



ENERGY STAR[®] Program Requirements

Product Specification for Lamps: Elevated Temperature Light Output Ratio

Draft Test Method Rev. Jan-2013

1 OVERVIEW

The following test method shall be used for determining the light output ratio of directional integrated compact fluorescent lamps (CFLs) and directional integrated LED lamps (“LED lamps”) (“lamps”) tested in an elevated temperature environment compared to an ambient temperature environment. Two measurement methods are provided for performing Elevated Temperature Light Output Ratio test (ETLOR). The test procedure contrasts the light output of lamps in restricted airflow luminaires to the light output of lamps in an ambient temperature environment.

2 APPLICABILITY

ENERGY STAR test requirements are dependent upon the product, category of the product under evaluation. The following guidelines shall be used to determine the applicability of each section of this document:

- **This ETLOR applies to directional CFLs and directional solid-state lighting (SSL).**
- The test procedures in Section 7 shall be performed on products that are required to undergo the Elevated Temperature Light Output Ratio test in the Supplemental Testing Guidance for section 9.3 – Elevated Temperature Light Output Ratio.

3 DEFINITIONS

Unless otherwise specified, all terms used in this document are consistent with the definitions in the ENERGY STAR Eligibility Criteria for Lamps.

4 METHODS OF MEASUREMENT AND REFERENCE DOCUMENTS

4.1 IES Test Methods and Reference Documents

- A) IES LM-66-11. 2011. IES Approved Method for Electrical and Photometric Measurements of Single-Ended Compact Fluorescent Lamps, Illuminating Engineering Society, New York.
- B) IES LM-79-08. 2008. IES Approved Method for Electrical and Photometric Measurements of Solid-State Lighting Products, Illuminating Engineering Society, New York.

- C) IES LM-78-07. 2007 IES Approved Method for Total Luminous Flux Measurement of Lamps Using an Integrating Sphere Photometer, Illuminating Engineering Society, New York.
- D) IES LM-54-12. 2012. IESNA Testing Procedures Committee, IES Guide to Lamp Seasoning, Illuminating Engineering Society, New York.
- E) IES LM-28-89. 1989. Guide for the Selection, Care, and Use of Electrical Instruments in the Photometric Laboratory, IES Testing Procedures Committee, Illuminating Engineering Society, New York.

5 TEST SETUP

5.1 General

- A) Test Setup and Instrumentation: Test setup and instrumentation for the lamp operation portions of this procedure shall be in accordance with the requirements of IES LM-65-10, unless otherwise noted in this document. In the event of conflicting requirements, the ENERGY STAR test method shall take precedence.
- B) Lamp Seasoning and Preburning: Prior to the first readings, compact fluorescent lamps (CFL) shall be seasoned for 100 hours in accordance with IES-LM-54-99. CFLs shall be preburned in accordance with IES LM-66-11. CFLs shall be seasoned and preburned in the position that the lamps will undergo the ETLOR test. Seasoning shall be accomplished outside of any elevated temperature testing environment. LED lamps shall not be seasoned.
- C) Input Power for Photometric Measurements: During the stabilization and photometric testing of products intended to be powered from AC mains, the product shall be connected to a voltage source that meets the requirements in IES LM-66-11 or IES LM-79-08 as applicable. When selecting a power supply for use with integrated lamps, it is necessary to apply the appropriate power factor when specifying the volt-amp rating of the power supply. Many integrated lamps have a power factor in the range of 0.5 to 0.6.
- D) Ambient Temperature: Ambient temperature shall be as stated in the specification for the duration of the test. Temperature measurements shall be taken using a temperature measurement device consisting of a thermocouple junction or resistance temperature detector (RTD) probe combined with an appropriate meter. Thermocouples or probes shall be chosen to ensure accuracy within the test temperature range.
- E) Power Meter: Power meters shall be capable of measuring to the appropriate requirements of IES LM-66-11 and/or IES LM-79-08 as applicable.
- F) Environmental Conditions: The test environment shall be clean and free from large amounts of dust and moisture. During the lamps' ON cycle, drafts shall be minimized.
- G) Sample Selection: Samples shall be representative of the manufacturer's typical product. The samples shall be clean and thoroughly inspected before testing. Any flaws or inconsistencies in the lamp samples shall be noted.

5.2 Elevated Temperature Measurement: Measurement in a Thermal Chamber

- A) For the thermal chamber, utilize the Elevated Temperature Housing and Support found in the ENERGY STAR Program Requirements Product Specification for Lamps: Elevated Temperature Life Testing, Option A or Option B. Refer to sections 8.1 and 8.2 for specific details.
- B) Ambient air temperature measurements shall be taken at a location 1-in. below the base (defined as the lowest point on the metal Edison socket when installed in a base-up position) of the lamp and 2-in. from the base of the lamp toward the enclosure wall. Measurement points should be no more than one meter from the lamp in accordance to IES LM-66-11 and LM-79-08
- C) A controlled draft enclosure shall be used to limit air movement across the lamp to a maximum of 0.08 m/s (15.7 ft/min) when placed in the thermal chamber.
- D) The photometric measurement device shall consist of a securely mounted photodetector positioned such that the plane of its detector is horizontal. Sufficient shielding shall be incorporated such that only the light from the lamp under test is measured. This shielding can be accomplished by the use of a flat-black-painted tube that extends from the photodetector to the base of the lamp. Additionally, it is recommended that a piece of diffuse transmissive material be installed above the photodetector to diminish the sensitivity of the measurement from minor misalignments of the photodetector.

5.3 Elevated Temperature Measurement: Measurement in an Integrating Sphere

- A) A 4π sphere may be used for all lamps, and for directional lamps (only) a 2π sphere may be used.
- B) For 2π geometry integrating sphere systems in which the lamp is external to the sphere, a thermal chamber around the lamp may be used to achieve the elevated ambient temperature without elevating the temperature of the sphere. The thermal chamber may be in accordance with the *Elevated Temperature Housing and Support* section for Option A in Annex A - ENERGY STAR® Elevated Temperature Life Test.
- C) Integrating sphere or thermal chamber shall limit air movement across the lamp, using the method described in IES LM-66-11 section 5.3 to verify there is no discernible airflow.

6 TEST CONDUCT

6.1 Guidance for Implementation of Ambient Temperature Life Test Procedure

D) Photometric Measurements:

- 1) For integrating sphere measurements, refer to IES LM-66-11 or IES-LM-79-08 as applicable.
- 2) For non-integrating sphere measurements, the photodetector used for photometric measurements shall be a silicon detector corrected to closely fit the Commission Internationale de l'Eclairage (CIE) spectral luminous efficiency curve ($V\lambda$). For integrating sphere measurements, see IES LM-66-11 or IES-LM-79-08 as applicable.

E) Lamp Stabilization, Transfer and Re-stabilizations for CFLs:

- 1) Stabilize lamps per IES LM-66-11 or LM-79-08 as applicable. CFLs to be removed from the seasoning area for ETLOR testing shall be handled according to IES LM-66-11. All lamps shall be re-stabilized prior to taking photometric measurements.

7 TEST PROCEDURES FOR ALL PRODUCTS

7.1 General Test Procedures

A) Lamp Installation

- 1) Install the lamp in the thermally controlled environment or thermal chamber.

B) Initial Measurement:

- 1) Apply the rated lamp voltage while operating a thermally controlled environment such that the temperature at the test point is stable as determined by three measurements 5 minutes apart at 25°C not varying by more than $\pm 5^\circ\text{C}$.
- 2) Achieve lamp stabilization per the “Lamp Stabilization, Transfer and Re-stabilization” section, described above.
- 3) Measure and record light output, input electrical values and test point temperature.

C) Elevated Temperature Measurement

- 1) Apply the rated lamp voltage while operating a thermally controlled environment such that the temperature at the test point is stable per IES LM-66-11 or IES LM-79-08, as applicable.
- 2) Conduct measurement of each lamp following the procedures set forth in IES LM-66-11 or IES LM-79-08, as applicable, with the exception of temperature.

8 TEST REPORT FOR ALL PRODUCTS

ETLOR report data may be included in an overall performance report or a standalone report, and shall include the following test information:

- A) Manufacturer’s name and product identification
- B) Name and location of the testing facility
- C) Test date
- D) Lamp base orientation
- E) Electrical and photometric values at the 25°C ambient condition
- F) Electrical and photometric values at the elevated temperature condition

- G) Elevated Temperature Light Output Ratio, calculated as the light output at the elevated temperature condition divided by the light output at the 25°C ambient condition, expressed as a percentage