

$$\text{PF} = \frac{\text{Input power}}{\text{Input voltage} \times \text{input current}}$$

Where:

Input power is as defined in section 3.3.1, Input voltage is determined in accordance with section 3.3.2, expressed in volts, and Input current is determined in accordance with section 3.3.3, expressed in amps.

[54 FR 6076, Feb. 7, 1989, as amended at 56 FR 18682, April 24, 1991; 69 FR 18803, Apr. 9, 2004; 70 FR 60412, Oct. 18, 2005; 74 FR 54455, Oct. 22, 2009]

APPENDIX R TO SUBPART B OF PART 430—UNIFORM TEST METHOD FOR MEASURING AVERAGE LAMP EFFICACY (LE), COLOR RENDERING INDEX (CRI), AND CORRELATED COLOR TEMPERATURE (CCT) OF ELECTRIC LAMPS

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

2. *Definitions*

2.1 To the extent that definitions in the referenced IESNA and CIE standards do not conflict with the DOE definitions, the definitions specified in section 1.2 of IESNA LM-9 (incorporated by reference; see § 430.3), section 3.0 of IESNA LM-20 (incorporated by reference; see § 430.3), section 1.2 and the Glossary of IESNA LM-45 (incorporated by reference; see § 430.3), section 2 of IESNA LM-58 (incorporated by reference; see § 430.3), and Appendix 1 of CIE 13.3 (incorporated by reference; see § 430.3) 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 tenth, 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 (incorporated by reference; see § 430.3).

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 (incorporated by reference; see § 430.3).

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 (incorporated by reference; see § 430.3).

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 (incorporated by reference; see § 430.3).

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 (incorporated by reference; see § 430.3), except that lamps shall be operated at the appropriate voltage and current conditions as described in ANSI C78.375 (incorporated by reference; see § 430.3) and in ANSI C78.81 (incorporated by reference; see § 430.3) or ANSI C78.901 (incorporated by reference; see § 430.3), and lamps shall be operated using the appropriate reference ballast at input voltage specified by the reference circuit as described in ANSI C82.3 (incorporated by reference; see § 430.3). If, for a lamp, both low-frequency and high-frequency reference ballast settings are included in ANSI C78.81 or ANSI C78.901, the lamp shall be operated using the low-frequency reference ballast.

4.1.2 For lamps not listed in ANSI C78.81 (incorporated by reference; see § 430.3) nor in ANSI C78.901 (incorporated by reference; see § 430.3), the lamp shall be operated using the following reference ballast settings:

4.1.2.1 4-Foot medium bi-pin lamps shall be operated using the following reference ballast settings: T10 or T12 lamps are to use

236 volts, 0.43 amps, and 439 ohms; T8 lamps are to use 300 volts, 0.265 amps, and 910 ohms.

4.1.2.2 2-Foot U-shaped lamps shall be operated using the following reference ballast settings: T12 lamps are to use 236 volts, 0.430 amps, and 439 ohms; T8 lamps are to use 300 volts, 0.265 amps, and 910 ohms.

4.1.2.3 8-foot slimline lamps shall be operated using the following reference ballast settings:

(a) *T12 lamps*: 625 volts, 0.425 amps, and 1280 ohms.

(b) *T8 lamps*: 625 volts, 0.260 amps, and 1960 ohms.

4.1.2.4 8-foot high output lamps shall be operated using the following reference ballast settings:

(a) *T12 lamps*: 400 volts, 0.800 amps, and 415 ohms.

(b) *T8 lamps*: 450 volts, 0.395 amps, and 595 ohms.

4.1.2.5 4-foot miniature bipin standard output or high output lamps shall be operated using the following reference ballast settings:

(a) *Standard Output*: 329 volts, 0.170 amps, and 950 ohms.

(b) *High Output*: 235 volts, 0.460 amps, and 255 ohms.

4.1.3 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 (incorporated by reference; see §430.3). Lamps shall be operated at the rated voltage as defined in §430.2.

4.2.2 The test procedure shall conform with sections 5 and 9 of IESNA LM-45 (incorporated by reference; see §430.3), and the lumen output of the lamp shall be determined in accordance with section 9 of IESNA LM-45. 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 section 11 of IESNA LM-45.

#### 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 (incorporated by reference; see §430.3) or from an average intensity distribu-

tion 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 (incorporated by reference; see §430.3).

#### 4.4 Determination of Color Rendering Index and Correlated Color Temperature

4.4.1 The CRI shall be determined in accordance with the method specified in CIE 13.3 (incorporated by reference; see §430.3) for general service fluorescent lamps. The CCT shall be determined in accordance with the method specified in IESNA LM-9 (incorporated by reference; see §430.3) and rounded to the nearest 10 kelvin for general service fluorescent lamps. The CCT shall be determined in accordance with the CIE 15 (incorporated by reference; see §430.3) for incandescent lamps. The required spectroradiometric measurement and characterization shall be conducted in accordance with the methods set forth in IESNA LM-58 (incorporated by reference; see §430.3).

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

#### 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.

[62 FR 29240, May 29, 1997, as amended at 74 FR 34177, July 14, 2009]

### APPENDIX S TO SUBPART B OF PART 430—UNIFORM TEST METHOD FOR MEASURING THE WATER CONSUMPTION OF FAUCETS AND SHOWERHEADS

1. *Scope*: This Appendix covers the test requirements used to measure the hydraulic performance of faucets and showerheads.

#### 2. *Flow Capacity Requirements*:

a. *Faucets*—The test procedures to measure the water flow rate for faucets, expressed in gallons per minute (gpm) and liters per minute (L/min), or gallons per cycle (gal/cycle) and liters per cycle (L/cycle), shall be