ENERGY STAR® Program Requirements for Lamps

Elevated Temperature Light Output Ratio Test Method

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1 OVERVIEW

The following test method shall be used for determining product compliance with the Elevated Temperature Light Output Ratio (ETLOR) requirements in the ENERGY STAR Eligibility Criteria for Lamps.

Two measurement methods, contrasting the light output of lamps in restricted airflow luminaires to the light output of lamps in an ambient temperature environment, are provided below.

2 APPLICABILITY

This Elevated Temperature Light Output Ratio (ETLOR) Test Method applies to directional lamps; see the Lamps Specification for applicable exemptions.

3 DEFINITIONS

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

A) IES LM-65-10. 2010. IES Approved Method for Life Testing of Compact Fluorescent Lamps, Illuminating Engineering Society, New York.

B) IES LM-66-14. 2014. IES Approved Method for Electrical and Photometric Measurements of Single-Based Compact Fluorescent Lamps, Illuminating Engineering Society, New York.

C) IES LM-79-08. 2008. IES Approved Method for Electrical and Photometric Measurements of Solid-State Lighting Products, Illuminating Engineering Society, New York.

D) 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.

E) IES LM-54-12. 2012. IES Guide to Lamp Seasoning, Illuminating Engineering Society, New York.

F) IES LM-28-12. 2012. Guide for the Selection, Care, and Use of Electrical Instruments in the Photometric Laboratory, 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 (CFLs) shall be seasoned for 100 hours in accordance with IES-LM-54-12. 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 capacity of the power supply.

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 metrics of IES LM-66-11 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.

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 outlined in the ENERGY STAR Elevated Temperature Life Test Method, Option A or Option B. Refer to sections 8 and 9 of the ENERGY STAR Elevated Temperature Life Test for specific details.

B) Ambient air temperature measurements shall be taken at a location 1 inch 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 inches 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 or IES 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 or 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 8.2 for Option A in the 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.

6 TEST CONDUCT

A) 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 (Vλ).

B) Lamp Stabilization for All lamps, Transfer and Re-stabilizations for CFLs:

1) Stabilize lamps per IES LM-66-11 or LM-79-08 as applicable.

2) CFLs to be removed from the seasoning area for ETLOR testing shall be handled according to IES LM-66-11.

7 TEST PROCEDURES

A) Lamp Installation

Install the lamp in the thermally controlled environment or thermal chamber.

B) Initial Measurement:

1) Apply the rated lamp voltage while operating in a thermally controlled environment such that the temperature at the apparatus or integrating sphere test point is stable as determined by three measurements, 5 minutes apart at ambient temperature per the specification, and the three measurements not varying by more than ±1°C.
2) Achieve lamp light output stabilization per the "Lamp Stabilization for All lamps, Transfer and Re-stabilizations for CFLs" section, described above. Lamp stabilization may be concurrent with temperature stabilization.
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 in 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 the elevated temperature.

8 TEST REPORT

ETLOR report data may be included in an overall performance report or a stand alone 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) Elevated temperature light output measurement method used

F) Electrical, photometric, and temperature values at the ambient condition

G) Electrical, photometric, and temperature values at the elevated temperature condition

H) Elevated Temperature Light Output Ratio, calculated as the light output at the elevated temperature condition divided by the light output at the ambient condition, expressed as a percentage