2016 versions of ANSI C78.81 and ANSI C 78.901 and IEC 60081 Amendment 6 are within testing tolerances and therefore, will have minimal impact on current requirements. However, the 2016 versions of ANSI C78.81 and ANSI C78.901 remove the low frequency specifications from lamp datasheets for the 32 W 4-foot medium bipin T8 lamp, 59 W 8-foot single pin T8 lamp, and 32 W 2-foot U-shaped medium bipin T8 lamp. Low frequency lamp characteristics and reference ballast characteristics are necessary to determine the appropriate reference lamp for testing low frequency ballasts. In the March 2019 NOPR, DOE proposed adding the low frequency specifications absent in the latest versions of the industry standards directly in appendix Q to ensure measured values are not impacted. 84 FR 9910, 9916-9917.

NEMA supported DOE's proposal to incorporate up-to-date industry standards. (NEMA, No. 3 at p. 3) ASAP/ACEEE also supported the updates if they improve the accuracy of the test procedures, avoid biasing the results, and provide representative results. (ASAP/ACEEE, No. 8 at p. 2) ASAP/ACEEE added that they were not aware of any such problems with the updates proposed. *Id.*

Consistent with its assessment in the March 2019 NOPR, DOE has determined that, because updates to industry standard references do not involve substantive changes to the test setup and methodology, they would not affect measured values. DOE has not identified any potential for bias or non-representative results under these updates as proposed. DOE has determined that incorporation by reference of the latest versions of industry standards will better align DOE's test procedure with updates to test methods that industry considers to be improvements to previous methods and also increase the clarity of DOE test methods. Hence, in this final rule DOE incorporates by reference for appendix Q the industry standards ANSI C78.81-2016, ANSI C78.375A-2014, ANSI C78.901-2016, ANSI C82.1-2004 (R2008, R2015), ANSI C82.2-2002 (R2007, R2016) (referred to as ANSI C82.2-2016 in this rulemaking), ANSI C82.3-2016, ANSI C82.11-2017, ANSI C82.77 and IEC 60081 Amendment 6 (see Table III.1).

Additionally, DOE is ensuring that the necessary low frequency specifications no longer in ANSI C78.81-2016 or ANSI C78.901-2016 remain available in appendix Q. Hence, in this final rule, for the 32 W 4-foot medium bipin T8 lamp, 59 W 8-foot single pin T8 lamp, and 32 W 2-foot U-shaped medium bipin T8 lamp, DOE is specifying directly in new section 2.3.3 of appendix Q the following low frequency specifications: (1) the low frequency lamp

characteristics (*i.e.*, arc wattage, approximate cathode wattage, total wattage, voltage, and current), (2) reference ballast characteristics (*i.e.*, rated input voltage, reference current, impedance) and (3) cathode heating requirements for rapid start circuits. These specifications are the same as those in the earlier versions of the standards, ANSI C78.81-2010 and ANSI C78.901-2005.

In the March 2019 NOPR, DOE also proposed to incorporate by reference for appendix Q the following industry standards not already incorporated: (1) ANSI C82.77-2002²⁸ because this standard is explicitly referenced by ANSI C82.11-2017, which DOE proposed to incorporate by reference; and (2) IEC 62301²⁹ because it provides specific instructions for standby mode measurements. 84 FR 9910, 9914-9917.

Signify suggested that DOE reference the 2014 version of ANSI C82.77 rather than the 2002 version and noted that ANSI is currently working on an update, with expected publication in 2019. Signify specified that the two major changes in the 2014 version were to describe harmonic current limits for LED lighting and the displacement and harmonic factor optional power quality metric. (Signify, No. 7 at p. 1)

For testing high frequency ballasts, DOE's test procedure references the 2002 version of ANSI C82.11, which DOE is updating to the 2017 version in this final rule. While ANSI C82.11-2002 provides the limits for harmonic distortion of input currents, ANSI C82.11-2017

²⁸ ANSI Standard C82.77, American National Standard— Harmonic Emission Limits—Related Power Quality Requirements (approved January 17, 2002).

²⁹ IEC 62301, Household electrical appliances—Measurement of standby power (Edition 2.0, 2011-01).

references ANSI C82.77-2002 for these limit specifications. The harmonic distortion input current limits in ANSI C82.77-2002 are the same as those specified in ANSI C82.11-2002. Because the update to ANSI C82.11 references the 2002 version of ANSI C82.77, DOE proposed to incorporate by reference ANSI C82.77-2002 into appendix Q. 84 FR 9910, 9915. Additionally, in its normative references section, ANSI C82.11-2017 states that at the time of publication the editions indicated are valid and lists the 2002 version of ANSI C82.77. While the section also encourages the possibility of applying the most recent editions, at the time of publication of ANSI C82.11-2017, the 2014 version of ANSI C82.77 was available but not referenced by the standard. The harmonic distortion input current limits for modular office furniture, which includes fluorescent lamp sources, is 155 percent in the 2014 version compared to 32 percent in the 2002 version. DOE notes that the key changes in the 2014 version of ANSI C82.77 noted by stakeholders are not relevant (*i.e.*, LED lighting harmonic current limits and optional power quality metric) to DOE's FLB test procedure. Therefore, in this final rule DOE is adopting the 2002 version of ANSI C82.77 for incorporation by reference.

DOE also received comments on IEC 62301, which it proposed for incorporation by reference for measurements of standby mode power of fluorescent lamp ballasts. These comments are discussed in section III.E of this document, which specifically addresses standby mode and addresses the related comments.

C. Definitions

In the March 2019 NOPR, DOE proposed several updates to definitions related to the FLB test procedure. Currently, "designed and marketed" means that the intended application of

the lamp is clearly stated in all publicly available documents (*e.g.*, product literature, catalogs, and packaging labels).³⁰ In the March 2019 NOPR, DOE proposed to specify explicitly that the term also includes the intended application of ballast consistent with the application of the definition of “designed and marketed” to fluorescent lamp ballasts. 84 FR 9910, 9917.

DOE also proposed to update definitions for the instant-start, programmed-start, and rapid-start starting methods in appendix Q. Specifically, DOE proposed to add language to these definitions stating that these starting methods are typically indicated on publicly available documents of a fluorescent lamp ballast. DOE finds that this language will provide further guidance in identifying the starting method of the ballast.

Additionally, DOE proposed to remove the following terms in appendix Q that are currently defined but will no longer be used in the revised test procedure: “AC control signal,” “cathode heating,” “DC control signal,” “F34T12 lamp,” “F96T12/ES lamp,” “F96T12HO/ES lamp,” “PLC control signal,” and “wireless control signal.” “AC control signal” and “DC control signal” are not reflective of the products currently available on the market, and the rest of the terms are not used in the FLB test procedure.

NEMA and Signify agreed with DOE’s proposed removal of unused definitions. (NEMA, No. 3 at p. 3; Signify, No. 7 at p. 3) DOE has determined that the removal of definitions

³⁰ The definition of “designed and marketed” is applicable to terms related to the following covered lighting products: Fluorescent lamp ballasts; fluorescent lamps; general service fluorescent lamps; general service incandescent lamps; general service lamps; incandescent lamps; incandescent reflector lamps; medium base compact fluorescent lamps; and specialty application mercury vapor lamp ballasts. 10 CFR 430.2.

described in this section will improve the clarity of FLB test procedure and will not affect measured values.

Hence, in this final rule DOE is (1) updating the term “designed and marketed” in 10 CFR 430.2 to include the intended application of ballasts, (2) updating language in definitions of “instant-start,” “programmed-start,” and “rapid-start,” and (3) removing the following terms in the Definitions section of appendix Q: “AC control signal,” “cathode heating,” “DC control signal,” “F34T12 lamp,” “F96T12/ES lamp,” “F96T12HO/ES lamp,” “PLC control signal,” and “wireless control signal.”

D. Amendments to Active Mode Test Method

1. General

In the March 2019 NOPR, DOE proposed several updates to appendix Q regarding instrumentation, test setup, test conditions, and measurements. DOE also proposed a general instruction in section 2.1 (“Active Mode Procedure”) that specifications in referenced industry standards that are recommended, stated as “shall” or “should” be met, or that are not clearly mandatory are, for purposes of the DOE test procedure, mandatory (unless they conflict with language in appendix Q) to ensure testing is conducted in a uniform manner by different entities to yield consistent results. 84 FR 9910, 9918. DOE received no comments on this proposed change. DOE has determined this is not a substantive change to the test procedure, and will not change measured values. DOE is adopting section 2.1 as proposed.

2. Instrumentation

In the March 2019 NOPR, DOE proposed to reference section 9 (“Electrical Instruments”) of ANSI C78.375A-2014 in section 2.2 (“Instruments”) of the active mode test procedure instead of referencing ANSI C82.2 generally. The reference to ANSI C82.2 is being updated from the 2002 version to the 2016 version in this final rule. Both versions of ANSI C82.2 reference ANSI C78.375A-1997 but also specify that the latest version of ANSI C78.375 applies. The latest version of ANSI C78.375 (the 2014 version) makes no updates to its electrical instruments section compared to the 1997 version (see section III.B). 84 FR 9910, 9919.

DOE did not receive any comments on these proposed amendments. DOE has determined that directly referencing ANSI C78.375A-2014 improves the readability of the DOE test procedure by identifying subsequently referenced industry standards, that this change does not make substantive changes to the test procedure, and that this amendment will not change measured values. In this final rule, DOE adopts the clarifications regarding references to industry standards in the “Instrumentation” section as described in this section.

3. Test Setup

In the March 2019 NOPR, DOE proposed several amendments to section 2.3 (“Test Setup”) of the active mode test procedure in appendix Q. These included: (1) more precisely referencing industry standards, (2) renaming the “Power Analyzer” subsection to “Test Circuits” and clarifying the specified power analyzer capabilities, (3) clarifying selection of reference lamps, and (4) clarifying instructions for identifying the reference lamp.

a. References to Industry Standards

Section 2.3.1 of the active mode test procedure in appendix Q references ANSI C82.1 and ANSI C78.81 without specific instruction regarding applicability to low- or high-frequency ballasts. In the March 2019 NOPR, DOE proposed to specify use of ANSI C82.1 to test low-frequency ballasts and use of ANSI C82.11 to test high-frequency ballasts. 84 FR 9910, 9918. DOE also proposed to remove the reference to ANSI C78.81, which contains no wiring instructions. *Id.* In conjunction with referencing ANSI C82.1, DOE proposed to add an instruction to disregard section 5.3 (“Ballast Output”) of the standard. *Id.* Section 5.3 of ANSI C82.1 specifies minimum power factor requirements, which may be confused with the minimum power factor requirements set forth in DOE's energy conservation standards for fluorescent lamp ballasts (see 10 CFR 430.32(m)). In referencing ANSI C82.11, DOE proposed to disregard section 5.3.1 (“Ballast Factor”) in the standard because the DOE test procedure does not specify determination of ballast factor. 84 FR 9910, 9918. DOE also proposed to disregard Annex D (“Dimming Ballast Energy Efficiency Test Method”) and section 5.13 (“Ballast Efficiency”) in ANSI C82.11 for the active mode test procedure of measuring BLE at full light output, a metric that is different from ballast efficiency described in these sections. 84 FR 9910, 9918-9919.

DOE did not receive any comments on the proposed amendments. DOE has determined that these updates provide clearer instructions on using referenced industry standards and do not make substantive changes to the test procedure or change measured values. In this final rule, DOE adopts the clarifications regarding references to industry standards in the “Test Setup” section as described in this section.

b. Updates to Power Analyzer

In the March 2019 NOPR, DOE also proposed to rename the “Power Analyzer” section (section 2.3.2 of appendix Q) to “Test Circuits” because it provides instructions regarding not only the power analyzer but also for connecting the power supply, ballast, and lamp in the appropriate circuit. Section 2.3.2.1 of appendix Q requires that the power analyzer must have “n + 1” channels where “n” is the number of lamps the ballast can operate. In the March 2019 NOPR, DOE also proposed to specify that “n” is the maximum number of lamps the ballast is designed and marketed to operate, to ensure that the power analyzer has enough channels. 84 FR 9910, 9918.

DOE did not receive any comments on the proposed amendments. DOE has determined these updates provide clearer instructions regarding the power analyzer setup and do not make substantive changes to the test procedure or change measured values. In this final rule, DOE adopts the clarifications regarding the power analyzer setup as described in this section.

c. Selection of Reference Lamps

As compared to when DOE initially established a test procedure for fluorescent lamp ballasts, the market now offers certain ballasts that each can operate lamps of more than one lamp base type and diameter—for example, ballasts that can operate T5 (miniature bipin), T8 (medium bipin), and T12 lamps (both recessed double contact and slimline). Because appendix Q currently does not specify which reference lamp to select for these types of ballasts, in the March 2019 NOPR, DOE proposed to provide additional direction in appendix Q. First, DOE

proposed in newly added section 2.3.3.3 that a ballast designed and marketed to operate lamps of multiple base types, except for sign ballasts, must be tested with one base type in the following order of decreasing preference: medium bipin, miniature bipin, single pin, and recessed double contact. 84 FR 9910, 9918. Second, DOE proposed in newly added section 2.3.3.4 to require, after selecting the base type, a ballast designed and marketed to operate lamps of multiple diameters must be tested with one diameter in the following order of decreasing preference: T8, T5, or T12. *Id.*

NEMA stated that base type has less influence on efficiency measurements than the number and type of lamps being operated, emphasizing that the number of lamps is more relevant. (NEMA, No. 3 at p. 3) Signify commented that, while DOE's proposed criteria may work, because DOE's efficiency standard for fluorescent lamp ballasts is a function of the ballast circuit and output power, it would be simpler to specify choosing the maximum lamp power for multi-lamp type ballasts. Signify stated that testing for the highest lamp power results in testing for the highest efficiency requirement. Signify added that the ballast will operate at its maximum power with the maximum load regardless of lamp base type. (Signify, No. 7 at pp. 2-4)

DOE based the proposed selection of the base type and diameter of the reference lamp for ballasts that can operate multiple lamp types on the most common products on the market. As noted by commentators, base type does not impact lamp power. However, lamp diameters may impact lamp power. Hence, the order of preference dictated by most common diameter may not always result in selecting the lamp diameter with the maximum lamp power. Testing ballasts that can operate multiple lamp types with the most common lamp type provides test results more

appropriately representative of an average period of use. (See, 42 U.S.C. 6293(b)(3)) DOE also notes that, regardless of the selection of base type or diameter, section 2.3.1.4 of appendix Q already requires that the ballast be tested connected to the maximum number of lamps the ballast is designed and marketed to operate.

DOE has determined the updates to the selection of reference lamps for ballasts that can operate more than one lamp type adds consistency and repeatability to the test procedure and do not make substantive changes to the test procedure or change measured values. In this final rule, DOE adopts the selection criteria for reference lamps for ballasts that can operate more than one lamp type as described in this section.

d. Reference Lamp Identification

Section 2.3.1.3 of appendix Q, which pertains to testing in active mode, specifies that the fluorescent lamp used for testing must be a reference lamp as defined in ANSI C82.13 and be seasoned for at least 12 hours. ANSI C82.13 states that reference lamps are “seasoned lamps which under stable operating conditions and in conjunction with the specified reference ballast operate at” certain voltage, wattage, and current. In the March 2019 NOPR, DOE proposed further clarification in newly added section 2.3.3.1 that the reference lamp be tested with a reference ballast that meets the criteria of the 2016 version of ANSI C82.3, the industry standard for reference ballasts of fluorescent lamps. ANSI C82.13 also states that reference lamps must meet certain voltage, wattage, and current criteria under stable operating conditions. Hence, DOE also proposed to include the stabilization criteria for reference lamps as specified in newly added section 2.5.2.1 of appendix Q. 84 FR 9910, 9918.

In the March 2019 NOPR, DOE also proposed to remove references to “rapid-start lamps” and “instant-start lamps” in the “Ballast Type” column in Table A. The starting method (*e.g.* rapid start, instant start) is dictated by the type of ballast, and the lamp datasheet referenced by Table A for each lamp type provides the appropriate reference lamp specifications for the applicable starting method. As such, including the lamps' associated starting method in the Ballast Type column of this table is unnecessary and potentially confusing. DOE also proposed changing the title of the table from Table A to Table 1. 84 FR 9910, 9916, 9932.

DOE did not receive any comments on the proposed amendments related to the reference lamps. DOE has determined these updates provide explicit instructions to ensure correct procedures and requirements are followed when identifying a reference lamp that meets the definition in ANSI C82.13. DOE has further determined that these amendments do not make substantive changes to the test procedure or change measured values. In this final rule, DOE adopts the changes relating to identifying reference lamps described in this section.

4. Test Conditions

Section 2.4 of appendix Q, which pertains to the active mode test procedure, generally references ANSI C82.2 for all test conditions. In the March 2019 NOPR, DOE proposed to specifically reference ANSI C82.2-2016 sections 3 “Pertinent measurements” and 4 “Electrical supply characteristics—test ballast measurement circuits.” DOE also proposed to remove instructions in section 2.4.1 of appendix Q regarding normative references in ANSI C82.2, since

DOE proposed directly referencing industry standards when necessary rather than relying generally on the normative references in ANSI C82.2.

Similarly, section 2.4.2 of appendix Q generally references ANSI C78.375 to specify requirements for room temperature and air circulation in the test facility. In the March 2019 NOPR, DOE proposed to specifically reference ANSI C78.375A-2014 section 4, “Ambient Conditions for Lamp Measurements,” which contains the appropriate information for temperature and air movement requirements.

DOE did not receive any comments on these proposed amendments. DOE determined that these updates provide more direct references to industry standards, and do not make substantive changes to the test procedure or change measured values. In this final rule, DOE is revising general references to ANSI C82.2 and ANSI C78.375A in section 2.4 of appendix Q to provide more precise references to sections 3 and 4 of ANSI C82.2-2016 and section 4 of ANSI C78.375A-2014, as described in this section.

5. Test Method for Ballast Luminous Efficiency

In the March 2019 NOPR, DOE proposed the following amendments to section 2.5 (“Test Method”) of appendix Q, which pertains to the active mode test procedure: (1) revising the stabilization procedure, including adding a second stabilization option, and (2) requiring measuring lamp arc current and voltage as root mean square (“RMS”) values.

a. Stabilization Criteria

In response to the June 2015 framework document, Signify (as Philips Lighting) recommended DOE adopt a second stabilization option to use when measuring BLE that was developed by industry stakeholders. (Philips Lighting, Docket EERE-2015-BT-STD-0006, No. 8 at pp. 2-5) This stabilization option was also supported by comments from NEMA and Universal Lighting Technologies (“ULT”). (NEMA, Docket EERE-2015-BT-STD-0006, No. 12 at p. 2; ULT, Docket EERE-2015-BT-STD-0006, No. 6 at p. 2) DOE evaluated the second stabilization option as recommended by Signify and proposed its adoption in the March 2019 TP NOPR (“Option 2”). 84 FR 9910, 9919. The Option 2 stabilization method proposed would incorporate by reference the method in Annex D of ANSI C82.11. Specifically, DOE proposed that stable operating conditions under this option be determined according to steps 1 through 6 of section D.2.1 in Annex D of ANSI C82.11.

NEMA and Signify supported DOE’s proposal to allow the Option 2 stabilization method for measuring the BLE of ballasts at full light output, stating it reduces testing burden and data management complexity without affecting the accuracy of energy efficiency measurements. (NEMA, No. 3 at p. 4; Signify, No. 7 at p. 6) NEMA suggested DOE offer both Option 1 and Option 2 stabilization methods because some manufacturers will choose to continue with the Option 1 method. (NEMA, No. 3 at p. 4) ASAP/ACEEE supported use of the optional Option 2 stabilization method so long as it is statistically comparable to the current method. ASAP/ACEEE asked DOE to demonstrate that the two options provide statistically identical results before allowing the Option 2 stabilization method. (ASAP/ACEEE, No. 8 at p. 2)

DOE has determined that the second stabilization method will save overall testing time, particularly when testing large batches of ballasts. In response to the June 2015 framework document, Signify (as Philips Lighting) provided BLE test data using both methods for T5 and T8 rapid start and T8 instant start ballasts. For each type of ballast, Philips tested five units of four different models and provided an average BLE for each model at 120 V and 277 V. (Philips Lighting, Docket EERE-2015-BT-STD-0006, No. 8, pp. 2-5)³¹ Because the data did not include total lamp arc power for the ballast models, DOE could not conduct an analysis of how these reported values would comply with FLB standards. DOE did again review and compare the methodologies of the two options. Option 2 is different from Option 1 as follows: 1) Option 2 involves pre-heating the ballast in an oven and pre-burning the lamp with a similar ballast while Option 1 does not; and 2) Option 2 requires reaching stable conditions over a five-minute window while Option 1 requires a four-minute window. DOE has determined the difference between the two methods is not substantive enough to yield different final represented values. Pre-heating the ballast will mainly allow the ballasts to be stabilized more quickly and the difference between a five-minute and four-minute window is minimal. Therefore, DOE has determined that Option 2 only impacts the time it takes to achieve stabilization and does not impact final represented values. In this final rule DOE adopts the second stabilization option (“Option 2”) as described in the March 2019 NOPR.

Currently, section 2.5.1.2.1 of appendix Q requires that lamp arc voltage, current, and power be measured once per second while determining stability. In the March 2019 NOPR,

³¹ These documents were submitted to the docket of DOE's rulemaking to review energy conservation standards for fluorescent lamp ballasts (Docket No. EERE-2015-BT-STD-0006).

DOE proposed to modify the requirement that lamp arc voltage, current, and power be measured once per second, to require instead that those factors be measured once per minute in the Option 1 stabilization method. The once-per-minute requirement is already incorporated in the Option 2 stabilization method. 84 FR 9910, 9919-9920.

NEMA and Signify supported DOE's proposal to change the sampling frequency from one second to one minute in the Option 1 stabilization method, asserting the change will reduce the data storage needs and associated costs. (NEMA, No. 3 at p. 3; Signify, No. 7 at pp. 4-5) NEMA added that lamp-and-ballast systems have high thermal mass and that temperature does not change quickly, thereby generating redundant data at a per-second sampling frequency. (NEMA, No. 3 at p. 3)

As stated in the March 2019 NOPR, DOE reviewed the stabilization criteria in IES LM-9 (proposed in the Option 2 stabilization method) and tentatively determined that taking measurements once per minute to determine if a fluorescent lamp has stabilized is sufficient to determine if a fluorescent lamp ballast has stabilized. 84 FR 9910, 9919. Therefore, DOE has determined that a per-second sampling frequency is unnecessary and its removal would not impact final steady-state conditions reached. In this final rule, DOE is changing the sampling frequency from one second to one minute in the Option 1 stabilization method.

Section 2.5.1.2 of appendix Q currently requires operating the ballast at full output for at least 15 minutes but no longer than 1 hour until stable operating conditions are reached. In the March 2019 NOPR, DOE stated that it does not find a need to restrict the maximum time

required to achieve stable operating conditions and therefore proposed to remove the maximum time of one hour required to achieve stable operating conditions in the Option 1 stabilization method. 84 FR 9910, 9919-9920.

NEMA and Signify supported changing the requirement that fluorescent lamp ballasts cannot be operated for longer than one hour to determine stable operating conditions. NEMA stated that in some cases, especially with ballasts that are potted,³² it may take some time for ballast components to reach optimal operating temperature. Signify stated that, for a ballast tested with an amalgam lamp or any other energy saving lamp type, the proposed change may reduce test costs by preventing repeat testing if the system has not stabilized in an hour. (NEMA, No. 3 at pp. 3-4; Signify, No. 7 at p. 5) ASAP/ACEEE expressed concern that lifting the one hour restriction may result in test data being collected before ballasts achieve stable operating conditions. (ASAP/ACEEE, No. 8 at p. 2)

Per both Option 1 and Option 2 stabilization methods, a lamp-ballast system is determined to be stable when the differences in measured values of each lamp arc voltage, current, and power do not exceed one percent over a four-minute moving window. To achieve stabilization, this criterion must be met even if the stabilization period exceeds one hour. Hence, in this final rule DOE is removing the maximum stabilization time requirement, as it is irrelevant in determining whether final steady-state conditions have been reached.

³² In electronics, “potting” refers to the process of filling an electronic assembly with a solid or gelatinous compound to provide shock and vibration resistance, as well as protection against moisture and corrosion.

b. Measurements

Based on general industry practice of electrical circuit measurements, DOE has interpreted the measurements for lamp arc current and lamp arc voltage to be RMS values. In the March 2019 NOPR, DOE proposed to make explicit this industry practice. 84 FR 9910, 9920.

DOE did not receive any comments on this proposed amendment. DOE has determined that these updates provide clearer instructions on taking measurements consistent with industry practice and do not make substantive changes to the test procedure or change measured values. In this final rule, DOE adopts the explicit direction that measurements of lamp arc current and lamp arc voltage must be RMS values.

In the March 2019 NOPR, DOE also proposed to amend references to sections of ANSI C82.2 as they pertain to taking measurements. 84 FR 9910, 9920. Specifically, DOE proposed to remove references to sections 3.2.1 and 4 of ANSI C82.2 for measuring input current and voltage. DOE initially determined that 3.2.1 of ANSI C82.2 lists parameters to measure for ballast input operating conditions and provides no measurement specifications and that section 4 of ANSI C82.2 provides electrical supply specifications relevant to test conditions but not measurements. *Id.* DOE also proposed to retain the reference to section 7 of ANSI C82.2, but add instruction to disregard references to Figure 1 and Figure 3, as Figure 1 is not relevant for input power measurements and Figure 3 is unnecessary as it specifies a circuit to measure current in rapid start ballasts, which is already provided in the DOE test procedure. *Id.*

NEMA supported DOE's proposal to replace the existing ANSI C82.2 references stating: section 3.2.1 referenced the ballast efficiency factor metric and not BLE; and the referenced figures showed separate wattage, voltage and current meters, whereas modern testing facilities would be using power analyzers to take measurements. (NEMA, No. 3 at p. 4) Signify suggested DOE retain section 4, stating that several technical requirements in section 4 affect electrical and energy efficiency measurements. (Signify, No. 7 at p. 7)

DOE agrees that section 4 of ANSI C82.2 is a pertinent section to reference. Because it provides electrical supply specifications, DOE references it in the "Test Conditions" section rather than in the "Test Method" section of the active mode test procedure. DOE has determined that section 3.2.1 of ANSI C82.2 is unnecessary, as it only lists parameters to measure for ballast input operating conditions but provides no measurement specifications. Regarding the referenced figures, only Figure 2 in ANSI C82.2, which involves measuring a ballast's input voltage and current, is relevant to taking input measurements. Hence, in this final rule, in the "Test Method" section of the active mode test procedure, DOE removes references to sections 3.2.1 and 4 for measuring input voltage and input current, and instead specifies section 7 with the exclusion of Figure 1 and Figure 3 for measuring input power, input voltage, and input current.

6. Measuring Ballast Performance at Less Than Full Light Output

In the March 2019 NOPR, DOE assessed comments received in response to the June 2015 framework document regarding measuring the performance of fluorescent lamp ballasts at dimmed light output levels and proposed a method to measure ballast efficiency ("BE") at reduced light output levels for representations in the marketplace. 84 FR 9910, 9920-9921. The

proposed BE measurement was the ballast output power divided by the ballast input power, where the ballast output power includes not only the lamp arc power but also the filament power (*i.e.*, “cathode power”) and power provided for other features such as networking and sensors. Thus, the proposed BE measurement was different than BLE, which does not include filament power in the ballast output power measurement. The proposal did not require manufacturers to test for and measure BE; but, if a manufacturer were to choose to make representations of BE at reduced light output levels, it would have been required to use the test procedure for the BE metric provided in Annex D of ANSI C82.11-2017. Consistent with Annex D, DOE's proposed test method would have applied only to measurements at light output levels at or greater than 50 percent of full light output and require use of the Option 2 stabilization method (see section III.D.5.a of this document). 84 FR 9910, 9921.

DOE received several comments on the proposed test method for measuring BE at reduced light output levels. NEMA stated that, when dimming a fluorescent lamp ballast, cathode heat must be applied³³ to ensure that the reduction in the arc discharge current does not result in shortened lamp lifetime. NEMA asserted that power required to maintain cathode heat (*i.e.*, cathode power, filament power) must be included in the ballast output power measurement. NEMA added that, because the arc discharge and cathode heating currents flow through the same wire and low levels of power are being measured, it is not possible to make reliable measurements below 50 percent light output. (NEMA, No. 3 at p. 4) Signify supported DOE's proposed test method for BE, stating that the test procedures in ANSI C82.11-2014 provide a

³³ NEMA referenced NEMA Standard LL-9 2011 for guidance related to cathode heat requirements during dimming.

high level of accuracy and repeatability for measurements at 50 percent and full light output.
(Signify, No. 7 at p. 6)

NEMA described a multi-channel measurement approach for BE testing that relies on 13 time-synchronized channels for a 4-lamp fluorescent lamp ballast to capture the input and output power in the same time interval. NEMA stated this approach would require (1) three power analyzers, each costing about \$20,000, as most power analyzers have a maximum of six channels, and (2) a test management computer system and software costing about \$5,000 to control and synchronize the analyzers. NEMA stated that, while some labs may have this equipment, others may not and may choose not to make the expenditure; resulting in some manufacturers not making BE representations of some or all of their products that may require it. (NEMA, No. 3 at p. 5) Signify stated that the test method for measuring BE at reduced light outputs does not necessarily require purchasing new equipment, as power analyzers are also used to measure BLE. Signify explained that the test method can be implemented utilizing (1) a dedicated multi-channel power analyzer, (2) two or more power analyzers used simultaneously, or (3) one power analyzer measuring one lamp port at a time. Signify noted that a multi-channel power analyzer can cost between \$2,200 to \$20,000, which is comparable to a power analyzer. Signify also stated that the test method for measuring BE would already be adopted by any lab that is accredited to National Voluntary Laboratory Accreditation Program and that tests ballasts at reduced light output levels per ANSI standards. (Signify, No. 7 at pp. 9, 13-14)

Lutron asserted that the efficiency measurement of ballasts at reduced light outputs specified in ANSI C82.11-2014 is slightly different than that required to meet CEC's Title 20

energy efficiency regulations for deep-dimming³⁴ fluorescent lamp ballasts, and therefore may require significant re-testing without resulting in any energy savings. Lutron added that testing efficiency at reduced light output will be very expensive, as it requires highly specialized equipment and third-party labs will be able to test only a few samples per day. Lutron also noted that the test method for measuring BE at reduced light outputs had been available in ANSI C82.11 since 2014, giving manufacturers ample opportunity to begin publishing such efficiencies. Lutron stated it did not foresee an equivalent DOE test method to increase the use of this metric, as manufacturers are no longer investing in fluorescent technology. (Lutron, No. 6 at pp. 2-3)

CEC and CA IOUs stated that DOE's proposed BE metric is an inappropriate measurement of efficiency at reduced light outputs, as it does not count cathode power used at lower light outputs as a loss. (CA IOUs, No. 5 at p. 1; CEC, No. 4 at p. 1) CEC stated that, while certain dimming levels require cathode heating to protect against lamp failure, this is not necessary at all dimming levels. (CEC, No. 4 at p. 2) CA IOUs stated that the BE metric would result in falsely high efficiency ratings, and CEC asserted that the BE metric would allow any amount of cathode power to be used, whether necessary or not. (CA IOUs, No. 5 at p. 1; CEC, No. 4 at p. 2)

ASAP/ACEEE stated that energy efficiency ratings for dimmable ballasts should reflect both the light level output at which a ballast must provide cathode power to sustain lamp ignition

³⁴ "Deep-dimming fluorescent lamp ballast" means a fluorescent ballast that is capable of operating lamps in dimmed operating modes at any number of levels at or below 50 percent of full output. California Title 20 Appliance Efficiency Regulations.

and the efficiency of the ballast to illuminate the lamp. They recommended DOE review comments submitted by CEC to revise the proposed BE test method. (ASAP/ACEEE, No. 8 at pp. 1-2) CA IOUs stated that, while cathode power is required at lower lamp currents, it is not necessary at typical lamp currents nearer to full output, and multiple manufacturers employ cathode “cut out”,³⁵ which removes cathode power when it is not required. CA IOUs stated that cathode cut out can result in significant energy savings and should be considered a key metric for determining ballast efficiency. CA IOUs added this can only be done using the BLE metric at low light output levels. CA IOUs stated DOE should include testing for both BE and BLE regardless of light output level. (CA IOUs, No. 5 at pp. 3-4)

CEC also suggested alternative options including (1) requiring measurement of both ballast BLE and BE for any performance measurements at light levels less than 100 percent, (2) requiring the BLE measurement at the light level output just above the threshold where cathode heating would be necessary as well as at light levels above this threshold, and measurement of BE at light outputs below this level³⁶, or (3) an alternative method that allows for the amount of, and cut-in light level output point of, cathode power to be measured. (CEC, No. 4 at pp. 1-3)

ASAP/ACEEE expressed concern that DOE’s proposed test method does not specifically measure cathode power at any light output less than 100 percent. (ASAP/ACEEE, No. 8 at pp. 1-2) CEC added that the technical challenges to measuring the BLE at light output levels less

³⁵ The term “cut out” refers to removing all power to the lamp electrodes after lamp ignition.

³⁶ CEC suggested using NEMA Standard LL9-2011, section 2.2 to develop this method.

than 50 percent should not be a reason for DOE to not develop appropriate efficiency metrics and standards for dimming ballasts. (CEC, No. 4 at pp. 3-4)

DOE is maintaining the metric of BLE at full light output for representations and for determining compliance with the current energy conservation standards. The BLE metric accounts for cathode power as a loss because DOE's test procedure isolates lamp arc voltage by capturing cathode power in the input power measurement, but not in the output power measurement (which is quantified as total lamp arc power). 76 FR 25216 (May 4, 2011). Therefore, all else being equal, ballasts that use cathode power are measured as less efficient at full light output than those that do not because cathode power increases the measured input power but not the measured total lamp arc power.

Based on further consideration, including the comments received, DOE is not adopting a BE test method. DOE proposed the BE measurement to include cathode power in ballast output power to account for its necessary use at reduced light output levels. Regarding determining at what light output level cathode power is necessary, manufacturers can apply different cathode cut out designs. DOE does not have data on the light output levels at which cathode power is applied and current product marketing material does not specify the cathode cut out light output level. The industry standard, NEMA Standard LL9-2011, specifies minimum and maximum voltages across cathodes in dimmed operation. However, incorporating such parameters in a metric may influence manufacturer choice as to cathode cut designs that can be employed in fluorescent lamp ballasts. A lamp and ballast manufacturer may be able to employ only the minimum amount of cathode power necessary because the lamp can be designed to only require the minimum amount of cathode power, while a manufacturer that produces only ballasts may

have to provide more cathode power to ensure that its ballasts can operate all lamps since the minimum amount of cathode power required can vary by lamp. DOE finds that it is important to allow for flexibility in designing ballasts, and a metric should not favor one approach over another.

Given these issues the proposed BE test method may not provide an accurate representation of efficiency for all dimmable ballasts at all reduced light outputs. DOE is not aware of an industry standard at this time that provides a test method to accurately capture the efficiency of a ballast at reduced light output levels. Additionally, current energy conservation standards for fluorescent lamp ballasts do not require efficiency measurements at lower light outputs. Because the proposed BE test method may not provide the most accurate representations, and such a test method is not necessary for compliance, DOE is not adopting a test method for measuring ballast efficiency at reduced light outputs in this final rule.

E. Amendments to Standby Mode Test Method

Currently, the measurement of standby mode power is not required to determine compliance with energy conservation standards for fluorescent lamp ballasts. However, if a manufacturer chooses to make any representations with respect to the standby mode power use of fluorescent lamp ballasts, section 3 of appendix Q requires standby mode power testing to be performed in accordance with ANSI C82.2.

EPCA directs DOE to establish test procedures to include standby mode energy consumption, “taking into consideration the most current versions of Standards 62301 and 62087

of the International Electrotechnical Commission[.]” (42 U.S.C. 6295(gg)(2)(A)) IEC Standard 62087 applies only to audio, video, and related equipment, and therefore is not relevant to lighting products. The current standby mode test procedure is consistent with procedures outlined in IEC Standard 62301, which applies generally to household electrical appliances. 74 FR 54445, 54449 (Oct. 22, 2009). To provide a test method that would be familiar to FLB manufacturers at the time the standby mode test procedure was initially established, DOE referenced language and methodologies presented in 2002 edition of ANSI C82.2. *Id.*

In the March 2019 NOPR, DOE proposed requiring stabilization and subsequent measurement of standby mode energy consumption according to the measurements in section 5 of IEC 62301 (edition 2.0), instead of ANSI C82.2. IEC 62301, which applies generally to household electrical appliances, provides requirements specifically for measuring standby mode energy consumption, whereas ANSI C82.2 does not. For consistency within the test procedure and to reduce the test burden, DOE also proposed that the appendix Q requirements for instruments, test setup and test conditions for the active mode test procedure be followed for standby power measurements. (This includes direction regarding the input voltage at which to test when the ballast can operate at multiple input voltages, which is not currently specified by the current test conditions referenced in ANSI C82.2.) Furthermore, unlike the active mode test procedure, DOE proposed not to require use of reference lamps because lamps are not turned on during the measurement of standby mode power consumption. Additionally, DOE proposed that whatever lamp to which the ballast is connected be turned on initially at full light output for the purpose of ensuring the ballast is not defective. 84 FR 9910, 9921-9922.

NEMA stated that DOE should not incorporate IEC 62301 at this time, as the IEC is currently working on lighting-specific standards and adoption of a less-appropriate method of measurement could negatively impact the product sector. (NEMA, No. 3 at p. 5) Similarly, Signify suggested DOE should wait for either ANSI or IEC to publish a standby power test method for fluorescent lamp ballasts, and noted that IEC is currently considering developing a standby power test method for lighting devices based on IEC 62301, but that the committee found it necessary to make some changes, explanations, and adaptations to the appliances standby power test method provided in IEC 62301. (Signify, No. 7 at p. 8) Lutron agreed with NEMA's comments that, if DOE needs to reference a standard for standby power, it should wait to reference the lighting-specific IEC standard under development. Lutron further stated in its written comments that during the public meeting for the Process Rule³⁷, stakeholder discussion had included the possibility that test procedures may need to be updated quickly with the consensus of all stakeholders. Lutron stated that such a consensus could be achievable for adopting a lighting-specific IEC standard for FLB standby mode power measurements. (Lutron, No. 6 at p. 3)

Fluorescent lamp ballasts are included in the scope of the IEC 63201, which applies to electrical products with a rated input voltage between 100 V a.c. to 250 V a.c. for single phase products and 130 V a.c. to 480 V a.c. for other products. DOE has determined that the instructions and criteria specified in IEC 62301 for stabilization and subsequent measurement of standby mode power consumption are appropriate for fluorescent lamp ballasts. DOE has not

³⁷ Information regarding the Process Rule can be found on <https://www.regulations.gov>, Docket number EERE-2017-BT-STD-0062-0163 at <https://www.regulations.gov/document?D=EERE-2017-BT-STD-0062-0163>.

received any comments specifying technical reasons as to why the use of IEC 62301 would not result in representative FLB standby mode power measurements. Moreover, IEC 62301 provides specific instruction regarding the measurement of standby power, whereas the currently referenced industry test procedure, ANSI C82.2, does not. DOE is largely maintaining the same instruments, test setup, and test conditions to measure standby mode power as are used to measure active mode power; these requirements are largely contained in ANSI C82.2. IEC 62301 is only referenced regarding stabilization and when taking the actual power measurement as the stabilization and power measurement of a ballast that is not operating a lamp is not included in ANSI C82.2.

DOE acknowledges that industry is in the process of developing a lighting-specific standby mode power test method, but at the present, no such industry standard has been issued. DOE will review any such industry standby mode power test method once it becomes available. At this time, DOE has determined that IEC 62301 is more appropriate for measuring standby mode power than the currently referenced ANSI C82.2, which makes no mention of standby mode power. As such DOE is amending appendix Q to reference IEC 62301 in place of ANSI C82.2 for the measurement of standby mode power consumption.

CEC supported DOE's proposed standby mode test method if it explicitly captures ballast features not associated with light output such as networking and sensors. (CEC, No. 4 at p. 4) ASAP/ACEEE also supported the recommendation of the CA IOUs provided in response to the June 2015 framework document³⁸ that ballasts with communication and control capabilities be

³⁸ ASAP/ACEEE referenced the CA IOUs comment submitted under Docket No. EERE-2015-BT-STD-0006.

tested with the ballasts connected to a network and with communication and control capabilities enabled. (ASAP/ACEEE, No. 8 at pp. 2-3)

Section 3.2.1 of appendix Q specifies that, if standby mode power is measured, fluorescent lamp ballasts that are designed and marketed for connection to control devices must be tested with all commercially available compatible control devices connected in all possible configurations. DOE is maintaining this instruction in this final rule as it sufficiently addresses connection of all features necessary for the operation of the fluorescent lamp ballast designed and marketed to connect to control devices.

ASAP/ACEEE requested DOE provide the technical basis for DOE's initial determination in the March 2019 NOPR that specific lamps to which the ballast is connected do not affect standby mode energy, as well as the applicability to all fluorescent lamp ballasts. (ASAP/ACEEE, No. 8 at pp. 2-3)

Regarding connection of lamps, DOE tested the standby mode power consumption of certain digital ballasts with 1 to 3 different types of controllers with and without lamps connected to the ballast. Table III.2 shows standby mode power consumption measurements for a ballast and controller combination with and without lamps connected and differences in power consumption.

Table III.2 Standby Mode Power Consumption With and Without Lamps

Ballast and controller combination	Standby power consumption with lamps (mW)	Standby power consumption without lamps (mW)	Difference in standby power consumption (mW)
1	595	590	5
2	590	591	-1
3	592	592	0
4	91.9	87.5	4.4
5	91.2	86.6	4.6
6	88.3	87.1	1.2
7	903	904	-1

DOE found that the difference in standby mode power consumption with lamps versus without lamps ranged from 0 milliwatts (“mW”) to 5 mW. These differences are within general tolerances of measurements. Per IEC 62301 section 5, for products that have power measurements equal to or less than 1 W, stability is achieved when the power difference is at or less than 10 mW/h across a certain time period. Using the stability criteria of 10 mW/h as a general guideline for expected fluctuations in measurements, DOE finds differences in observed power measurements with lamps versus without lamps to be de minimis. Hence, DOE has determined that testing with or without a lamp does not impact measured values and therefore, the lamp connected to the ballast does not impact measured values. Further, standby power consumption is measured after lamps at full light output are turned off. In this state, the power being consumed by the ballast cannot be applicable to the lamp, as fluorescent lamps do not have any features that consume standby power, nor is there any residual power consumption from the lamp having been turned on.

ASAP/ACEEE also suggested the standby mode test procedure reference the active mode test procedure sections pertaining to instrumentation and connection of lamps. (ASAP/ACEEE,

No. 8 at pp. 2-3) As stated previously, DOE is applying the requirements in the active mode test procedure for instrumentation and test setup to the standby power measurements.

DOE has determined that the proposed amendments to the standby mode energy consumption test procedure provide further clarity to the test steps by referencing a more appropriate industry standard for the actual measurement of power and that the proposed amendments do not affect measured values. Therefore, in this final rule, DOE adopts the amendments to the standby mode test procedure for fluorescent lamp ballasts as described in this section.

F. Amendments to 10 CFR 430.23(q)

In the March 2019 NOPR, DOE proposed to remove paragraphs specifying the calculation of estimated annual energy consumption and estimated annual operating cost for fluorescent lamp ballasts in 10 CFR 430.23(q), as these calculations are not required by DOE or the Federal Trade Commission. DOE also proposed to add a paragraph in 10 CFR 430.23(q) to calculate power factor using appendix Q. 84 FR 9910, 9922. Signify supported DOE's proposal to include a description of power factor calculation and remove calculations for estimated annual energy consumption and annual operating cost. (Signify, No. 7 at p. 8)

DOE has determined that these proposed updates to 10 CFR 430.23(q) provide further clarification and would not impact current requirements of the DOE test procedure or measured values. In this final rule DOE adopts the changes to 10 CFR 430.23(q) described in this section.

G. Amendments to 10 CFR 429.26

In the March 2019 NOPR, DOE proposed explicitly requiring reporting average total lamp arc power in certification reports for fluorescent lamp ballasts. Average total lamp arc power, a value that is already determined in appendix Q, is necessary to determine the required minimum BLE for an FLB model. Manufacturers are already reporting average total lamp arc power when certifying basic models, thus, DOE does not expect any changes in burden. DOE also proposed to require that average total lamp arc power be rounded to the nearest tenth of a watt. Additionally, DOE proposed to specify that the represented value of average total lamp arc power must be equal to the mean of the sample. Finally, DOE proposed to remove “annual energy operating costs” in 10 CFR 429.26(a)(2)(i), as this value is not required by DOE or the Federal Trade Commission. 84 FR 9910, 9922.

DOE did not receive any comments on the proposed amendments to the reporting requirements. DOE has determined that these proposed updates to 10 CFR 429.26 provide further clarification and would not impact current requirements of the DOE test procedure, change measured values, or change the current reporting burden. In this final rule, DOE adopts the changes to 10 CFR 429.26 described in this section.

H. Effective and Compliance Dates

The effective date for the adopted test procedure amendment is **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**. EPCA prescribes that all representations of energy efficiency and energy use, including those made on marketing materials and product labels, must be made in accordance with an amended test procedure, beginning 180 days after publication of the final rule in the *Federal Register*. (42

U.S.C. 6293(c)(2)) EPCA provides an allowance for individual manufacturers to petition DOE for an extension of the 180-day period if the manufacturer may experience undue hardship in meeting the deadline. (42 U.S.C. 6293(c)(3)) To receive such an extension, petitions must be filed with DOE no later than 60 days before the end of the 180-day period and must detail how the manufacturer will experience undue hardship. (*Id.*)

I. Test Procedure Costs and Impact

EPCA requires that test procedures adopted by DOE not be unduly burdensome to conduct. In this final rule, DOE amends the existing test procedure for fluorescent lamp ballasts by providing a second stabilization option for measuring BLE. The amendments also: (1) update references to industry standards; (2) clarify the selection of reference lamps; (3) remove extraneous requirements in the stabilization procedure; and (4) revise the test procedure for measuring standby mode energy consumption. DOE has determined that the test procedure as amended by this final rule will not be unduly burdensome for manufacturers to conduct and instead will decrease the test burden for manufacturers.

This final rule will result in a net cost savings to manufacturers, as presented in Table III.3 and Table III.4 of this document.

Table III.3 Summary of Cost Impacts for Fluorescent Lamp Ballasts

Category	Present Value (thousand 2016\$)	Discount Rate (percent)
Cost Savings		
Reduction in Future Testing Costs	74	3
	28	7
Total Net Cost Impact		
Total Net Cost Impacts	(74)	3
	(28)	7

Table III.4 Summary of Annualized Cost Impacts for Fluorescent Lamp Ballasts

Category	Annualized Value (2016\$)	Discount Rate (percent)
Cost Savings		
Reduction in Future Testing Costs	2,222	3
	1,982	7
Total Net Cost Impact		
Total Net Cost Impacts	(2,222)	3
	(1,982)	7

Further discussion of the cost impacts of the test procedure amendments are presented in the following paragraphs.

a. Option 2 Stabilization Method

In this final rule, DOE is allowing manufacturers to use a second stabilization option (*i.e.*, “Option 2”) when measuring BLE. As described in section III.D.5.a, the Option 2 stabilization method would minimize the time the test lamps are off, thereby reducing the stabilization time and, consequently, the overall testing time. DOE estimates the cost savings of the Option 2 stabilization method to be \$2,519 annually. This estimate is based on a savings of 15 minutes per ballast test (due to reduced stabilization time). Inputs to the calculation were updated in this notice to reflect the most recent known values. Based on a median hourly labor rate of \$40.96³⁹ per electrical engineering technician (this includes an inflation factor of 31 percent to account for the cost of providing benefits), DOE estimates the savings to be \$10.24 per ballast test, or \$40.96 per basic model, assuming four ballast tests per basic model. DOE does not expect all manufacturers to choose to use the Option 2 stabilization method. Based on the manufacturers that already possess the equipment necessary for Option 2 (*i.e.*, an oven for ballasts), DOE

³⁹ Bureau of Labor Statistics, Occupational Employment Statistics, available at: <https://www.bls.gov/oes/current/oes173023.htm> (May 2018). Last accessed January 9, 2020.

estimates that only four manufacturers (comprising about 18 percent of FLB manufacturers) will choose to utilize the Option 2 stabilization method. DOE estimates that these manufacturers combined offer about 246 basic models of fluorescent lamp ballasts, comprising about 54 percent of all basic models certified in DOE's Compliance Certification Database.⁴⁰ New basic models of fluorescent lamp ballasts are introduced and certified to DOE about once every four years. Thus, DOE estimates overall annualized industry savings due to proposing the Option 2 stabilization method to be \$2,222 at a 3 percent discount rate and \$1,982 at a 7 percent discount rate. In summary, DOE's analysis indicates that allowing the Option 2 stabilization method would result in a reduction of future testing (see Table III.3 and Table III.4).

DOE has determined that the amendment to allow manufacturers to use the Option 2 stabilization method will not require changes to the designs of fluorescent lamp ballasts, and that the amendments will not impact the utility of such product or impact the availability of available FLB options. The amendments will not impact the representations of FLB energy efficiency. Manufacturers will be able to rely on data generated under the test procedure in effect prior to the adoption of this amendment. As such, retesting of fluorescent lamp ballasts will not be required solely as a result of DOE's adoption of this amendment to the test procedure.

b. Additional Amendments

The remainder of the amendments adopted in this final rule will not impact test costs: (1) updating references to industry standards; (2) clarifying the selection of reference lamps; (3)

⁴⁰ DOE's Compliance Certification Database is available at https://www.regulations.doe.gov/certification-data/#q=Product_Group_s%3A*. Last accessed January 9, 2020.

removing extraneous requirements in the stabilization procedure; and (4) revising the test procedure for measuring standby mode energy consumption.

First, in this final rule, DOE is incorporating by reference newer versions of already referenced industry standards in DOE's FLB test procedure (see section III.B). Regarding the adoption of the latest versions of industry standards, Signify stated that there would hardly be any additional burden to a testing facility that has been accredited to the current edition of ANSI standards, and further the use of the latest versions would keep testing facilities up-to-date on current technologies and provide access to more modern test methods. (Signify, No.7, p. 14)

Second, in this final rule, DOE is providing additional clarifications on how to select reference lamps to address, in particular, new products on the market (*i.e.* ballasts that can operate multiple lamp types) (see section III.D.3.c). The additional direction on selecting reference lamps reflects the current FLB market.

Third, this final rule removes a maximum operating time for stabilization and changes the requirement to take measurements from once per second to once per minute during the stabilization process (see section III.D.5.a). DOE finds that these changes to the stabilization process will have no impact on costs or test burden. Removing the maximum operating time may prevent the restart of the stabilization procedure in certain cases, but due to the unpredictable nature, DOE is unable to quantify how many products may experience an increase or decrease in stabilization time. The reduction in the frequency (*i.e.*, seconds to minute) of measuring data during stabilization will reduce the amount of data required to determine

stabilization. However, because this data is collected electronically, changing the measurement frequency results in no cost savings based on time and labor.

Finally, for taking standby mode measurements in this final rule, DOE changes the industry standard reference from ANSI C82.2 to IEC 62301 Section 5; specifies that use of reference lamps is not required; and aligns instrumentation, test setup, and test conditions for taking active mode measurements with standby mode measurements (see section III.E). IEC 62301 Section 5 provides detailed instructions but does not change the overall method of obtaining power measurements and does not require new or additional instrumentation. Currently manufacturers are not making representations of standby power mode.

DOE has determined that the amendments described above do not require additional measurements, steps, or instruments, and therefore will have no impact on cost. Manufacturers will be able to rely on data generated under the test procedure in effect prior to the adoption of this amendment.

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 12866, Regulatory Planning and Review, 58 FR 51735 (Oct. 4, 1993). Accordingly, this action was not subject to review under the Executive order by the Office of Information and Regulatory Affairs (“OIRA”) in OMB.

B. Review Under Executive Orders 13771 and 13777

On January 30, 2017, the President issued Executive Order (E.O.) 13771, “Reducing Regulation and Controlling Regulatory Costs.” E.O. 13771 stated the policy of the executive branch is to be prudent and financially responsible in the expenditure of funds, from both public and private sources. E.O. 13771 stated it is essential to manage the costs associated with the governmental imposition of private expenditures required to comply with Federal regulations.

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

- (i) Eliminate jobs, or inhibit job creation;
- (ii) Are outdated, unnecessary, or ineffective;
- (iii) Impose costs that exceed benefits;
- (iv) Create a serious inconsistency or otherwise interfere with regulatory reform initiatives and policies;
- (v) Are inconsistent with the requirements of Information Quality Act, or the guidance issued pursuant to that Act, in particular those regulations that rely in whole or in part on

data, information, or methods that are not publicly available or that are insufficiently transparent to meet the standard for reproducibility; or

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

DOE concludes that this rulemaking is consistent with the directives set forth in these executive orders. This final rule is estimated to result in a cost savings. The final rule yields annualized cost savings of approximately \$1,982 using a perpetual time horizon discounted to 2016 at a 7 percent discount rate. Therefore, this final rule is an E.O. 13771 deregulatory action.

C. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of a final regulatory flexibility analysis (“FRFA”) for any final rule where the agency was first required by law to publish a proposed rule for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by 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>. DOE certified in the March 2019 NOPR that the adopted amendments will not have a significant economic impact on a substantial number of small entities. The factual basis of this certification is set forth in the following paragraphs.

The Small Business Administration (“SBA”) considers a business entity to be a small business, if, together, with its affiliates, it employs less than a threshold number of workers specified in 13 CFR part 121. These size standards and codes established by the North American Industry Classification System (“NAICS”) and are available at <https://www.sba.gov/document/support--table-size-standards>. FLB manufacturing is classified under NAICS 335311, “Power, Distribution, and Specialty Transformer Manufacturing.” The SBA sets a threshold of 750 employees or fewer for an entity to be considered as a small business for this category.

To estimate the number of companies that could be small businesses that manufacture these ballasts, DOE conducted a market survey using publicly available information. DOE’s research involved reviewing information provided by trade associations (*e.g.*, NEMA), information from individual company websites, market research tools (*i.e.*, Hoover’s reports) and DOE’s Certification Compliance Database. DOE screened out companies that do not meet the definition of a “small business” or are completely foreign owned and operated. DOE identified no small businesses that manufacture fluorescent lamp ballasts in the United States. DOE requested comment on its tentative determination that there are no small businesses that manufacture fluorescent lamp ballasts in the United States. NEMA was not aware of any small businesses that manufacture fluorescent lamp ballasts in the United States. (NEMA, No. 3 at pp. 5-6) Signify stated that it did not have sufficient data to comment on this topic. (Signify, No. 7 at p. 16)

Based on the criteria outlined earlier and the reasons discussed in this section, DOE previously certified in the March 2019 TP NOPR that the amendments adopted in this final rule

will not have a significant economic impact on a substantial number of small entities. The factual basis for this certification has not changed. Therefore, DOE concludes that the cost effects accruing from the final rule would not have a “significant economic impact on a substantial number of small entities,” and that the preparation of a FRFA is not warranted. DOE has submitted a certification and supporting statement of factual basis to the Chief Counsel for Advocacy of the Small Business Administration for review under 5 U.S.C. 605(b).

D. Review Under the Paperwork Reduction Act of 1995

Manufacturers of fluorescent lamp ballasts 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 fluorescent lamp ballasts. (See generally 10 CFR part 429.) The collection-of-information requirement for the certification and recordkeeping is subject to review and approval by OMB under the Paperwork Reduction Act (“PRA”). This requirement has been approved by OMB under OMB control number 1910-1400. Public reporting burden for the certification is estimated to average 35 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

DOE is adopting slight modifications to the reporting requirements for fluorescent lamp ballasts. DOE received no comments on its proposal and has determined that these updates to 10 CFR 429.26 do not impact current reporting burden.

Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the PRA, unless that collection of information displays a currently valid OMB Control Number.

E. Review Under the National Environmental Policy Act of 1969

In this final rule, DOE establishes test procedure amendments that it expects will be used to develop and implement future energy conservation standards for fluorescent lamp ballasts. DOE has determined that this rule falls into a class of actions that are categorically excluded from review under the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.) and DOE's implementing regulations at 10 CFR part 1021. Specifically, 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.

F. Review Under Executive Order 13132

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

federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. DOE examined this final rule and determined that it will not have a substantial direct effect on the States, on the relationship between the National Government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the products that are the subject of this final rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297(d)) No further action is required by Executive Order 13132.

G. 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, this final rule meets the relevant standards of Executive Order 12988.

H. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (“UMRA”) requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Pub. L. 104-4, sec. 201 (codified at 2 U.S.C. 1531). For a regulatory action resulting in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of \$100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a 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 final rule according to UMRA and its statement of policy and determined that the rule contains neither an intergovernmental mandate, nor a mandate that may result in the expenditure of \$100 million or more in any year, so these requirements do not apply.

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

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

J. Review Under Executive Order 12630

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

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

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

L. Review Under Executive Order 13211

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 significant energy action. A “significant energy action” is defined as any action by an agency that promulgated or is expected to lead to promulgation of a final rule, and that (1) is a significant regulatory action under Executive Order 12866, or any successor order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (3) is designated by the Administrator of OIRA as a significant energy action. For any significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use if the regulation is implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

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

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

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

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

The modifications to the test procedure for fluorescent lamp ballasts adopted in this final rule incorporates testing methods contained in the following commercial standards:

- 1) ANSI Standard C78.901, “American National Standard for Electric Lamps – Single-Based Fluorescent Lamps – Dimensional and Electrical Characteristics,” 2016;
- 2) ANSI C78.81-2016, “American National Standard for Electric Lamps—Double-Capped Fluorescent Lamps—Dimensional and Electrical Characteristics,” 2016;
- 3) ANSI C78.375A, “American National Standard for Electric Lamps – Fluorescent Lamps – Guide for Electrical Measures,” 2014;
- 4) ANSI Standard C82.11-2017, “American National Standard for Lamp Ballasts – High Frequency Fluorescent Lamp Ballasts - Supplements,” 2017;
- 5) ANSI Standard C82.77, “American National Standard for Lighting Equipment—Harmonic Emission Limits—Related Power Quality Requirements for Lighting Equipment,” 2002;
- 6) ANSI Standard C82.1, “American National Standard for Lamp Ballasts—Line Frequency Fluorescent Lamp Ballast,” 2015;
- 7) ANSI Standard C82.2, “American National Standard for Lamp Ballasts—Method of Measurement of Fluorescent Lamp Ballasts,” 2016;

- 8) ANSI Standard C82.3, (“ANSI C82.3”) “American National Standard for Lamp Ballasts – Reference Ballasts for Fluorescent Lamps,” approved April 8, 2016.
- 9) IEC Standard 60081, “Double Capped Fluorescent Lamps – Performance specifications (Amendment 6, Edition 5.0, August 2017),” 2013; and
- 10) IEC Standard 62301, “Household electrical appliances – Measurement of standby power (Edition 2.0, January 2011),” 2011.

DOE has evaluated these standards and is unable to conclude whether they fully comply with the requirements of section 32(b) of the FEAA (*i.e.*, whether they were developed in a manner that fully provides for public participation, comment, and review.) DOE has consulted with both the Attorney General and the Chairman of the FTC about the impact on competition of using the methods contained in these standards and has received no comments objecting to their use.

N. Congressional Notification

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

O. Description of Materials Incorporated by Reference

In this final rule, DOE incorporates by reference the test standard published by ANSI, titled “American National Standard for Electric Lamps—Single-Based Fluorescent Lamps—Dimensional and Electrical Characteristics,” ANSI/NEMA C78.901-2016. ANSI C78.901-2016 is an industry accepted test standard that describes physical and electrical characteristics of

single-based fluorescent lamps. The test procedure adopted in this final rule references sections of ANSI C78.901-2016 for characteristics of reference lamps that must be used when testing fluorescent lamp ballasts. ANSI C78.901-2016 is readily available on ANSI's website at <http://webstore.ansi.org/>.

In this final rule, DOE incorporates by reference the test standard published by ANSI, titled "American National Standard for Electric Lamps—Double-Capped Fluorescent Lamps—Dimensional and Electrical Characteristics," ANSI C78.81-2016. ANSI C78.81-2016 is an industry accepted test standard that describes the physical and electrical characteristics of double-capped fluorescent lamps. The test procedure adopted in this final rule references sections of ANSI C78.81-2016 for characteristics of reference lamps that must be used when testing fluorescent lamp ballasts. ANSI C78.81-2016 is readily available on ANSI's website at <http://webstore.ansi.org/>.

In this final rule, DOE incorporates by reference the test standard published by ANSI, titled "American National Standard for Electric Lamps – Fluorescent Lamps – Guide for Electrical Measures," ANSI C78.375A-2014. ANSI C78.375A-2014 is an industry accepted test standard that describes procedures for measuring the electrical characteristics of fluorescent lamps. The test procedure adopted in this final rule references sections of ANSI C78.375A-2014 for testing performance of fluorescent lamp ballasts. ANSI C78.375A-2014 is readily available on ANSI's website at <http://webstore.ansi.org/>.

In this final rule, DOE incorporates by reference the test standard published by ANSI, titled “American National Standard for Lamp Ballasts – High Frequency Fluorescent Lamp Ballasts – Supplements,” ANSI/NEMA C82.11-2017. ANSI/NEMA C82.11-2017 is an industry accepted test standard that describes characteristics and measurements of high frequency fluorescent lamp ballasts. The test procedure adopted in this final rule references sections of ANSI/NEMA C82.11-2017 for testing performance of fluorescent lamp ballasts. ANSI/NEMA C82.11-2017 is readily available on ANSI’s website at <http://webstore.ansi.org/>.

In this final rule, DOE maintains the incorporation by reference of the test standard published by ANSI, titled “American National Standard for Lamp Ballasts—Definitions for Fluorescent Lamps and Ballasts,” ANSI C82.13-2002. ANSI C82.13-2002 is an industry accepted standard that provides definitions for terms used in ANSI C78 and ANSI C82 series standards for fluorescent lamps and ballasts. ANSI C82.13-2002, incorporated by reference provides definitions for terms used in the DOE test procedure for fluorescent lamp ballasts. ANSI C82.13-2002 is readily available on ANSI’s website at <http://webstore.ansi.org/>.

In this final rule, DOE incorporates by reference sections of the test standard published by ANSI, titled “American National Standard Harmonic Emission Limits—Related Power Quality Requirements for Lighting Equipment,” ANSI C82.77-2002. ANSI C82.77-2002 is an industry accepted standard that describes maximum harmonic emission limits for lighting equipment. ANSI/NEMA C82.11-2017, incorporated by reference in this final rule for testing high frequency fluorescent lamp ballasts, references ANSI C82.77-2002 to determine the

maximum harmonic emission limits of the input current to the ballast. ANSI C82.77-2002 is readily available on ANSI's website at <http://webstore.ansi.org/>.

In this final rule, DOE incorporates by reference the test standard published by ANSI, titled "American National Standard for Lamp Ballasts—Line Frequency Fluorescent Lamp Ballast," ANSI C82.1-2004 (R2008, R2015). ANSI C82.1-2004 (R2008, R2015) (also referred to in this rulemaking as "ANSI C82.1-2015") is an industry accepted test standard that describes characteristics and measurements of line frequency fluorescent lamp ballasts. The test procedure adopted in this final rule references ANSI C82.1-2004 (R2008, R2015) for testing performance of fluorescent lamp ballasts. ANSI C82.1-2004 (R2008, R2015) is readily available on ANSI's website at <http://webstore.ansi.org/>.

In this final rule, DOE incorporates by reference the test standard published by ANSI, titled "American National Standard for Lamp Ballasts—Method of Measurement of Fluorescent Lamp Ballasts," ANSI C82.2-2002 (R2007, R2016). ANSI C82.2-2002 (R2007, R2016) (also referred to in this rulemaking as ANSI C82.2-2016) is an industry accepted standard for testing line frequency fluorescent lamp ballasts. The 2016 version is a reaffirmation of the 2002 version. ANSI C82.2-2002 (R2007, R2016) is readily available on ANSI's website at <http://webstore.ansi.org/>.

In this final rule, DOE incorporates by reference the test standard published by ANSI, titled "American National Standard for Lamp Ballasts – Reference Ballasts for Fluorescent Lamps," ANSI C82.3-2016. ANSI C82.3-2016 (also referred to in this rulemaking as ANSI

C82.3) is an industry accepted standard that describes characteristics and requirements of fluorescent lamp reference ballasts. The test procedure adopted in this final rule references ANSI C82.3-2016 for determining a reference fluorescent lamp to use when testing the performance of fluorescent lamp ballasts. ANSI C82.3-2016 is readily available on ANSI's website at <http://webstore.ansi.org/>.

In this final rule, DOE incorporates by reference the test standard published by IEC, titled, "Double Capped Fluorescent Lamps – Performance specifications (IEC 60081:1997/AMD6, Amendment 6, Edition 5.0, August 2017)," IEC 60081 Amendment 6. IEC 60081 Amendment 6 is an industry accepted test standard that describes physical and electrical characteristics of double-capped fluorescent lamps. The test procedure adopted in this final rule reference sections of IEC 60081 Amendment 6 for characteristics of reference lamps that must be used when testing fluorescent lamp ballasts. IEC 60081 Amendment 6 is readily available on IEC's website at <https://webstore.iec.ch/home>.

In this final rule, DOE incorporates by reference the test standard published by IEC, titled "Household electrical appliances – Measurement of standby power (Edition 2.0, January 2011)," IEC 62301 (Edition 2.0). IEC 62301 (Edition 2.0) is an industry accepted test standard that describes measurements of electrical power consumption in standby mode, off mode, and network mode. The test procedure adopted in this final rule reference sections of IEC 62301 (Edition 2.0) for testing standby mode power consumption of fluorescent lamp ballasts. IEC 62301 (Edition 2.0) is readily available on IEC's website at <https://webstore.iec.ch/home>.

V. Approval of the Office of the Secretary

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

List of Subjects

10 CFR Part 429

Administrative practice and procedure, Confidential business information, Energy conservation, Household appliances, Reporting and recordkeeping requirements.

10 CFR Part 430

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

Signing Authority

This document of the Department of Energy was signed on July 1, 2020, by Alexander N. Fitzsimmons, Deputy Assistant Secretary for Energy Efficiency, 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 July 2, 2020.

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

For the reasons stated in the preamble, DOE amends parts 429 and 430 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. Section 429.26 is amended by:

- a. Revising the introductory text of paragraph (a)(2)(i);
- b. Adding paragraph (a)(2)(iii); and
- c. Revising paragraphs (b)(2) and (c).

The revisions and addition read as follows:

§429.26 Fluorescent lamp ballasts.

(a) * * *

(2) * * *

(i) Any represented value of the energy consumption of a basic model for which consumers would favor lower values shall be greater than or equal to the higher of:

* * * * *

(iii) The represented value of average total lamp arc power must be equal to the mean of the sample, where:

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

$\bar{x}$ is the sample mean;

n is the number of units in the sample; and

x_i is the i^{th} unit.

(b) * * *

(2) Pursuant to §429.12(b)(13), a certification report must include the following public product-specific information: The ballast luminous efficiency, the average total lamp arc power, the power factor, the number of lamps operated by the ballast, and the type of lamps operated by the ballast (*i.e.*, wattage, base, shape, diameter, and length).

(c) *Rounding requirements.* (1) Round ballast luminous efficiency to the nearest thousandths place.

(2) Round power factor to the nearest hundredths place.

(3) Round average total lamp arc power to the nearest tenth of a watt.

PART 430--ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS

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

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

4. Section 430.2 is amended by revising the definition of “Designed and marketed” to read as follows:

§430.2 Definitions.

* * * * *

Designed and marketed means that the intended application of the lamp or ballast is clearly stated in all publicly available documents (*e.g.*, product literature, catalogs, and packaging labels). This definition is applicable to terms related to the following covered lighting products: Fluorescent lamp ballasts; fluorescent lamps; general service fluorescent lamps; general service incandescent lamps; general service lamps; incandescent lamps; incandescent reflector lamps; medium base compact fluorescent lamps; and specialty application mercury vapor lamp ballasts.

* * * * *

5. Section 430.3 is amended by:

- a. Revising paragraph (a);
- b. Removing the references “§430.2, §430.32, appendix Q,” and adding in their place “§§430.2 and 430.32” in paragraph (e)(5);
- c. Removing the words “appendix Q and” in paragraph (e)(6);
- d. Removing the words “, appendix Q,” in paragraph (e)(7);
- e. Redesignating paragraphs (e)(17) through (21) as (e)(22) through (26);
- f. Redesignating paragraphs (e)(6) through (16) as follows:

Old paragraph	New paragraph
(e)(6)	(e)(7)
(e)(7)	(e)(9)
(e)(8)	(e)(10)
(e)(9)	(e)(12)
(e)(10)	(e)(13)
(e)(11)	(e)(14)
(e)(12)	(e)(15)
(e)(13)	(e)(16)
(e)(14)	(e)(17)
(e)(15)	(e)(19)
(e)(16)	(e)(20)

- g. Adding new paragraphs (e)(6), (8), and (11);
- h. Revising newly redesignated paragraphs (e)(15) and (16);
- i. Removing the words “appendix Q and” in newly redesignated paragraph (e)(17);
- j. Adding new paragraph (e)(18);
- k. Revising newly redesignated paragraph (e)(19);
- l. Adding new paragraph (e)(21);
- m. Adding Note 1 to paragraph (e);
- n. Revising paragraph (o)(2); and
- o. Removing the references “appendices C1, D1, D2, G, H, I, J2, N, O, P, X, X1, Y, Z, BB, and CC to subpart B” in paragraph (o)(6) and adding in their place the references “appendices C1, D1, D2, G, H, I, J2, N, O, P, Q, X, X1, Y, Z, BB, and CC to subpart B”.

The revisions and additions read as follows:

§430.3 Materials incorporated by reference.

(a) *General.* We incorporate by reference the following standards into this part. The material listed has been approved for incorporation by reference by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. To enforce any edition other than that specified in this section, the Department of Energy must publish a document in the Federal Register and the material must be available to the public. All approved material is available for inspection at U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, 6th Floor, 950 L'Enfant Plaza, SW., Washington, DC 20024, (202) 586-2945, or go to: www1.eere.energy.gov/buildings/appliance__standards/. Standards can be obtained from the sources listed in this section. Material is also available for inspection at the National Archives and Records Administration (NARA). For information on the availability

of this material at NARA, email fedreg.legal@nara.gov, or go to: www.archives.gov/federal-register/cfr/ibr-locations.html.

* * * * *

(e) * * *

(6) ANSI C78.81-2016, (“ANSI C78.81-2016”), American National Standard for Electric Lamps—Double-Capped Fluorescent Lamps— Dimensional and Electrical Characteristics, approved June 29, 2016, IBR approved for appendix Q to subpart B.

* * * * *

(8) ANSI C78.375A-2014, (“ANSI C78.375A”), American National Standard for Electric Lamps - Fluorescent Lamps—Guide for Electrical Measures, approved August 28, 2014, IBR approved for appendix Q to subpart B.

* * * * *

(11) ANSI/NEMA C78.901-2016 (“ANSI C78.901-2016”), American National Standard for Electric Lamps—Single-Based Fluorescent Lamps—Dimensional and Electrical Characteristics, ANSI approved August 23, 2016, IBR approved for appendix Q to subpart B.

* * * * *

(15) ANSI C82.1-2004 (R2008, R2015), (“ANSI C82.1”), American National Standard for Lamp Ballasts—Line Frequency Fluorescent Lamp Ballasts, approved November 20, 2015; IBR approved for appendix Q to subpart B.

(16) ANSI C82.2-2002 (R2007, R2016), (“ANSI C82.2”), American National Standard for Lamp Ballasts—Method of Measurement of Fluorescent Lamp Ballasts, approved July 12, 2016, IBR approved for appendix Q to subpart B.

* * * * *

(18) ANSI C82.3-2016, (“ANSI C82.3”), American National Standard for Reference Ballasts for Fluorescent Lamps, approved April 8, 2016; IBR approved for appendix Q to subpart B.

(19) ANSI/NEMA C82.11-2017, (“ANSI C82.11”), American National Standard for Lamp Ballasts—High-Frequency Fluorescent Lamp Ballasts, approved January 23, 2017; IBR approved for appendix Q to subpart B.

* * * * *

(21) ANSI C82.77-2002, (“ANSI C82.77”) Harmonic Emission Limits—Related Power Quality Requirements for Lighting Equipment, approved January 17, 2002; IBR approved for appendix Q to subpart B.

* * * * *

Note 1 to paragraph (e). The standards referenced in paragraphs (e)(6), (8), (11), (15), (16), (18), (19), and (21) of this section were all published by National Electrical Manufacturers Association (NEMA) and are also available from National Electrical Manufacturers Association, 1300 North 17th Street, Suite 900, Rosslyn, Virginia 22209, <https://www.nema.org/Standards/Pages/default.aspx>.

* * * * *

(o) * * *

(2) IEC 60081:1997/AMD6, (“IEC 60081”), Double-capped fluorescent lamps – Performance specifications (Amendment 6, Edition 5.0, August 2017); IBR approved for appendix Q to subpart B.

* * * * *

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

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

* * * * *

(q) *Fluorescent lamp ballasts*. (1) Calculate ballast luminous efficiency (BLE) using appendix Q to this subpart.

(2) Calculate power factor using appendix Q to this subpart.

* * * * *

7. Appendix Q to subpart B of part 430 is revised to read as follows:

Appendix Q to Subpart B of Part 430 – Uniform Test Method for Measuring the Energy Consumption of Fluorescent Lamp Ballasts

Note regarding effective date: After [INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*] and prior to [INSERT DATE 180 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*] any representations with respect to energy use or efficiency of fluorescent lamp ballasts must be in accordance with the results of testing pursuant to this appendix or the test procedures as they appeared in appendix Q to this subpart revised as of January 1, 2020. On or after [INSERT DATE 180 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*], any representations, including certifications of compliance for ballasts subject to any energy conservation standard, made with respect to the energy use or efficiency of fluorescent lamp ballasts must be made in accordance with the results of testing pursuant to this appendix.

0. Incorporation by Reference

DOE incorporated by reference ANSI C78.81-2016, ANSI C78.375A, ANSI C78.901-2016, ANSI C82.1, ANSI 82.2, ANSI 82.3, ANSI 82.11, ANSI C82.13, ANSI 82.77, IEC 60081, and IEC 62301, each in their entirety in §430.3; however, only enumerated provisions of ANSI C78.375A, ANSI C82.2, and IEC 62301 are applicable to this appendix, as follows:

(a) ANSI C78.375A, as follows:

- (i) Section 4, Ambient conditions for temperature measurement, as specified in section 2.4.2 of this appendix; and
- (ii) Section 9, Electrical instruments, as specified in sections 2.2.1, 2.2.2, and 2.2.3 of this appendix.

(b) ANSI C82.2, as follows:

- (i) Section 3, Pertinent measurements, as specified in section 2.4.1 of this appendix;
- (ii) Section 4, Electrical supply characteristics – test ballast measurement circuits, as specified in section 2.4.1 of this appendix; and
- (iii) Section 7, Test measurements circuits, as specified in sections 2.5.6, 2.5.7, and 2.5.8 of this appendix.

(c) IEC 62301 as follows:

- (i) Section 5, Measurements, as specified in sections 3.4.3 and 3.4.4 of this appendix.

1. Definitions

1.1. *Average total lamp arc power* means the sample mean of the total lamp arc power of the ballast units tested.

1.2. *Dimming ballast* means a ballast that is designed and marketed to vary its output and that can achieve an output less than or equal to 50 percent of its maximum electrical output.

1.3. *High frequency ballast* is as defined in ANSI C82.13 (incorporated by reference; see §430.3).

1.4. *Instant-start* is the starting method used in instant-start systems as defined in ANSI C82.13, as typically indicated on publicly available documents of a fluorescent lamp ballast (e.g., product literature, catalogs, and packaging labels).

1.5. *Low-frequency ballast* is a fluorescent lamp ballast that operates at a supply frequency of 50 to 60 Hz and operates the lamp at the same frequency as the supply.

1.6. *Programmed-start* is the starting method used in a programmed-start system as defined in ANSI C82.13, as typically indicated on publicly available documents of a fluorescent lamp ballast (e.g., product literature, catalogs, and packaging labels).

1.7. *Rapid-start* is the starting method used in rapid-start type systems as defined in ANSI C82.13, as typically indicated on publicly available documents of a fluorescent lamp ballast (e.g., product literature, catalogs, and packaging labels).

1.8. *Reference lamp* is a fluorescent lamp that meets the operating conditions of a reference lamp as defined by ANSI C82.13.

1.9. *Residential ballast* means a fluorescent lamp ballast that meets Federal Communications Commission (FCC) consumer limits as set forth in 47 CFR part 18 and is designed and marketed for use only in residential applications.

1.10. *RMS* is the root mean square of a varying quantity.

1.11 *Sign Ballast* means a ballast that has an Underwriters Laboratories Inc. Type 2 rating and is designed and marketed for use only in outdoor signs.

2. Active Mode Procedure for Measuring BLE at Full Light Output

2.1. Where ANSI C82.2 (incorporated by reference; see §430.3) references ANSI C82.1, use ANSI C82.1 (incorporated by reference; see §430.3) for testing low-frequency ballasts and use ANSI C82.11 (incorporated by reference; see §430.3) for testing high-frequency ballasts. In addition when applying ANSI C82.2, use the standards ANSI C78.375A, ANSI C78.81-2016, ANSI C82.1, ANSI C82.11, ANSI C82.13, ANSI C82.3, ANSI C82.77, and ANSI C78.901-2016 (incorporated by reference; see §430.3) instead of the normative references in ANSI 82.2. Specifications in referenced standards that are recommended, that “shall” or “should” be met, or that are not clearly mandatory, are mandatory. In cases where there is a conflict between any industry standard(s) and this appendix, the language of the test procedure in this appendix takes precedence over the industry standard(s).

2.2. Instruments

2.2.1. All instruments must meet the specifications of section 9 of ANSI C78.375A.

2.2.2. *Power Analyzer*. In addition to the specifications in section 9 of ANSI C78.375A, the power analyzer must have a maximum 100 pF capacitance to ground and frequency response between 40 Hz and 1 MHz.

2.2.3. *Current Probe*. In addition to the specifications in section 9 of ANSI C78.375A, the current probe must be galvanically isolated and have frequency response between 40 Hz and 20 MHz.

2.3. Test Setup

2.3.1. Connect the ballast to a main power source and to the fluorescent lamp(s) as specified in this section. Ensure the ballast is connected to fluorescent lamp(s) according to any manufacturer's wiring instructions on or sold with each unit (including those provided online). To test a low-frequency ballast, follow ANSI C82.1 but disregard section 5.3 of ANSI C82.1. To test a high-frequency ballast, follow ANSI C82.11 but disregard sections 5.3.1 and 5.13 and Annex D of ANSI C82.11.

2.3.2. In the test setup, all wires used in the apparatus, including any wires from the ballast to the lamps and from the lamps to the measuring devices, must meet the following specifications:

2.3.2.1. Use the wires provided by the ballast manufacturer and only the minimum wire length necessary to reach both ends of each lamp. If the wire lengths supplied with the ballast are too short to reach both ends of each lamp, add the minimum additional wire length necessary to reach both ends of each lamp, using wire of the same wire gauge(s) as the wire supplied with the ballast. If no wiring is provided with the ballast, use 18 gauge or thicker wire.

2.3.2.2. Keep wires loose. Do not shorten or allow bundling of any wires. Separate all wires from each other, and ground them to prevent parasitic capacitance.

2.3.3. Test each ballast with only one fluorescent lamp type. Select the one type of fluorescent lamp for testing as follows:

2.3.3.1. Each fluorescent lamp must meet the specifications of a reference lamp as defined by ANSI C82.13, be seasoned at least 12 hours, and be stabilized as specified in 2.5.2.1 of this appendix. Test each reference lamp with a reference ballast that meets the criteria of ANSI C82.3. For low frequency ballasts that operate:

(a) 32 W 4-foot medium bipin T8 lamps, use the following reference lamp specifications: 30.8 W, arc wattage; 1.7 W, approximate cathode wattage (with 3.6 V on each cathode); 32.5 W, total wattage; 137 V, voltage; 0.265 A, current. Test the selected reference lamp with the following reference ballast specifications: 300 V, rated input voltage; 0.265 A, reference current; 910 ohms, impedance. Use the following cathode heat requirements for rapid start: 3.6 V nominal, voltage; 2.5 V min, 4.4 V max, limits during operation; 11.0 ohms +/- 0.1 ohms, dummy load resistor; 3.4 V min, 4.5 V max, voltage across dummy load.

(b) 59 W 8-foot single pin T8 lamps, use the following reference lamp specifications: 60.1 W, arc wattage; 270.3 V, voltage; 0.262 A, current. Test the selected reference lamp with the following reference ballast specifications: 625 V, rated input voltage; 0.260 A, reference current; 1960 ohms, impedance.

(c) 32 W 2-foot U-shaped medium bipin T8 lamps, use the following reference lamp specifications: 30.5 W, arc wattage; 1.7 W, approximate cathode wattage (with 3.6 V on each cathode); 32.2 W, total wattage; 137 V, voltage; 0.265 A, current. Test the selected reference lamp with the following reference ballast specifications: 300 V, rated input voltage; 0.265 A,

reference current; 910 ohms, impedance. Use the following cathode heat requirements for rapid start: 3.6 V nominal, voltage; 2.5 V min, 4.4 V max, limits during operation; 11.0 ohms +/- 0.1 ohms, dummy load resistor; 3.4 V min, 4.5 V max, voltage across dummy load.

2.3.3.2 For any sign ballast designed and marketed to operate both T8 and T12 lamps, use a T12 lamp as specified in Table 1 of this appendix.

2.3.3.3. For any ballast designed and marketed to operate lamps of multiple base types, select lamp(s) of one base type, in the following order of decreasing preference: Medium bipin, miniature bipin, single pin, or recessed double contact.

2.3.3.4. After selecting the base type (per section 2.3.3.3), select the diameter of the reference lamp. Any ballast designed and marketed to operate lamps of multiple diameters, except for any sign ballast capable of operating both T8 and T12 lamps, must be tested with lamps of one of those diameters, selected in the following order of decreasing preference: T8, T5, or T12.

2.3.3.5. Connect the ballast to the maximum number of lamps (lamp type as determined by 2.3.3.2, 2.3.3.3, and 2.3.3.4 of this section) the ballast is designed and marketed to operate simultaneously.

For any ballast designed and marketed to operate both 4-foot medium bipin lamps and 2-foot U-shaped lamps, test with the maximum number of 4-foot medium bipin lamp(s).

2.3.3.6. Test each ballast with the lamp type specified in Table A of this section that corresponds to the lamp diameter and base type the ballast is designed and marketed to operate.

TABLE 1 TO SECTION 2.3.3.6—LAMP-AND-BALLAST PAIRINGS AND FREQUENCY ADJUSTMENT FACTORS

	Lamp type		Frequency adjustment factor (β)	
		Nominal lamp wattage	Low-frequency	High-frequency
Ballast type	Lamp diameter and base			
Ballasts that operate straight-shaped lamps (commonly referred to as 4-foot medium bipin lamps) with medium bipin bases and a nominal overall length of 48 inches	T8 MBP (Data Sheet 7881-ANSI-1005-4)*	32	0.94	1.0
	T12 MBP (Data Sheet 7881-ANSI-1006-1)*	34	0.93	1.0
Ballasts that operate U-shaped lamps (commonly referred to as 2-foot U-shaped lamps) with medium bipin bases and a nominal overall length between 22 and 25 inches	T8 MBP (Data Sheet 78901-ANSI-4027-2)*	32	0.94	1.0
	T12 MBP**	34	0.93	1.0
Ballasts that operate lamps (commonly referred to as 8-foot-high output lamps) with recessed double contact bases and a nominal overall length of 96 inches	T8 HO RDC (Data Sheet 7881-ANSI-1501-2)*	86	0.92	1.0
	T12 HO RDC (Data Sheet 7881-ANSI-1017-1)*	95	0.94	1.0
Ballasts that operate lamps (commonly referred to as 8-foot slimline lamps) with single pin bases and a nominal overall length of 96 inches	T8 slimline SP (Data Sheet 7881-ANSI-1505-1)*	59	0.95	1.0
	T12 slimline SP (Data Sheet 7881-ANSI-3006-1)*	60	0.94	1.0
Ballasts that operate straight-shaped lamps (commonly referred to as 4-foot miniature bipin standard output lamps) with miniature bipin bases and a nominal length between 45 and 48 inches	T5 SO Mini-BP (Data Sheet 60081-IEC-6640-7)*	28	0.95	1.0
Ballasts that operate straight-shaped lamps (commonly referred to as 4-	T5 HO Mini-BP	54	0.95	1.0

foot miniature bipin high output lamps) with miniature bipin bases and a nominal length between 45 and 48 inches	(Data Sheet 60081-IEC-6840-6)*			
Sign ballasts that operate lamps (commonly referred to as 8-foot high output lamps) with recessed double contact bases and a nominal overall length of 96 inches	T8 HO RDC (Data Sheet 7881-ANSI-1501-2)*	86	0.92	1.0
	T12 HO RDC (Data Sheet 7881-ANSI-1019-1)*	110†	0.94	1.0
MBP, Mini-BP, RDC, and SP represent medium bipin, miniature bipin, recessed double contact, and single pin, respectively. * Data Sheet corresponds to ANSI C78.81-2016, ANSI C78.901-2016, or IEC 60081 page number (incorporated by reference; see §430.3). ** No ANSI or IEC Data Sheet exists for 34 W T12 MBP U-shaped lamps. For ballasts designed and marketed to operate only T12 2-foot U-shaped lamps with MBP bases and a nominal overall length between 22 and 25 inches, select T12 U-shaped lamps designed and marketed as having a nominal wattage of 34 W. † This lamp type is commonly marketed as 110 W; however, the ANSI C78.81-2016 Data Sheet (incorporated by reference; see §430.3) lists nominal wattage of 113 W. Test with specifications for operation at 0.800 amperes (A).				

2.3.4. Test Circuits

2.3.4.1. The power analyzer test setup must have exactly $n + 1$ channels, where n is the maximum number of lamps (lamp type as determined by sections 2.3.3.2, 2.3.3.3, and 2.3.3.4 of this appendix) a ballast is designed and marketed to operate. Use the minimum number of power analyzers possible during testing. Synchronize all power analyzers. A system may be used to synchronize the power analyzers.

2.3.4.2. *Lamp Arc Voltage.* Attach leads from the power analyzer to each fluorescent lamp according to Figure 1 of this section for rapid- and programmed-start ballasts; Figure 2 of this section for instant-start ballasts operating single pin (SP) lamps; and Figure 3 of this section for instant-start ballasts operating medium bipin (MBP), miniature bipin (mini-BP), or recessed

double contact (RDC) lamps. The programmed- and rapid-start ballast test setup includes two 1000 ohm resistors placed in parallel with the lamp pins to create a midpoint from which to measure lamp arc voltage.

2.3.4.3. *Lamp Arc Current.* Position a current probe on each fluorescent lamp according to Figure 1 of this section for rapid- and programmed-start ballasts; Figure 2 of this section for instant-start ballasts operating SP lamps; and Figure 3 of this section for instant-start ballasts operating MBP, mini-BP, and RDC lamps.

For the lamp arc current measurement, set the full transducer ratio in the power analyzer to match the current probe to the power analyzer.

$$Full\ Transducer\ Ratio = \frac{I_{in}}{V_{out}} \times \frac{R_{in}}{R_{in} + R_s}$$

Where: I_{in} is the current through the current transducer, V_{out} is the voltage out of the transducer, R_{in} is the power analyzer impedance, and R_s is the current probe output impedance.

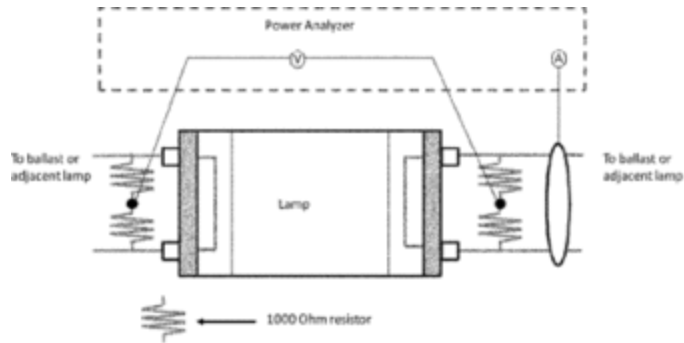


Figure 1: Programmed- and Rapid-Start Ballast Instrumentation Setup

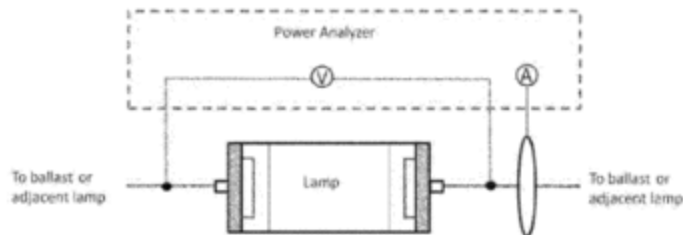


Figure 2: Instant-Start Ballasts that Operate SP Lamps Instrumentation Setup

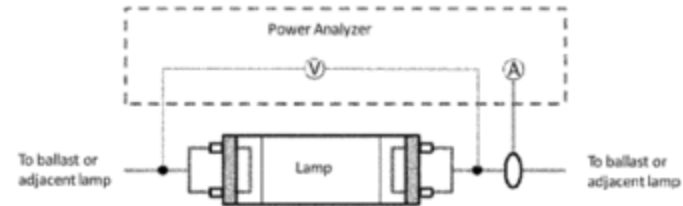


Figure 3: Instant-Start Ballasts that Operate MBP, mini-BP, and RDC Lamps Instrumentation Setup

2.4. Test Conditions

2.4.1. Establish and maintain test conditions for testing fluorescent lamp ballasts in accordance with sections 3 and 4 of ANSI C82.2.

2.4.2. *Room Temperature and Air Circulation.* Maintain the test area at 25 ± 1 °C, with minimal air movement as defined in section 4 of ANSI C78.375A.

2.4.3. *Input Voltage.* For any ballast designed and marketed for operation at only one input voltage, test at that specified voltage. For any ballast that is neither a residential ballast nor a sign ballast but is designed and marketed for operation at multiple voltages, test the ballast at 277 V

$\pm 0.1\%$. For any residential ballast or sign ballast designed and marketed for operation at multiple voltages, test the ballast at 120 V $\pm 0.1\%$.

2.5. *Test Method*

2.5.1. Connect the ballast to the selected fluorescent lamps (as determined in section 2.3.3 of this appendix) and to measurement instrumentation as specified in the Test Setup in section 2.3 of this appendix.

2.5.2. Determine stable operating conditions according to Option 1 or Option 2.

2.5.2.1. Option 1. Operate the ballast for at least 15 minutes before determining stable operating conditions. Determine stable operating conditions by measuring lamp arc voltage, current, and power once per minute in accordance with the setup described in section 2.3 of this appendix. The system is stable once the difference between the maximum and minimum for each value of lamp arc voltage, current, and power divided by the average value of the measurements do not exceed one percent over a four minute moving window. Once stable operating conditions are reached, measure each of the parameters described in sections 2.5.3 through 2.5.9 of this appendix.

2.5.2.2 Option 2. Determine stable operating conditions for lamp arc voltage, current, and power according to steps 1 through 6 of section D.2.1 in Annex D of ANSI C82.11.

2.5.3. *Lamp Arc Voltage*. Measure lamp arc voltage in volts (RMS) using the setup in section 2.3.4.2.

2.5.4. *Lamp Arc Current*. Measure lamp arc current in amps (RMS) using the setup in section 2.3.4.3 of this appendix.

2.5.5. *Lamp Arc Power*. The power analyzer must calculate output power by using the measurements from sections 2.5.3 and 2.5.4 of this appendix.

2.5.6. *Input Power*. Measure the input power in watts to the ballast in accordance with section 7 of ANSI C82.2 (disregard references to Figure 1 and Figure 3).

2.5.7. *Input Voltage*. Measure the input voltage in volts (RMS) to the ballast in accordance with section 7 of ANSI C82.2 (disregard references to Figure 1 and Figure 3).

2.5.8. *Input Current*. Measure the input current in amps (RMS) to the ballast in accordance with section 7 of ANSI C82.2 (disregard references to Figure 1 and Figure 3).

2.5.9. *Lamp Operating Frequency*. Measure the frequency of the waveform delivered from the ballast to any lamp used in the test in accordance with the setup in section 2.3 of this appendix.

2.6. Calculations

2.6.1. Calculate ballast luminous efficiency (BLE) as follows (do not round values of total lamp arc power and input power prior to calculation):

$$\text{Ballast Luminous Efficiency} = \frac{\text{Total Lamp Arc Power}}{\text{Input Power}} \times \beta$$

Where: Total Lamp Arc Power is the sum of the lamp arc powers for all lamps operated by the ballast as measured in section 2.5.5 of this appendix, Input Power is as determined by section

2.5.6 of this appendix, and β is equal to the frequency adjustment factor in Table 1 of this appendix.

2.6.2. Calculate Power Factor (PF) as follows (do not round values of input power, input voltage, and input current prior to calculation):

$$PF = \frac{\text{Input Power}}{\text{Input Voltage} \times \text{Input Current}}$$

Where: Input Power is measured in accordance with section 2.5.6 of this appendix, Input Voltage is measured in accordance with section 2.5.7 of this appendix, and Input Current is measured in accordance with section 2.5.8 of this appendix.

3. Standby Mode Procedure

3.1. The measurement of standby mode power is required to be performed only if a manufacturer makes any representations with respect to the standby mode power use of the fluorescent lamp ballast. When there is a conflict, the language of the test procedure in this appendix takes precedence over IEC 62301 (incorporated by reference; see §430.3).

Specifications in referenced standards that are not clearly mandatory are mandatory.

Manufacturer's instructions, such as "instructions for use" referenced in IEC 62301 mean the manufacturer's instructions that come packaged with or appear on the unit, including on a label.

It may include an online manual if specifically referenced (e.g., by date or version number) either on a label or in the packaged instructions. Instructions that appear on the unit take precedence over instructions available electronically, such as through the internet.

3.2. Test Setup

3.2.1. Take all measurements with instruments as specified in section 2.2 of this appendix. Fluorescent lamp ballasts that are designed and marketed for connection to control devices must be tested with all commercially available compatible control devices connected in all possible configurations. For each configuration, a separate measurement of standby power must be made in accordance with section 3.4 of this appendix.

3.2.2. Connect each ballast to the maximum number of lamp(s) as specified in section 2.3 (specifications in 2.3.3.1 are optional) of this appendix. Note: ballast operation with reference lamp(s) is not required.

3.3. Test Conditions

3.3.1. Establish and maintain test conditions in accordance with section 2.4 of this appendix.

3.4. Test Method and Measurements

3.4.1. Turn on all of the lamps at full light output.

3.4.2. Send a signal to the ballast instructing it to have zero light output using the appropriate ballast communication protocol or system for the ballast being tested.

3.4.3. Stabilize the ballast prior to measurement using one of the methods as specified in section 5 of IEC 62301.

3.4.4. Measure the standby mode energy consumption in watts using one of the methods as specified in section 5 of IEC 62301.

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