

ENERGY STAR® Integral LED Lamp Specification Technical Clarifications

Issued August 25, 2010

The ENERGY STAR Integral LED Lamps specification (“the specification”) was finalized on December 3, 2009, and amended to version 1.1 on March 22, 2010 to revert the minimum operating frequency requirement to 120 Hz; additional information is available on the ENERGY STAR [website](#).

Since testing has begun, the U.S. Environmental Protection Agency (EPA) has received questions expressed by testing laboratories and manufacturers about some testing requirements. The purpose of this document is to address those questions to help ensure a smooth and successful market introduction of ENERGY STAR qualified integral LED lamps (LED lamps). The following topics are addressed in this document:

1. Product variations
2. Equivalency claims
3. Lighting Facts labels
4. Use of model numbers already in the market
5. Lumen maintenance testing for lamps 10W or greater
6. Corrected Center Beam Intensity Benchmark Tool

Should you have any further questions on these matters please contact your ENERGY STAR account manager or Alex Baker at baker.alex@epa.gov or (202) 343-9272.

Product Variations

Any variation in lamp design that impacts the performance of the lamp is considered a new, separate product and therefore must be tested in accordance with all requirements detailed in the specification. EPA will permit the use of long term lumen maintenance data across multiple model numbers which vary only in paint color and/or beam angle. Variations in paint shall be limited to color/pigmentation only; lumen maintenance data may not be applied across multiple models which employ variations in the type of paint employed. To apply lumen maintenance data across multiple models which vary only in paint color/pigmentation, EPA will require submission of *in-situ* temperature measurements of each of the models in question (refer to specification for *in-situ* temperature measurement details).

The use of long term lumen maintenance data across multiple models which vary only in beam angle will be permitted so long as the variation between models is limited to the dimensions of the secondary optics (e.g. lens thickness, refractor patterns), and so long as these changes do not have a measureable effect on *in-situ* temperature measurements. Variations in secondary optic material will not be permitted. To apply lumen maintenance data across multiple models which vary only in beam angle, EPA will require the following to be submitted:

- *in-situ* temperature measurements of each of the models in question (refer to specification for *in-situ* temperature measurement details)
- a signed statement on the partner company’s letterhead stating that there are no material variations between the models in question except for the dimensions of the secondary optics

Intentionally submitting false information to the U.S. government is a criminal violation of the False Statements Act, Title 18 U.S.C. section 1001.

Equivalency Claims

The Integral LED Lamp specification does not set tolerances for performance requirements, and does not allow for the rounding of values.

However, for product packaging, equivalency claims to replace incandescent and halogen products will be evaluated based on reported test values, with one exception. Directional LED lamps are intended to replace incandescent and halogen lamps which themselves may leverage tolerances detailed in ANSI C78.379-2006 sections 4.1 and 4.3; these same tolerances may be considered in the evaluation of LED lamp packaging claims for ENERGY STAR qualification.

For Lighting Facts™ labeling, partners may use tolerances outlined by the U.S. Department of Energy's (DOE) Lighting Facts program to report rounded performance values on packaging.

Lighting Facts Labels

The specification packaging requirements detail that LED lamp performance data must be submitted to the DOE [Lighting Facts program](#), and that product packaging must include labels provided by that program. However, the U.S. Federal Trade Commission (FTC) has created a similar [Lighting Facts label](#) which will be required on packaging for all medium screw-base lamps sold in the U.S. beginning July 19, 2011.

Consistent with the Integral LED Lamp specification, lamp performance data for all ENERGY STAR qualified LED lamps must be submitted to DOE's Lighting Facts program, however, manufacturers of medium screw-base lamps have the option of which label to place on their packaging: the DOE or FTC label. Beginning on July 19, 2011 only the FTC label will be permitted on packaging of medium screw base ENERGY STAR qualified LED lamps. **While manufacturers may elect to use the DOE label on packaging until the effective date of the FTC-mandated label, EPA strongly encourages the use of the FTC label from the start to minimize confusion in the marketplace.**

The DOE label will still be available for use on materials *other than product packaging*, such as cut sheets, promotional literature, and web sites after the FTC effective date. Specific questions about Lighting Facts should be directed to that program at info@lightingfacts.com.

Please note: you must submit your lamp performance data to the Lighting Facts program prior to submitting for ENERGY STAR qualification.

Please note: ENERGY STAR qualified LED lamps employing base types other than medium screw-base are not affected by the FTC requirement, and must still adhere to the labeling requirements in the specification.

Use of Model Numbers Already in the Market

As detailed in the packaging requirements on page 8 of the specification, model numbering requirements state that the model number of an LED lamp submitted for qualification must be different from any earlier, non-qualified versions of the product already introduced into the market. The intent of this requirement is to avoid confusion in the market place resulting from the ENERGY STAR labeling of some, but not all, units of a given model number, potentially leading to misunderstandings about the performance of non-labeled units.

EPA has received feedback from manufacturing partners that in some instances, integral LED lamp products have been or are being developed for market introduction prior to ENERGY STAR qualification, with the intent of maintaining the same model number after qualification. Moving forward, partners wishing to maintain model numbers of LED lamps already in the market and submitted for qualification may do so by providing with their qualification submittal a letter, on the partner company's letterhead, stating that no material or performance changes have been made to the model between original market introduction and submittal for ENERGY STAR qualification.

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Lumen Maintenance Testing for Lamps 10W or Greater¹

Lamps that draw 10W² or more must be subjected to elevated temperature testing for lumen maintenance. For this criterion, the integral LED lamp specification references the "ENERGY STAR CFL Elevated Temperature Test" detailed in Appendix B of the [ENERGY STAR CFL V4.0 specification](#).

The elevated temperature test procedures, identified in Appendix B of the CFL specification as "Option A" and "Option B" and created to meet the needs of the CFL program, were developed to simulate the environment of a reflector CFL in an airtight recessed downlight installed within an insulated ceiling (non-reflector compact fluorescent lamps and non-integrated compact fluorescent lamps were excluded from these test procedures). As such, certain elements of the original referenced test procedures must be modified or disregarded to account for differences in technology and the specific requirements outlined in the integral LED lamp specification. Below are clarifications related to the elevated temperature test procedures.

¹ Excludes Decorative Lamps

² Lamps with nominal wattage claims below 10 watts cannot have any one sample tested over 9.9 watts.

Lumen Maintenance Testing for Lamps 10W or Greater (con't)

Testing Apparatus

“Option A” requires reflector lamps to be seasoned in the Halo® model H7UICAT incandescent downlight housing.

“Option B” requires an Elevated Temperature Testing Apparatus employing a flat section of perforated substrate with ceramic lampholders arranged in a rectangular array and radiant baffles at $55^{\circ}\text{C} \pm 5^{\circ}\text{C}$ to both season and measure light output during testing.

Testing Apparatus: LED Lamps Clarification

For the purposes of elevated temperature testing for LED lamps, a fixture or apparatus is not required. The lamps may be burned in open air in the base-up and base-down positions so long as the required ambient temperature of 45 C is maintained. The spacing between lampholders shall remain the same as specified in Option B where the lampholders must be positioned between 8 and 12 inches on center. Whether testing is performed in an open chamber or a specially designed apparatus, testing should be performed according to the following steps:

1. Measure 5 lamps base-up, and 5 lamps base-down according to IES LM-79-08 (LM-79) at $T=0$.
2. Keeping the orientation of each sample consistent with the orientation of testing in step 1, age the lamps for 6,000 hours at an ambient temperature of 45°C .
3. After 6,000 hrs of aging, re-test the 10 samples in their original orientation according to LM-79.
4. Compare the step 1 measurements of each sample to the step 3 measurements of each sample.

Additional clarifications about specific aspects of the referenced “Option A” and “Option B” test procedures are detailed below.

Operating Cycles

Options A & B state: “Operation of the lamps shall be consistent with the provisions set forth in IESNA LM-65 Section 6.1; three hours ON and 20 minutes OFF.”

Operating Cycles: LED Lamps Clarification

Continuous operation is permitted instead of cycling, because unlike fluorescent products, cycling does not significantly impact the lumen maintenance of LEDs. The cycling used for fluorescent products aims to capture failure mechanisms found in fluorescent technology. EPA will accept tests that have already been performed with the cycling detailed in Options A & B.

Lumen Maintenance Testing for Lamps 10W or Greater (con't)

Ambient Conditions

Options A & B state: “The ambient temperature shall be maintained at 25°C + 10°C. 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.”

Option B states: “The operating temperature within the apparatus (represented as the average of at least four measurement locations specified in Section 8.4...) shall be maintained at 55°C ± 5°C during the on cycle. The operating temperature within the apparatus shall be achieved within 45 minutes upon on-cycle initiation (additional incandescent lamps may be added as heat sources to achieve this).”

Ambient Conditions: LED Lamps Clarification

For lamps consuming 10 watts or more, the required minimum ambient temperature during aging is 45°C as detailed in the specification on pages 9, 11, 14, 15, and 16. This temperature is 10 degrees lower because LED lamps consume less power and generate less heat than a CFL reflector.

Elevated Temperature Housing/Apparatus

Option A states: “Testing shall be conducted using the Halo® model H7UICAT incandescent downlight housing. No substitutions shall be allowed. No trim shall be used. Luminaires shall be oriented such that the lamp operates vertical base-up during the life test. The luminaires may be arranged in a horizontal plane or stacked vertically. If stacked vertically, a minimum spacing of 24 inches must be maintained between the bottoms of each row.”

Option B states: “The interior of the Elevated Temperature Testing Apparatus shall be on a flat section of perforated substrate with ceramic lampholders arranged in a rectangular array. The perforated substrate shall have holes of a minimum diameter of 1/4in. spaced at a maximum spacing of 1in. on center. The spacing between lampholders shall be no less than 8in. on center and no greater than 12in. on center. 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 10in. in height...”

Elevated Temperature Housing/Apparatus: LED Lamps clarification

The Integral LED Lamps specification requires 10 samples per model, 5 oriented base-up and 5 base-down.

In Option B, baffles were originally required for CFL testing to enable photometric readings within the Elevated Temperature Testing Apparatus. Baffles are not required for LED lamp testing because the lamps are removed from the apparatus to be tested according to IES LM-79. Additionally, this apparatus was designed for all ten samples to be tested base-up, while the LED lamps specification requires 5 samples base-down and 5 base-up. Therefore, this apparatus would need to be modified to reorient the sockets for LED lamps.

EPA understands that the reference to the CFL Elevated Temperature Test in the Integral LED Lamps specification may have led to some confusion, and will therefore accept lumen maintenance testing performed with all lamps operated base-up. However, lamps that have been determined to meet all other ENERGY STAR criteria and were only tested

in the base-up position, must list on the packaging that the results are based on base-up operation only.

Corrected Center Beam Intensity Benchmark Tool

Please be advised that early versions of this tool contained an error; the correct version of the center beam intensity benchmark tool should have “Log CBCP Two-sigma Lower Bound” for both PAR and MR lamps. The correct version is also in the early initial qualification form available at www.energystar.gov/lightingresources. Other materials will soon be made available with the corrected tool included.

Partners are strongly encouraged to dispense with any saved earlier versions of the calculator, which would include “Log CBCP One-sigma Lower Bound” in spreadsheet cell H37. If you have only accessed the calculator online you may need to clear your browser cache and temporary files to ensure you view the most recent version.