[6450-01-P]

DEPARTMENT OF ENERGY

10 CFR Parts 429 and 431

[Docket No. EERE-2010-BT-TP-0044]

RIN: 1904-AC37

Energy Conservation Program for Certain Commercial and Industrial Equipment: Test Procedures for High-Intensity Discharge Lamps

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

ACTION: Notice of proposed rulemaking.

SUMMARY: The U.S. Department of Energy (DOE) proposes to establish its test procedures for high-intensity discharge (HID) lamps under the Energy Policy and Conservation Act of 1975 (EPCA), as amended. The proposed test procedures are based on industry standard procedures and practices already established by the American National Standards Institute (ANSI), the Illuminating Engineering Society of North America (IES), and the International Commission on Illumination (Commission Internationale de l'Eclairage (CIE)). The proposed test procedures would include measurement of parameters to enable calculation of lamp efficacy (in lumens per watt or lm/W), and would also provide for the efficiency measurement of directional lamps using center beam intensity (in candelas) and beam angle. The proposed procedures would also

measure lumen maintenance (i.e., the fraction or percentage of lamp light output relative to initial output, over time) at 40 percent and 70 percent of rated lamp lifetime. Correlated color temperature (CCT) and color rendering index (CRI) would also be measured as potential means to delineate equipment classes for HID lamps. This notice of proposed rulemaking (NOPR) also discusses DOE's conclusion that HID lamps do not operate or use energy in standby mode or off mode. Therefore, DOE does not propose test procedures for these modes.

DATES: DOE will hold a public meeting on **Thursday, January 19, 2012**, from 9 a.m. to 2 p.m., in Washington, DC. The meeting will also be broadcast as a webinar. See section V, "Public Participation," for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

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

ADDRESSES: The public meeting will be held at the U.S. Department of Energy, Forrestal Building, Room 8E-089 1000 Independence Avenue, SW., Washington, DC 20585. To attend, please notify Ms. Brenda Edwards at (202) 586-2945. Please note that foreign nationals visiting DOE Headquarters are subject to advance security screening procedures. Any foreign national wishing to participate in the meeting should advise DOE as soon as possible by contacting Ms. Brenda Edwards at (202) 586-2945 to initiate the necessary procedures. Please also note that

those wishing to bring laptop computers into the Forrestal Building will be required to obtain a property pass. Visitors should avoid bringing laptop computers, or allow an extra 45 minutes for security screening procedures. Persons can attend the public meeting via webinar. For more information, refer to the Public Participation section near the end of this notice.

Any comments submitted must identify the NOPR for test procedures for high-intensity discharge lamps, and provide docket number EERE-2010-BT-TP-0044 and/or regulatory information number (RIN) 1904-AC37. Comments may be submitted using any of the following methods:

1. Federal eRulemaking Portal: www.regulations.gov. Follow the instructions for submitting comments.
2. Email: HIDLamps-2010-TP-0044@ee.doe.gov. Include the docket number EERE-2010-BT-TP-0044 and/or RIN 1904-AC37 in the subject line of the message.
3. Mail: Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, Mailstop EE-2J, 1000 Independence Avenue, SW., Washington, DC, 20585-0121. If possible, please submit all items on a CD. It is not necessary to include printed copies.
4. Hand Delivery/Courier: Ms. Brenda Edwards, U.S. Department of Energy, Building Technologies Program, 950 L'Enfant Plaza, SW., Suite 600, Washington, DC, 20024. Telephone: (202) 586-2945. If possible, please submit all items on a CD. It is not necessary to include printed copies.

For detailed instructions on submitting comments and additional information on the rulemaking process, see section V of this document (Public Participation).

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

A link to the docket web page can be found at: http:// www1.eere.energy.gov/buildings/appliance_standards/commercial/high_intensity_discharge_lamps.html. This web page will contain a link to the docket for this notice on the regulations.gov site. The regulations.gov web page will contain simple instructions on how to access all documents, including public comments, in the docket. See section V for information on how to submit comments through regulations.gov.

FOR FURTHER INFORMATION CONTACT:

Dr. Tina Kaarsberg, U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Building Technologies Program, EE-2J, 1000 Independence Avenue, SW., Washington, DC, 20585-0121. Telephone: (202) 287-1393. Email: Tina.Kaarsberg@ee.doe.gov.

Ms. Elizabeth Kohl or Ms. Jennifer Tiedeman, U.S. Department of Energy, Office of the General Counsel, GC-71, 1000 Independence Avenue, SW., Washington, DC, 20585-0121. Telephone: (202) 586-7796 or (202) 287-6111. Email: Elizabeth.Kohl@hq.doe.gov or Jennifer.Tiedeman@hq.doe.gov.

SUPPLEMENTARY INFORMATION

I. Background and Authority

Title III of the Energy Policy and Conservation Act (42 U.S.C. 6291, et seq.; "EPCA" or, "the Act") sets forth a variety of provisions designed to improve energy efficiency. (All references to EPCA refer to the statute as amended through the Energy Independence and Security Act of 2007 (EISA 2007), Pub. L. 110-140 (Dec. 19, 2007)). Part B of title III (42 U.S.C. 6291–6309) establishes the "Energy Conservation Program for Consumer Products Other Than Automobiles." Part C of title III, "Certain Industrial Equipment" (42 U.S.C. 6311–6317),

establishes an energy conservation program for such equipment. (For editorial reasons, Parts B and C were re-designated as Parts A and A-1 on codification in the U.S. Code). While HID lamps are defined in 42 U.S.C. 6291(46), DOE is required to set standards for HID lamps in 42 U.S.C. 6317(a)(1)). Therefore, DOE has determined that the provisions of Part C are applicable to HID lamps.

Under EPCA, this program consists essentially of four parts: (1) testing; (2) labeling; and (3) Federal energy conservation standards; and (4) certification, compliance, and enforcement. The testing requirements consist of test procedures that manufacturers of covered equipment must use (1) as the basis for certifying to DOE that their equipment complies with the applicable energy conservation standards adopted under EPCA (42 U.S.C. 6295(s) and 6316(a)); and (2) for making representations about the efficiency of this equipment (42 U.S.C. 6315(b)). Similarly, DOE must use these test requirements to determine whether the equipment complies with any relevant standards promulgated under EPCA. (42 U.S.C. 6295(s) and 6316(a)(1))

General Test Procedure Rulemaking Process

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

EPCA requires DOE to prescribe test procedures for HID lamps within 30 months of determining that energy conservation standards are technologically feasible and economically justified, and would result in significant energy savings. (42 U.S.C. 6317(a)(1)) DOE published a positive final notice of determination (determination) regarding HID lamps on July 1, 2010, concluding that energy conservation standards for certain HID lamps are technologically feasible and economically justified, and would likely result in significant energy savings. 75 FR 37975. DOE intends to publish any final HID lamp test procedures by January 1, 2013.

In today's NOPR, DOE proposes to establish test procedures for HID lamps based on industry standards pertaining to HID lamp measurements.

II. Summary of the Notice of Proposed Rulemaking

The proposed test procedures include methods to determine lamp power and lumen output[1] (lamp efficacy in lumens per watt), and would also provide for the efficiency measurement of directional lamps using center beam intensity (in candelas[2])[3] and beam angle. The proposed procedures would also measure lumen maintenance (i.e., the percentage of lamp light output relative to initial output, over time)[4] at 40 percent and 70 percent of rated lamp

[1] A lumen is a unit of light output weighted to the spectral response of the human eye.
[2] One candela is equal to one lumen per steradian.
[3] Center beam intensity is synonymous with centerbeam candlepower (commonly abbreviated as CBCP). Candlepower is now an obsolete term, but equates directly to the candela.
[4] Lumen maintenance is the percentage or fraction of initial lumens. The higher the lumen maintenance value (closer to 1.00), the more the source maintains the initial efficacy at the point time measured.

lifetime. CCT and CRI would also be measured because DOE may consider delineating HID equipment classes using these metrics.

Efficacy of HID lamps is calculated based on the measured lumen output and the measured input electrical power. DOE proposes that the input power measurements be performed using the measurement methods for lamp current and voltage prescribed in American National Standards Institute (ANSI) C78.389-2006 (C78.389), "Electric Lamps - High Intensity Discharge - Methods of Measuring Characteristics," and the measurement method for lumen output prescribed in Illuminating Engineering Society of North America (IES) LM-51 (LM-51), "Approved Method for the Electrical and Photometric Measurements of High Intensity Discharge Lamps," and the measurement method for luminous intensity prescribed in ANSI C78.379-2006 (C78.379), "For Electric Lamps – Classification of Beam Patterns of Reflector Lamps." DOE also proposes that lamp current, voltage, and lumen output measurements be performed while operating the lamp with an appropriately rated reference ballast.[5] DOE proposes that lumen maintenance measurements be performed using the measurement methods prescribed in IES LM-47 (LM-47), "IESNA Approved Method for Life-Testing of HID Lamps." Under DOE's proposal, CCT and CRI would be obtained from spectroradiometric measurements of the light output in the visible spectrum.[6] CCT and CRI would be calculated by numerical evaluation of the color characteristics as prescribed in International Commission on Illumination (Commission Internationale de l'Eclairage (CIE)) 13.3 and CIE 15 using spectroradiometric measurement data.

[5] An appropriately rated reference ballast provides specified power, voltage, and current required to operate the lamp. Its ballast and power supply specifications are from data sheets listed by the references in ANSI C78.389. They are intended to provide reasonable stringency in terms of power quality and to ensure repeatable and consistent electrical measurements.

[6] Spectroradiometry is the measurement of the spectral content of a radiating source as a function of wavelength.

The following industry standards and test procedures relevant to this NOPR are proposed to be incorporated by reference into the HID test procedure at 10 CFR part 431, subpart Y:

1. ANSI C78.379-2006, "For Electric Lamps - Classification of Beam Patterns of Reflector Lamps";
2. ANSI C78.389-R2009, "For Electric Lamps - High Intensity Discharge - Methods of Measuring Characteristics" (sections 1.0, 2.0, 3.0, and Figure 1);
3. CIE 13.3-1995 (CIE 13.3), "Technical Report: Method of Measuring and Specifying Colour Rendering Properties of Light Sources";
4. CIE 15:2004 (CIE 15), "Technical Report: Colorimetry";[7]
5. IES LM-47-01, "Approved Method for Life Testing of High Intensity Discharge (HID) Lamps"; and
6. IES LM-51-00, "Approved Method for the Electrical and Photometric Measurements of High Intensity Discharge Lamps" (sections 1.0, 3.2, 9.0, 10.0, 11.0, and 12.0).

As discussed in further detail in section III.E, DOE has concluded that HID lamps (without ballasts) are incapable of either standby mode or off mode energy use. HID lamps do not have additional features besides light output and thereby cannot operate in standby mode. HID lamps cannot be in off mode because there is no condition in which the lamp is connected to the main power source (via the ballast) and is not in a mode already accounted for in either active mode or standby mode. Therefore, DOE does not propose measurement methods to determine energy use in either standby mode or off mode for HID lamps.

[7] "Colorimetry" referenced is the science and technology of human color perception.

III. Discussion

DOE proposes to require measurement of both photometric and electrical characteristics of HID lamps to calculate HID lamp efficacy. DOE reviewed ANSI C78.379, ANSI C78.389, CIE 13.3, CIE 15, IES LM-47, and IES LM-51 in developing the proposed test procedures for HID lamps. From these industry test procedures, DOE proposes lamp selection, test setup, and test conditions for HID lamps.

The proposed photometric measurement methods for lamp light output (also referred to as luminous flux) for omni-directional lamps, measured in lumens, and luminous intensity for directional lamps, measured in candelas,[8] are detailed in LM-51. CCT and CRI typically are derived from spectroradiometric measurement of lamp light output. Color measurement and calculation of CCT are detailed in CIE 15. Calculation of CRI is detailed in CIE 13.3.

The proposed electrical measurement methods are provided in ANSI C78.389 and include line voltage, lamp voltage, current (measured in amperes), and lamp electrical power input (measured in watts). Under ANSI C78.389, electrical measurements are to be performed when operating the lamp with an appropriately rated reference ballast that provides specified power, voltage, and current required to operate the lamp as stated in data sheets referenced by ANSI C78.389. The reference ballast itself is to be operated from a power supply with specified voltage and impedance requirements. Reference ballast and power supply specifications, set

[8] Center beam intensity is the intensity at nadir (directly in front of the lamp). Luminous intensity is the output in candelas at multiple angles beyond nadir and is how beam angle is calculated.

forth in the standards referenced by ANSI C78.389, are intended to provide a level of power quality that enables repeatable and consistent electrical measurements.

DOE further proposes that, prior to any measurement, lamps be stabilized by the methods specified for each lamp type in ANSI C78.389, section 3.7. A lamp is considered to be stabilized when successive electrical characteristic measurements remain within a given percentage range over a given period of time. There is some variation in the ANSI measurement procedure to determine lamp stabilization proposed for the three types of HID lamps—mercury vapor (MV), high-pressure sodium (HPS), and metal halide (MH). For MV lamps, electrical characteristic measurement values must remain within 1 percent of each other for three consecutive measurements over a 15 minute period. For HPS lamps, electrical characteristic measurement values must also remain within 1 percent of each other for three consecutive measurements spaced 10–15 minutes apart. For MH lamps, electrical characteristic measurement values may vary up to 3 percent of each other for three consecutive measurements spaced 10–15 minutes apart.

In accordance with the stabilization methods in ANSI C78.389, DOE specifies a lamp aging time and burning position, as described in section III.D. DOE further proposes that all test measurements be performed at an ambient temperature of 25 °C ±5 °C with an interior air speed rate of less than or equal to 0.5 meters/second.

The following sections set forth proposed definitions for the HID test procedure, detailed discussion of the proposed test method, and proposed laboratory accreditation requirements.

A. Definitions

In today's proposed rule, DOE proposes definitions for the following terms based on the EPCA definitions of these terms: "ballast" (42 U.S.C. 6291(58)), "color rendering index" (42 U.S.C. 6291(30)(J)), "correlated color temperature" (42 U.S.C. 6291(30)(K)), "high-intensity discharge lamp" (42 U.S.C. 6291(46)), "mercury vapor lamp" (42 U.S.C. 6291(47)(A)), and "metal halide lamp" (42 U.S.C. 6291(63)).

As explained in section III.A.1, DOE also proposes to adopt definitions of "beam angle," "directional lamp," "high-pressure sodium lamp," "lamp electrical power input," "lamp wattage," "lumen maintenance," "rated luminous flux or rated lumen output," and "self-ballasted lamp." Many of the proposed definitions are identical or very similar to the definitions set forth in 10 CFR part 430 for consumer products. As discussed in section III.A.2, DOE also proposes to amend the definition of "ballast efficiency." As discussed in III.A.3, DOE proposes a definition of "basic model" for HID lamps.

1. Definitions Relevant to High-Intensity Discharge Lamps

In this NOPR, DOE proposes to define the following terms: "beam angle," "directional lamp," "high-pressure sodium lamp," "lamp efficacy," "lamp electrical power input," "lamp wattage," "lumen maintenance," "rated luminous flux or rated lumen output," and "self-ballasted lamp."

DOE proposes to define "beam angle" as follows: "'Beam angle' means the beam angle (or angles) as measured according to the requirements of ANSI C78.379, including complex beam angles as described in ANSI C78.379."

DOE proposes to define "directional lamp" as follows: "'Directional lamp' means a lamp emitting at least 80 percent of its light output within a solid angle of π steradians (corresponding to a cone with an angle of 120 degrees)."[9]

DOE proposes to define "high-pressure sodium lamp" as follows: "'High-pressure sodium (HPS) lamp' means a high-intensity discharge lamp in which the major portion of the light is produced by radiation from sodium vapor operating at a partial pressure of about 6,670 pascals (approximately 0.066 atmospheres or 50 torr) or greater." By including pressure equivalents in both atmospheres and torr, DOE's proposed definition would harmonize with the existing statutory definition of "mercury vapor lamp," which includes both units of pressure (pascals and atmospheres). (42 U.S.C. 6291(47)(A))[10]

[9] DOE reviewed definitions for directional lamps with optical characteristic similar to those of HID directional lamps (e.g., incandescent reflector lamps) and found that definitions for reflector lamps typically focus on the construction of the lamp and not the direction in which the light leaves the lamp. 10 CFR 430.2 Existing HID lamps that are considered directional are offered in various bulb shapes (e.g., R40, R111, PAR 20, PAR 30, and PAR 38), and future lamps may take different non-conforming shapes and forms while providing similar light output delivery. Therefore the proposed DOE definition is based on the directional delivery of light output and not the construction of the lamp. The proposed definition of "directional lamp" is based on the European Union definition (Commission Regulation (EC) No 244/2009, O.J. L 76, 24 March 2009).

[10] DOE proposes to define "high-pressure sodium lamp" based on a comment from the National Electrical Manufacturers Association (NEMA) in response to the HID lamps notice of proposed determination, 75 FR 22031, 22033 (April 27, 2010), and discussed in the HID lamps final determination, 75 FR 37975, 37977 (July 1, 2010). NEMA recommended that DOE adopt the definition for "HPS lamps" from ANSI C82.9-1996, "American National Standard for High-Intensity Discharge and Low-Pressure Sodium Lamps, Ballasts and Transformers – Definitions (ANSI C82.9)." (Docket No. EERE-2006-DET-0112, NEMA, No. 0021.1 at p. 3) Under subsection 3.27, "Definitions," ANSI C82.9-1996 defines "HPS lamp" as "[a] high-intensity-discharge (HID) lamp in which the major portion of the light is produced from radiation from sodium vapor operating at a partial pressure of about 6.67×10^3 pascals (50 torr) or greater." DOE proposes to adopt a similar definition.

DOE proposes to adopt a definition for "lamp efficacy" similar to that set forth at 10 CFR part 430, subpart B, appendix R,[11] where DOE defines "lamp efficacy" as "the ratio of measured lamp lumen output in lumens to the measured lamp electrical power input in watts, rounded to the nearest tenth, in units of lumens per watt." DOE proposes in this rulemaking to replace "lamp lumen output" with "rated luminous flux or rated lumen output" and to add the abbreviation "lm/W" after "lumens per watt." The term "rated luminous flux or rated lumen output" is consistent with DOE's proposed definition for "lumen maintenance," and means the same thing as "lamp lumen output." Therefore, DOE proposes to define "lamp efficacy" as follows: "'Lamp efficacy' means the ratio of rated lumen output (or rated luminous flux) to the measured lamp electrical power input in watts, rounded to the nearest tenth, in units of lumens per watt (lm/W)."[12]

DOE proposes to define "lamp electrical power input" as follows: "'Lamp electrical power input' means the total electrical power input to the lamp, including both arc and cathode power where appropriate, at the reference condition, in units of watts." This definition is the same as that set forth at 10 CFR part 430, subpart B, appendix R.

[11] 10 CFR 430.2 defines lamp efficacy as "the measured lumen output of a lamp in lumens divided by the measured lamp electrical power input in watts expressed in units of lumens per watt (LPW)." 10 CFR part 430, subpart B, appendix R defines it as "the ratio of measured lamp lumen output in lumens to the measured lamp electrical power input in watts, rounded to the nearest tenth, in units of lumens per watt." The primary difference between the definitions is the rounding of the values.

[12] DOE notes that EPCA defines "lamp efficacy" to mean the lumen output of a lamp divided by its wattage, expressed in lumens per watt. This proposed definition interprets the EPCA definition for this rulemaking.

DOE proposes the following definition for "lamp wattage" in this rulemaking: "'Lamp wattage' means the total electrical power required by a lamp in watts, measured following the initial aging period referenced in the relevant industry standard." (42 U.S.C. 6291(30)(O))[13]

DOE proposes a definition for "lumen maintenance" as follows: "'Lumen maintenance' means the luminous flux or lumen output at a given time in the life of the lamp and expressed as a percentage of the rated luminous flux or rated lumen output, respectively." This definition is the same as that set forth at 10 CFR part 430, subpart B, appendix W, section (2)(c).

DOE proposes a definition for "rated luminous flux or rated lumen output" as follows: "'Rated luminous flux or rated lumen output' means the initial lumen rating (100 hour) declared by the manufacturer, which consists of the lumen rating of a lamp at the end of 100 hours of operation."[14] This is the same definition as is set forth at 10 CFR part 430, subpart B, appendix W, section (2)(d).

DOE proposes to define "self-ballasted lamp"[15] based on the definition for "self-ballasted CFL lamp" found in 10 CFR 430 subpart B, appendix W, section (2)(h), as follows: "'Self-ballasted lamp' means a lamp unit that incorporates all elements that are necessary for the starting and stable operation of the lamp in a permanent enclosure, and that does not include any replaceable or interchangeable parts."

[13] The EPCA definition for "lamp wattage" is "the total electrical power consumed by a lamp in watts, after the initial seasoning period referenced in the appropriate IES standard test procedure and including, for fluorescent, arc watts plus cathode watts." This proposed definition interprets the EPCA definition for this rulemaking.
[14] Luminous flux is the numerator in the lamp efficacy equation.
[15] Self-ballasted lamps have different characteristics from lamps that work with an external ballast. This definition is required to distinguish this lamp type.

2. Definition of "Ballast Efficiency" for Metal Halide Lamp Fixtures

DOE proposes an amended definition of "ballast efficiency" for metal halide lamp fixtures, currently set forth at 10 CFR 431.322, to correspond to the definitions proposed in section III.B.1. Currently, "ballast efficiency" for a high-intensity discharge fixture means, in relevant part, the efficiency of a lamp and ballast combination, expressed as a percentage, and calculated in accordance with the following formula: Efficiency = P_{out}/P_{in} where:

(1) P_{out} equals the measured operating lamp wattage;

(2) P_{in} equals the measured operating input wattage;"

10 CFR 431.322[16]

The meaning of the term "P_{out}" as currently defined for ballast efficiency is the same as DOE is proposing for "lamp electrical power input." To avoid confusion where "P_{out}" refers to the lamp wattage when testing a ballast for HID fixtures, and "lamp electrical power input" refers to lamp wattage when testing a HID lamp, DOE proposes to amend the definition of "ballast efficiency" as follows: "'Ballast efficiency' means, in the case of a high-intensity discharge fixture, the efficiency of a lamp and ballast combination, expressed as a percentage, and calculated in accordance with the following formula: Efficiency = Lamp electrical power input / Ballast power input where:

[16] EPCA provides a similar definition for the ballast efficiency of an HID ballast and authorizes DOE to modify the definition as necessary or appropriate to carry out the purposes of EPCA. (42 U.S.C. 6291(59)) DOE proposes the amended definition for HID fixtures in accordance with this provision of EPCA because the proposed definition would eliminate ambiguity in the terms used to measure energy efficiency for HID fixtures.

(1) Lamp electrical power input means the total electrical power input to the lamp, including both arc and cathode power where appropriate, at the reference condition, units of watts;

(2) Ballast power input equals the measured operating input wattage;

(3) The lamp, and the capacitor when the capacitor is provided, shall constitute a nominal system in accordance with the ANSI C78.43 (incorporated by reference; see §431.323);

(4) For ballasts with a frequency of 60 Hz, ballast power input and lamp electrical power input shall be measured after lamps have been stabilized according to section 4.4 of ANSI C82.6 (incorporated by reference; see §431.323) using a wattmeter with accuracy specified in section 4.5 of ANSI C82.6; and

(5) For ballasts with a frequency greater than 60 Hz, ballast power input and lamp electrical power input shall have a basic accuracy of ±0.5 percent at the higher of either 3 times the output operating frequency of the ballast or 2.4 kHz."

3. Definition of "Basic Model" for High-Intensity Discharge Lamps

DOE also proposes a definition of "basic model" for the HID lamp test procedures. DOE provides extensive discussion of the concept of "basic model" in the 2010 NOPR for certification, compliance, and enforcement. 75 FR 56796, 56798–99 (Sept. 16, 2010).

DOE proposes to define "basic model" for HID lamps as follows: "'Basic model' with respect to HID lamps means all units of a given type of covered equipment (or class thereof) manufactured by one manufacturer, having the same primary energy source and which have essentially identical electrical, physical, and functional (or hydraulic) characteristics that affect

energy consumption, energy efficiency, water consumption, or water efficiency, and are rated to operate a given lamp type and wattage."

DOE invites comment on the definitions set forth in this section.

B. Test Procedure for Measuring Energy Efficiency of High-Intensity Discharge Lamps

1. Test Setup and Conditions

The proposed test procedures adopt the methods and safety precautions set forth in ANSI C78.389 and LM-51 to obtain consistent and reproducible measurements of the electrical and photometric characteristics of HID lamps. In particular, the lamps being tested are to be operated at the specified conditions (i.e., tested at a given temperature and air speed), with the appropriate power supply characteristics, the lamps operating on the reference circuit before measurements are taken, and the appropriate instrumentation. Each of these factors is described in the following discussion. Lamp stabilization and aging are discussed in section III.B.2, Lamp Selection and Setup.

As stated previously, photometric characteristics proposed to be measured are total luminous flux (lumens), luminous intensity (candelas), CCT, and CRI. Lamp electrical characteristics proposed to be measured are those required to calculate lamp efficacy during normal operation (e.g., line voltage, lamp voltage, input current, and lamp electrical power input). All measured quantities are proposed to be obtained using an appropriately rated reference ballast or power source whose characteristics are within the required specifications listed in section III.B.1.c. The test equipment required to conduct all the test procedures' electric

and photometric measurements is proposed to be calibrated and meet the required performance specifications in ANSI C78.389 and LM-51.

a. Ambient Conditions

The test apparatus must be operated in a location where ambient conditions (e.g., ambient temperature and air speed) are stable, in accordance with the specifications listed as follows.

i. Ambient Test Temperature

DOE proposes an ambient temperature requirement of 25 °C ±5 °C for HID lamp testing in accordance with ANSI C78.389. This is the industry standard temperature for testing most ballasted and non-ballasted light sources (both HID and other types of sources). It is also the temperature required by the MH lamp ballast[17] test procedures final rule. 75 FR 10950, 10956 (March 9, 2010). Although HID lamps are not as sensitive as other lamps to temperature, temperature still affects their performance such that it could affect test results. A specific, standardized, temperature allows for the use of relative photometry for light fixtures. Thus, an ambient temperature requirement of 25 °C ±5 °C is followed in industry standards and practices for HID lamps. DOE invites comment on the proposed ambient temperature requirement.

ii. Air Speed

DOE proposes an air speed limit of ≤ 0.5 meters per second (m/s) for HID lamp testing because, as detailed in the following, higher air speeds affect photometric and electrical data measurements. Although LM-51, section 2.3, states that special precautions against normal room air movements are unnecessary, ANSI C78.389, section 3.3, states that ambient conditions shall

[17] MH (metal halide) is one of the three types of HID lamps.

be draft-free (but provides no definition of the term "draft-free"). During the public meeting for the MH lamp ballast test procedures NOPR, the National Electrical Manufacturers Association (NEMA) requested a definition of "draft-free." (Docket No. EERE-2008-BT-TP-0017, NEMA, No. 0013 at p. 13)[18] Following the public meeting and comment period, DOE received a comment from NEMA requesting that DOE either define "draft-free" or remove it from the MH lamp ballast test procedures. (Docket No. EERE-2008-BT-TP-0017, NEMA, No. 0024 at p. 3) In preparing the MH lamp ballast test procedures final rule, DOE reviewed industry test procedures for the topic of air speed. (Various documents use different terms; therefore, DOE also specifically reviewed the terms "airflow" and "air movement.") 75 FR at 10956 (March 9, 2010). DOE found that air speed requirements varied, with some industry test procedures using non-quantitative terms such as "still air" or "draft free." This proposed HID lamps air speed requirement is the same as the MH lamp ballast testing requirement. DOE's view is that specifying a maximum air speed requirement as part of the test conditions acknowledges industry practices intended to minimize forced convection cooling that could affect measured photometric and electrical data. Thus, DOE proposes to adopt for HID lamp testing the air speed limit of ≤ 0.5 m/s used for testing MH lamp ballasts (75 FR at 10957 (March 9, 2010)) and invites comment on this proposed requirement.

b. Power Supply Characteristics

DOE proposes power supply characteristics for HID lamps test procedures based on ANSI C78.389 and LM-51, as follows.

[18]A notation in this form provides a reference for information that is in the docket of DOE's rulemaking to develop test procedures for metal halide lamp ballasts (Docket No. EERE-2008-BT-TP-0017), which is maintained at www.regulations.gov. This notation indicates that the statement preceding the reference is document number 0013 in the docket for the metal halide lamp ballasts test procedures rulemaking, and appears at page 13 of that document.

i. Voltage Waveshape

DOE proposes to adopt the waveshape requirements set forth in ANSI C78.389 for HID lamp testing. DOE proposes that any lamp being tested be operated with a sinusoidal voltage supply waveshape as recommended by ANSI C78.389, section 3.2, which states that the waveshape of the power supply shall have a root-mean-square (RMS)[19] summation of the harmonic components that remains below 3 percent of the fundamental frequency (i.e., the lowest frequency of the waveform). DOE invites comment on these proposed voltage waveshape requirements.

ii. Voltage Regulation

DOE proposes to adopt the voltage regulation requirements set forth in LM-51, section 3.2, for HID lamp testing, which states that the voltage regulation shall be within ±0.1 percent. DOE also considered ANSI C78.389, section 3.2, which states that the power supply voltage should be regulated such that it will be steady and free of sudden changes (e.g., noise, line transients) and shall be regulated to within ±0.5 percent of the reference ballast voltage rating. ANSI C78.389, section 3.2, also notes that if automatic voltage regulation is not provided, constant checking and readjustments of the supply will be necessary for accurate lamp test measurements. DOE proposes to use the LM-51 requirement for voltage regulation, however, to minimize variations in electrical and photometric measurements and provide more consistent test measurements. DOE proposes that voltage regulation be within ±0.1 percent of the reference ballast voltage rating. DOE invites comment on the voltage requirements proposed.

[19] RMS – is the root-mean-square and comes from a mathematical formula that calculates the "effective" value of any alternating current wave shape. "True" means that the RMS is calculated to the formula where "average responding" use scaling function to calculate the value. "True" is the more accurate type.

iii. Power Supply Impedance

For HID lamp testing, DOE proposes to adopt the power supply impedance measurement method and impedance limit specified in ANSI C78.389, section 3.2, which requires that power supply impedance remain at or below 2 percent of the reference ballast impedance, measured at the point where the reference ballast and lamp are connected. This method requires that variable autotransformers or other voltage transformation devices have kilovolt-ampere ratings of at least five times the lamp wattage. DOE invites comment on this proposed power supply impedance measurement method and impedance limit.

c. Reference Ballasts

DOE proposes to adopt the reference ballast requirements of ANSI C78.389 for HID lamp testing. For HID lamp measurements (electrical and photometric), ANSI C78.389, section 3.4, requires that tested lamps be operated with (1) an appropriately rated reference ballast or (2) a reference ballast with variable impedance that can be set to match the impedance and electrical requirements for each lamp type to be tested. ANSI C78.389 states that the reference ballast should have the impedance and the electrical characteristics required by the lamp being tested to prevent the measured characteristics from differing from those stated by the lamp manufacturer. DOE notes that a ballast with different electrical characteristics, regardless of its impedance, can materially alter the measured electrical characteristics of the lamp.[20] If electrical readings are to be taken on a lamp for which no ANSI standard exists, DOE proposes that the HID reference

[20] ANSI C78.389 states that measuring lamp characteristics using ballasts other than reference ballasts produces results that are not consistent with these test procedures and are only valid for the ballast and circuit used to obtain the results.

ballast have impedance appropriate for the lamp as specified in the standards incorporated by reference in ANSI C78.389.

DOE has determined that reference ballasts are readily available, based on review of industry literature, communication with independent testing laboratories, and communication with industry, and that their use is likely to provide repeatable and consistent measurements. DOE invites comment on its proposed reference ballast requirements based on ANSI C78.389.

d. Instrumentation

DOE proposes to adopt the electrical and photometric instrumentation requirements of ANSI C78.389 and LM-51, respectively, for its HID lamp test procedures. The instruments proposed here for electrical measurements are described in ANSI C78.389, section 3.8. The instruments proposed here for photometric instruments are described in LM-51, section 9.0. These instrumentation requirements for electrical and photometric measurements are detailed in the following sections.

i. Instrumentation Required for Electrical Measurement

DOE proposes that instruments used for electrical measurements be accurate to better than 0.75 percent over a frequency range of 40 to 1000 Hz, with calibration capability (e.g., scale calibration). These accuracy and range requirements are the same as the industry requirement in ANSI C78.389, section 3.8.1.

DOE also proposes that instrument impedance be high compared to the load impedance (high impedance is typically in the megaohm range) for voltage measurements, and low compared to the load impedance (low impedance is typically in the milliohm range) for current measurements to reduce the effects of the measurement instrumentation in the circuit. Specifically, for lamp current measurements, instruments connected in series with the HID lamp being tested would have an impedance such that the voltage drop remains at or below 2 percent (1 percent for HPS lamps) of the rated lamp voltage under the proposal, unless the instrument impedance has already been included as part of the reference ballast impedance. If corrections for the presence of instrumentation in the circuit are to be avoided, the voltage drop shall be at or below 0.75 percent (0.50 percent for HPS lamps) of the rated lamp voltage. For lamp voltage measurements, instruments connected in parallel with the lamp being tested are proposed to not draw more than 1 percent of the rated lamp current. If the correction due to the presence of such instruments is to be avoided, then the current draw is proposed to be limited to 0.5 percent of the rated lamp current. These proposals are consistent with section 3.8.2 of ANSI C78.389.

DOE proposes that instruments selected for HID lamp voltage and current measurement be of the true RMS type and have a specified accuracy and frequency response adequate to meet the specified uncertainty requirements (i.e., ±0.5 percent for voltage and current and ±0.75 percent for wattage).

ii. Instrumentation for Photometric Measurement

DOE proposes that the photometer have a relative spectral responsivity that approximates that of the human eye (i.e., the V-lambda (V(λ)) function). DOE accepts use of either an

integrating sphere or a goniophotometer for such measurements. DOE proposes that photometric measurements of color characteristics be specified in terms of the CIE colorimetry system and CRI. LM-51 provides further details regarding photometric measurements as well as colorimetry and CRI.

In the case of integrating sphere measurements, the spectral responsivity would be measured taking into account the relative spectral throughput of the sphere and detector spectral responsivity.[21] The detector used in an integrating sphere measurement must have a wide field of view (approximating a cosine response) to maximize the sampled area of the sphere wall during measurement. If a diffuser is used on the detector, its surface would need to be mounted flush with the sphere wall.

An integrating sphere for luminous flux measurements must be large enough to allow the sphere's interior ambient temperature to reach thermal equilibrium at the specified ambient temperature and to permit the internal baffle(s) to be small relative to the size of the integrating sphere.

For measurements using a goniophotometer, DOE proposes that the detector required for intensity distribution measurements have a cosine response. This proposed requirement is particularly important for those cases in which the calibration source subtends a smaller viewing angle than the test source. The intensity distribution around a lamp would be determined with a photometer at a recommended minimum distance of five times the longest dimension of the

[21] The relative spectral throughput of an integrating sphere is the ratio of the spectral irradiance on the detector port of the sphere by a reference light source and the spectral irradiance of the same source measured outside the integrating sphere.

lamp. The axis of rotation used to vary the angle between the lamp and the detector is to preserve the lamp orientation relative to the detector to provide measurement consistency and repeatability.

These proposals are consistent with LM-51-00. DOE invites comment on these proposed requirements for instrumentation.

2. Lamp Selection and Setup

a. Basic Model

For HID lamp testing, DOE proposes that the energy efficiency characteristics of each basic model be determined using these test procedures. As discussed in section III.A.2, a "basic model" is a group of lamp models that are essentially identical in design and performance. The rated performance characteristics proposed to be measured (i.e., lumen output, CCT, and CRI) should be similar for all of the lamps represented by a basic model.

b. Sampling Plans

For HID lamp testing, DOE proposes a lamp sampling method similar to that used for general service fluorescent lamps, incandescent reflector lamps, and general service incandescent lamps (GSFL/GSIL/IRL).[22] 10 CFR 430.27(a)(2)(i)–(ii)

DOE proposes to adopt the lamp sampling method from 10 CFR 429.27 for HID lamp testing as follows:

[22] DOE is currently amending the GSFL/GSIL/IRL test procedures. 76 FR 566661 (Sept. 14, 2011).

For each basic model of HID lamps, samples of production lamps from a minimum sample size of 21 lamps are to be tested, and the results for all samples are to be averaged over a consecutive 12-month period. The manufacturer is to randomly select a minimum of three lamps from each month of production for a minimum of 7 months out of the 12-month period. If production occurs during fewer than 7 of such 12 months, the manufacturer is to randomly select three or more lamps from each month of production, and the number of lamps selected for each month is to be distributed as evenly as practicable among the months of production to obtain a minimum sample of 21 lamps. Due to inherent uncertainty in any sample measurement, the confidence limit is set to 95 percent based on the sample's statistical t-test.[23] Any represented characteristic value of a basic model is to be based on this sample and this characteristic value is to be no greater than the lower of:

(A) The mean of the sample, where:

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

and $\bar{X}$ is the sample mean of the characteristic value,[24]

n is the number of samples, and

x_i is the i^{th} sample;

Or,

(B) The lower 95 percent confidence limit (LCL) of the characteristic value true mean divided by 0.97, where:

[23] A t-test is used to determine if two sample groups from the same population are "statistically" different, e.g., variability of distribution about the sample mean. The t-test evaluates this statistical difference by calculating the ratio of sample group mean difference to group variance. This ratio is analogous to a signal to noise ratio: the higher the ratio, the less likely it is that the difference between the two groups is random.

[24] The characteristic value represents the individual observations within a sample.

$$LCL = \bar{X} - t_{0.95}\left(\frac{s}{\sqrt{n}}\right)$$

and $\bar{X}$ is the sample mean of the characteristic value,

s is the sample standard deviation,

n is the number of samples, and

$t_{0.95}$ is the t statistic for a 95-percent one-tailed confidence interval with n-1 degrees of freedom (from statistical tables).

In determining the proposed sampling plan requirements, DOE reviewed sample size requirements for voluntary programs for HID lamps (ENERGY STAR®), European testing requirements, and sample size requirements for other lighting technologies.

ENERGY STAR luminaires (i.e., light fixtures) specification includes testing requirements for luminaires using HID lamps. Metal halide (quartz and ceramic) and HPS lamps are the only HID lamps allowed for ENERGY STAR-qualified luminaires. ENERGY STAR lamp-ballast efficacy testing requires a minimum sample of three lamp-ballast combinations. The remaining ENERGY STAR criteria (CCT, CRI, and lumen maintenance) require a minimum 10 samples of each lamp model be tested.

In 2009, Commission Regulation (EC) No 245 was published in the Official Journal of the European Union. This document included both energy efficiency standards and testing requirements for fluorescent and HID lamps. Annex IV of the document defines the sample size for all lamps as a total of 20 lamps of the same model and from the same manufacturer, randomly selected.

DOE also surveyed testing requirements for non-HID light sources. In 2011, the IES published TM-21-11, which provides the methodology for the lumen maintenance of light-emitting diode (LED) sources and requires a sample size of 20 LEDs. Covered lighting products and equipment where non-power values are being measured (e.g., lumens, CCT, CRI, lumen maintenance) typically have sample sizes of 21 including general service fluorescent, general service incandescent, and incandescent reflector lamps (10 CFR 429.27) and candelabra base incandescent lamps and intermediate base incandescent lamps (10 CFR 429.40). Bared or covered (no reflector) medium base compact fluorescent lamps (CFLs), however, have sample sizes that vary with the value being measured. Only 5 lamps are needed for efficacy or lumen maintenance, 6 unique (and not previously tested) lamps are required for rapid cycle stress testing, and a minimum of 10 units are required for life testing for these CFLs.

Based on its review of sample size requirements, DOE proposes to use a sample size of 21 for HID lamps. This is the same requirement as GSFL/GSIL/IRL, and is similar to the European Union's requirement of 20 samples. An odd number of lamps is required to establish a majority of surviving or failed lamps for life testing, whereas an even number could produce a 50-50 split. Although lamp life is not a metric required in these proposed test procedures, manufacturers will likely use the same set of lamps for life testing as they do for the lumen maintenance testing. The sample size of 21 addresses the variability in lamp production, and the 95 percent confidence limit minimizes the tolerances in the testing instrumentation.

In summary, DOE proposes to base the sampling method for HID lamp testing on the method set forth in 10 CFR 429.27. For each basic model of HID lamp, DOE proposes that the same samples be used for measuring color characteristics as were used for luminous output (i.e., lumens and candelas (where required)) and power. The sampling method for HID lamps would be set forth as a new section in 10 CFR part 429. DOE invites comment on the accuracy and applicability of the proposed sampling method, and whether an alternative sampling method would be more appropriate for HID lamps.

c. Lamp Aging and Stabilization

For HID lamp testing, DOE proposes a lamp aging method based on ANSI C78.389, section 3.7, to ensure stable photometric, color, and electrical characteristics of the lamp being tested. Aging is performed once, for 100 hours, on every lamp before stabilization and testing. ANSI C78.389, section 3.7, requires that, during the aging period, the lamp be operated in the same orientation in which it will be used.[25] DOE invites comment on the proposed lamp aging method for HID lamp testing. Standard lamp orientation (burning position) would be base up unless otherwise designated by the manufacturer.[26]

Lamps being tested for lumen maintenance are proposed to be operated with an appropriately rated ballast as described in section III.B.1.c, or power source under specified normal operating conditions, defined in the following sections, and be operated in the same orientation used for the test procedures.

[25] For example, if the lamp is to be operated in the base-down position, the lamp must be operated ("burned in" or "aged") in that base-down position.
[26] Lamp orientation is designated in the lamp designation (catalog code) and included in manufacturer catalogs, specification sheets, and the packaging.

DOE also proposes a lamp stabilization method based on ANSI C78.389, section 3.7. Under this proposal, after its one-time aging period, a lamp being tested should achieve stable operation prior to any measurements. DOE included metal halide lamp operational stability in the MH lamp ballast test procedures final rule, determining operational stability for tested ballasts based on three consecutive measurements of lamp power, 5 minutes apart, in which the three measurements had to remain within 2.5 percent tolerance. 75 FR at 10958 (March 9, 2010). As detailed in ANSI C78.389, section 3.7, HID lamp stabilization requirements vary with lamp type. Table III.1 lists the lamp warm-up, stabilization, and re-stabilization requirements for MV, HPS, and MH lamps under ANSI C78.289. For example, MV lamps require a 15 to 20 minute warm-up period, with stable operation indicated by three consecutive measurements of the lamp's electrical characteristics over a 15 minute period that vary by 1 percent or less.

Table III.1 ANSI C78.389 HID Lamp Warm-Up and Stabilization Criteria

Lamp Type	Lamp Warm-Up Time	Stabilization Criteria
MV	15–20 mins	3 successive measurements (voltage and current) 5 minute measurement intervals Change in value < 1.0%
HPS	1 hour	3 successive measurements (voltage and current) 10-15 minute measurement intervals Change in value < 1.0%
MH	6 hours Operated within ±10% rated wattage	3 successive measurements (voltage and current) 10-15 minute measurement intervals Change in value < 3.0%

For HID lamp testing, DOE proposes to adopt the more detailed lamp-specific stabilization requirements of ANSI C78.389, section 3.7, as shown in Table III.1. DOE invites comment on these proposed requirements, as well as any appropriate alternative lamp stabilization procedures.

d. Lamp/Circuit Transfer

DOE proposes to adopt the lamp transfer and re-stabilization methods of ANSI C78.389, section 3.7, for HID lamp testing. HID lamps are very sensitive to movement once they are warmed up and stabilized. Therefore, any significant movement or disturbance could destabilize the lamp operation, altering its output or electrical characteristics and requiring the lamp to be re-stabilized prior to testing. The re-stabilization time varies by lamp type, whether the lamp arc has been extinguished, and whether lamp orientation has changed. Lamps are often "pre-burned" on a different ballast than that used for final electrical and photometric testing, which requires moving and re-stabilizing the lamp before final testing can begin.

The lamp cool down and transfer requirements of ANSI C78.389, section 3.7, are shown in Table III.2. The requirements vary by HID lamp type and with the specifics of the lamp movement. Under ANSI requirements, MH lamps that will be physically relocated without a change in orientation must be allowed to cool to 60 °C before moving and then be warmed up for 30 minutes in the new location before stabilization measurements may begin. If its orientation changes, the MH lamp is to be operated for 6 hours in the final testing orientation before stabilization measurements may be taken. HPS lamps require a cooling period of at least 1 hour before the lamps may be moved and restarted prior to stabilization measurements. MV lamps do not require cooling, but must be warmed up before stabilization measurements may be taken after the lamps are moved.

Alternatively, LM-51, section 6.2, states that stabilization may be minimized by switching the lamp between ballasts without extinguishing the arc. Less warm-up time is required if the two ballasts being switched are electrically equivalent; otherwise, an additional warm-up period of 5 to 10 minutes may be required. According to LM-51, section 6.2, some HID lamps may require a brief cooling period before testing may be restarted, in which case another 10 to 30 minutes of warm-up time may be required before stabilization measurements may be taken. LM-51 does not specifically give guidance regarding the cooling requirements, whereas ANSI C78.389 gives specific requirements (e.g., time or temperature) for cooling. LM-51 also generalizes re-stabilization, whereas ANSI C78.389 provides specific guidance for re-stabilization requirements for each of the HID lamp types. Therefore, given the sensitivity to movement of certain types of HID lamps, DOE has opted for the ANSI C78.389 re-stabilization requirements.

Table III.2 ANSI C78.389 HID Lamp Cool Down and Re-stabilization Requirements

Lamp Type	Cooling Requirement	Re-stabilization Time
MV	None	Not in standard Reconfirm stabilized operations upon transfer/restrike
HPS	Allow to cool for 1 hour minimum before relocating	Not in standard Reconfirm stabilized operations upon transfer/restrike
MH	Cool to below 60 ^{o}C if relocating	No relocation no reorientation – 30 minutes Relocation with no reorientation – 30 minutes Reorientation – 6 hours

In summary, DOE proposes to adopt the lamp transfer and re-stabilization methods of ANSI C78.389, section 3.7, for HID lamp testing, as summarized in Table III.2. DOE invites comment on these proposed methods, as well as any alternative appropriate lamp transfer and re-stabilization methods.

e. Lamp Orientation

DOE proposes to adopt the lamp orientation requirements of ANSI C78.389, section 3.6, for HID lamp testing. Lamp orientation is critical for the testing of most HID lamps, and industry procedures have been developed to ensure the correct orientation is maintained for consistent electrical and photometric measurements.

ANSI C78.389, section 3.6, requires that a lamp marked or designated on the lamp's data sheet for use in a specific operating position be tested in that position. If no operating position is specified or the lamp is marked "universal," the lamp is to be operated in the base up position.

In contrast, LM-51 does not contain lamp orientation requirements for testing, except to note that lamp orientation during warm-up must be the same as that during photometry. LM-51 also states that the manufacturer's specifications should be consulted for any restrictions on lamp orientation.

In summary, DOE proposes to adopt the more specific lamp orientation requirements of ANSI C78.389, section 3.6, for HID lamp testing because ANSI provides specific guidance for both MH and MV lamps where lamp position is critical. ANSI C78.389 also provides default guidance if no position is specified. DOE invites comment on these proposed requirements, as well as on any appropriate alternative lamp testing orientation requirements.

3. Special Considerations for Directional Lamps

Directional lamps, which are typically reflector lamps with a discernible beam pattern, have different set-up and measurement requirements than do omni-directional lamps. Care must be taken to ensure a directional lamp is properly positioned prior to testing for accurate measurement of center beam intensity and beam angle. There are also additional calculations required to determine the beam angle of directional lamps. DOE proposes that set-up and measurement of directional lamps be done in accordance with ANSI C78.379, which provides classification of beam patterns and specification of directional lamp measurement and evaluation. DOE invites comment on its proposal to adopt the test methods outlined in ANSI C78.379 for directional lamps.

C. Laboratory Accreditation Program

DOE proposes to adopt the requirements for selecting testing laboratories for HID lamps from the GSFL/GSIL/IRL test procedures final rule. 74 FR 31829, 31841 (July 6, 2009). That rule states that testing is to be conducted by test laboratories accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) or by an accrediting organization recognized by NVLAP. NVLAP establishes standards for the accreditation of laboratories that test for compliance with relevant industry standards pursuant to 15 CFR 285.3. A manufacturer's or importer's own laboratory, if accredited, may be used to conduct the applicable testing. 15 CFR 285.3

DOE invites comment on these proposed requirements, as well as any alternative requirements for testing laboratory selection.

D. Test Measurements and Calculations

1. Measurement and Calculation of Efficacy

DOE proposes that HID lamp efficacy be calculated as the lumen output divided by the input lamp wattage measured, with the resulting quotient rounded off to the nearest tenth of a lumen per watt. This requirement is consistent with the 2009 GSFL/GSIL/IRL test procedures final rule, in which DOE required testing to a tenth of a lumen per watt. 74 FR 31829, 31836 (July 6, 2009). DOE invites comment on this proposed efficacy calculation method.

2. Measurement and Calculation of Center Beam Intensity and Beam Angle

As indicated in section III.B.3, directional lamps have different set-up and measurement requirements than do omni-directional lamps. DOE proposes to adopt the procedure described in ANSI C78.379 for measuring center beam intensity, beam angle, and other relevant characteristics of directional lamps with symmetrical or asymmetrical beams. For lamps with complex beam patterns (e.g., containing multiple lobes of varying intensity), DOE proposes to adopt the procedure described in ANSI C78.379, annex A, for HID lamp testing. DOE invites comment on the proposed test procedures, as well as any appropriate alternative test procedures for center beam intensity measurement.

3. Test Method for Measuring Lumen Maintenance

DOE received comments on the proposed HID lamps determination from NEMA supporting DOE's inclusion of lumen maintenance in potential energy conservation standards. (Docket No. EERE-2006-DET-0112, NEMA, No. 0021 at p. 2) DOE proposes to include

measuring lumen maintenance (i.e., the percentage (or fraction) of lamp light output relative to initial output, over time) for HID lamps. As discussed in the HID lamp determination technical support document, different manufacturers choose different points of rated life to measure lumen maintenance for the different HID lamps.[27] The proposed DOE test method for lumen maintenance would provide a standard measurement for this metric. In addition, lumen maintenance is a more significant issue for HID lamps than for other electric lamps, and DOE already measures lumen maintenance for compact fluorescent lamps, using the procedure at 10 CFR 430, subpart B, appendix W. For HID lamp testing, DOE proposes to adopt the test method described in LM-47, wherein lamp lumen maintenance is determined after initial lamp aging and initial lumen output measurement. At a minimum, the lumen maintenance measurements are to be collected at 40 percent and 70 percent of rated lamp life, as described in LM-47.

DOE invites comment on the proposed test method, as well as any appropriate alternative test method for determining HID lamp lumen maintenance.

4. Measurement and Calculation of Correlated Color Temperature and Color Rendering Index

DOE proposes to adopt CCT and CRI measurement methods based on CIE 15 and CIE 13.3. The CIE is internationally accepted as the authority for industry standards and references for color, colorimetry, and related practices and procedures. CIE recommendations are peer-reviewed by committee and revised and expanded as needed given new developments in lighting

[27] U.S. Department of Energy–Office of Energy Efficiency and Renewable Energy. Energy Conservation Program for Commercial and Industrial Equipment: Technical Support Document: High-Intensity Discharge Lamps Analysis of Potential Energy Savings Final Determination. June 2010. Washington, D.C. www1.eere.energy.gov/buildings/appliance_standards/commercial/pdfs/hid_nod_tsd_ch3_ta_07_01_2010.pdf.

practice and science. DOE has previously incorporated these standards in the GSFL/GSIL/IRL test procedures final rule. 74 FR 31829, 31834 (July 6, 2009).

In the past, DOE has used CCT to define and categorize certain kinds of lamps (e.g., modified-spectrum fluorescent and incandescent lamps, and general service fluorescent lamps). DOE also created product classes and set efficacy standards based on CCT in the GSFL/GSIL/IRL test procedures final rule. 74 FR at 34097 (July 6, 2009). DOE is considering chromaticity (CCT) as a means to define equipment classes and set energy conservation standards for HID lamps. Currently, there are no industry-accepted color/chromaticity guidelines for HID lamps. DOE examined industry practices and, in particular, the recommendations from IES and CIE organization and industry standards regarding color. For HID lamp testing, DOE proposes to adopt the procedures and methods in CIE 15 to determine HID lamp CCT.

DOE is also considering CRI as a means to define equipment classes and set energy conservation standards for HID lamps. DOE proposes to adopt the methods and procedures set forth in CIE 13.3 to determine lamp CRI. In particular, the methods identified in CIE 13.3 determine a set of 14 special CRI values, 8 of which are used to calculate the lamp CRI.[28,29]

[28] The special values or indices are not actually measured. Standard measurement software incorporates algorithms that compare the measured color information against the indices. CRI then averages the values for special values 1–8.

[29] DOE notes that individual special CRI values can also be used to assess the color rendering or reproduction ability of a lamp for a certain color or colors. When a lighting application requires saturated color rendering to provide accurate or enhanced color appearance, however, the CRI value may not provide sufficient information to make the appropriate choice of lamp. The special CRI value R_9 provides additional color rendering information necessary to select lamps. DOE may consider the CRI value R_9 in setting standards for HID lamps but does not propose measurement of that value in today's test procedures for HID lamps.

DOE invites comment on the proposal to adopt the procedures and methods set forth in CIE 15 to determine lamp CCT, and the procedure and methods in CIE 13.3 to determine CRI, as well as any appropriate alternative methods for determining these lamp color properties.

E. Standby Mode and Off Mode Energy Usage

As discussed previously in section II, there is no standby mode or off mode energy use by HID lamps. DOE has preliminarily concluded that HID lamps do not operate in a standby or off mode. If a covered product is a single-function product and does not offer any secondary user-oriented or protective functions, it does not satisfy the EPCA definition for "standby mode." (42 U.S.C. 6259(gg)(1)(A)(iii)) All covered equipment that meets a relevant definition of HID lamp is single-function equipment that does not offer any secondary user-oriented or protective functions, thus HID lamps do not operate in standby mode. With respect to off mode, HID lamps must be entirely disconnected from the main power source (i.e., the lamp is switched off) in order to not provide any active mode or standby mode functions (i.e., emit light or instant start readiness state), to meet the second provision in the definition of "off mode." (42 U.S.C. 6259(gg)(1)(A)(ii))[30] Therefore, DOE has determined that the HID lamps that are the subject of this rulemaking do not operate in standby mode or off mode, and does not propose to incorporate a test method for either of these modes into the test procedures for HID lamps.[31]

[30] While EPCA authorizes DOE to amend these mode definitions, DOE believes that amendment is unnecessary because the active mode definition is appropriate for HID lamps, and the proposed active mode test procedure accounts for the energy use of these lamps.

[31] In the GSFL/GSIL/IRL test procedure final rule, DOE concluded that measuring off mode and standby mode energy consumption is not applicable to GSFL, GSIL, and IRL because, according to the definitions of ''standby mode'' and ''off mode,'' current technologies of GSFL, GSIL, and IRL do not employ these two modes of operation. As such, DOE did not expand the test procedures to incorporate measurement methods for off mode or standby mode energy consumption of GSFL, GSIL, and IRL. 74 FR 31820, 31833 (July 6, 2009).

F. Effective Date and Compliance Date to the Test Procedures and Compliance Date for Submitting High-Intensity Discharge Certification Reports

The effective date for these test procedures would be 30 days after publication of any final test procedures in the Federal Register**.**

The compliance date for making any representations of the energy efficiency derived from the test procedures is 180 days from the date of the publication of any final test procedures in the Federal Register. On or after that date, any such representations, including those made on marketing materials and product labels, would be required to be based on results generated under the final test procedures and the applicable sampling plans.

Until DOE establishes energy conservation standards for HID lamps, manufacturers, including importers, are not required to submit compliance statements or certification reports for HID lamps. DOE will address these requirements should DOE establish energy conservation standards for HID lamps.

IV. Procedural Issues and Regulatory Review

A. Review Under Executive Order 12866

The Office of Management and Budget (OMB) has determined that test procedure rulemakings do not constitute "significant regulatory actions" under section 3(f) of Executive Order 12866, "Regulatory Planning and Review," 58 FR 51735 (Oct. 4, 1993). Accordingly, this

action was not subject to review under the Executive Order by the Office of Information and Regulatory Affairs (OIRA) in the OMB.

B. Review Under the Regulatory Flexibility Act

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

Today's proposed rule would adopt test procedures for HID lamps based on active industry testing standards, ANSI C78.379, ANSI C78.389, CIE 13.3, CIE 15, IES LM-47, and IES LM-51. DOE has reviewed today's proposed rule under the provisions of the Regulatory Flexibility Act and the policies and procedures published on February 19, 2003. For the reasons explained as follows, DOE certifies that this test procedure rulemaking would not have a significant economic impact on a substantial number of small entities.

The Small Business Administration (SBA) has set size standards for an entity to be classified as a "small business" for the purpose of the regulatory flexibility analysis. DOE used

the SBA's size standards to determine whether any small entities would be required to comply with the rule. See 13 CFR part 121. The size standards are listed by NAICS code and industry description and are available at www.sba.gov/sites/default/files/Size_Standards_Table.pdf. DOE identified applicable size standards for HID lamp manufacturers as NAICS 335110, "Electric Lamp Bulb and Part Manufacturing," and NAICS 335121, "Residential Electric Lighting Fixture Manufacturing." The SBA's size standard for the respective NAICS codes are 1,000 employees or less (NAICS 335110) and 500 employees or less (NAICS 335121).

DOE examined small business manufacturers of equipment covered by this rulemaking to determine whether any of these manufacturers qualified as a small business under the SBA size standards. DOE conducted a market survey in which it reviewed industry trade association membership directories (including NEMA), individual company websites, and marketing research tools (e.g., Dun and Bradstreet reports, Manta) to create a list of companies that manufacture or sell HID lamps covered by this rulemaking. Using these sources, DOE identified 15 possible manufacturers of HID lamps. Table IV.1 lists these manufacturers, the primary NAICS code for the company, and the SBA size standard for the applicable NAICS code.

Table IV.1 Possible Manufacturers of HID Lamps

Manufacturer	NAICS Code	SBA Threshold
Eiko	423610	100 employees
Eye (Iwasaki)	335121	500 employees
Fulham	335311	100 employees
GE Lighting	335121	500 employees
Halco	423610	1,000 employees
Havells	335110	1,000 employees
LiteTronics	423610	1,000 employees
OSRAM SYLVANIA	423490	100 employees
Philips	339112	500 employees
Superior Lamp Inc.	335110	1,000 employees
Superior Lamp Inc.	335110	1,000 employees

Technical Consumer Products (TCP Inc.)	452990	$30M in sales
Topaz	423610	100 employees
Ushio America	423610	100 employees
Venture	335110	1000 employees
Westinghouse Lighting	423610	100 employees

Of the 15 companies listed in the table,[32] DOE could not identify any small business manufacturers. All of the companies either exceeded the applicable size standard, were foreign owned and operated, or were not manufacturers of HID lamps.

In addition, DOE notes that the proposed test procedures for HID lamps are based on test procedures developed and already in general use by industry. These are the same industry standards that manufacturers would need for existing voluntary performance standards, such as the ENERGY STAR program requirements that are the basis for the proposed test procedures. The costs of this testing are described in the following paragraph.

DOE reviewed the potential costs for testing basic models of HID lamps for lumen output, power input, lumen maintenance, color characteristics, and, when applicable, intensity. Recently, NEMA provided a detailed list of costs for testing the lifetime of general service incandescent lamps. Although this is a different product, the two test procedures share elements. Per NEMA's itemized list, $66 is needed for materials per lamp tested and labor and benefits equate to $30 per lamp tested. (Docket No. EERE-2011-BT-TP-0012, NEMA, No. 0008 at p. 4) The HID lamps test procedures involve more tasks (i.e., measuring lumens, measuring power, measuring color characteristics, lumen maintenance) than a lifetime test (e.g., operating the

[32] Table IV.1 has 16 entries because DOE located two headquarters for Superior Lamp Inc.; however, both headquarters appear to belong to the same company.

lamps until a sample population fails); therefore, labor and material costs will probably be somewhat greater for the HID test procedures. DOE estimates approximately between $100 to $200 in both materials and labor per lamp for the HID lamp test procedures. Therefore, with a sample size of 21, the total costs per basic model are between $2,100 and $4,200.

In this NOPR, DOE also proposes to require test facilities conducting HID lamp efficacy, color, and lumen maintenance testing to be accredited by NVLAP or an organization recognized by NVLAP. When accreditation is sought for the first time, DOE has determined that NVLAP imposes fees of $9,000 and $8,000 on years one and two of accreditation, respectively. For the years following, the fees alternate between $5,000 and $8,000, with the $8,000 fee corresponding to the on-site evaluation required every other year. DOE does not expect this requirement to impose a significant additional burden for most manufacturers. Most HID lamp manufacturers also make other lamps that are currently covered products (e.g., GSFL, GSIL, IRL, medium-base compact fluorescent lamps). The test procedures for those lamps already require a laboratory accredited by NVLAP or an NVLAP-recognized organization.

Because the proposed test procedure incorporates the same industry standards that manufacturers would need for existing voluntary performance standards, such as the ENERGY STAR program requirements that are the basis for the proposed test procedures, and because NVLAP certification is already required for other types of lamps typically made by HID manufacturers, DOE does not find that the requirements in this document would result in any significant increase in testing costs.

For the reasons stated in this section, DOE certifies that this proposed rule would not have a significant impact on a substantial number of small entities. Accordingly, DOE has not prepared a regulatory flexibility analysis for this rulemaking. DOE's certification and supporting statement of factual basis will be provided to the Chief Counsel for Advocacy of the Small Business Administration pursuant to 5 U.S.C. 605(b). DOE seeks comment regarding whether the proposed amendments in today's rule would have a significant economic effect on any small entities.

C. Review Under the Paperwork Reduction Act of 1995

There is currently no information collection requirement related to the test procedure for HID lamps. In the event that DOE proposes an energy conservation standard with which manufacturers must demonstrate compliance, or otherwise proposes to require the collection of information derived from the testing of HID lamps according to this test procedure, DOE will seek OMB approval of such information collection requirement.

Manufacturers of covered products must certify to DOE that their products comply with any applicable energy conservation standard developed by DOE. In certifying compliance, manufacturers must test their products according to the applicable DOE test procedure, including any amendments adopted for that test procedure.

DOE established regulations for the certification and recordkeeping requirements for certain covered consumer products and commercial equipment. 76 FR 12422 (March 7, 2011). The collection-of-information requirement for the certification and recordkeeping was subject to review and approval by OMB under the Paperwork Reduction Act (PRA). This requirement was

approved by OMB under OMB Control Number 1910-1400. Public reporting burden for the certification was estimated to average 20 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

As stated above, in the event DOE proposes an energy conservation standard for HID lamps with which manufacturers must demonstrate compliance, DOE will seek OMB approval of the associated information collection requirement. DOE will seek approval either through a proposed amendment to the information collection requirement approved under OMB Control Number 1910-1400 or as a separate proposed information collection requirement.

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

D. Review Under the National Environmental Policy Act of 1969

In this proposed rule, DOE proposes test procedures that it expects will be used to develop and implement future energy conservation standards for HID lamps. DOE has determined that this rule falls into a class of actions that are categorically excluded from review under the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.) and DOE's implementing regulations at 10 CFR part 1021. Specifically, this proposed rule would establish test procedures without affecting the amount, quality, or distribution of energy usage, and

therefore would not result in any environmental impacts. Thus, this rulemaking is covered by Categorical Exclusion A6 under 10 CFR part 1021, subpart D, which applies to any rulemaking that interprets or amends an existing rule without changing the environmental effect of that rule. Accordingly, neither an environmental assessment nor an environmental impact statement is required.

E. Review Under Executive Order 13132

Executive Order 13132, "Federalism," 64 FR 43255 (Aug. 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 at13735. DOE has examined this proposed rule and has determined that it would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the equipment that are the subject of today's proposed rule. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (42 U.S.C. 6297(d)) No further action is required by Executive Order 13132.

F. Review Under Executive Order 12988

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

G. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA) requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Pub. L. 104-4, sec. 201 (codified at 2 U.S.C. 1531). For a proposed

regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of $100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed "significant intergovernmental mandate," and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect small governments. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820; also available at www.gc.doe.gov. DOE examined today's proposed rule according to UMRA and its statement of policy and determined that the rule contains neither an intergovernmental mandate, nor a mandate that may result in the expenditure of $100 million or more in any year, so these requirements do not apply.

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

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

I. Review Under Executive Order 12630

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

J. Review Under the 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 today's proposed rule under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

K. Review Under Executive Order 13211

Executive Order 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," 66 FR 28355 (May 22, 2001), requires Federal agencies to prepare and submit to OMB a Statement of Energy Effects for any proposed significant energy action. A "significant energy action" is defined as any action by an agency that promulgated or is expected to lead to promulgation of a final rule, and that: (1) is a significant regulatory action under Executive Order 12866, or any successor order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy; or (3) is designated by the

Administrator of OIRA as a significant energy action. For any proposed significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use should the proposal be implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

Today's regulatory action to create the test procedures for measuring the energy efficiency of HID lamps is not a significant regulatory action under Executive Order 12866. Moreover, it would not have a significant adverse effect on the supply, distribution, or use of energy, nor has it been designated as a significant energy action by the Administrator of OIRA. Therefore, it is not a significant energy action, and, accordingly, DOE has not prepared a Statement of Energy Effects.

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

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

The proposed test procedures incorporate testing methods contained in the following commercial standards:

1. ANSI C78.379-2006, "For Electric Lamps - Classification of Beam Patterns of Reflector Lamps";
2. ANSI C78.389-R2009, "For Electric Lamps - High Intensity Discharge - Methods of Measuring Characteristics" (sections 1.0, 2.0, 3.0, and Figure 1);
3. CIE 13.3-1995, "Technical Report: Method of Measuring and Specifying Colour Rendering Properties of Light Sources";
4. CIE 15:2004, "Technical Report: Colorimetry";
5. IES LM-47-01, "Approved Method for Life Testing of High Intensity Discharge (HID) Lamps"; and
6. IES LM-51-00, "Approved Method for the Electrical and Photometric Measurements of High Intensity Discharge Lamps" (sections 1.0, 3.2, 9.0, 10.0, 11.0, and 12.0).

DOE evaluated these standards and is unable to conclude whether they fully comply with the requirements of section 32(b) of the Federal Energy Administration Act, (i.e., that they were developed in a manner that fully provides for public participation, comment, and review). Before prescribing a final rule, DOE will consult with the Attorney General and the Chairman of the FTC about the effect of these test procedures on competition.

V. Public Participation

A. Attendance at Public Meeting

The time, date, and location of the public meeting are listed in the DATES and ADDRESSES sections at the beginning of this document. If you plan to attend the public meeting, please notify Ms. Brenda Edwards at (202) 586-2945 or Brenda.Edwards@ee.doe.gov. As explained in the ADDRESSES section, foreign nationals visiting DOE Headquarters are subject to advance security screening procedures.

In addition, you can attend the public meeting via webinar. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's website www1.eere.energy.gov/buildings/appliance_standards/commercial/high_intensity_discharge_lamps.html. Participants are responsible for ensuring their systems are compatible with the webinar software.

B. Procedure for Submitting Prepared General Statement for Distribution

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

C. Conduct of Public Meeting

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

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

At the end of all prepared statements on a topic, DOE will permit participants to clarify their statements briefly and comment on statements made by others. Participants should be prepared to answer questions by DOE and by other participants concerning these issues. DOE representatives may also ask questions of participants concerning other matters relevant to this rulemaking. The official conducting the public meeting will accept additional comments or

questions from those attending, as time permits. The presiding official will announce any further procedural rules or modification of the above procedures that may be needed for the proper conduct of the public meeting.

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

D. Submission of Comments

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

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

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

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

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

Submitting comments via email, hand delivery, or mail. Comments and documents submitted via email, hand delivery, or mail also will be posted to regulations.gov. If you do not want your personal contact information to be publicly viewable, do not include it in your comment or any accompanying documents. Instead, provide your contact information on a cover

letter. Include your first and last names, email address, telephone number, and optional mailing address. The cover letter will not be publicly viewable as long as it does not include any comments.

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

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

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

Confidential Business Information. According to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email, postal mail, or hand delivery two well-marked copies: one copy of the

document marked confidential including all the information believed to be confidential, and one copy of the document marked non-confidential with the information believed to be confidential deleted. Submit these documents via email or on a CD, if feasible. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

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

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

E. Issues on Which DOE Seeks Comment

DOE proposes that HID lamp efficacy testing be based on the industry standards ANSI C78.379, ANSI C78.389, CIE 13.3, CIE 15, LM-47, and LM-51.

DOE invites comments and data on the proposed HID lamp test procedures. Although comments are welcome on all aspects of this rulemaking, DOE is particularly interested in comments on the following:

1. Definitions

DOE seeks comments on all of the proposed definitions in this NOPR; see section III.A.

2. Ambient Test Temperatures

DOE invites comments and data on the applicability of the proposed ambient test temperature requirements (25 °C ±5 °C) based on ANSI C78.389. DOE is particularly interested in comments on whether an alternate set of ambient test conditions might be more appropriate for HID lamp testing. See section III.B.1.a.i for a discussion of the proposed ambient temperature conditions.

3. Air Speed

DOE invites comments and data on the appropriateness of adopting the maximum air speed limit (5 ≤ meters per second) for HID lamp testing that DOE required for the MH lamp ballast test procedures. See section III.B.1.a.ii for a discussion of the proposed air movement requirements.

4. Power Supply Characteristics

DOE invites comments on the appropriateness of adopting the waveshape and power source impedance requirements set forth in ANSI C78.389 and the voltage regulation requirement set forth in LM-51, as summarized and discussed in section III.B.1.b.

5. Reference Ballasts

DOE invites comments on the proposed reference ballast requirements and the appropriateness of adopting the recommendations in ANSI C78.389, as summarized and discussed in section III.B.1.c.

6. Instrumentation

DOE invites comments on the proposed instrumentation specifications and the appropriateness of adopting these requirements from the industry standards ANSI C78.389, section 3.8, and LM-51, section 9.0, as summarized and discussed in section III.B.1.d.

7. Sampling Plans

DOE invites comments and data on the precision and applicability of the proposed sample of 21 for HID lamps for testing. DOE seeks comments on whether an alternative sampling method exists that might be more appropriate for HID lamps. See section III.B.2.b for a discussion of the proposed sampling method.

8. Lamp Aging and Stabilization

DOE invites comments and data on the applicability of the proposed 100-hour lamp aging requirement and lamp stabilization method, both of which are set forth in ANSI C78.389, section 3.7. DOE is particularly interested in whether a preferred lamp aging or lamp stabilization approach exists within the industry. See section III.B.2.c for a discussion of the proposed lamp aging and stabilization conditions and requirements.

9. Lamp/Circuit Transfer

DOE has proposed that lamp transfer and re-stabilization methods of HID lamps be performed using the method described in section 3.7 of ANSI C78.389. DOE invites data and comments on whether an alternative method for re-stabilization after lamp transfer should be considered. See section III.B.2.d for a discussion of the method for lamp transfer and re-stabilization.

10. Lamp Orientation

DOE invites comments on the appropriateness of DOE's proposed adoption of the lamp orientation requirements specified in section 3.6 of ANSI C78.389, which require base up positioning unless the manufacturer specifies a different orientation on the lamp, lamp packaging, or lamp data sheet. DOE also seeks comments on whether a preferred lamp orientation approach exists within the industry for lamp testing. See section III.B.2.e for a discussion of the proposed lamp orientation requirements.

11. Special Consideration for Directional Lamps

DOE invites comments on the proposed set-up and measurement methods for directional lamps based on ANSI C78.379. See section III.B.3 for a discussion of proposed beam angle calculations, and section III.D.2 for a discussion of proposed test set-up and measurement requirements.

12. Laboratory Accreditation Program

DOE has proposed adopting the lab accreditation plan in the GSFL/GSIL/IRL test procedures, which would require laboratories that have been accredited by NVLAP or by an accrediting organization recognized by NVLAP for the testing of HID lamps. DOE invites comments on whether additional or alternative requirements for testing laboratories should be considered. See section III.C for a discussion of the proposed laboratory accreditation program.

13. Test Measurements and Calculations

DOE invites data and comments on the applicability of the proposed measurement and calculation of lamp efficacy procedures for omni-directional lamps, as well as the proposed efficiency measurements and calculation procedures for directional lamps using center beam intensity and beam angle. DOE also seeks comment on the measurement methods proposed for lumen maintenance and color characteristics (CCT and CRI) according to the requirements of ANSI C78.379, CIE 13.3, CIE 15, IES LM-47, and LM-51. See section III.E for a discussion of the proposed testing measurements and calculations.

14. Small Entities

DOE seeks comments on its reasoning that the proposed test procedures will not have a significant effect on a substantial number of small entities.

VI. Approval of the Office of the Secretary

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

List of Subjects

10 CFR Part 429

Administrative practice and procedure, Buildings and facilities, Business and industry, Energy conservation, Grants programs – energy, Housing, Reporting and recordkeeping requirements, Technical assistance.

10 CFR Part 431

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

Issued in Washington, DC, on November 28, 2011.

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

For the reasons stated in the preamble, DOE proposes to amend parts 429 and 431 of chapter II of title 10, of the Code of Federal Regulations, as set forth as follows.

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

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

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

2. In §429.2 revise paragraph (a) to read as follows:

§429.2 Definitions.

(a) The definitions found in §§430.2, 431.2, 431.62 431.72, 431.82, 431.92, 431.102, 431.132, 431.152, 431.172, 431.192, 431.202, 431.222, 431.242, 431.262, 431. 282, 431.292, 431.302, 431.322, 431.442, and 431.452 apply for purpose of this part.

* * * * *

3. Section 429.55 is added to read as follows:

§429.55 High-intensity discharge (HID) lamps.

(a) Sampling plan for selection of units for testing. (1) The requirements of §429.11 are applicable to high-intensity discharge (HID) lamps. HID lamps include high-pressure sodium, mercury vapor, and metal halide lamps.

(2)(i) For each basic model of HID lamp, samples of production lamps shall be obtained from a 12-month period, tested, and the results averaged. A minimum sample of 21 lamps shall be tested. The manufacturer shall randomly select a minimum of 3 lamps from each month of production for a minimum of 7 out of the 12-month period. In the instance where production occurs during fewer than 7 of such 12 months, the manufacturer shall randomly select 3 or more lamps from each month of production, where the number of lamps selected for each month shall be distributed as evenly as practicable among the months of production to attain a minimum sample of 21 lamps. Any represented value of lamp efficacy and lumen maintenance of a basic model shall be based on the sample and shall be less than or equal to the lower of:

(A)The mean of the sample, where:

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

and $\bar{X}$ is the sample mean;

n is the number of samples; and

x_i is the i^{th} sample;

Or,

(B)The lower 95 percent confidence limit (LCL) of the true mean divided by 0.97, where:

$$LCL = \bar{X} - t_{0.95}\left(\frac{s}{\sqrt{n}}\right)$$

and $\bar{X}$ is the sample mean;

s is the sample standard deviation;

n is the number of samples, and

$t_{0.95}$ is the t statistic for a 95-percent one-tailed confidence interval with n-1 degrees of freedom (from appendix A).

(ii) For each basic model of high-intensity discharge lamp, the color rendering index (CRI) shall be measured from the same lamps selected for the lumen output and watts input measurements in paragraph (a)(2)(i) of this section i.e., the manufacturer shall measure all lamps for lumens, lamp electrical input power, and CRI. The CRI shall be represented as the average of a minimum sample of 21 lamps and shall be less than or equal to the lower of:

(i)The mean of the sample, where:

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

and $\bar{X}$ is the sample mean;

n is the number of samples; and

x_i is the i^{th} sample;

Or,

(ii) The lower 95 percent confidence limit (LCL) of the true mean divided by 0.97, where:

$$LCL = \bar{X} - t_{0.95}\left(\frac{s}{\sqrt{n}}\right)$$

and $\bar{X}$ is the sample mean;

s is the sample standard deviation;

n is the number of samples, and

$t_{0.95}$ is the t statistic for a 95-percent one-tailed confidence interval with n-1 degrees of freedom (from appendix A).

(b) Certification reports.

[Reserved]

(c) Test data. Manufacturers must include the production date codes and the accompanying decoding scheme corresponding to all of the units tested for a given basic model in the detailed test records maintained under §429.71.

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

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

Authority: 42 U.S.C. 6291–6317.

2. Subpart 431.2 is amended by adding in alphabetical order, definitions for "Ballast", "Beam angle", "Color rendering index or CRI", "Correlated color temperature", "Directional lamp", "High-intensity discharge lamp", "High-pressure sodium (HPS) lamp", "Lamp efficacy", "Lamp electrical power input", "Lamp wattage", "Lumen maintenance", "Mercury vapor lamp", "Metal halide lamp", "Rated luminous flux or rated lumen output", and "Self-ballasted lamp" to read as follows:

§431. 2 Definitions.

* * * * *

Ballast means a device used with an electric discharge lamp to obtain necessary circuit conditions (voltage, current, and waveform) for starting and operating.

Beam angle means the beam angle (or angles) as measured according to the requirements of ANSI C78.379 (incorporated by reference, see §431.453), including complex beam angles, as described in ANSI C78.379.

Color rendering index or CRI means the measured degree of color shift objects undergo when illuminated by a light source as compared with the color of those same objects when illuminated by a reference source of comparable color temperature.

Correlated color temperature means the absolute temperature of a blackbody whose chromaticity most nearly resembles that of the light source.

* * * * *

Directional lamp means a lamp emitting at least 80 percent of its light output within a solid angle of π steradians (corresponding to a cone with an angle of 120 degrees).

* * * * *

High-intensity discharge lamp means an electric-discharge lamp in which –

(i) The light-producing arc is stabilized by the arc tube wall temperature; and

(ii) The arc tube wall loading is in excess of 3 watts/cm^2, including such lamps that are high-pressure sodium, mercury vapor, and metal halide lamps.

High-pressure sodium (HPS) lamp means a high-intensity discharge lamp in which the major portion of the light is produced by radiation from sodium vapor operating at a partial pressure of about 6,670 pascals (approximately 0.066 atmospheres or 50 torr) or greater.

* * * * *

Lamp efficacy means the ratio of rated lumen output (or rated luminous flux) to the measured lamp electrical power input in watts, rounded to the nearest tenth, in units of lumens per watt (lm/W).

Lamp electrical power input means the total electrical power input to the lamp, including both arc and cathode power where appropriate, at the reference condition, units of watts.

Lamp wattage means the total electrical power required by a lamp in watts measured following the initial aging period referenced in the appropriate industry standard.

Lumen maintenance means the luminous flux or lumen output at a given time in the life of the lamp and expressed as a percentage of the rated luminous flux or rated lumen output, respectively.

Mercury vapor lamp means a high-intensity discharge lamp, including clear, phosphor-coated, and self-ballast screw base lamps, in which the major portion of the light is produced by radiation from mercury typically operating at a partial vapor pressure in excess of 100,000 Pa (approximately 1 atm).

Metal halide lamp means a high-intensity discharge lamp in which the major portion of the light is produced by radiation of metal halides and their products of dissociation, possibly in combination with metallic vapors.

* * * * *

Rated luminous flux or rated lumen output means the initial lumen rating (100 hour) declared by the manufacturer, which consists of the lumen rating of a lamp at the end of 100 hours of operation.

Self-ballasted lamp means a lamp unit that incorporates all elements that are necessary for the starting and stable operation of the lamp in a permanent enclosure, and that does not include any replaceable or interchangeable parts.

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§431. 282 [Amended]

3. Section 431.282 is amended by removing the definitions of “ballast”, “high intensity discharge lamp”, and “mercury vapor lamp”.

4. Section 431.322 is amended by removing the definitions of “ballast” and “metal halide ballast”, and revising the definition of “ballast efficiency” to read as follows:

§431. 322 Definitions concerning metal halide lamp ballasts and fixtures.

* * * * *

Ballast efficiency means, in the case of a high-intensity discharge fixture, the efficiency of a lamp and ballast combination, expressed as a percentage, and calculated in accordance with the following formula: Efficiency = Lamp electrical power input / Ballast power input where:

(1) Lamp electrical power input means the total electrical power input to the lamp, including both arc and cathode power where appropriate, at the reference condition, units of watts;

(2) Ballast power input equals the measured operating input wattage;

(3) The lamp, and the capacitor when the capacitor is provided, shall constitute a nominal system in accordance with the ANSI C78.43 (incorporated by reference; see §431.323);

(4) For ballasts with a frequency of 60 Hz, ballast power input and lamp electrical power input shall be measured after lamps have been stabilized according to section 4.4 of ANSI C82.6 (incorporated by reference; see §431.323) using a wattmeter with accuracy specified in section 4.5 of ANSI C82.6; and

(5) For ballasts with a frequency greater than 60 Hz, ballast power input and lamp electrical power input shall have a basic accuracy of ±0.5 percent at the higher of either 3 times the output operating frequency of the ballast or 2.4 kHz.

* * * * *

5. Subpart Y is added to part 431 to read as follows:

Subpart Y – High-Intensity Discharge Lamps

Sec.

§431.451 Purpose and scope.

This subpart contains energy conservation requirements for high-intensity discharge lamps, pursuant to Part A-1 of Title III of the Energy Policy and Conservation Act, as amended, and 42 U.S.C. 6311–6317.

§431.452 Definitions concerning high-intensity discharge lamps.

Basic model with respect to HID lamps means lamps that are of the same designation, or class, and that have identical electrical characteristics and performance characteristics—including wattage, bulb shape, base, lumen output, starting method, correlated color temperature (CCT), and color rendering index (CRI)—and do not have any differing physical or functional characteristics that affect their energy use.

§431.453 Material incorporated by reference.

(a) General. We incorporate by reference the following standards into Subpart Y of Part 431. 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. Any subsequent amendment to a standard by the standard-setting organization will not affect the DOE regulations unless and until amended by DOE. Material is incorporated as it exists on the date of the approval, and a notice of any change in the material will be published in the Federal Register. All approved material is available for inspection at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030 or go to www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html. Also, this 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, 202-58602945, or fo to: http://www1.eere.energy.gov/buildings/appliance_standards/. Standards can be obtained from the sources listed as follows.

(b) ANSI. American National Standards Institute, 25 W. 43rd Street, 4th Floor, New York, NY 10036, 212–642–4900, or go to www.ansi.org.

(1) ANSI C78.379-2006 ("ANSI C78.379"), For Electric Lamps – Classification of the Beam Patterns of Reflector Lamps, approved 2006, IBR approved for §431.454.

(2) ANSI C78.389-2004 (R2009) ("ANSI C78.389"), American National Standard Institute Electric Lamps - High Intensity Discharge - Methods of Measuring Characteristics, approved August 9, 2009, IBR approved for §431.454.

(c) CIE. International Commission on Illumination (Commission Internationale de l'Eclairage) Central Bureau, Kegelgasse 27, A–1030, Vienna, Austria, 011+43 1 714 31 87 0, or go to http://www.cie.co.at.

(1) CIE 13.3-1995 ("CIE 13.3"), Technical Report: Method of Measuring and Specifying Colour Rendering Properties of Light Sources, 1995. IBR approved for §431.454.

(d) CIE 15:2004 ("CIE 15"), Technical Report: Colorimetry, 2004. IBR approved for §431.454.

(c) IES. Illuminating Engineering Society of North America, 120 Wall Street, Floor 17, New York, NY 10005-4001, 212-248-5000, or go to www.iesna.org.

(1) IES LM-47-01 ("LM-47"), Approved Method for Life Testing of High Intensity Discharge (HID) Lamps, 2001. IBR approved for §431.454.

(2) IES LM-51-00 ("LM-51"), Approved Method for the Electrical and Photometric Measurements of High Intensity Discharge Lamps, 2000. IBR approved for §431.454.

§431.454 Uniform test method for calculation of lamp efficacy and lumen maintenance from lamp measurements.

(a) Test Method for Measuring Energy Efficiency of High-Intensity Discharge Lamps

(1) Test Setup and Conditions.

The lamps being tested are to be operated at the required specified conditions with the lamps stabilized and operating on the reference circuit before any measurements are taken.

Photometric characteristics to be measured are total luminous flux (lumens), luminous intensity (candelas), and color characteristics (CCT and CRI). Lamp electrical characteristics to be measured are those required to calculate lamp efficacy during normal operation (e.g., line voltage, lamp voltage, input current, and lamp electrical power input). All measured quantities must be obtained using an appropriately rated reference ballast or power source whose characteristics are within the required specifications listed as follows. The test equipment required to conduct all the necessary test procedure electrical and photometric measurements must be within calibration and meet the required performance specifications in ANSI C78.389 (incorporated by reference, see §431.453) and LM-51 (incorporated by reference, see §431.453). All lamps to be tested must be aged for 100 hours in the same burning position as would be used during testing; typical lamp orientation will be base up unless otherwise designated by the manufacturer. Prior to any measurement, all lamps must be stabilized according to specific methods for each lamp type identified in ANSI C78.389, section 3.7. Lamps placed into long-term testing to determine lumen maintenance shall be operated with an appropriately rated ballast, as described as follows, or power source under specified normal operating conditions, outlined as follows, and must be operated in the orientation specified in paragraph (b)(4) of this section.

(i) Ambient Conditions

The test apparatus must be operated in a location where ambient conditions are stable (e.g., ambient temperature and air movement), in accordance with the specifications listed as follows.

A. Ambient Test Temperature

The ambient temperature shall be 25 °C ±5 °C.

B. Air Speed

The air speed limit shall be ≤ 0.5 meters per second.

(ii) Power Supply Characteristics

Power supply characteristics and instrumentation requirements are specified in ANSI C78.389 and LM-51.

A. Waveshape

Waveshape requirements are set forth in ANSI C78.389. The lamp being tested shall be operated with a sinusoidal voltage supply, and the power supply voltage waveshape shall have a root-mean-square summation of the harmonic components that does not exceed 3 percent of the fundamental frequency.

B. Voltage Regulation

The power supply voltage shall be regulated to within ±0.1 percent of the reference ballast voltage rating.

C. Power Supply Impedance

The power supply impedance shall not exceed 2 percent of the reference ballast impedance measured at the point where the reference ballast and lamp are connected. This method implies that variable autotransformers or other voltage transformation devices have kilovolt-amperes ratings of at least five times the normal lamp wattage.

(iii) Reference Ballasts

For HID lamp testing, the reference ballast used must meet the requirements of ANSI C78.389. For HID lamp measurements (electrical and photometric), the tested lamps must be operated with (1) an appropriately rated reference ballast or (2) a reference ballast with variable impedance that can be set to match each lamp type to be tested. The reference ballast must have the impedance and the electrical characteristics required by the lamp being tested. If electrical

readings are to be taken on a lamp for which no ANSI standard exists, the ballast used shall comply with the general requirements for HID lamp reference ballasts and have impedance appropriate for the lamp as specified in ANSI C78.389.

(iv) Instrumentation

The instruments required for electrical measurements are described in ANSI C78.389, section 3.8. The required photometric instruments are described in LM-51, section 9.0.

A. Instrumentation Required for Electrical Measurement

Instruments used for electrical measurements must be accurate to better than 0.75 percent over a frequency range of 40 to 1000 Hz, with calibration capability (e.g., scale calibration). See ANSI C78.389, section 3.8.1. Instruments connected in series with the HID lamp being tested are to have an impedance such that the voltage drop does not exceed 2 percent (1 percent for HPS lamps) of the rated lamp voltage, unless the impedance has already been included as part of the reference ballast impedance. To avoid instrument-in-circuit corrections, the voltage drop shall not exceed 0.75 percent (0.50 percent for HPS lamps) of the rated lamp voltage. For lamp voltage measurements, instruments connected in parallel with the lamp being tested shall draw less than 1 percent of the rated lamp current. To avoid correcting for the presence of such instruments, the current draw shall be limited to 0.5 percent of the rated lamp current. Instruments selected for HID lamp voltage and current measurement shall be of the true RMS type and have a specified accuracy and frequency response adequate to meet the specified uncertainty requirements (i.e., ±0.5 percent for voltage and current and ±0.75 percent for wattage).

B. Instrumentation for Photometric Measurement

The photometer shall have a relative spectral responsivity that approximates the V-lambda (V(λ)) function. The detector used in an integrating sphere measurement shall have a wide field of view (approximating a cosine response). If a diffuser is used on the detector, its surface shall be mounted flush with the sphere wall. An integrating sphere shall be used for luminous flux measurements and must be large enough to allow the sphere interior ambient temperature to reach thermal equilibrium at the specified ambient temperature and to permit the internal baffle(s) to be small relative to the size of the integrating sphere. In the case of goniophotometer measurements, the detector required for intensity distribution measurements shall have a cosine response. The intensity distribution around a lamp may be determined with a photometer at a recommended minimum distance of five times the longest dimension of the lamp. The axis of rotation chosen to vary the angle between the lamp and the detector shall preserve the lamp orientation relative to the detector to provide measurement consistency and repeatability. Photometric measurements of color characteristics shall be specified in terms of the CIE colorimetry system and CRI.

(b) Lamp Selection and Setup

(1) Lamp Aging and Stabilization

For HID lamp testing, a lamp must be aged using the aging method set forth in ANSI C78.389, section 3.7 (incorporated by reference, see §431.453). A 100-hour aging period must be used by manufacturers of HID lamps to ensure stable photometric, color qualities, and electrical characteristics of the lamp being tested. This aging is performed once for every lamp before stabilization and testing. During the aging period, the lamp must be operated in the same orientation in which it will be used.

After this one-time aging process, a lamp being tested must achieve stable operation prior to any measurements and the lamp stabilization method specified in ANSI C78.389, section 3.7, must be used. As detailed in ANSI C78.389, HID lamp stabilization requirements vary with lamp technology. Table I lists the lamp warm-up, stabilization, and re-stabilization requirements for MV, HPS, and MH lamps.

Table I ANSI C78.389 HID Lamp Warm-Up and Stabilization Criteria

Lamp Type	Lamp Warm-Up Time	Stabilization Criteria
MV	15–20 mins	3 successive measurements (voltage and current) 5 minute measurement intervals Change in value < 1.0%
HPS	1 hour	3 successive measurements (voltage and current) 10-15 minute measurement intervals Change in value < 1.0%
MH	6 hours Operated within ±10% rated wattage	3 successive measurements (voltage and current) 10-15 minute measurement intervals Change in value < 3.0%

(2) Lamp/Circuit Transfer

Lamp transfer and re-stabilization must be conducted according to ANSI C78.389, section 3.7.

The lamp cool down and transfer requirements of ANSI C78.389, section 3.7, are shown in Table II. The requirements vary with HID lamp type, as well as with the specifics of the lamp movement. MH lamps that will be physically relocated without a change in orientation must be allowed to cool to 60 °C before moving and then warmed up for 30 minutes in any new location before stabilization measurements may begin; if the orientation will change, the MH lamp must be operated for 6 hours in the final testing orientation before stabilization measurements may be taken. HPS lamps require a cooling period of at least 1 hour before the lamp may be moved and

re-started prior to stabilization measurements. MV lamps do not require cooling, but must be warmed up before stabilization measurements may be taken after the lamps are moved.

Table II ANSI C78.389 HID Lamp Cool Down and Re-stabilization Requirements

Lamp Type	Cooling Requirement	Re-stabilization Time
MV	None	Not in standard Reconfirm stabilized operations upon transfer/restrike
HPS	Allow to cool for 1 hour minimum before relocating	Not in standard Reconfirm stabilized operations upon transfer/restrike
MH	Cool to below 60 °C if relocating	No relocation no reorientation – 30 minutes Relocation with no reorientation – 30 minutes Reorientation – 6 hours

(3) Lamp Orientation

Lamp orientation requirements are those specified in ANSI C78.389, section 3.6, for HID lamp testing. A lamp marked or otherwise designated for use in a specific operating position must be tested in that position. If no operating position is specified or the lamp is marked "universal," the lamp shall be operated in the base up position.

(c) Laboratory Accreditation Program

Testing for HID lamps shall be conducted by test laboratories accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) or by an accrediting organization recognized by NVLAP. NVLAP establishes standards for the accreditation of laboratories that test for compliance with relevant industry standards pursuant to 15 CFR 285.3. A manufacturer's or importer's own laboratory, if accredited, may be used to conduct the applicable testing.

(d) Test Measurements and Calculations

(1) Measurement and Calculation of Efficacy

HID lamp efficacy shall be calculated as the lumen output divided by the input lamp wattage measured, with the resulting quotient rounded off to the nearest tenth of a lumen per watt.

(2) Measurement and Calculation of Center Beam Intensity and Beam Angle

The test procedure described in ANSI C78.379 (incorporated by reference, see §431.453) shall be followed for measuring center beam intensity and beam angle of directional lamps with symmetrical or asymmetrical beams. For lamps with complex beam patterns, the test procedure described in ANSI C78.379, annex A, shall be followed.

(3) Test Method for Measuring Lumen Maintenance

HID lamp lumen maintenance shall be determined, following the method specified in LM-47 (incorporated by reference, see §431.453), after initial lamp aging and initial lumen output measurement. At a minimum, the lumen maintenance measurements shall be collected at 40 percent and 70 percent of rated lamp life, as described in LM-47.

(4) Measurement and Calculation of Correlated Color Temperature and Color Rendering Index

HID lamp CCT and CRI shall be determined using the methods for measurement and characterizing color set forth in CIE 15 and CIE 13.3 (incorporated by reference, see §§431.453).

§431.455 Energy conservation standards and their compliance dates.

[Reserved]

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