

## DEPARTMENT OF ENERGY

## Office of Energy Efficiency and Renewable Energy

## 10 CFR Part 430

[Docket No. EE-RM-220-IF]

RIN 1904-AA61

## Energy Conservation Program for Consumer Products; Fluorescent and Incandescent Lamp Test Procedures

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

ACTION: Final rule.

**SUMMARY:** This Final Rule amends the currently effective Interim Final Rule on test procedures for certain fluorescent and incandescent lamps and promulgates new and revised regulatory definitions applicable to lamps based on public comments. Lighting manufacturers must use these test procedures to meet the lamp standards in the Energy Policy Act of 1992.

**DATES:** This rule is effective June 30, 1997. The incorporation by reference of certain publications listed in the regulations is approved by the Director of the **Federal Register** as of June 30, 1997.

**ADDRESSES:** Public comments on the Interim Final Rule and the documents incorporated by reference may be viewed at the Department of Energy Freedom of Information Reading Room, U.S. Department of Energy, Forrestal Building, Room 1E-190, 1000 Independence Avenue, SW, Washington, DC 20585, (202) 586-3142, between the hours of 9:00 a.m. and 4:00 p.m., Monday through Friday, except Federal holidays.

The Department of Energy (DOE or the Department) is incorporating by reference the following industry consensus test standards:

1. Illuminating Engineering Society of North America LM-16-1993, "IESNA Practical Guide to Colorimetry of Light Sources."

2. Illuminating Engineering Society of North America LM-20-1994, "IESNA Approved Method for Photometric Testing of Reflector-Type Lamps."

3. Illuminating Engineering Society of North America LM-58-1994, "IESNA Guide to Spectroradiometric Measurements."

4. *Illuminating Engineering Society of North America Lighting Handbook, Reference and Application*, 8th Edition, 1993, Chapter 6, Light Sources.

5. American National Standards Institute C78.21-1989, "Incandescent Lamps—PAR and R Shapes."

6. American National Standards Institute C79.1-1994, "Nomenclature for Glass Bulbs—Intended for Use with Electric Lamps."

Copies of the Illuminating Engineering Society of North America (IESNA) standards may also be obtained from IESNA, Publications Department, 120 Wall Street, Floor 17, New York, NY 10005-4001, (212) 248-5000. Copies of the American National Standards Institute (ANSI) standards may also be obtained from ANSI, 11 West 42nd Street, New York, NY 10036, (212) 642-4936.

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**SUPPLEMENTARY INFORMATION:****I. Introduction**

Part B of Title III of the Energy Policy and Conservation Act, as amended (EPCA or the Act), establishes the Energy Conservation Program for Consumer Products Other Than Automobiles.<sup>1</sup> The consumer and commercial products currently subject to this program (covered products) include general service fluorescent lamps and incandescent reflector lamps, the subjects of today's Final Rule.

The Act specifies that the Secretary of Energy shall prescribe test procedures for fluorescent lamps and incandescent reflector lamps taking into consideration the applicable IESNA or ANSI standards. Section 323(b)(6) of EPCA, 42 U.S.C. 6293(b)(6). The IESNA and ANSI test methods for these products have been reviewed by the National Institute of Standards and Technology of the United States Department of Commerce (NIST) in consultation with the National Electrical Manufacturers Association (NEMA), which represents the lamp manufacturers with the predominant market share. The Department has determined that the referenced test procedures effectively measure lamp efficacy and color rendering index, and they are not unduly burdensome to conduct. Therefore, today's Final Rule incorporates by reference the test methods found in IESNA standards LM-

<sup>1</sup> Part B of Title III of EPCA, as amended, is referred to in this Final Rule as the "Act", and provisions of the Act are referred to either as "Section \_\_\_ of the Act" or as "Section \_\_\_." Part B of Title III is codified at 42 U.S.C. 6291-6309.

16-1993, LM-20-1994, and LM-58-1994 for testing and measuring the color rendering index and performance of fluorescent lamps and incandescent reflector lamps. These revisions of IESNA standards LM-16, LM-20, and LM-58 replace older standards incorporated by reference in the Interim Final Rule on Test Procedures for Fluorescent and Incandescent Lamps (the Interim Final Rule). 59 FR 49468, September 28, 1994. This Final Rule incorporates by reference Chapter 6 from the *IESNA Lighting Handbook* which shows incandescent lamp filament configurations. This Final Rule also incorporates by reference the nomenclature for glass bulbs for lamps found in ANSI C79.1-1994 and the PAR and R bulb shape descriptions found in ANSI C78.21-1989.

Additionally, today's rule extends the date for submission of compliance statements and certification reports for existing lamps to 6 months from the publication of this rule, modifies the sampling plan, and adds definitions for colored lamps, rated voltage, elliptical reflector (ER) and bulged reflector (BR) lamps, and rough and vibration service incandescent lamps.

## II. Background Information

The Interim Final Rule added a new section in the Code of Federal Regulations establishing test procedures for general service fluorescent lamps, medium base compact fluorescent lamps, and general service incandescent lamps. CFR Appendix R to Subpart B of Part 430. The test procedures incorporated by reference ANSI Standards C78.1-1991, C78.2-1991, C78.3-1991, C78.375-1991, C82.3-1983; IESNA Standards LM-9-1988, LM-16-1984, LM-20-1982, LM-45-1991, LM-58-1983, LM-66-1991; and the International Commission on Illumination, Publication 13.2-1974. To provide consumer confidence in the test measurements, the Interim Final Rule adopted a sampling plan based on a 99-percent confidence limit for testing general service fluorescent lamps, general service incandescent lamps, and medium base compact fluorescent lamps. The sampling provisions required testing from a minimum sample of 20 lamps. The Interim Final Rule required that testing be done in a laboratory that is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP), a division of NIST.

The energy conservation standards for general service fluorescent and incandescent reflector lamps prescribed in the Act were included in the Interim Final Rule. The Interim Final Rule also

included certification requirements and definitions of terms related to standards and test procedures for lamps.

The Final Rule differs from the Interim Final Rule in the following principal ways:

- The sampling plan was revised from 20 to 21 lamps.
- Confidence limits were set at 95 percent.
- The derating factor was changed from 0.99 to 0.97.
- The test voltage for incandescent lamps was changed to the rated voltage as defined in this rule.
- The definition of basic model was revised to be independent of a lamp's photometric distribution (i.e., beam spread).
- Definitions for rated wattage and for residential straight-shaped lamp for fluorescent lamps were added.
- The definition of cold temperature fluorescent lamp was revised to require markings for cold temperature use on the lamp.
- The calculations of annual operating costs and energy consumption were revised to allow manufacturers to use any price and operating hour assumptions if the assumptions are clearly and accurately described.
- A provision for use of the pre-1996 valuation for lumens and definitions clarifying coverage of certain fluorescent lamps were added.
- Definitions for BR and ER incandescent lamps, for colored lamps and for rough or vibration service incandescent lamps were added.
- A requirement for manufacturers of new lamp models to state they believe new lamps will meet energy efficiency standards was added.

Additionally, today's rule provides for submission of manufacturer's compliance statements for existing lamps 6 months from the publication of today's rule. The rule also discusses the 25-watt fluorescent lamp issues and describes the Department's rationale for the residential straight-shaped lamp definition.

## III. Discussion of Comments and Changes to the Interim Final Rule

The Department received 45 written comments in response to the September 28, 1994, Interim Final Rule. The Department also held a hearing on November 15, 1994, a workshop on July 19, 1995, and a public meeting on March 5, 1996, to discuss issues raised by comments and other issues that required clarification. Attendees represented lamp importers, energy and environmental groups, state energy offices, lighting consultants, NIST and most of the U.S. lamp manufacturers.

### A. General Comments

#### (1) Compliance Statements and Certification Reports

NEMA requested that manufacturers be given a choice of testing by industry protocols or by DOE test procedures. NEMA commented that this choice would allow manufacturers flexibility in testing lamps for compliance with energy conservation standards. NEMA proposed that if testing is conducted in accordance with DOE test procedures, DOE should extend the date for submission of compliance statements and certification reports for existing lamps to 6 months from the publication of this rule. NEMA requested that if DOE elects for a period shorter than 12 months, DOE adjust the sampling rules in 10 CFR § 430.24(r)(1) and (2) (NEMA, No. 14 at 8.<sup>2</sup>)

The Department has determined that compliance statements and certification reports should be based only on DOE test procedures, as amended by this Final Rule. DOE believes that manufacturers will be able to complete their compliance statements and certification reports within 6 months of the publication of this Final Rule. Under the Interim Final Rule, manufacturers should have collected by November 1, 1995, all or most of the samples needed for testing. The revised sampling plan requires three lamps per month for 7 out of 12 months. The changes in the rule relating to testing and certification at rated voltage for incandescent lamps and the derating factor have no effect on sample selection. Therefore, the Department has decided that it will consider as timely those compliance statements and certification reports for existing lamps that manufacturers file within 6 months from the publication of this Final Rule. Manufacturers will have one year to file compliance and certification reports for new lamp models.

#### (2) Recertification of 8-Foot Fluorescent Lamps

NEMA asked the Department to clarify in the preamble to the Final Rule that lamps tested prior to May 1, 1994, to meet standards that went into effect on May 1, 1994, would not need to be retested nor would compliance statements and certification reports need to be resubmitted. (NEMA, No. 4 at 5.) NEMA referred to its letter to DOE dated February 22, 1993, which outlined the procedures industry would

<sup>2</sup>The Department assigned docket numbers and comment numbers to comments we received on the Interim Final Rule.

use to test and certify 8-foot fluorescent lamps to DOE. (NEMA, No. 14 at 8.)

The test procedures and sampling provisions for lamp efficacy and color rendering index (CRI) in the NEMA letter dated February 22, 1993, are in fact similar to those in the Interim Final Rule. The only difference is that the sampling plan for CRI proposed in the letter requires only 10 lamps from any two production lots from the 12 months, whereas the sampling plan in the Interim Final Rule requires testing for CRI from the same 20 lamps which were tested for lamp efficacy. (NEMA, No. 23 at 1-8.)

The Department agrees with NEMA and will not require recertification of 8-foot lamps. The Department concludes that CRI determined from a 10-lamp subset of the 20-lamp sample used for the lamp efficacy testing will be sufficient for testing 8-foot fluorescent lamps. Therefore, manufacturers' compliance statements and certification reports submitted in accordance with the test procedures in the February 22, 1993 letter from NEMA are acceptable for certification of existing 8-foot lamps. Furthermore, DOE will not construe the Final Rule as requiring manufacturers to conduct new testing or to resubmit compliance statements and certification reports for basic models of 8-foot fluorescent lamps that the manufacturer tested in accordance with those guidelines prior to May 1, 1994. New products distributed for sale after today must be tested and certified to today's rule.

### (3) Devaluation of the Lumen

The lumen values in the lamp energy conservation standards in the Act are based on a value established in 1975 for the lumen. In January 1996, NIST devalued the lumen by 1.1 percent to bring U.S. lumen measurements into agreement with other industrialized countries. NEMA requested that the Final Rule provide a separate adjustment factor for the devaluation of the lumen so that the lamp efficacy measurements of lumens per watt (W) are consistent with the value of the lumen used to determine the lamp efficacy in the energy conservation standards. NEMA and Litetronics recommended that lumen values derived from testing be multiplied by 1.011 to account for the devaluation. (NEMA, No. 14 at 4; Litetronics, No. 12 at 1.)

NIST has issued a notice to all users of lamp measurement standards announcing a 1.1 percent lower realization (devaluation) of the lumen. Since NIST calibrated all of the current standard lamps (see Section F of this

part for more on standard lamps) with the old lumen value, the Department will require that all measurements be reported in 1995 lumens until such time as the reference lamps are recalibrated. The Final Rule provides a conversion factor of 1.011 which is to be used to multiply measurements made on equipment calibrated to the new lumen standard. This is found in Appendix R at 10 CFR Part 430, Subpart B, "Test Methods and Measurements."

### (4) Monitoring Sales Data for Loopholes

The American Council for an Energy Efficient Economy (ACEEE) suggested that DOE set up a means of monitoring sales of lamp products exempt under the Energy Policy Act of 1992 (EPAAct). Monitoring would apply to ER, BR, rough or vibration service, and colored incandescent lamps; as well as cold temperature, colored, and 4-foot fluorescent lamps less than 28 watts. This monitoring would determine if any of these categories undergo large increases in sales. ACEEE suggested that DOE collect the data or work with the Census Bureau to collect such data. If monitoring shows increases in sales of exempted products, DOE should investigate and develop regulations to better define these exemptions. (ACEEE, No. 16 at 4.)

The Department believes that this suggestion has merit and will use statistics obtained from the Census Bureau and NEMA, if available, to monitor sales data to determine if exempted lamps are experiencing significant increases in market share beyond the growth forecast from pre-1992 data.

### (5) DOE and FTC Coordination on Testing and Labeling

NEMA requested that DOE state that its test procedures do not supplant Federal Trade Commission (FTC or the Commission) rules. NEMA further requested that DOE clarify that Sections 430.23 and 430.62 of 10 CFR Part 430 only apply to manufacturers' compliance and certification for minimum efficacy and CRI standards and not to representations of lumens, watts, or life. NEMA stated that "enforcement of manufacturers' representations of performance criteria, such as lumens, watts, and life, requires consideration of additional factors that take account of measurement uncertainties and process and materials variations." (NEMA, No. 6 at 2-3.)

The DOE measures of energy consumption in § 430.23 of 10 CFR Part 430 apply to manufacturers' representations of lamp efficacy and CRI in the case of fluorescent lamps but not

to representations of lamp lumens or watts. The DOE certification requirements in § 430.62 of 10 CFR Part 430 apply only to manufacturers' compliance and certification for minimum efficacy and CRI standards and the report of lamp lumens and wattage output as required by § 325(i)(7) of EPCA, U.S.C. 6295(i)(7). Lumens and wattage are not measures of energy use (per § 323(c) of EPCA, U.S.C. 6293(c)) and therefore neither the DOE sampling plan nor the test procedures apply to such representations.

At the March 5, 1996, lamp workshop, NEMA stated that application of the sampling plan and confidence limits in the DOE test procedures should be strictly for determining lamp efficacy and CRI and not to be applied to representations in marketing brochures, advertising, etc. ACEEE cautioned the Department to let FTC determine the accuracy and sampling requirements for labeling and not to make an implied endorsement of current levels of accuracy. The FTC representative confirmed that the Commission would accept measurements from DOE test procedures, but that the use of DOE test procedures are not required by the Commission. (Lamp Meeting Transcript, March 5, 1996, at 232-261.)

NEMA commented that representations require less accuracy than the certification reports and that the one-sided statistical test for confidence in meeting the minimum standards does not apply where a two-sided statistical test should be used for representing the average value of lamp efficacy, lumens, or watts. NEMA claimed that FTC regulations allow manufacturers to use acceptable industry practice for determining the accuracy of lamp labels. Furthermore, NEMA claimed that DOE regulations on confidence limits should not apply until FTC requires the same confidence limits for test results appearing on labels. (Lamp Meeting Transcript, March 5, 1996, at 232-261.)

The Department believes that the one-sided confidence limit reduces the testing burden on manufacturers and assures the consumer that lamp performance will meet or exceed the lamp efficacy standards. Furthermore, the Act requires that any manufacturer making representations of lamp efficacy and energy consumption must do so according to DOE test procedures and sampling plans. This ensures that consumers get lamp performance that is at least as good as represented.

The Act prohibits manufacturers, retailers, distributors and private labelers from making any representations in writing (including

labels) or in any advertisements with respect to energy use or efficiency or the cost of energy consumed unless the product under consideration has been tested in accordance with DOE test procedures, and unless the representations fairly disclose the results of the testing. Section 323(c) of EPCA, 42 U.S.C. 6293(c). Furthermore, the Act requires manufacturers to file with DOE a laboratory report certifying the average lumen output and wattage consumption for each lamp type. Section 325(i)(7) of EPCA, 42 U.S.C. 6295(i)(7). Consequently, manufacturers must use the Department's test procedures including calculation of sample means and confidence limits to certify lamp efficacy and CRI. Manufacturers also must use these procedures to measure lumen output and wattage consumption for the laboratory report. The Department believes that its test procedures for lamps will fulfill the FTC requirements for lamp testing.

#### B. 25-Watt Lamp

The energy efficiency standards for 4-foot medium bi-pin fluorescent lamps are prescribed in § 325(i)(1) of EPCA, 42 U.S.C. 6295(i)(1). Lamps with a rated wattage of 28 or more must meet a minimum lamp efficacy of 75 lumens per watt. The standard precludes the manufacture of most 40-watt halophosphate (e.g., cool white, warm white) lamps and permits the use of 34-watt halophosphate lamps instead. In response to consumer demand and safety concerns, manufacturers have developed a lower wattage 4-foot lamp for residential use. These lamps typically have wattages of less than 28 when used on low-power-factor residential ballasts. However, in a commercial application on high-power-factor ballasts, these lamps can operate at wattages as high as 40 and may not meet the applicable standards for covered lamps. The issues of safety, relabeling, rated wattage and exemption by low wattage are discussed below.

##### (1) Safety

Manufacturers and NEMA commented that the reduced wattage lamp (i.e., 34-watt lamp) may overheat the ballast and cause damage if used with a low-power-factor ballast. Low-power-factor ballasts are used primarily in residential applications, but older ballasts of that type may still be in use in some commercial buildings. NEMA commented that a large number of low-power-factor ballasts exist in small office fixtures, in residential fixtures, and in shop-light fixtures. (NEMA, No. 18 at 1.) If the 40-watt lamp in these

fixtures is replaced with a 34-watt lamp, the ballast is subjected to a current about 35 percent higher than rated and an input wattage about 15 percent higher than rated. NEMA states that "the increased current and wattage can cause ballasts to operate at a temperature significantly over the maximum temperature for which they were designed." (NEMA News Release, April 10, 1995, page 1.) NEMA suggests that people should use 40-watt lamps unless the ballast label specifically allows the use of 34-watt energy-saver lamps. (NEMA, No. 18 at 1.)

The Department discussed the safety risks of the 34-watt energy-saver lamp with the staff of the Consumer Product Safety Commission (CPSC). A CPSC representative attended the July 19, 1995, lamp workshop at which manufacturers, NEMA and energy advocates discussed safety concerns. In response, the CPSC representative recommended that industry provide a description of the problem and a corrective action plan. (Workshop Transcript, July 19, 1995, at 182.)

At the July 19, 1995, lamp workshop, General Electric (GE) stated it had developed a 25-watt, 6,000 hour cool white lamp for low-power-factor ballast applications. (Workshop Transcript, July 19, 1995, at 182.) GE and Philips commented that the 25-watt lamp was developed to provide a safe alternative to the 34-watt energy-saver lamp. They claimed the new lamp is a cost effective replacement for the old shop-light lamps and is specifically designed with a shorter life for use in residential shop-light fixtures. (GE, No. 33 at 1-6; Philips, No. 34 at 1-3.)

DOE believes using 34-watt lamps with low-power-factor ballasts is a safety hazard. This hazard can be eliminated by use of a properly designed 40-watt or 25-watt lamp because these lamps do not cause the lighting system to operate at higher current when used with a low-power-factor ballast. Because the Department has allowed the sale of 25-watt lamps for residential use only and manufacturers sell several types of 40-watt lamps which meet the standards, safe lamps are readily available to consumers, so the safety hazard is minimal.

##### (2) Relabeling of 40-Watt Halophosphate Lamps

Osram Sylvania (OSI) claimed that imported 40-watt lamps could easily be relabelled as 25-watt lamps to avoid the standard. (OSI, No. 11 at 1.) GE claimed that the risk of mislabeled 40-watt import products is very small because of shipping and handling costs, potential

DOE penalties, and the small import market. (GE, No. 33 at 1-6; Meeting Transcript, March 5, 1996, at 65.)

At the lamp meeting on March 5, 1996, GE recommended that DOE adopt an approach the Canadian government is using to prevent relabeling. The Canadian definition of general service fluorescent lamp includes a clause that makes any lamp subject to standards if it is physically and electrically equivalent to a regulated lamp. OSI and Philips agreed with this recommendation. GE clarified its recommendation with a statement that if the lamp is physically and electrically equivalent—and life, lumens, and watts are not altered—then the lamp is equivalent for labeling purposes. (Meeting Transcript, March 5, 1996, at 33, 84, 90, 288, and 309.)

The Canadian government issued an amendment to its Energy Efficiency Regulations with respect to fluorescent lamps and incandescent reflector lamps on November 7, 1995. Among other changes to these regulations, the Canadian government revised the definition of "general service fluorescent lamp." The amended definition makes any fluorescent lamp subject to standards if it is a physical and electrical equivalent of one of the following four lamp types: (1) a 48" rapid-start lamp rated at 28 watts or more; (2) a rapid-start U-shaped lamp rated at 28 watts or more; (3) a rapid-start, 96", 0.800 ampere, high-output lamp; or (4) an instant-start, 96", slimline lamp rated at 52 watts or more.

NEMA recommended in its November 4, 1996, letter that DOE not add a proposed fifth clause on lamp equivalency to the fluorescent lamp definition. In a later discussion, NEMA claimed that the proposed clause would create a new class of lamps which had not been reviewed by the stakeholder community. In its letter, NEMA proposed that the clarification of equivalent lamps be added to the preamble. (NEMA, No. 45 at 1 and 2.)

Based on consideration of the comments, the Department will not include a criterion for physical and electrical equivalency in its definition of fluorescent lamp in 10 CFR § 430.2. However, by interpretation, the Department will consider a fluorescent lamp as a covered fluorescent lamp if it has substantially equivalent physical and electrical characteristics when operated on a covered fluorescent lamp's reference ballast.

##### (3) Rated Wattage

The term "rated wattage" is used in the definition of fluorescent lamps in § 321(a)(30)(A) of the Act, but it is not

defined in the statute. Furthermore, the statutory energy conservation standards do not apply to 4-foot medium bi-pin fluorescent lamps rated less than 28 watts. Section 321(a)(30)(A)(i) of the Act, 42 U.S.C. 6291(a)(30)(A)(i). Noting that § 323(b)(6) of the Act requires the Secretary to prescribe test procedures that take into consideration the applicable IESNA or ANSI standard, the Department is defining "rated wattage," for purposes of 4-foot fluorescent lamps, based on ANSI C78.1-1991.

NEMA recommended that rated wattage, and thus lamp coverage, be determined by using the reference ballast specifications in the ANSI standards measured in accordance with either ANSI C78.375 or IESNA LM-9. (NEMA, No. 35 at 7.) A proposed draft ANSI standard of lamp characteristics for the 25-watt fluorescent lamp was noted in several comments, and there was unanimity among manufacturers at the March 1996 lamp meeting to use the ANSI C78.1 reference ballast characteristics to determine fluorescent lamp wattage. (Meeting Transcript, March 5, 1996, at 17-24; Philips, No. 34 at 1-3; OSI, No. 30 at 1-2.)

The Alliance to Save Energy (ASE) recommended that the Department develop a simple regulation that states "If a lamp can operate on a commercial (high-power-factor) ballast, it should be tested by the standards set up for lamps that operate on commercial ballasts." (ASE, No. 31 at 1-3.) GE claimed that mandating testing for compliance on a commercial ballast is unfair to manufacturers because the product was not designed for that use. (GE, No. 38 at 1-5.) OSI recommended that DOE adopt only the industry standards in effect at the time the statute became effective. (OSI, No. 30 at 1-2.)

GE claimed that its 25-watt lamp is not subject to regulation because it is rated below the statutory limit. (GE, No. 33 at 1.) However, OSI claimed that the 25-watt lamp, when operated on high-power-factor ballasts, is really a 40-watt cool white lamp and therefore must meet DOE standards. Furthermore, it cites DOE's letter of August 30, 1995, which states that lamp operating characteristics "are determined by testing with a reference ballast (per ANSI standards) and not by the lamp's use or application such as when connected to a low-power-factor ballast." (OSI, No. 17 at 1 and No. 30 at 1.) The Alliance to Save Energy claimed that the 25-watt lamp does not meet DOE standards during operation on high-power-factor ballasts. (ASE, No. 31 at 1-3.)

To reduce commercial crossover of its 25-watt lamp, GE stated it has designed

the cathode used in the 25-watt lamp for an arc current of 250 milliamperes (mA) versus the 430 mA arc current for lamps designed for use with commercial ballasts. GE states that operation of the 25-watt lamp at the high current of a commercial ballast will cause severe overheating of the cathode which will result in a lamp life of not more than 6,000 hours. By contrast, GE claimed that the 34-watt cool white energy-saver lamp will operate 20,000 hours on a commercial ballast. (GE, No. 33 at 1-6.) Philips stated that its 25-watt lamp is designed with a cathode that will shorten lamp life to 6,000 hours and cause severe end darkening if it is used on a commercial, high-power-factor ballast. (Philips, No. 34 at 1-3.)

Based on its statistics, GE claimed that lamp life greatly controls market distribution of fluorescent lamps. GE claimed that a 6,000-hour life would be a deterrent to use of the 25-watt lamp on high-power-factor ballasts. However, OSI and environmentalists were skeptical that the 6,000 hour life would be short enough to discourage the use of the 25-watt lamp on high-power-factor ballasts. (Meeting Transcript, March 5, 1996, at 31.)

GE calculated that the maximum number of previously sold 40-watt cool white lamps which may migrate to the new 25-watt shop-light is 14 million, or 3.5 percent of the total market. (GE, No. 39 at 1-5.) OSI claimed that home center markets, where this 25-watt lamp would be sold, typically sell 50-60 percent of their lighting products to commercial users, so there is a high likelihood that these lamps would be put into commercial use. (OSI, No. 11 at 1.) OSI claimed that the lost energy savings for each four-lamp fixture, using 40-watt lamps instead of the 34-watt lamps intended by EPart, are 60 kilowatt hours (kWh) per 3,000-hour year. (OSI, No. 11 at 1.) ASE claimed that up to 1 billion kWh of energy savings could be lost. (ASE, No. 31 at 1-3.)

In a June 26, 1996, letter to the GE Lighting Division, the Department restated its position on the 25-watt lamp. In that letter, the Department stated that lamps that have a wattage of 28 or more when used with a high-power-factor ballast are subject to regulation unless they are designed or marketed exclusively for residential applications. The letter explained that a lamp will be considered to be designed or marketed exclusively for residential applications if: (1) it will not function for more than 100 hours on a commercial high-power-factor ballast or (2) it has a life of 6,000 hours or less on a commercial high-power-factor ballast

and (a) it is marked for residential applications only; (b) it is distributed only through consumer/residential channels, (c) it is packaged and labeled in a manner that clearly states its applications; (d) it is distributed for retail sale in boxes of 30 lamps or less; (e) it is listed only in the manufacturer's consumer/residential catalogs or price lists or, if listed with commercial/industrial lamps, it is listed in a separate residential section and is clearly marked by notes or warnings about improper use on the same page; and (f) the manufacturer clearly states that improper use of the lamp voids any warranty, explicit or implied. (DOE, No. 41 at 1-2.)

In response to the June 1996 DOE letter, GE claimed that the rated wattage of its lamp is less than 28 in its intended use. GE also claimed that the Shoplite is rated in accordance with industry practice using ANSI standards. Furthermore, GE claimed DOE's basis for coverage depends on the possible misapplication of the product, which has no precedent in the appliance program and exceeds DOE's authority. GE stated, however, that the company is contemplating the marketing and labeling requirements as prescribed to provide more assurance that the Shoplite will be used as intended. (GE, No. 42 at 1-2.)

Also in response to the June 1996 DOE letter, OSI claimed that if a 25-watt lamp is exempt from the lamp standards in EPart, it is because the lamp's rated wattage is less than the 28 watt statutory minimum. OSI stated that DOE's requirements related to lamp life are not relevant to determining coverage. OSI commented that the DOE letter also failed to address the fact that the 1991 ANSI standard only defines reference ballast characteristics for a 40-watt lamp and, hence, there are no approved ANSI reference ballast characteristics for a 25-watt lamp. OSI also suggested that DOE add a reference to the draft ANSI standard for the 25-watt lamp to prevent other nominal lamp wattages from claiming an exemption. (OSI, No. 43 at 1-3.)

NEMA agreed with DOE's proposal in its June 1996 letter to exclude 25-watt lamps that are designed or marketed exclusively for residential use. It claimed that the exclusion should apply without limitations to all straight-shaped lamps less than 28 watts. NEMA claimed that the six marketing and labeling requirements were too detailed and it requested development of consistent exclusion guidelines. (NEMA, No. 44 at 1-3.)

The Department is concerned there may be little discernable difference

between a fluorescent lamp subject to the Act's requirements (e.g., a 40-watt cool white) and a lamp rated at less than 28 watts and "intended" for residential use (e.g., a 25-watt shop-light). The Department believes these products can be used in a commercial application without any appreciable difference in utility unless consumers and distributors are well aware of their short life. The Department has determined that rated wattage is based on testing with a reference ballast having characteristics similar to a high-power-factor commercial ballast unless the manufacturer demonstrates the lamp is being used in residential applications only. A manufacturer can show this by using lamp technology that would result in a life of 100 hours or less when used on a high-power-factor ballast or by using a shorter life lamp (6,000 hour life or less on a high-power-factor ballast) marked for residential use only and by marketing strategies that will restrict the lamp to residential applications. The Department is defining such a lamp as a residential straight-shaped lamp. In its letter of November 4, 1996, NEMA agreed with DOE's definition of "residential straight-shaped lamp."

The precise wording of the permanent lamp marking is not prescribed, but manufacturers should clearly indicate that the intended use is exclusively for residential applications. Furthermore, the test for a 6,000 hour life on a residential straight-shaped lamp when used with a commercial high-power-factor ballast shall be based on competent and reliable scientific determinations made in accordance with generally accepted industry test practice.

NEMA also proposed that "rated wattage, with respect to 4-foot medium bi-pin lamps, is less than 28 watts if the wattage of the lamp on the reference ballast for which it is specified is less than 28 watts and the lamp is specifically designated and exclusively marketed based on the operating characteristics of the lamp on such reference ballast." (NEMA, No. 45 at 2.) Based on recommendations in the record to use industry test procedures, the Department is defining "rated wattage" for four foot fluorescent lamps as the nominal wattage found in ANSI C78.1-1991 based on the description of rated wattage in Annex A.2 of ANSI C78.1-1991 (concerning 34- and 40-watt lamps). If the lamp is a residential straight-shaped lamp that is not found in Annex A-2 of ANSI C78.1-1991, the rated wattage is determined by the wattage consumed when the lamp is operated at the reference conditions under which the lamp was designed to

operate. For lamps that are not found in ANSI C78.1-1991 and that are not residential straight-shaped lamps (defined in item (4) of this part), rated wattage is determined by testing in accordance with ANSI C78.375-1991, using the lamp data sheets in ANSI C78.1-1991 for T8, T10 or T12 lamps as appropriate. If a manufacturer believes that application of this definition of rated wattage to a particular lamp is inappropriate, it may request a waiver from the test procedure (see 10 CFR § 430.27).

The Department believes that its testing, marketing and labeling requirements are sufficient to prevent most of the crossover of this lamp and similar lamps into the commercial market. However, DOE may monitor the sale and distribution of lamps that are labeled as 25-watt lamps to determine whether these conditions are effective. If the Department finds 25-watt lamps or similar lamps are being used in significant numbers for applications where they will perform within the covered range of wattages in spite of the conditions imposed by today's rule, the Department will consider whether further limitations are needed.

#### *C. R, BR and ER Incandescent Lamps*

Section 321(30)(C)(ii) of the Act, 42 U.S.C. 6291(30)(C)(ii), contains exemptions for several types of incandescent reflector lamps including those for ER (elliptical reflector) and BR (bulged reflector) bulb shapes. The industry differentiates the ER and BR lamps from R (reflector) lamps by their shape characteristics. Since the ER is a specialty lamp used in recessed lighting applications, its shape is unique. However, the BR lamp shape is not well defined, so the Department believes it is necessary to describe this lamp by shape and wattage characteristics to avoid misuse of the exemption.

At the July 19, 1995, workshop, Philips distributed copies of ANSI C79.1-1994, which shows a line sketch of the ER and BR bulb shapes and some text describing the "B" and "E" modifiers. (Workshop Transcript, July 19, 1995, at 157.) NEMA claimed that ER and BR lamps should be defined by reference to ANSI C79.1-1994. (NEMA, No. 14 at 8.)

In its notice reopening the comment period on the Interim Final Rule, the Department stated it believed the definitions in ANSI C79.1-1994 were new definitions because earlier versions of the document did not describe these bulb shapes and additional descriptive criteria were needed such as dimensions for a longer neck, a reflective coating,

and a reduced wattage filament. 61 FR 7431 (February 28, 1996).

At the lamp meeting on March 5, 1996, OSI provided descriptions and examples of the R, BR, and ER lamps. OSI noted that the R lamp will not meet the lamp efficacy standards and compared the R lamp to the exempt BR and ER lamps. OSI stated the BR lamp has a bulge around the neck and it has a secondary curved reflector in the neck area, which reflects the light forward into the beam. This reflector reduces the light that gets trapped by the neck of the bulb. OSI claimed the shape first appeared in ANSI C79.1-1980 as a reference in the appendix, and therefore ANSI C79.1-1994 only clarifies the bulb shape. OSI stated the bulbs have universal application; that is, they can be used anywhere an R lamp would be used. OSI claimed, however, that to the untrained observer, the R and BR bulb shapes are nearly indistinguishable.

OSI stated the ER lamp has two foci: one at the back of the lamp and the other about two inches in front of the lens. This means the light passes through the focus point in front of the lens before it spreads. OSI claimed this lamp is used in deep fixtures or small aperture fixtures because less light is lost in the fixture. OSI stated the ER lamp has a long neck because the filament is placed at the rear focus and more length is needed for the stem configuration. It also has a long neck because it is a replacement for the 150-watt R lamp. The ER lamp has a well-defined shape that is readily apparent. (Meeting Transcript, March 5, 1996, at 172-176.)

In its comments, ACEEE attached a copy of a September 17, 1991, draft of the EAct legislation, which did not include any BR or ER exemptions. ACEEE claimed these exemptions were added to protect a small manufacturer. (ACEEE, No. 16 at 2.) In a memo to ACEEE, OSI noted the exemption protects special markets and claimed the exemptions will be used by manufacturers to avoid standards. (ACEEE, No. 16, Attached Memo.) ACEEE requested that DOE restore the original intent of EAct by defining ER and BR lamps so applications of these lamps are limited to their original purposes. (ACEEE, No. 16 at 2.)

To correct some mistakes in the record, OSI claimed: (1) the BR lamp is not marketed for recessed applications; (2) the BR lamp is more efficient than the rough/vibration service R lamp; (3) the BR lamp is a less costly lamp for the residential reflector lamp market than the halogen parabolic aluminized reflector lamp (PAR), which usually meets or exceeds the lamp efficacy

standards; (4) OSI sells a special high-efficiency 65-watt BR lamp that meets the efficacy standards; and (5) the ANSI C79.1-1994 bulb shape specification is a result of the mandatory ANSI 5-year revision cycle, and it is fundamental to all lamp/fixture interchangeability. (OSI, No. 22 at 1.)

At the lamp meeting in March 1996, NEMA, ACEEE, Duro-Test, and Philips recommended that DOE use the lamp bulb shapes in ANSI C79.1-1994 as the basis for the definition of BR and ER lamps. NEMA and Duro-Test suggested that ANSI C78.21-1989 would provide a more complete definition and some dimensions of the ER bulb shape. In the Reopening Notice, DOE proposed a maximum wattage, in addition to bulb shape, as a defining criterion for BR lamps. In response, NEMA accepted the DOE proposal. There was no suggestion from manufacturers or interested parties that DOE incorporate any reflector requirements into its definition. (Meeting Transcript, March 5, 1996, at 166-98.)

In their comments, NEMA and Duro-Test proposed two options for BR30 wattages: exactly 85 or less than 66. They also proposed a maximum of 120 W for the BR40 lamp. (NEMA, No. 35 at 5; Duro-Test, No. 32 at 2.) NEMA proposed that any BR lamp that meets the standard should be allowed. (NEMA, No. 35 at 5.) The Department accepts wattage limits on the BR30 and BR40 reflector lamps since they have the largest market share. Wattage limits will also help to maintain energy savings that could otherwise be lost if full wattage BR lamps are substituted for PAR and R lamps which must meet the energy standards.

Given the shape characteristics in ANSI C79.1-1994 and ANSI C78.21-1989, the Department is convinced that ER lamps are a specialty product which need no further definition. The Department believes it is necessary to describe BR lamps by the shape characteristics given in Figure 1 on page 7 of ANSI C79.1-1994 and by wattage characteristics because the BR shape is not well defined in ANSI C79.1-1994 and it is easy for manufacturers to substitute BR lamps for R lamps. Since BR lamps are less expensive than the halogen lamps that meet the standards, the substitution of BR lamps for R lamps would severely reduce the energy savings potential of the law. NEMA, the efficiency advocates, and manufacturers agreed that maximum wattage limits should be included in the definition of BR lamps which have the largest market share. Therefore, BR30 and BR40 lamps are exempt if they comply with the DOE wattage limits. Exempt BR30 lamps

include only lamps with rated wattages of 85 or less than 66, and exempt BR40 lamps will include only lamps with a maximum rated wattage of 120. If a BR lamp meets the energy efficiency standards and a manufacturer chooses to file a certification of compliance with the Department, such lamps are not subject to the wattage limits. The definitions for BR and ER lamps are in 10 CFR § 430.2.

#### D. Colored Lamps

In the Notice of Proposed Rulemaking, the Department defined colored fluorescent and colored incandescent lamps because § 321(30)(B)(iii) of EPCA, 42 U.S.C. 6291(30)(B)(iii), and § 321(30)(C)(ii) of EPCA, 42 U.S.C. 6291(30)(C)(ii), contain exemptions for colored lamps without defining what a colored lamp is. These exemptions are needed since colored lamps are inherently less efficient than non-colored lamps and colored lamps use tinting and filters to produce light with a certain spectral composition, causing the absorption or reflection, or both, of a significant amount of light. In the Interim Final Rule, the Department defined a colored fluorescent lamp as a fluorescent lamp with a CRI less than 30 or color correlated temperatures (CCT) below 2,500 Kelvin (K) or above 7,000 K. Colored incandescent lamps were defined by a CRI less than 50 or a CCT below 2,500 K or above 7,000 K. 59 FR 49478, September 28, 1994.

The following discussion of colored lamps is divided into the subtopics of (1) chromaticity, (2) CRI and CCT, (3) neodymium lamps and (4) plant lamps.

##### (1) Chromaticity

In its Reopening Notice, the Department sought comment on a colored lamp definition using  $x$  and  $y$  chromaticity<sup>3</sup> coordinates that lie outside of the area on a chromaticity diagram. 61 FR 7431. NEMA withdrew its proposal for a test related to chromaticity because the CCT and CRI values proposed by DOE in its Reopening Notice fairly define colored lamps. (NEMA, No. 35 at 5 and 6.)

##### (2) CRI and CCT

In its Reopening Notice, the Department proposed revised colored lamp definitions based on CRI or CCT. A colored fluorescent lamp would be defined as a lamp with a CRI value less

<sup>3</sup>Chromaticity is a descriptive characteristic of the color of a light specified by the coordinates  $x$ ,  $y$ , and  $z$ , which are the ratios of each of the tristimulus values to their sum. The tristimulus values of a light are the amounts of each of the three primary colors required to match the color of the light.

than 40 or a CCT not above 2,500 K for red and yellow colors or not below 6,600 K for blue and green colors, and a colored incandescent lamp would be defined as a lamp with CRI values below 50 or a CCT not above 2,500 K for red and yellow colors or not below 4,600 K for blue and green colors. 61 FR 7431.

At the lamp meeting on March 5, 1996, and in written comments, NEMA endorsed the Department's proposal for the definition of colored lamps using the CCT and CRI values proposed in the Reopening Notice. NEMA asked the Department to clarify that either a CCT value or a CRI value is sufficient to determine that a lamp is colored. (Meeting Transcript, March 5, 1996, at 124-132; NEMA, No. 35 at 6.)

The colored lamp definition in the Notice of Proposed Rulemaking caused confusion due to undefined CCT for some colored lamps. The mathematical procedures for computing CCT don't work for some values of  $x$  and  $y$  chromaticity (blue colors, etc.) because these procedures try to project to a point on the blackbody locus equal to infinite color temperature. It was also difficult to compute CCT for purple colors that lie below the blackbody locus, because the curve of the locus results in more than one CCT value for a single chromaticity. As a result, the CCT portion of the definition has been revised so that a lamp would be considered colored as long as the CCT is outside of a given range. 59 FR 49478.

The revision of the CRI values and CCT ranges proposed in the Reopening Notice is based on comments from Duro-Test and NEMA regarding the appropriate boundary points that separate non-colored lamps from lightly tinted lamps. Raising the maximum CRI for colored fluorescent lamps from 30 to 40 will include the gold lamp as a colored lamp but will not allow exempt status for any non-colored lamps. By narrowing the range for non-colored fluorescent lamp CCT to 2500-6600 K, green fluorescent lamps will qualify as colored lamps. And by narrowing the range for non-colored incandescent lamp CCT to 2500-4600 K, green and blue incandescent lamps will qualify as colored lamps.

The Department believes the CCT and the CRI methods are both valid indicators of the color characteristics of lamps, although they are slightly different. Some lamps may be considered colored according to both methods, whereas others may be considered colored according to one or the other. However, meeting either criteria is sufficient to demonstrate the colored characteristic. Also, two

methods give the manufacturers flexibility to use the test method that is least burdensome.

Therefore, the Department is defining a colored fluorescent lamp as a lamp with a CRI value less than 40 or a color correlated temperature less than 2,500 K for red and yellow colors or not greater than 6,600 K for blue and green colors. Colored incandescent lamps are defined as lamps with CRI values below 50 or a lamp color correlated temperature less than 2,500 K for red and yellow colors or greater than 4,600 K for blue and green colors. These lamps must be designated and marketed specifically as colored lamps.

### (3) Neodymium Lamps

In its Reopening Notice, the Department proposed that incandescent lamps with lens filters containing 5 percent or more neodymium are colored lamps. The Neodymium filter adjusts the light spectrum for reptile lighting applications. 61 FR 7431. NEMA and Duro-Test agreed with the Department's proposal for exempting lamps containing 5 percent or more Neodymium in the lens. (Duro-Test, No. 32 at 2; NEMA, No. 35 at 6.) In today's rule, the Department is exempting Neodymium lamps containing 5 percent or more Neodymium in the lamp lens.

### (4) Plant Lamps

In its Reopening Notice, the Department proposed that incandescent lamps used for growing plants would be specifically exempted and must be designated as such on the lamp and in marketing materials. 61 FR 7431. Duro-Test proposed an exemption for incandescent plant lamps that are specifically designated and marketed for growing plants. It defined a plant light as an incandescent lamp with a filter used to suppress the yellow and green portions of the spectrum. (Duro-Test, No. 32 at 2.) The Department is exempting incandescent plant lamps that contain a filter to suppress the yellow and green portion of the spectrum. Plant lamps must be specifically designated and marketed for plant growing applications.

### E. Rough or Vibration Service Lamps

In the Notice of Proposed Rulemaking, the Department proposed to define rough or vibration service incandescent lamps because § 321(30)(C)(ii) of the Act contains an exemption for these lamps without providing a definition. These lamps are inherently less efficient than normal service lamps because the lamps have stronger filament mounting configurations with more supports that

conduct heat away from the filament causing a lower filament temperature, and, thus, lower luminous efficacy. In its proposed definition, the Department defined a rough or vibration service lamp by a filament configuration of C-17 or C-22 or the ability to pass a vibration test. 59 FR 49478. The vibration test consisted of subjecting the lamp to vibrations at frequencies ranging from 5 Hertz (Hz) to 33 Hz, at specified amplitudes. Some manufacturers expressed concern that the vibration test was too easy to pass, and might allow exemptions for lamps not meant for vibration service. The Department initiated a discussion on a revised vibration test at the March 5, 1996, meeting. (Meeting Transcript, March 5, 1996, at 207-210.)

In written comments regarding the March 1996 meeting, NEMA, Duro-Test and Litetronics supported a prescriptive definition of a rough or vibration service lamp that defines such a lamp with a C11 (5 support), C17 (8 support), or C22 (16 support) filament configuration, excluding lead wires, as depicted in chapter six of the *IESNA Lighting Handbook*. NEMA and Duro-Test recommended that rough or vibration service lamps should be designated and marketed specifically for rough or vibration service applications. NEMA and Litetronics also recommended that DOE continue to work on an alternative performance-based vibration test for other rough or vibration service lamps but advised DOE to promulgate rules with only the prescriptive definitions. (NEMA, No. 35 at 8, Duro-Test, No. 32 at 3 and Litetronics, No. 36 at 2.) L.D., Inc., commented that a C11 (5 support) filament exemption would allow manufacture of a two-piece outdoor PAR lamp with 5-7 times the life of a standard PAR lamp, which will save cost and labor by requiring fewer lamp replacements. (L.D., Inc., No. 38 at 1.)

There is a consensus among manufacturers that C11, C17 and C22 filament configurations are rough or vibration service incandescent reflector lamps. Based on consideration of the comments, DOE believes that a C11 filament configuration also provides adequate support for rough or vibration service and has included C11, C17 and C22 filaments in today's Final Rule. In addition, DOE has included a requirement that the lamp be designated and marketed specifically for rough and vibration service.

Therefore, the Department has taken a prescriptive approach to the definition of a rough or vibration service incandescent reflector lamp. Since this approach may limit a manufacturer's flexibility to design for some

applications, the Department will continue to evaluate the parameters for a vibration test for incandescent reflector lamps. DOE will invite input from manufacturers, NEMA and other interested parties. Any new vibration test parameters will be promulgated in future rulemakings.

### F. Sampling Plan and Confidence Limits

The Interim Final Rule required a minimum sample size of 20 lamps per year and a confidence limit based on a "t" test with a one-sided confidence limit of 99 percent. The sample size was selected to promote statistically valid results without imposing an undue testing burden on the manufacturers. The 99-percent confidence limit was selected on the assumption that lamp variability within a single basic model was not very large. 59 FR 49468. The discussion of sampling plan and confidence limits is divided into the following subtopics: (1) sample size, (2) derating the sample mean, (3) variability and confidence limits, (4) derating factor, and (5) "z" Test.

#### (1) Sample Size

NEMA proposed several clarifications to the sample size given in the Interim Final Rule. First, it proposed that the minimum sample size be raised from 20 to 21 lamps. Second, it proposed a minimum of three lamps for each month of seven months. Third, it suggested the lamps be divided as evenly as "practicable" among the months of "planned" production to attain a minimum sample of 21 lamps. This change would apply only to instances where lamps are manufactured for fewer than 7 months of the year. (NEMA, No. 4 at 24.) Philips also favored the revised sampling plan outlined in the NEMA comments. (Philips, No. 3 at 2.)

Based on the comments, the Department is revising the sample size to 21 lamps because the addition of one lamp to the sample will improve the statistical results with little additional testing burden. The Department will require that manufacturers sample a minimum of three lamps per month for 7 months of a 12-month period if production occurs for 7 or more months in the 12-month period. If production occurs for fewer than 7 months during a 12-month period, the Department will allow manufacturers to divide the total required sample as evenly as practicable among the months of planned production to attain a minimum sample of 21 lamps.

#### (2) Derating the Sample Mean

NEMA proposed that the mean of the sample ( $X^{lpw}$ ) be divided by 0.98 to



account for a 2 percent uncertainty from the NIST standard lamp and secondary standard lamps developed by manufacturers. (NEMA, No. 14 at 2.) The Department will not allow use of a 0.98 factor to derate the average lumen per watt measurement because the NIST uncertainty in the lumen output of the standard lamps is randomly distributed.

### (3) Variability and Confidence Limits

NEMA commented that measurements from lamp testing are subject to several types of variability or uncertainty and that process and material variations will cause differences in the performance of each lamp. It claimed that testing variability is not sufficiently addressed by the DOE requirements for sample size and confidence limits. NEMA stated that "the resulting variabilities in test measurements necessitate special tolerances for purposes of enforcing the EPCA standards." (NEMA, No. 4 at 27)

NEMA claimed there are also inherent variations in measurements due to uncertainty in the lumen output of standard lamps traceable to NIST. (NEMA, No. 4 at 27.) Lamp lumen measurements are made by comparison to a standard lamp traceable to NIST. Standard lamps from NIST have certificates of error attached to them. When manufacturers calibrate a secondary or working standard lamp from the NIST standard lamp additional errors are introduced. NEMA includes a table of estimated cumulative errors from the NIST standard lamp to the calibrated working standard lamp which lists an error in the measurement from 1.75 percent for an incandescent PAR lamp to 2.95 percent for a 96" high output fluorescent lamp. (NEMA, No. 4, Supplement at 2-3.)

NEMA provided an estimate of the cumulative tolerance factor for general service fluorescent lamps of 2.95 percent in the supplemental comments. It clarified the term "tolerance factor" by showing that a 2.95 percent tolerance factor applied to a lumen-per-watt standard of 80 would permit any sample test measurement greater than or equal to 77.64 lumens per watt to meet the standard. NEMA recommended that DOE specify a cumulative tolerance factor for all lamps subject to efficacy standards. NEMA also stated that the same lamp measured in different laboratories in an NVLAP proficiency test can have up to a 7 percent variability in lumens per watt. (NEMA, No. 4 Supplement at 2-3.) ACEEE commented that the NEMA proposals seem based on the worst case situation in which every conceivable factor would cause the most error possible in

lamp efficacy. It recommended that DOE account for the probability of both overestimating and underestimating measurements and the way these probabilities affect the confidence of an estimate. Since there is currently considerable variation in test results among laboratories, ACEEE recommended that DOE provide for expected improvements in testing as the NVLAP program matures. (ACEEE, No. 16 at 1.) NEMA requested that the confidence limits be reduced from the proposed 99 percent to 95 percent due to manufacturing variability. (NEMA, No. 4 at 25.) NEMA, Duro-Test and Litetronics recommended that DOE prescribe a 95-percent confidence limit and a derating factor of 0.97. (NEMA, No. 35 at 3; Duro-Test, No. 32 at 1; Litetronics, No. 36 at 1.)

The Department believes that all variability can be accounted for by the confidence limit equation using the "t" test and the derating factor. DOE and NIST staff reviewed NEMA data that show the variability in lamp test measurements for representative fluorescent and incandescent lamp types. The NEMA data support a 0.97 derating factor, based upon the demonstrated uncertainties in the NIST standard lamps and the estimated uncertainty due to transfer of those standards to secondary standards and laboratory measurements. Therefore, today's Final Rule includes the Department's revised statistical test for confidence limits which incorporate a 95-percent confidence limit and a derating factor of 0.97.

### (4) Derating Factor

NEMA commented that it has demonstrated the need for a further adjustment to the confidence limit derating factor of 0.97 which it proposed on February 8, 1995. (NEMA, No. 14 at 2.) NEMA representatives and NIST and DOE staff met on August 23, 1995, to discuss the measurement uncertainties. NEMA representatives provided data showing that several lamps would fail to meet the standard if the 99-percent confidence limit and the 0.99 derating factor is applied. NEMA cautioned that it could not determine whether smaller manufacturers would be penalized by a 95-percent confidence limit and a 0.97 derating factor. (NEMA, No. 24 at 1-9.) During the meeting, NEMA claimed that these data support a 95-percent confidence limit and 0.95 derating factor. (DOE Memo to File, August 29, 1995, No. 19 at 1.) NEMA suggested that further adjustments of the derating factor may be needed to account for bias in the NIST standard lamps and

uncertainties in manufacturing and measurement processes. (NEMA, No. 24 at 1-9.)

Litetronics preferred to have a lower derating factor (i.e., 0.95) because it claimed that its test equipment was not as sophisticated as that of the large manufacturers, and it cannot afford the \$40 million state-of-the-art production lines (which reduce product variability) that large manufacturers have. (Meeting Transcript, March 5, 1996, at 109.) NEMA, Duro-Test and Litetronics state that a special derating factor of 0.95 should be applied to small manufacturers with revenues less than \$75 million and with sales less than 10 percent of total industry sales of covered general service incandescent or fluorescent lamps. (NEMA, No. 35 at 3; Duro-Test, No. 32 at 1; Litetronics, No. 36 at 1.)

There does not appear to be a valid reason for having separate derating factors based on the size of the manufacturer. The equipment needed to conduct these measurements is not prohibitively expensive for a manufacturer that has laboratory facilities. Moreover, manufacturers can use independent laboratories if desired. No data were submitted to support the claim that product variability is greater for smaller manufacturers.

### (5) "z" Test

NEMA requested that the confidence limits in the Interim Final Rule be specified as formulas using a "z" test based on a historically derived standard deviation. (NEMA, No. 4 at 25.) The "z" test is similar to the "t" test, except that it uses the population standard deviation rather than the sample standard deviation and a different table of statistical values. Philips commented that these statistical estimates provide adequate protection for the consumer without undue burden on the manufacturer. (Philips, No. 3 at 2.)

In subsequent comments, NEMA proposed that the confidence limit equation use a "z" test and be derated by 0.95. The equation is given as:

$$\frac{\bar{X}_{1pw} - z_{0.95}(\sigma/\sqrt{n})}{0.95}$$

where  $z_{0.95} = 1.645$  and sigma ( $\sigma$ ) is derived from the manufacturer's historical test experience. (NEMA, No. 14 at 2.) In its Reopening Notice, the Department proposed the standard deviation for the "z" test should be derived from a minimum test data sample of 60 or more lamps of the same basic model; and statistical data for lamps must be measured by accredited laboratories. 61 FR 7431. NEMA argued

for a sample size of 50 lamps, and it claimed that most of the historical data had not been developed at accredited laboratories because the accreditation program was so new. (Lamp Meeting Transcript, March 5, 1996, at 107-108.)

In written comments, NEMA withdrew its request for a "z" test for the confidence limit. (NEMA, No. 35 at 3.) While the "z" test has some advantages, the Department will not implement it in this rule for the following reasons. First, the relevant measurements must be conducted by accredited laboratories, and most of the available data were not collected that way. Second, determining population standard deviation at accredited laboratories would require a large number of measurements—on the order of 60 units—to be valid. This could be a significant testing burden.

#### G. Rated Voltage Range

In its notice reopening the comment period on the Interim Final Rule, the Department proposed that lamps with voltages within  $\pm 10$  percent of the 115-130 V range (i.e., voltages greater than or equal to 103.5 and less than or equal to 143.0) were "at least partially within a rated voltage range of 115-130 V," and thus subject to the energy efficiency standards. 61 FR 7431.

With respect to "rated voltage range," the definition of "incandescent reflector lamp" in the Act refers to a "rated voltage or voltage range that lies at least partially within 115 to 130 V." Section 321(30)(C)(ii) of EPCA, 42 U.S.C. 6291(30)(C)(ii). The Interim Final Rule also uses the same definition in 10 CFR § 430.2. NEMA recommended expansion of the voltage range given in the statute to a range of 100-150 V, asserting that the statutory limit could unintentionally allow evasion of the standards requirements for certain products. Under the language in the statute, for example, a product rated at 131 V would not be subject to the standard. Yet this product would perform acceptably in a 130 V environment and could be sold for such applications. (NEMA, No. 4 at 15 and No. 14 at 5.)

GE and NEMA commented that the Department's proposal to increase the 115-130 V range  $\pm 10$  percent would be unacceptable because manufacturers do not represent their incandescent lamps with a  $\pm 10$  percent voltage tolerance as the Department suggests in its notice. Instead NEMA, GE, Phillips and OSI prefer the Department use a range of 100-150 V. (Meeting Transcript, March 5, 1996, at 133-64.)

Bleasby recommended that DOE use the NEMA voltage range of 100-150

instead of the current definition of 115-130 because Natural Resources Canada uses the 100-150 range in its definition. Additionally, he claimed that the 115-130 V range has caused lamp designs of 114 V to avoid labeling and standards. However, lamp designs of 99 V would have a very short life and, likewise, designs of 151 V would have very low light output on nominal 120 V circuits. (P. Bleasby, No. 26 at 1.)

OSI and ASE claimed that an incandescent lamp can operate over a wide voltage range, wider in fact than 100-150 V. However, at voltages greater than the design voltage, the lamp light output increases but the life is reduced by 7 percent for each 1 percent increase in lamp operating voltage. A similar relationship holds for voltages below the design voltage. In this instance, the lamp light output decreases, but lamp life increases by 7 percent for each 1 percent reduction in voltage. For practical reasons, manufacturers would not be able to market lamps designed for 99 V or 151 V because consumers would have little use for them. (Meeting Transcript, March 5, 1996, at 133-64.)

The Department believes that incandescent lamps have an assumed range of use over different line voltages, due to the variations in line voltage typically encountered throughout the United States. This fact is incorporated into the definition of rated voltage in ANSI C78.21-1989, which states that the "voltage range is a series of rated voltages related to commonly available supply lines." DOE believes that the statutory definition of incandescent lamp, which refers to a voltage "that lies at least partially in the range of 115 to 130 V," was intended to include the operational range of voltages in most U.S. homes and businesses. The Department also believes that there is a large possibility for evasion of the efficiency standards by manufacturers who rate lamps outside the statutory range although these lamps are intended for operation within the range. These lamps could substantially damage markets of companies producing lamps which meet the standards and would result in lost energy savings. Therefore, general service incandescent lamps and incandescent reflector lamps with a voltage rating greater than or equal to 100 V and less than or equal to 150 V are subject to the standards according to DOE's definition of rated voltage. This interpretation is found in the definition of rated voltage in 10 CFR § 430.2.

#### H. Test Voltage for Incandescent Lamps

Neither the definition of incandescent lamp in § 321(30)(C) of the Act, 42 U.S.C. 6291(30)(C), nor the Illumination

Engineering Society LM-20, "Approved Method for Photometric Testing of Reflector-Type Lamps," defines the test voltage. Therefore, since the Act required labeling at 120 V, the Department required testing of all incandescent lamps at 120 V in the Interim Final Rule. 59 FR 49468.

In its comments, NEMA asked the Department to allow testing of incandescent lamps at their design voltage. Otherwise, NEMA commented, certain 125 and 130 V lamps would be banned from the market by failing to meet the standards if tested at 120 V. NEMA also claimed that 125 and 130 V lamps serve two market niches: regions in the country where power line voltage is greater than the nominal 120 volts (V); and applications requiring long-life lamps. (NEMA, No. 7 at 1-4 and No. 14 at 4.) Manufacturers claim they would be forced to sell lamps with decidedly shorter lives than the 125 and 130 V lamps currently in the marketplace if DOE requires compliance with the standards at 120 V. (Trojan, No. 15 at 2; Litetronics, No. 12 at 1.) Bleasby recommended that DOE allow testing at design voltages of 120, 125 and 130 V. He claimed that this testing regime is needed for harmonization with international test procedures. (P. Bleasby, No. 26 at 1.)

In its notice reopening the comment period, the Department requested comments on a proposal to test incandescent lamps at the voltage marked on the lamp, or at the mean of the voltage range marked on the lamp. 61 FR 7431. NEMA supported this proposal. NEMA also recommended that DOE adopt the International Electrotechnical Commission definition of rated voltage from Standard 432-1. (NEMA, No. 35 at 4.)

The Department believes that lamps manufactured to comply with standards at 120 V will have a shorter life when applied on power systems with voltages greater than 120. This would result in the removal of most 125 and 130 V lamps from the marketplace because these lamps would not offer any longer life to consumers and because the longer life filaments would not meet the lamp efficacy standards at 120 V. Therefore, the Department will allow testing of incandescent lamps at the rated voltage, as defined in today's rule, or at the mean of the rated voltage range. Incandescent lamps with voltages between 100 and 115, and including 100 and 115, shall be tested at 115 V if the lamp can operate at 115 V, and incandescent lamps with voltages between 130 and 150, and including 130 and 150, shall be tested at 130 V if the lamp can operate at 130 V. Lamps not

marked with a voltage shall be tested at 120 V (see the definitions of "Design Voltage" and "Rated Voltage" in 10 CFR § 430.2). This approach provides for testing incandescent lamps at a known voltage for certification to the lamp efficacy standards while accommodating the FTC requirements for labeling, which allow testing and labeling at the design voltage. The approach is also less confusing for enforcement testing because the test voltage is either marked on the lamp or fixed at 115 V or 130 V.

*I. Basic Model*

The definition of basic model involves defining a class of lamps that are similar in design and performance to the extent that their performance can be determined by a representative sample. The lamps included in a specific basic model need not be entirely identical, particularly regarding characteristics that are not subject to performance standards. However, lamp characteristics of lumens, watts and CRI, which are measured to determine regulatory compliance, should be designed to be the same for all of the lamps included in a basic model.

NEMA requested that the definition of "basic model" use the phrase "similar light output" instead of "essentially identical" to avoid ambiguity in classifying lamp models due to inherent variations in manufacturing. (NEMA, No. 14 at 5.) The Department disagrees

with the NEMA request to replace "essentially identical" with "similar" because it interprets the phrase "essentially identical" to allow some variation and flexibility in light output and electrical and color characteristics.

NEMA asked the Department to remove the requirements for photometric characteristics in the definitions of basic models for both general service fluorescent and general service incandescent lamps. NEMA stated that lamps with different beam spreads would require distinct basic models since photometric characteristics refer to the directional distribution of the light from the lamp. NEMA claimed lamp photometry does not directly bear on energy efficiency. (NEMA, No. 14 at 5.) The Department has deleted the word "photometric" and replaced it with the words "light output" so that the basic model will not be restricted to lamps of a specific beam spread.

NEMA also recommended that the Department include a reference to total forward lumens for reflector lamps in the basic model definition. (NEMA, No. 14 at 5.) The definition for basic model of a general service incandescent lamp does not need to contain the phrase "total forward lumens for reflector lamps" because Appendix R, § 4.3.2, states that lumen output shall be determined as total forward lumens, and the IESNA test procedure LM-20 is

designed to measure only forward lumens.

NEMA asked the Department to illustrate the revised definition of basic model for a general service fluorescent lamp in the preamble to the Final Rule by reference to a family of 40-watt general service fluorescent lamps, with similar light output and lumens per watt characteristics, but with different color temperatures. Also, NEMA requested a similar illustration for a basic model of an incandescent reflector lamp by reference to two reflector lamps of the same type and with similar total forward lumens and wattage, but with different beam angles. NEMA asserted that these two reflector lamps should be the same basic model. (NEMA, No. 4 at 14.)

DOE has revised the definition of basic model for general service fluorescent lamps to include all lamps with essentially identical light output, power input, and luminous efficacy, regardless of their photometric distribution or CCT. Fluorescent lamps with similar CRIs are included if the CRI meets or exceeds the minimum standards. The definitions of general service fluorescent lamp and incandescent reflector lamp can be found in 10 CFR § 430.2. The following examples are offered to illustrate two families of general service fluorescent lamps that have the same lumen output but different CRI and therefore must be considered as two basic models:

FLUORESCENT LAMP BASIC MODEL #1

Lamp designation	Lamp wattage	Lamp lumen output	Lamp CCT K	Lamp CRI
F40T12 Type A .....	40	3200	3000	70
F40T12 Type B .....	40	3200	4000	70
F40T12 Type C .....	40	3200	5000	70

FLUORESCENT LAMP BASIC MODEL #2

Lamp designation	Lamp wattage	Lamp lumen output	Lamp CCT K	Lamp CRI
F40T12 Type D .....	40	3200	3000	80
F40T12 Type E .....	40	3200	4000	80
F40T12 Type F .....	40	3200	5000	80

Similarly, all of the lamps in a family of incandescent reflector lamps would be considered to be the same basic model if they produced the same total lumen output and used the same power input, even if their photometric distributions (i.e., beam spreads) differed. The following example is given:

INCANDESCENT REFLECTOR LAMP BASIC MODEL #1

Lamp designation	Lamp wattage	Lamp lumen output	Beam spread
PAR30 Type A .....	75	975	spot.

INCANDESCENT REFLECTOR LAMP BASIC MODEL #1—Continued

Lamp designation	Lamp wattage	Lamp lumen output	Beam spread
PAR30 Type B .....	75	975	flood.

*J. Measures of Energy Consumption*

In the Interim Final Rule, the Department described the methods for calculating the estimated operating costs or energy consumption of lamps, based on a comparative use cycle of 1,000 hours per year. The comparative use cycle was intended to be used similarly to the way it was used with fluorescent lamp ballasts, whereby estimated annual operating cost can be multiplied by a factor that represents the anticipated use of the product.

NEMA requested these calculation methods be deleted because FTC does not require annual operating costs or energy consumption on lamp labels since it was determined that such information would not be useful to consumers. (NEMA, No. 4 at 16.) NEMA also commented the procedures for estimating annual energy consumption and operating costs exceeded the Department's authority under § 323(c) of the Act, 42 U.S.C. 6293(c). NEMA further asserted that the Department should subscribe to the FTC findings on annual energy consumption and operating costs because estimated lamp usage is variable and there are no established usage patterns. Therefore, NEMA claimed, computations of annual operating costs or energy consumption based on a comparative use cycle of 1,000 hours per year would be questionable. (NEMA, No. 4 at 16–21.) Texas Gas Transmission Corporation (TGTC) commented that it "strongly supported" reporting energy consumption as the estimated annual operating cost expressed in dollars per year but gave no reasons. (TGTC, No. 2 at 4.)

The Department did not require reporting of operating costs or energy consumption information in its Interim Final Rule. Methods for calculating those quantities were given for use in manufacturer representations of energy efficacy, CRI, and energy consumption for general service fluorescent lamps and for incandescent reflector lamps. Since FTC determined that operating costs would not be useful, the Department will delete the calculation of annual operating costs for all lamps. The provisions of § 324(c)(7) of the Act, 42 U.S.C. 6294(c)(7), do not prevent the Department from prescribing calculation

methods for representations of energy consumption or lamp efficacy for covered lamps. The Department will continue to require that representations of lamp efficacy and annual energy consumption use data measured by the DOE test procedures. Any number of operating hours may be used to calculate annual energy consumption if the hours and other assumptions are clearly and accurately described in the representation. (See 10 CFR 430.23(r).)

*K. CRI Testing*

NEMA commented that the sample size for CRI could be smaller than the 20 units tested for lumens and watts. (NEMA, No. 4 at 25.) The Department believes that CRI testing of the same lamps as selected for the lumen and wattage tests is necessary to correlate the average CRI with the average lumens per watt. Furthermore, the Department does not believe a substantial testing burden will result from this level of CRI testing. Therefore, the Department will require that the same sample of 21 lamps tested for luminous efficacy be used for the CRI Test.

*L. Lamp Test Period for New and Existing Lamp Models*

NEMA stated its understanding that the provision in 10 CFR § 430.24 pertaining to sampling rules for lamps manufactured for fewer than 7 of 12 preceding months applies to existing models only. NEMA believes that 10 CFR § 430.24 should be clarified to allow new models manufactured after November 1, 1995, to be tested over the full 12-month period following such manufacture. (NEMA, No. 4 at 8.)

The Department believes that 10 CFR § 430.24 clearly applies to all basic models of lamps whether new or existing, and it rejects NEMA's attempt to limit application of this section to existing lamps. However, the Department revised 10 CFR § 430.24(r) to clarify sampling requirements for lamps manufactured during fewer than 7 of 12 months within a 12-month period. In this case, manufacturers shall distribute as evenly as possible the random selection of lamps among the months when production occurs.

At the July 19, 1995, workshop, DOE asked whether a shorter test period would be adequate to determine

whether fluorescent and incandescent reflector lamps could meet the lumen-per-watt standards for the initial testing of existing lamps. (Workshop Transcript, July 19, 1995, at 240–261.) In response, NEMA proposed a 6-month test period for existing and future lamps if the month-by-month sampling rules are modified. (NEMA, No. 14 at 10.) The Department declines to adopt NEMA's proposal for a 6-month test period for future lamp products because the statute requires a 12-month test period.

*M. Certification Data*

NEMA commented that 10 CFR § 430.62(c) requires a compliance statement and certification report to be submitted to DOE for new models of covered products prior to or concurrent with any distribution of such model. NEMA claimed that this provision is inconsistent with the last sentence of § 325(i)(7) of the Act, 42 U.S.C. 6295(i)(7), which states that manufacturers have 12 months from the commencement of production of new lamp models to send a report of the lumen output and wattage consumption to DOE. (NEMA, No. 4 at 7.)

NEMA commented that manufacturers must be permitted to sell new models of lamps prior to submission of a certification report based on testing during the first 12 months of manufacturing. NEMA also proposed that the certification report be submitted within 1 month after the 12 month test period. NEMA suggests that a statement of good faith compliance could be submitted prior to distribution of new basic lamp models if the Department is concerned that manufacturers could use the test period to distribute standard lamps. (NEMA, No. 14 at 10.)

Section 325(i)(7) of EPCA, 42 U.S.C. 6295(i)(7), provides that lamp manufacturers shall have 12 months from the commencement of production to test new products and to certify that they comply with the energy conservation standards. During this test period, however, new lamps that are sold shall meet the applicable standards. The Department will require a statement from manufacturers that new lamp products meet the applicable standards based on information, testing, and analysis such as design analysis,

prototype and initial production tests. The statement must be signed by a responsible company official and contain the date of commencement of manufacturing for each basic model of lamp. A certification report will be required within 1 month following the end of the 12-month testing period. The statement and clarification of the allowance for 12 months' testing of new or existing products is reflected in 10 CFR § 430.62, Submission of Data.

#### *N. Medium Base Compact Fluorescent Lamps and General Service Incandescent Lamps*

In its Interim Final Rule, the Department stated that "covered product" includes medium base compact fluorescent lamps, to be consistent with the labeling requirements in § 324(a)(2)(C)(i) of EPCA, 42 U.S.C. 6294(a)(2)(C)(i). Furthermore, the Department included the statutory definition for medium base compact fluorescent lamps in the Interim Final Rule. It also expressly included a requirement to calculate the lamp efficacy in 10 CFR § 430.23(r)(2). 59 FR 49468.

NEMA commented that the Department did not have authority under EPCA, as amended, to issue test procedures for medium base compact fluorescent or non-reflector general service incandescent lamps because these products are not covered products. Therefore, NEMA proposed that covered product be revised to include medium base compact fluorescent lamps and general service incandescent lamps. It requested the Department revise the definition of "general service fluorescent lamp" to expressly include medium base compact fluorescent lamps. Additionally, NEMA suggested the Department revise the definition of "medium base compact fluorescent lamp" to exclude the 4-foot straight and 2-foot U-shaped lamps with wattages greater than 28, and 8-foot slimline and high-output lamps. NEMA also suggested that a change was needed at 10 CFR § 430.62(r)(2) to expressly exclude medium base compact fluorescent lamps from certification reporting. (NEMA, No. 4 at 2, 10 and 11.)

The Department believes that a revision to the definition of medium base compact fluorescent lamp to exclude clauses 1-4 in the definition of fluorescent lamp is unnecessary because a medium base compact fluorescent lamp is not a fluorescent lamp in the context of this regulation; it is a substitute for an incandescent general service lamp. The Department has removed the reference to medium base

compact fluorescent lamps and general service incandescent lamps in 10 CFR § 430.23(r)(2), but no other changes are needed in that section because the definitions of basic model adequately delineate which products are subject to standards. Consequently, the Department will not require a certification or compliance report on general service incandescent lamps which are not reflector lamps or on medium base compact fluorescent lamps.

The Department believes that products such as general service incandescent lamps and medium base compact fluorescent lamps that are subject to labeling are covered products. Therefore, the Department has included test procedures for general service incandescent lamps to provide a basis for possible future energy efficiency standards. The Act directs the Department to initiate a rulemaking within 24 months of the effective date of the labeling rule to determine if standards should be promulgated for additional general service incandescent lamps. Section 325(i)(5) of EPCA, 42 U.S.C. 6295(i)(5). Furthermore, the Department has included test procedures for medium base compact fluorescent lamps because the statute considers these lamps as a "direct replacement for general service incandescent lamps" by definition. Section 321(30)(S) of EPCA, 42 U.S.C. 6291(30)(S). Given the Department's future need for data to determine whether or not to establish standards, the Department will prescribe test procedures for general service incandescent lamps and medium base compact fluorescent lamps.

#### *O. Test Procedures*

NEMA requested that the efficacy measurements for incandescent reflector and general service incandescent lamps be rounded to the nearest .5 lumens per watt rather than the nearest .1 lumens per watt to be consistent with the way the standards were specified. (NEMA, No. 4 at 26.) The Department will continue rounding to the nearest tenth of a lumen per watt to be consistent with conventional practice, to ensure consistency in converting test data into final results, and to retain the significant figures in the standard. For example, if the measured lumens per watt lies between 11.0 and 11.1, and is 11.05 or greater, the value shall be rounded up and reported as 11.1 lumens per watt; if the measured lumens per watt is less than 11.05, the value shall be rounded down and reported as 11.0 lumens per watt.

In the Interim Final Rule, the Department requested comments on the likelihood of greater measurement variations when testing medium base compact fluorescent lamps without a reference ballast. 59 FR 49468. In response, NEMA stated that industry experience suggested it was appropriate to specify the same confidence limits and sample sizes for medium base compact fluorescent lamps as for general service fluorescent lamps. (NEMA, No. 4 at 27.) The Department will not change its sampling plan to account for testing a medium base compact fluorescent lamp without a reference ballast.

The Interim Final Rule incorporated IESNA standard LM-20-1982, incandescent reflector lamp test methods. NEMA, Philips, and IESNA recommended that the Department incorporate by reference the revised 1994 version of LM-20. (NEMA, No. 4 at 28; IESNA, No. 1 at 1; Philips, No. 3 at 2.) Furthermore, IESNA commented that IESNA documents LM-16 (colorimetry of light sources), LM-20 (incandescent reflector lamp test methods) and LM-58 (spectroradiometric measurements) had later publication dates than those listed. (IESNA, No. 1 at 1.) Likewise, NEMA requested that these publication dates be updated. (NEMA, No. 4 at 29.)

The Department has amended the dates of LM-16, LM-20 and LM-58 to the latest published dates. The revision for LM-16 adds state of the art radiometry sensors, and the revisions for LM-58 reorganize the document, add new equations and add diode array sensing. The revisions for LM-20 will make testing of incandescent reflector lamps easier because manufacturers may now use the integrating sphere measurement technique. These revised industry test standards are listed at 10 CFR 430.22(b). Also note that DOE revised section 430.22 to list the industry test standards by the respective standards issuing organizations to make the referenced standards easier to locate.

NEMA requested that subparagraph 4.3.2. of Appendix R, Subpart B, of 10 CFR Part 430 incorporate the entire text of LM-66 for compact fluorescent lamps rather than only Sections 11 and 13. (NEMA, No. 4 at 29.) Philips commented that the Department must remove the requirement for a reference ballast so that an integrally ballasted compact fluorescent lamp can be tested. (Philips, No. 3 at 2.) The Department does not require or use measurements with a reference ballast because that would require separation of the bulb and ballast, which is not possible with an integrally ballasted lamp. However,

since LM-66 contains no provision for measuring integrally ballasted compact fluorescent lamps, the Department will clearly state that it is excepting the requirement for a reference ballast. The Department has incorporated the entire LM-66 because it refers to Sections 1, 2, 3, 7, 11 and 13. However, the Department modified the test requirements in LM-66 to use an integral ballast instead of a reference ballast in its regulations. (See Part 430, Subpart B, Appendix R, paragraph 4.4.)

In their comments regarding the Interim Final Rule, NEMA and Philips stated that the Department incorrectly required the use of alternating current with the IESNA LM-45 test procedure for testing incandescent lamps. (NEMA, No. 4 at 30; Philips, No. 3 at 2.) The Department notes that the IESNA LM-45 standard allows measurements to be performed using direct current or alternating current. Therefore, the Department will modify Appendix R to allow testing with either direct current or alternating current at the rated lamp voltage. (See 10 CFR, Part 430, Subpart B, Appendix R, paragraph 4.2.1.)

NEMA requested the Department amend paragraph 4.3.2 of Appendix R, Subpart B, of 10 CFR Part 430 to permit manufacturers to use the spherical photometry method in accordance with the revised IESNA LM-20-1994. (Spherical photometry was expressly prohibited in 10 CFR, Subpart B, Appendix R, § 4.3.2.) NEMA further stated that light output for incandescent reflector lamps should be measured as total forward lumens. (NEMA, No. 4 at 31.)

The Department lifted its prohibition on the use of the integrating sphere and is referencing IESNA LM-20-1994, which allows the spherical photometry method. IESNA LM-20 was revised so that the measurement procedure for total flux measurement using an integrating sphere, § 7.2, would properly measure only the forward lumens emitted by a reflector lamp, with special care taken to determine sphere photometric calibration using a reference source with similar beam distribution.

In its comments regarding the Interim Final Rule, NEMA requested deletion of selective references to IESNA LM-45 for testing incandescent lamps and inclusion of the entire LM-45. (NEMA, No. 4 at 33.) Although the Interim Final Rule incorporates IESNA LM-45 in its entirety, there are several instances where terms are defined differently within IESNA LM-45. Selective references are necessary to ensure that the most precise definitions are applied to the DOE test procedures.

#### *P. Definitions*

In its comments regarding the Interim Final Rule, NEMA stated that the word "only" was omitted from the definition of fluorescent lamp in 10 CFR § 430.2. This omission creates a difference from the statutory language of § 321(30)(A) of EPCA, 42 U.S.C. 6291 (30)(A). (NEMA, No. 4 at 11.) The Department has revised the definition to include the word "only."

In comments regarding the Interim Final Rule, NEMA suggested that the definition of a cold temperature fluorescent lamp should include a requirement to etch the lamp "FOR COLD TEMPERATURE USE" and a requirement for a similar designation in marketing materials. (NEMA, No. 4 at 12.) The Department believes that marking the lamp for cold temperature use and designating it as such in marketing materials will restrict this lamp's use to exempt applications. Therefore, the Department will require manufacturers to expressly designate the lamp for cold temperatures with markings on the lamp and in marketing materials; however, the Department is not specifying the exact language.

#### *Q. National Voluntary Laboratory Accreditation Program (NVLAP)*

In the laboratory accreditation program at 10 CFR § 430.25(b), the Department references *NVLAP Handbook 150-01*, July 1994, "Energy Efficient Lighting Products." The Department has determined that *NVLAP Handbook 150-01* is not adequate for laboratory accreditation to DOE test procedures because the handbook does not specifically require laboratory accreditation to the DOE test procedures. This is of particular concern to DOE where international agreements allow NVLAP to recognize foreign accrediting organizations without any requirement to accredit laboratories to the DOE test procedures. Consequently, NVLAP has issued a DOE supplement to *Handbook 150-01* which changes § 5, and Appendices B, C, and G. The new DOE supplement will be used to accredit lighting laboratories to the DOE test procedures. (*NVLAP Handbook 150-1 Supplement*.)

The Department has changed 10 CFR § 430.25 to state that test laboratories must be accredited to perform the DOE test procedures. This includes foreign laboratories accredited by foreign accrediting bodies who may have mutual recognition agreements with NVLAP.

#### *R. Long-life Halogen Lamps*

Litetronics commented it has developed a line of 5,000-hour halogen

lamps, which are direct competitors to the exempt BR and ER lamps. It claimed these halogen lamps are 20 percent more efficient than ER and BR reflector lamps. However, these lamps will not meet the energy efficiency standards. The lamps are designed for high ceiling applications such as hotel lobbies and shopping malls where it is very expensive to change lamps. Litetronics requested the Department provide an exemption or some other consideration for these lamps in the Final Rule. (Litetronics, No. 12 at 2.)

The advantages of a long-life halogen PAR lamp over the BR and ER exempt lamps were discussed at the lamp workshop on July 19, 1995. Litetronics claimed this lamp is 20 percent more efficient than BR or ER lamps. Angelo Brothers cautioned that an exemption for a long-life halogen lamp would create another loophole for less efficient PAR halogen lamps. OSI stated that several of the lamp manufacturers could take existing halogen lamps, extend their life, and argue for exemption. (Workshop Transcript, July 19, 1995, at 159.)

In further comments, Litetronics claimed long-life halogen lamps were developed after the passage of EPCA assuming halogen lamps would automatically meet the standards. Litetronics claimed it spent resources to develop an energy efficient long-life halogen lamp which has an average life greater than 4,000 hours and will almost meet the minimum lumen per watt requirements in the incandescent reflector lamp standards. Furthermore, Litetronics proposed an interpolation of the lumen per watt and wattage levels by one watt increments since it claimed that all incandescent lamp efficacies change in direct proportion to wattage. Litetronics presented a table showing how closely its 4,000 hour halogen lamps meets its revised lumen per watt number. (Litetronics, No. 21 at 1.) The Litetronics lumen per watt data on its long-life halogen lamps was evaluated by NIST. NIST found the long-life halogen lamp does not meet the standards although it is more efficient than incandescent long-life lamps. Based on the NIST report, DOE concluded that the Litetronics long-life halogen lamp does not meet the energy efficiency standards. DOE also evaluated the interpolation scheme and determined that an interpolation large enough to include these long-life halogen lamps would significantly reduce average lamp efficacy levels below the minimums required by the statute.

Since the exemptions in the statute are for specific applications and do not

provide an express exemption for long-life halogen lamps, the Department can not provide any exemption for these lamps. The Department can only amend standards in a future rulemaking. Although life testing is possible, DOE has decided that this exemption would be difficult to enforce due to test times that exceed 10,000 hours and the need for large samples. However, the Department may reconsider these lamps in a future lamp rulemaking.

#### IV. Procedural Requirements

##### A. Review Under the National Environmental Policy Act of 1969

In this rule, the Department will finalize test procedures that will implement statutorily mandated energy conservation standards for incandescent and fluorescent lamps. These test procedures were published as an Interim Final Rule on September 28, 1994, at 59 FR 49468. The Department determined that the Interim Final Rule was covered under the Categorical Exclusion found at paragraph A.6 of Appendix A to Subpart D, 10 CFR Part 1021, which applies to the establishment of procedural rulemakings. This Final Rule is also a procedural rulemaking and its implementation will not affect the quality or distribution of energy usage and therefore will not result in any environmental impacts. Accordingly, neither an environmental assessment nor an environmental impact statement is required.

##### B. Review Under Executive Order 12866, "Regulatory Planning and Review"

This regulatory action is not a significant regulatory action under Executive Order 12866, "Regulatory Planning and Review." 58 FR 51735 (October 4, 1993). Accordingly, this action is not subject to review under the Executive Order by the Office of Information and Regulatory Affairs.

##### C. Review Under the Regulatory Flexibility Act of 1980

The Regulatory Flexibility Act of 1980, 5 U.S.C. § 603, requires the preparation of an initial regulatory flexibility analysis for every rule which 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. The Department provided the required certification when it published its Interim Final Rule on September 28, 1994, at 59 FR 49468. Consequently, no further action is required for this rulemaking.

##### D. Review Under Executive Order 12612, "Federalism"

Executive Order 12612, "Federalism," 52 FR 41685 (October 30, 1987), requires that regulations, rules, legislation, and any other policy actions be reviewed for any substantial direct effect on States, on the relationship between the National Government and States, or in the distribution of power and responsibilities among various levels of government. If there are substantial effects, then the Executive Order requires preparation of a federalism assessment to be used in all decisions involved in promulgating and implementing a policy action.

The rule published today would not regulate the States. It primarily would affect the manner in which DOE promulgates energy conservation standards for residential and commercial products, water conservation standards, test procedures, and certification of compliance by manufacturers prescribed under the Energy Policy and Conservation Act. State regulation in this area is largely preempted by the Energy Policy and Conservation Act. Today's rule would not alter DOE's authority and responsibility to regulate in this area. Accordingly, DOE has determined that preparation of a federalism assessment is unnecessary.

##### E. Review Under Executive Order 12630, "Governmental Actions and Interference With Constitutionally Protected Property Rights"

It has been determined pursuant to Executive Order 12630, "Governmental Actions and Interference with Constitutionally Protected Property Rights," 52 FR 8859 (March 18, 1988), that this regulation would not result in any takings which might require compensation under the Fifth Amendment to the United States Constitution.

##### F. Review Under the Paperwork Reduction Act of 1980

No new information or recordkeeping requirements are imposed by this rulemaking. Accordingly, no OMB clearance is required under the Paperwork Reduction Act (44 U.S.C. 3501 *et seq.*).

##### G. Review Under Executive Order 12988, "Civil Justice Reform"

With respect to the review of existing regulations and the promulgation of new regulations, § 3(a) of Executive Order 12988, "Civil Justice Reform," 61 FR 4729 (February 7, 1996), imposes on executive agencies the following requirements: (1) eliminate drafting

errors and ambiguity; (2) write regulations to minimize litigation; and (3) provide a clear legal standard for affected conduct rather than a general standard and promote simplification and burden reduction. With regard to the review required by § 3(a), § 3(b) of the Executive Order 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 reducing burdens; (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 the Executive Order requires Executive agencies to review regulations in light of applicable standards in § 3(a) and 3(b) to determine whether they are met or it is unreasonable to meet one or more of them. DOE reviewed today's Final Rule under the standards of § 3 of the Executive Order and determined that, to the extent permitted by law, it meets the requirements of those standards.

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

Pursuant to § 301 of the Department of Energy Organization Act (Pub. L. 95-91), the Department of Energy is required to comply with § 32 of the Federal Energy Authorization Act (FEAA), as amended by § 9 of the Federal Energy Administration Authorization Act of 1977 (Pub. L. 95-70). Section 32 provides in essence that, where a proposed or Final Rule involves or uses commercial standards, the rulemaking must inform the public of the use and background of such standards.

This Final Rule incorporates by reference Illuminating Engineering Society of North America and American National Standards Institute commercial test procedures to measure the efficacy of general service fluorescent and incandescent lamps, medium base compact fluorescent lamps and the color rendering index of fluorescent lamps. The commercial standards are: IESNA LM-16-1993, IESNA LM-20-1994, IESNA LM-58-1994 and the *Illuminating Engineering Society Lighting Handbook*, Chapter 6, and American National Standards Institute standards C78.21-1989 and C79.1-1994.

The Department of Energy has evaluated IESNA Standards LM-16-

1993, LM-20-1994 and LM-58-1994 and the *Illuminating Engineering Society of North America Lighting Handbook*, Chapter 6, and American National Standards Institute standards C78.21-1989 and C79.1-1994 in light of the public participation criteria of § 32(b). The Department was unable to conclude whether development of these standards fully complied with § 32(b) regarding the manner of public participation.

As required by § 32(c), the Department of Energy has consulted with the Attorney General and the Chairman of the Federal Trade Commission concerning the impact of these standards on competition prior to prescribing final test procedures. Neither the Attorney General nor the FTC Chairman rejected any of these industry test standards for anticompetitive reasons.

*I. Review Under Small Business Regulatory Enforcement Fairness Act of 1996*

As required by 5 U.S.C. 801, DOE will report to Congress promulgation of the rule prior to its effective date. 5 U.S.C. 801. The report will state that it has been determined that the rule is not a "major rule" as defined by 5 U.S.C. 804(3).

*J. Review Under the Unfunded Mandates Reform Act of 1995*

Section 202 of the Unfunded Mandates Reform Act of 1995 ("Unfunded Mandates Act") (signed into law on March 22, 1995) requires that the Department prepare a budgetary impact statement before promulgating a rule that includes a Federal mandate that may result in expenditure by state, local, and tribal governments, in the aggregate, or by the private sector, of \$100 million or more in any one year. The budgetary impact statement must include: (1) identification of the Federal law under which the rule is promulgated; (2) a qualitative and quantitative assessment of anticipated costs and benefits of the Federal mandate and an analysis of the extent to which such costs to state, local, and tribal governments may be paid with Federal financial assistance; (3) if feasible, estimates of the future compliance costs and of any disproportionate budgetary effects the mandate has on particular regions, communities, non-Federal units of government, or sectors of the economy; (4) if feasible, estimates of the effect on the national economy; and (5) a description of the Department's prior consultation with elected representatives of state, local, and tribal

governments and a summary and evaluation of the comments and concerns presented. The Department has determined that the action proposed today does not include a Federal mandate that may result in estimated costs of \$100 million or more to state, local, or tribal governments in the aggregate or to the private sector. Therefore, the requirements of Sections 203 and 204 of the Unfunded Mandates Act do not apply to this action.

**List of Subjects in 10 CFR Part 430**

Administrative practice and procedure, Energy conservation, Fluorescent and Incandescent lamps, Incorporation by reference.

Issued in Washington, DC, on April 21, 1997.

**Christine A. Ervin,**  
*Assistant Secretary, Energy Efficiency and Renewable Energy.*

For the reasons set forth in the preamble, Part 430 of Chapter II of Title 10, Code of Federal Regulations, is amended as set forth below.

**PART 430—ENERGY CONSERVATION PROGRAM FOR CONSUMER PRODUCTS**

1. The authority citation for Part 430 continues to read as follows:

**Authority:** 42 U.S.C. 6291-6309.

2. Section 430.1 is revised to read as follows:

**430.1 Purpose and scope.**

This part establishes the regulations for the implementation of part B of title III (42 U.S.C. 6291-6309) of the Energy Policy and Conservation Act (Pub. L. 94-163), as amended by Pub. L. 95-619, Pub. L. 100-12, Pub. L. 100-357, and Pub. L. 102-486 which establishes an energy conservation program for consumer products other than automobiles.

3. Section 430.2 of Subpart A is amended by revising paragraphs (15) and (16) in the definition "Basic model," by revising the definitions for "Cold temperature fluorescent lamp," "Fluorescent lamp," and "Incandescent lamp," and by adding new definitions for "BR incandescent reflector lamp," "Colored fluorescent lamp," "Colored incandescent lamp," "Correlated color temperature," "Design voltage," "ER incandescent reflector lamp," "Incandescent reflector lamp," "Rated voltage," "Rated wattage," "Residential straight-shaped lamp," "Rough or vibration service incandescent reflector lamp," and "Voltage range." These amendments occur in alphabetical order, to read as follows:

**§ 430.2 Definitions.**

\* \* \* \* \*  
*Basic model* \* \* \*  
\* \* \* \* \*

(15) With respect to general service fluorescent lamps, means lamps that have essentially identical light output and electrical characteristics—including lumens per watt and color rendering index (CRI)—and that do not have any differing physical or functional characteristics that affect energy consumption or efficacy.

(16) With respect to incandescent reflector lamps, means lamps that have essentially identical light output and electrical characteristics—including lumens per watt—and that do not have any differing physical or functional characteristics that affect energy consumption or efficacy.

\* \* \* \* \*  
*BR incandescent reflector lamp* means a reflector lamp that has a bulged section below the bulb's major diameter and above its approximate base line as shown in Figure 1 (RB) on page 7 of ANSI C79.1-1994. A BR30 lamp has a lamp wattage of 85 or less than 66 and a BR40 lamp has a lamp wattage of 120 or less.

\* \* \* \* \*  
*Cold temperature fluorescent lamp* means a fluorescent lamp specifically designed to start at -20°F when used with a ballast conforming to the requirements of ANSI Standard C78.1-1991, and is expressly designated as a cold temperature lamp both in markings on the lamp and in marketing materials, including but not limited to catalogs, sales literature, and promotional material.

\* \* \* \* \*  
*Colored fluorescent lamp* means a fluorescent lamp designated and marketed as a colored lamp, and with either of the following characteristics: a CRI less than 40, as determined according to the method given in CIE Publication 13.2 (see 10 CFR 430.22), or a lamp correlated color temperature less than 2,500K or greater than 6,600K.

*Colored incandescent lamp* means an incandescent lamp designated and marketed as a colored lamp that has a CRI less than 50, as determined according to the method given in CIE Publication 13.2 (see 10 CFR 430.22); has a correlated color temperature less than 2,500K or greater than 4,600K; has a lens containing 5 percent or more neodymium oxide; or contains a filter to suppress yellow and green portions of the spectrum and is specifically designed, designated and marketed as a plant light.

\* \* \* \* \*



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

\* \* \* \* \*

*Design voltage* with respect to an incandescent lamp means:

- (1) The voltage marked as the intended operating voltage;
- (2) The mid-point of the voltage range if the lamp is marked with a voltage range; or
- (3) 120 V if the lamp is not marked with a voltage or voltage range.

\* \* \* \* \*

*ER incandescent reflector lamp* means a reflector lamp with an elliptical section below the bulb's major diameter and above its approximate baseline as shown in Figure 1 (RE) on page 7 of ANSI C79.1-1994 (see 10 CFR 430.22) and a finished size and shape shown in ANSI C78.21-1989 including the referenced reflective characteristics in part 7 of ANSI C78.21-1989 (see 10 CFR 430.22).

\* \* \* \* \*

*Fluorescent lamp* means a low pressure mercury electric-discharge source in which a fluorescing coating transforms some of the ultraviolet energy generated by the mercury discharge into light, including only the following:

- (1) Any straight-shaped lamp (commonly referred to as 4-foot medium bi-pin lamps) with medium bi-pin bases of nominal overall length of 48 inches and rated wattage of 28 or more.
- (2) Any U-shaped lamp (commonly referred to as 2-foot U-shaped lamps) with medium bi-pin bases of nominal overall length between 22 and 25 inches and rated wattage of 28 or more.
- (3) Any rapid start lamp (commonly referred to as 8-foot high output lamps) with recessed double contact bases of nominal overall length of 96 inches and 0.800 nominal amperes, as defined in ANSI C78.1-1991.
- (4) Any instant start lamp (commonly referred to as 8-foot slimline lamps) with single pin bases of nominal overall length of 96 inches and rated wattage of 52 or more, as defined in ANSI C78.3-1991.

\* \* \* \* \*

*Incandescent lamp* means a lamp in which light is produced by a filament heated to incandescence by an electric current, including only the following:

- (1) Any lamp (commonly referred to as lower wattage non-reflector general service lamps, including any tungsten halogen lamp) that has a rated wattage between 30 and 199, has an E26 medium screw base, has a rated voltage or voltage range that lies at least

partially in the range of 115 and 130 volts, and is not a reflector lamp.

- (2) Any incandescent reflector lamp.
- (3) Any general service incandescent lamp (commonly referred to as a high- or higher-wattage lamp) that has a rated wattage above 199 (above 205 for a high wattage reflector lamp).

*Incandescent reflector lamp* (commonly referred to as a reflector lamp) means any lamp in which light is produced by a filament heated to incandescence by an electric current, which: is not colored or designed for rough or vibration service applications that contains an inner reflective coating on the outer bulb to direct the light; has an R, PAR or similar bulb shape (excluding ER or BR) with an E26 medium screw base; has a rated voltage or voltage range that lies at least partially in the range of 115 and 130 volts; has a diameter that exceeds 2.75 inches; and is either a low(er)-wattage reflector lamp that has a rated wattage between 40 and 205; or a high(er)-wattage reflector lamp that has a rated wattage above 205.

\* \* \* \* \*

*Rated voltage* with respect to incandescent lamps means:

- (1) The design voltage if the design voltage is 115 V, 130 V or between 115V and 130 V;
- (2) 115 V if the design voltage is less than 115 V and greater than or equal to 100 V and the lamp can operate at 115 V; and
- (3) 130 V if the design voltage is greater than 130 V and less than or equal to 150 V and the lamp can operate at 130 V.

\* \* \* \* \*

*Rated wattage*, with respect to 4-foot medium bi-pin T8, T10 or T12 lamps, means:

- (1) If the lamp is listed in ANSI C78.1-1991, the nominal wattage of a lamp determined by the lamp designation in Annex A.2 of ANSI C78.1-1991; or
- (2) If the lamp is a residential straight-shaped lamp, the wattage a lamp consumes when operated on a reference ballast for which the lamp is designed; or
- (3) If the lamp is neither listed in ANSI C78.1-1991 nor a residential straight-shaped lamp, the wattage a lamp consumes when using reference ballast characteristics of 236 volts, 0.43 amps and 439 ohms for T10 or T12 lamps or reference ballast characteristics of 300 volts, 0.265 amps and 910 ohms for T8 lamps.

\* \* \* \* \*

*Residential straight-shaped lamp* means a low pressure mercury electric-

discharge source in which a fluorescing coating transforms some of the ultraviolet energy generated by the mercury discharge into light, including a straight-shaped fluorescent lamp with medium bi-pin bases of nominal overall length of 48 inches and is either designed exclusively for residential applications; or designed primarily and marketed exclusively for residential applications.

- (1) A lamp is designed exclusively for residential applications if it will not function for more than 100 hours with a commercial high-power-factor ballast.

(2) A lamp is designed primarily and marketed exclusively for residential applications if it:

- (i) Is permanently and clearly marked as being for residential use only;
- (ii) Has a life of 6,000 hours or less when used with a commercial high-power-factor ballast;
- (iii) Is not labeled or represented as a replacement for a fluorescent lamp that is a covered product; and
- (iv) Is marketed and distributed in a manner designed to minimize use of the lamp with commercial high-power-factor ballasts.

(3) A manufacturer may market and distribute a lamp in a manner designed to minimize use of the lamp with commercial high-power-factor ballasts by:

- (i) Packaging and labeling the lamp in a manner that clearly indicates the lamp is for residential use only and includes appropriate instructions concerning proper and improper use; if the lamp is included in a catalog or price list that also includes commercial/industrial lamps, listing the lamp in a separate residential section accompanied by notes about proper use on the same page; and providing as part of any express warranty accompanying the lamp that improper use voids such warranty; or
- (ii) Using other comparably effective measures to minimize use with commercial high-power-factor ballasts.

\* \* \* \* \*

*Rough or vibration service incandescent reflector lamp* means a reflector lamp: in which a C-11 (5 support), C-17 (8 support), or C-22 (16 support) filament is mounted (the number of support excludes lead wires); in which the filament configuration is as shown in Chapter 6 of the 1993 *Illuminating Engineering Society of North America Lighting Handbook*, 8th Edition (see 10 CFR 430.22); and that is designated and marketed specifically for rough or vibration service applications.

\* \* \* \* \*

*Voltage range* means a band of operating voltages as marked on an

incandescent lamp, indicating that the lamp is designed to operate at any voltage within the band.

\* \* \* \* \*

4. Section 430.22 of Subpart B, is amended by revising the heading for paragraph (a), revising paragraphs (a)(1) and (a)(2)(ii), removing paragraphs (a)(3) and (a)(4), redesignating paragraph (b) as (c), adding a new paragraph (b) and revising redesignated paragraph (c)(1), to read as follows:

**§ 430.22 Reference sources.**

(a) *Industry Test Standards Incorporated by Reference.*

(1) *General.* The following standards, which are not otherwise set forth in part 430, are incorporated by reference and made a part of part 430. The standards listed in this section have been approved for incorporation by reference by the Director of the Federal Register. The specified versions of the standards are incorporated, and any subsequent amendment to a standard by the standard-setting organization will not affect the DOE test procedures unless and until those test procedures are amended by DOE.

(2) \* \* \*

(ii) U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Hearings and Dockets, Forrestal Building, 1000 Independence Ave, SW, Washington, DC 20585.

(b) *List of Sources and Standards Incorporated by Reference.*

(1) American National Standards Institute (ANSI). The ANSI standards listed in this paragraph may be obtained from the American National Standards Institute, 1430 Broadway, New York, NY 10018, (212) 642-4900.

1. ANSI C78.1-1991, "for Fluorescent Lamps—Rapid-Start Types—Dimensional and Electrical Characteristics"
2. ANSI C78.2-1991, "for Fluorescent Lamps—Preheat-Start Types—Dimensional and Electrical Characteristics of Fluorescent Lamps"
3. ANSI C78.3-1991, "for Fluorescent Lamps—Instant-Start and Cold-Cathode Types—Dimensional and Electrical Characteristics"
4. ANSI C78.375-1991, "for Fluorescent Lamps—Guide for Electrical Measurements"
5. ANSI C82.3-1983 "for Reference Ballasts for Fluorescent Lamps"
6. ANSI C79.1-1994, "Nomenclature for Glass Bulbs—Intended for Use with Electric Lamps"
7. ANSI C78.21-1989, "Incandescent Lamps—PAR and R Shapes"

(2) Illuminating Engineering Society of North America (IESNA). The IESNA standards listed in this paragraph may be obtained from the Illuminating

Engineering Society of North America, 120 Wall Street, Floor 17, New York, NY 10005-4001, (212) 248-5000.

1. Illuminating Engineering Society LM-9-88, "IES Approved Method for the Electrical and Photometric Measurements of Fluorescent Lamps"
2. Illuminating Engineering Society of North America LM-16-1993, "IESNA Practical Guide to Colorimetry of Light Sources"
3. Illuminating Engineering Society of North America LM-20-1994, "IESNA Approved Method for Photometric Testing of Reflector-Type Lamps"
4. Illuminating Engineering Society of North America LM-45-91, "IES Approved Method for Electrical and Photometric Measurements of General Service Incandescent Filament Lamps"
5. Illuminating Engineering Society of North America LM-58-1994, "IESNA Guide to Spectroradiometric Measurements"
6. Illuminating Engineering Society of North America LM-66-1991, "IES Approved Method for the Electrical and Photometric Measurements of Single-Ended Compact Fluorescent Lamps"
7. *Illuminating Engineering Society of North America Lighting Handbook, Reference and Application*, 8th Edition, 1993, Chapter 6, Light Sources

(3) International Commission on Illumination (CIE). The CIE standards listed in this paragraph may be obtained from the International Commission on Illumination, CIE Bureau Central, Kegelgasse 27, A-1030, Vienna, Austria. CIE publications are also available from TLA Lighting Consultants, 7 Pond Street, Salem, MA 10970, (508) 745-6870.

1. International Commission on Illumination (CIE) Publication No. 13.2 1974, corrected reprint 1993, "Method of Measuring and Specifying Color Rendering Properties of Light Sources," ISBN 3 900 734 39 9

(c) *Reference Standards.* (1) *General.* The standards listed in this paragraph are referred to in the DOE test procedures and elsewhere in 10 CFR part 430 but are not incorporated by reference. These sources are given here for information and guidance.

\* \* \* \* \*

5. Section 430.23(r) is revised to read as follows:

**§ 430.23 Test procedures for measures of energy consumption.**

\* \* \* \* \*

(r) *General Service Fluorescent Lamps and General Service Incandescent Lamps.*

(1) The estimated annual energy consumption for general service fluorescent lamps and incandescent reflector lamps, expressed in kilowatt-hours per year, shall be the product of the input power in kilowatts as

determined in accordance with section 4 of Appendix R to this subpart and an average annual use specified by the manufacturer, with the resulting product rounded off to the nearest kilowatt-hour per year. Manufacturers must provide a clear and accurate description of the assumptions used for the estimated annual energy consumption.

(2) The lamp efficacy for general service fluorescent lamps shall be equal to the average lumen output divided by the average lamp wattage as determined in section 4 of Appendix R of this subpart, with the resulting quotient rounded off to the nearest lumen per watt.

(3) The lamp efficacy for incandescent reflector lamps shall be equal to the average lumen output divided by the average lamp wattage as determined in section 4 of Appendix R of this subpart, with the resulting quotient rounded off to the nearest tenth of a lumen per watt.

(4) The color rendering index of a general service fluorescent lamp shall be tested and determined in accordance with section 4.5 of Appendix R of this subpart and rounded off to the nearest unit.

6. Section 430.24(r) is revised to read as follows:

**§ 430.24 Units to be tested.**

\* \* \* \* \*

(r)(1) For each basic model of general service fluorescent lamp and incandescent reflector lamp, samples of production lamps shall be tested and the results for all samples shall be averaged for a 12-month period. A minimum sample of 21 lamps shall be tested. The manufacturer shall randomly select a minimum of three 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 a 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 of a basic model shall be based on the sample and shall be no greater than the lower of the mean of the sample or the lower 95-percent confidence limit of the true mean ( $X_L$ ) divided by 0.97, i.e.,

$$\frac{\bar{x} - t_{0.95} \left( \frac{s}{\sqrt{n}} \right)}{0.97}$$

where:

$\bar{x}$ =the mean luminous efficacy of the sample  
 s=the sample standard deviation  
 $t_{0.95}$ =the t statistic for a 95-percent confidence limit for n-1 degrees of freedom (from statistical tables)  
 n=sample size

(2) For each basic model of general service fluorescent lamp, the color rendering index (CRI) shall be measured from the same lamps selected for the lumen output and watts input measurements in paragraph (r)(1) of this section, i.e., the manufacturer shall measure all lamps for lumens, watts input, and CRI. The CRI shall be represented as the average of a minimum sample of 21 lamps and shall be no greater than the lower of the mean of the sample or the lower 95-percent confidence limit of the true mean ( $X_L$ ) divided by 0.97, i.e.,

$$\frac{\bar{x} - t_{0.95} \left( \frac{s}{\sqrt{n}} \right)}{0.97}$$

where:

$\bar{x}$ =the mean color rendering index of the sample  
 s=the sample standard deviation  
 $t_{0.95}$ =the t statistic for a 95-percent confidence limit for n-1 degrees of freedom (from statistical tables)  
 n=sample size

7. Section 430.25 is revised to read as follows:

**§ 430.25 Laboratory Accreditation Program.**

The testing for general service fluorescent lamps, general service incandescent lamps, incandescent reflector lamps, and medium base compact fluorescent lamps, shall be performed in accordance with Appendix R to this subpart and shall be conducted by test laboratories accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) or by an accrediting organization recognized by NVLAP. NVLAP is a program of the National Institute of Standards and Technology, U. S. Department of Commerce. NVLAP standards for accreditation of laboratories that test for compliance with standards for lamp efficacy and CRI are given in 15 CFR part 285 as supplemented by *NVLAP Handbook 150-01*, "Energy Efficient Lighting Products, Lamps and Luminaires." A manufacturer's or importer's own laboratory, if accredited, may conduct the applicable testing.

8. Sections 430.62(b) and (c) are revised to read as follows:

**§ 430.62 Submission of data.**

\* \* \* \* \*

(b) *Initial reporting requirements.* (1) Except as provided in paragraph (b)(2) of this section, all data required by paragraph (a) of this section shall be submitted on or before the effective date of the applicable energy conservation standard as prescribed in section 325 of the Act. For each basic model of a covered product to be distributed in commerce, each manufacturer and private labeler, or a representative of each manufacturer and private labeler, shall file a compliance statement and certification report, by certified mail, to Department of Energy, Office of Energy Efficiency and Renewable Energy, Office of Codes and Standards, Forrestal Building, 1000 Independence Avenue, SW, Washington, DC 20585-0121.

(2) Manufacturers of a basic model of a covered general service fluorescent lamp or incandescent reflector lamp shall file a compliance and certification report to DOE within 6 months from May 29, 1997.

(c) *New models.* (1) Except as provided in paragraph (c)(2) of this section, all information required by paragraph (a)(2) of this section shall be submitted for each new model prior to or concurrent with any distribution of such model. Any change to a basic model that affects energy consumption may constitute the addition of a new basic model subject to the requirements of § 430.61 of this part. If such change does not alter compliance with the applicable energy conservation standard for the basic model, the new model shall be considered certified without additional testing. In all cases, the information on the new model required by paragraph (a)(2) of this section shall be submitted, by certified mail, to: Department of Energy, Office of Energy Efficiency and Renewable Energy, Office of Codes and Standards, Forrestal Building, 1000 Independence Avenue, SW, Washington, DC 20585-0121. If a manufacturer discontinues a model, the manufacturer shall report such discontinuation by certified mail to the Department of Energy.

(2) Prior to or concurrent with the distribution of a new model of general service fluorescent lamp or an incandescent reflector lamp, a manufacturer shall submit a statement signed by a company official stating how the manufacturer determined that

the lamp meets or exceeds the energy conservation standards, including a description of any testing or analysis the manufacturer performed. This statement shall also list the model number or descriptor, lamp wattage and date of commencement of manufacture. Manufacturers of general service fluorescent lamps and incandescent reflector lamps shall submit the information required by paragraph (a)(2) of this section within one year after the date manufacture of that new model commences.

\* \* \* \* \*

9. Appendix R to Subpart B of Part 430—Uniform Test Method for Measuring Average Lamp Efficacy (LE) and Color Rendering Index (CRI) of Electric Lamps is revised to read as follows:

1. *Scope:* This appendix applies to the measurement of lamp lumens, electrical characteristics and CRI for general service fluorescent lamps, and to the measurement of lamp lumens and electrical characteristics for general service incandescent lamps, incandescent reflector lamps and medium base compact fluorescent lamps.

2. *Definitions*

- 2.1 To the extent that definitions in the IESNA and CIE standards do not conflict with the DOE definitions, the definitions specified in § 1.2 of IESNA LM-9, § 3.0 of IESNA LM-20, § 2 of IESNA LM-45, § 2 of IESNA LM-58, § 1.2 of IESNA LM-66 and § IV of CIE Publication No. 13.2 shall be included.
- 2.2 *ANSI Standard* means a standard developed by a committee accredited by the American National Standards Institute (ANSI).
- 2.3 *CIE* means the International Commission on Illumination.
- 2.4 *CRI* means Color Rendering Index as defined in § 430.2.
- 2.5 *IESNA* means the Illuminating Engineering Society of North America.
- 2.6 *Lamp efficacy* means the ratio of measured lamp lumen output in lumens to the measured lamp electrical power input in watts, rounded to the nearest whole number, in units of lumens per watt.
- 2.7 *Lamp lumen output* means the total luminous flux produced by the lamp, at the reference condition, in units of lumens.
- 2.8 *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.
- 2.9 *Reference condition* means the test condition specified in IESNA LM-9 for general service fluorescent lamps, in IESNA LM-20 for incandescent reflector lamps, in IESNA LM-45 for general service incandescent lamps and in IESNA LM-66 for medium base compact fluorescent lamps (see 10 CFR 430.22).

### 3. Test Conditions

3.1 *General Service Fluorescent Lamps:* For general service fluorescent lamps, the ambient conditions of the test and the electrical circuits, reference ballasts, stabilization requirements, instruments, detectors, and photometric test procedure and test report shall be as described in the relevant sections of IESNA LM-9 (see 10 CFR 430.22).

3.2 *General Service Incandescent Lamps:* For general service incandescent lamps, the selection and seasoning (initial burn-in) of the test lamps, the equipment and instrumentation, and the test conditions shall be as described in IESNA LM-45 (see 10 CFR 430.22).

3.3 *Incandescent Reflector Lamps:* For incandescent reflector lamps, the selection and seasoning (initial burn-in) of the test lamps, the equipment and instrumentation, and the test conditions shall conform to sections 4.2 and 5.0 of IESNA LM-20 (see 10 CFR 430.22).

3.4 *Medium Base Compact Fluorescent Lamps:* For medium base compact fluorescent lamps, the selection, seasoning and stabilization of the test lamps, and the test conditions, shall be as described in Sections 1, 2, 3, and 7 of IESNA LM-66 (see 10 CFR 430.22).

### 4. Test Methods and Measurements

All lumen measurements made with instruments calibrated to the devalued NIST lumen after January 1, 1996, shall be multiplied by 1.011.

#### 4.1 *General Service Fluorescent Lamps*

4.1.1 The measurement procedure shall be as described in IESNA LM-9, except that lamps shall be operated at the appropriate voltage and current conditions as described in ANSI C78.375 and in ANSI C78.1, C78.2 or C78.3, and lamps shall be operated using the appropriate reference ballast as described in ANSI C82.3 (see 10 CFR 430.22).

4.1.2 Lamp lumen output (lumens) and lamp electrical power input (watts), at the reference condition, shall be measured and recorded. Lamp efficacy shall be determined by computing the ratio of the measured lamp lumen output and lamp electrical power input at equilibrium for the reference condition.

#### 4.2 *General Service Incandescent Lamps*

4.2.1 The measurement procedure shall be as described in IESNA LM-45 (see 10 CFR 430.22). Lamps shall be operated at the rated voltage as defined in § 430.2.

4.2.2 The test procedure shall conform with section 7 of IESNA LM-45 and the lumen output of the lamp shall be determined in accordance with Sections 4.2a or 4.2b of IESNA LM-45 at the reference condition. Lamp electrical power input in watts shall be measured and recorded. Lamp efficacy shall be determined by computing the ratio of the measured lamp lumen output and lamp electrical power input at equilibrium for the reference condition. The test report shall conform to § 8 of IESNA LM-45 (see 10 CFR § 430.22).

#### 4.3 *Incandescent Reflector Lamps*

4.3.1 The measurement procedure shall be as described in IESNA LM-20 (see 10 CFR 430.22). Lamps shall be operated at the rated voltage as defined in § 430.2.

4.3.2 Lamp lumen output shall be determined as total forward lumens, and may be measured in an integrating sphere at the reference condition in accordance with § 7.2 of IESNA LM-20 (see 10 CFR 430.22) or from an average intensity distribution curve measured at the reference condition specified in § 6.0 of IESNA LM-20. Lamp electrical power input in watts shall be measured and recorded.

4.3.3 Lamp efficacy shall be determined by computing the ratio of the measured lamp lumen output and lamp electrical power input at equilibrium for the reference condition. The test report shall conform to section 10.0 of IES LM-20 (see § 430.22).

#### 4.4 *Medium Base Compact Fluorescent Lamps*

4.4.1 The measurement procedure shall be as described in IESNA LM-66 (see 10 CFR 430.22) except that the provisions of IESNA LM-66 which refer to operation of the lamp using a reference ballast do not apply to the testing of integrally ballasted compact fluorescent lamps. Lamps shall be operated at 120 V and 60 Hertz. Lamp lumen output shall be measured with the integral ballast according to section 11.3 of IESNA LM-66. Lamp electrical power input in watts shall be measured and recorded.

4.4.2 Lamp efficacy shall be determined by computing the ratio of the measured lamp lumen output and lamp electrical power input at equilibrium for the reference condition. The test report shall conform to section 13 of IESNA LM-66 (see 10 CFR 430.22).

#### 4.5 *Determination of Color Rendering Index*

4.5.1 The CRI shall be determined in accordance with the method specified in CIE Publication 13.2 for general service fluorescent lamps. The required spectroradiometric measurement and characterization shall be conducted in accordance with the methods given in IESNA LM-58 and IESNA LM-16 (see 10 CFR 430.22).

4.5.2 The test report shall include a description of the test conditions, equipment, measured lamps, spectroradiometric measurement results and CRI determination.

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