



ENERGY STAR[®] Program Requirements

Product Specification for Lamps:

Ambient Temperature Life Testing

Draft Test Method

Rev. Jan-2013

1 OVERVIEW

The following test method shall be used for determining product compliance with the Ambient Temperature Life Test (ATLT) requirements in the ENERGY STAR Eligibility Criteria for Lamps.

2 APPLICABILITY

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

- **The ATLT applies to decorative SSL of all wattages and omnidirectional SSL <10 watts (W).**
- The test procedures in Section 7 shall be performed on products that are required to undergo the Ambient Temperature Life Test in the Supplemental Testing Guidance for section 10.1 – Lumen Maintenance Requirements.
- The testing options that are available for the specific product in question are explained in the Supplemental Testing Guidance for section 10.1 – Lumen Maintenance Requirements.

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-65-01. 2010. IES Approved Method for Life Testing of Compact Fluorescent Lamps, IES Testing Procedures Committee, 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-54-12. 2012. IES Guide to Lamp Seasoning, Illuminating Engineering Society, New York.
- D) 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.

4.2 CIE Reference Document

- A) CIE-18.2.1983. 1983. The Basis of Physical Photometry, Commission Internationale de l'Eclairage, Bureau Central de la CIE, Vienna.

5 TEST SETUP

- 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: 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 ES LM-79-08.
- D) Input Power During Aging: During the product on time between photometric measurement points, products intended to be powered from AC mains shall be connected to a voltage source that meets the requirements in IES LM-65-10. 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.
- E) 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.

- F) Power Meter: Power meters shall be capable of measuring to the appropriate requirements of IES LM-79-08.
- G) 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.
- H) 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.

6 TEST CONDUCT

6.1 Guidance for Implementation of Ambient Temperature Life Test Procedure

- A) Photometric Measurements:
 - 1) For integrating sphere measurements, refer to IES-LM-79-08.
 - 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_{λ}). For integrating sphere measurements, see IES-LM-79-08.
- B) Lamp Monitoring:
 - 1) The lamps shall be monitored for continuous operation in accordance with IES LM-65-10, section 6.5.
- C) Operating Cycle:
 - 1) LED lamps may be operated continuously.

7 TEST PROCEDURES FOR ALL PRODUCTS

7.1 General Test Procedures

- A) Lamp Installation
 - 1) Install the lamp in the ambient temperature situation per the test option used.
- B) Initial Measurement:
 - 1) Conduct measurement of each lamp following the procedures set forth in IES LM-79-08 (hours = 0 for LED lamps). Record the results obtained at $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$.
- C) Lamp Operation:

- 1) Operate lamps per the appropriate operating cycle, modified by conditions described in the testing option selected (Option A, or B, below).

D) Additional Measurements:

- 1) Conduct additional photometric measurements as necessary per the ENERGY STAR Requirements for section 10.1 – Lumen Maintenance Requirements.

8 AMBIENT TEMPERATURE LIFE TEST FOR PRODUCTS: OPTION A

8.1 Ambient Conditions

- A) The ambient temperature around the apparatus shall be maintained within the specification designated operating temperature range.
- B) The perimeter of the apparatus shall be kept clear of obstacles so that airflow is not inhibited from entering the apparatus during the purge portion of the test cycle.
- C) The operating temperature within the apparatus shall be represented as the average of at least four measurement locations as specified in the “Temperature Measurement Locations” section (below) and shall be maintained at the temperature designated in the Supplemental Testing Guidance for section 10.1 – Lumen Maintenance Requirements during the ON cycle.
- D) The operating temperature within the apparatus shall be achieved within 45 minutes upon ON cycle initiation.

8.2 Controlled Temperature Testing Apparatus (See Figure 1)

The apparatus that is used for Elevated Temperature Life Testing (ETLT) may be used for the ATLT, if the device is capable of operating the lamps at the required temperature. The following section describes the requirements for the apparatus.

- A) The interior of the Controlled Temperature Testing Apparatus (CTTA) shall be a flat section of perforated substrate with ceramic lampholders arranged in a rectangular array.
- B) The perforated substrate shall have holes of a minimum diameter of ¼-in. spaced at a maximum spacing of 1-in. on center.
- C) The spacing between lampholders shall be no less than 8-in. on center and no greater than 12-in. on center.
- D) Radiant baffles shall be installed at the mid-point between all lampholders and along the perimeter of the lampholder array. The radiant baffles shall be constructed of an opaque, rigid material and shall be a minimum of 10-in. in height.
- E) The exterior of the CTTA shall be sealed and insulated to a minimum level of R-13 on all four sides and the hood.

- F) The sides of the apparatus shall extend a minimum of 12-in. below the bottom of the radiant baffles and shall have an intake section a minimum of 6-in. in height below the sides of the apparatus.
- G) The slope of the hood of the apparatus shall be at least 30° above the horizontal.
- H) The top of the hood shall be equipped with an exhaust fan and louver. The fan shall be sized to deliver a minimum of 4.0 cubic feet per minute (cfm) per square foot of apparatus area net of intake and exhaust restrictions.
- I) The exhaust fan shall be thermostatically controlled to maintain the appropriate ambient temperature within the apparatus.
- J) The louver shall automatically close when the fan is not operating.

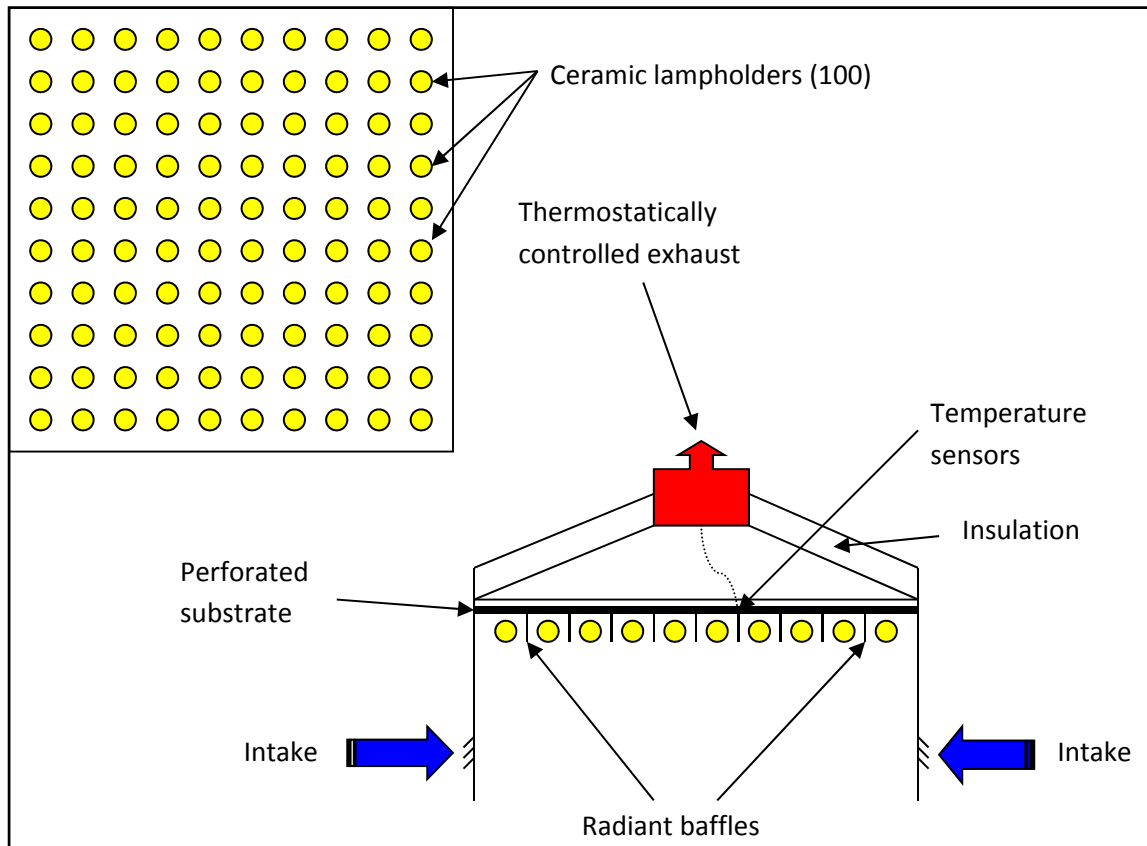


Figure 1: Option B Controlled Temperature Test Apparatus when used for ATLT

8.3 Temperature Measurement Locations

- A) The apparatus shall be equipped with at least four ambient temperature measurement devices.
- B) These devices shall be placed in at least two locations between 16 and 24 inches measured inwards from the perimeter of the apparatus and at least two locations between 16 and 24 inches measured outwards from the center of the apparatus.

- C) The operating temperature of the testing area is then defined as the average of at least four temperature readings within the testing area.
- D) The measurement points shall be located at the height of the lamps under test.

8.4 Photometric Measurements

There are two methods of photometric measurement, as applicable, for Ambient Temperature Testing Option A.

A) Option A Photometric Measurement Method 1:

- 1) 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 bottom edge of the radiant baffles.
- 2) 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.
- 3) Photometric measurements shall be acquired at a point at least two hours after the beginning of an ON cycle, allowing the light output of the lamp to reach a steady state. In the situation where the specified measurement time occurs before the lamp has reached its steady state operating time, the lamp shall be measured at the closest steady state period.

B) Option B Photometric Measurement Method 2:

- 1) The operating cycle shall be stopped at the appropriate measurement points during one of the OFF cycles, and lamps shall be measured in an integrating sphere according to IES LM-79-08.
- 2) If applicable, when all lamps have completed photometric testing, the lamps can be returned to the same socket in the apparatus and the ambient temperature life testing can continue.

9 AMBIENT TEMPERATURE LIFE TEST FOR PRODUCTS: OPTION B

9.1 Ambient Conditions

- A) The ambient temperature around the housing shall be maintained at the temperature designated in the Supplemental Testing Guidance for section 10.1 – Lumen Maintenance Requirements during the ON cycle.

9.2 Ambient Temperature Housing and Support

- A) The lamps may be burned in open air in the required testing orientation so long as the required ambient temperature is maintained.
- B) The spacing between lampholders shall be positioned between 6 and 12 inches on center, and there shall be a minimum of 2" space between lamps.

9.3 Temperature Measurement Locations

- A) If burned in open air, the testing area shall be equipped with at least four ambient temperature measurement devices.
- B) These devices shall be placed in at least two locations between 16 and 24 inches measured inwards from the perimeter of the testing area and at least two locations between 16 and 24 inches measured outwards from the center of the testing area.
- C) The operating temperature of the testing area is then defined as the average of at least four temperature readings within the testing area.
- D) The measurement point shall be located at the height of the lamps under test.