ENERGY STAR® Program Requirements For Lamps and Luminaires

Test Method – Noise

September-2015

---

1. OVERVIEW

This document defines the test method for measuring and reporting audible noise produced by a lamp.

2. APPLICABILITY

This noise test method applies to all compact fluorescent lamps (CFLs) and solid state lighting (SSL) lamps covered by the ENERGY STAR Product Specification for Lamps (Light Bulbs) that are marketed as dimmable.

3. DEFINITIONS

Unless otherwise specified below, all terms used in this document are consistent with the definitions in the ENERGY STAR Product Specification for Lamps (Light Bulbs).

Unit Under Test: The unit under test (UUT) refers the the specific lamp sample being tested.

Baseline Light Output: The baseline light output (BLO) refers to the stabilized light output of the unit under test (UUT) is operating without a dimmer in the circuit.

Maximum Control Position: The setting on the dimmer or control device intended to achieve the maximum light output during operation.

Maximum Light Output: The maximum light output (MaxLO) refers to the light output of the UUT when operating with a dimmer in the circuit at the Maximum Control Position.

Minimum Dimming Level Claimed: The minimum light output level of a UUT when operated with a dimmer in the circuit, as declared by the lamp manufacturer. Typically expressed as a percentage.

Minimum Light Output: The minimum light output (MinLO) refers to the minimum light output when the UUT is operating with a dimmer in the circuit.

Peak Noise: The highest time-averaged sound value recorded at a measurement point during stable operation of the UUT.

4 METHODS OF MEASUREMENT AND REFERENCE DOCUMENTS

4.1 IES Test Methods and Reference Documents

A) IES LM-66-14: 2014. IES Approved Method for Electrical and Photometric Measurements of Single-Based 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-54-12: 2012. IES Guide to Lamp Seasoning, Illuminating Engineering Society, New York.
D) ISO 7574-4 B.2.1: 1985. Statistical methods for determining and verifying stated noise emission values of machinery and equipment, International Organization for Standardization, Geneva, Swizerland.
E) ASA S12.55-2006/ISO3745:2003: 2006. Acoustical Society of America, New York.

5 RECOMMENDED PRACTICE TEST SETUP

5.1 General

A) Test Setup and Instrumentation: The test can be performed using a single microphone and rotating the product, or by using multiple microphones. Equipment required for measurement is as follows:

1) Regulated AC or DC power supply (as applicable to the UUT or transformer).

2) Multichannel oscilloscope with data storage capability or similar equipment for comparing output readings from a photodetector.

3) Appropriate attenuator probe(s), if applicable.

4) Photodetector capable of measuring relative light output.

5) Noise level measurement equipment.

6) Microphone(s).

7) Isolated sound chamber (e.g., anechoic chamber).

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-66-14. LED lamps shall not be seasoned.

C) Input Power for Measurements: The power requirements shall be per IES LM-66-14 or LM-79-08 as applicable. Note: When selecting a power supply, it is necessary to apply an appropriate power factor when specifying the Volt-Amp rating of the power supply.

D) Ambient Temperature: testing of the UUT shall take place in an ambient temperature of 25°C ± 5°C. Drafts shall be minimized.

E) Power Meter: Power meters shall be capable of measuring to the appropriate requirements of IES LM-66-14 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 samples shall be noted. The sample(s) used for noise testing shall be the same sample(s) used for the ENERGY STAR Flicker testing, if applicable, and can be the same sample(s) used for other testing.

6 TEST CONDUCT

6.1 Guidance for Noise Test Procedure

A) Photometric Measurements:

1) For absolute measurements, refer to IES LM-66-14 or IES-LM-79-08 as applicable with the exception of the guidance for stabilization.

2) 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 ($V\lambda$).

   a) Ensure that the measurement equipment receives the appropriate voltage range from the photodetector, using an amplifier if necessary.

B) Measurement Equipment:

1) The sound chamber shall provide an environment suitable for the sound testing of the UUT. External sources of noise shall be minimized.
2) The sound measurement equipment shall be capable of measuring A-weighted decibels.
3) The microphone(s) shall be placed at a distance of one (1) meter or less from the UUT to be measured.
   a) If multiple microphones are used, 6 microphones shall be placed about the UUT spaced 90° apart and aimed at the UUT.
   b) If a single microphone is used, the microphone shall be aimed at the UUT and the UUT holding device shall be capable of moving and holding the UUT so that six measurements about the UUT can be made 90° apart.
4) The sound level of the UUT shall be calculated from the measurement taken.
   a) The baseline level may be corrected for in accordance with ISO 7574-4:1985, B.2.1.
   b) ANSI standard S12.55-2006/ISO3745:2003 may be used as a reference document for other aspects of the measurements (calibration, etc.).

C) Transfer of CFL UUTs:

1) Care shall be exercised to maintain lamp orientation and avoid shaking or bumping the lamp during the transfer from seasoning area.

D) Low Voltage UUTs

1) UUTs designed for operation on low voltage transformers shall be operated on a compatible transformer specified or supplied by the lamp manufacturer.
2) Electrical measurements shall include characteristics of the UUT.

E) Measurements:

1) The following data shall be collected at each measurement point:
   a) Light output.
   b) Peak Noise Reading.
   c) Microphone Position at which the Peak Noise Reading occurs (e.g., 0 degrees / opposite lamp base).

7 TEST PROCEDURE FOR PRODUCTS CLAIMING DIMMABILITY

7.1 General Test Procedures for Noise at Baseline output

A) Install the UUT in the test environment without a dimmer in the circuit.

B) Set power supply to rated voltage and frequency of the device. If a range is specified, test sample at the midpoint of the range.

C) Record noise readings from measurement equipment to determine sound level in dBA. This is the control noise level.

D) Apply rated voltage/frequency to the device.

E) Allow UUT to stabilize per IES LM-66-14 or IES-LM-79-08 as applicable. If lamp has been stabilized for measurements previously and the stabilization time recorded, the lamp may be considered stabilized after operating for this period of time.

F) Record noise readings per Clause 6.1.E.1 from measurement equipment about the UUT to determine the peak sound level in dBA. This is the noise at the Baseline Light Output (BLO).

   1) If using a single microphone, note the position with the highest sound level (if applicable).

G) Remove power from UUT.

7.2 General Test Procedures for Noise on a Dimmer

A) Install dimmer into the UUT test circuit.

   1) The dimmer shall be located outside of the sound chamber.

B) Apply rated voltage/frequency to the dimmer or control device.

C) Adjust dimmer to the maximum control position.

D) Allow UUT to stabilize and verify by taking light output measurements every minute until consecutive measurements are no more than 0.5% apart, utilizing previously recorded UUT stabilization time or verify by mathematical means that the lamp is stabilized.

E) Record noise readings per Clause 6.1.E.1 from measurement equipment about the UUT to determine the peak sound level in dBA. This is the noise at the MaxLO.

F) Adjust dimmer so that the light output is the lower of:

   1) 20% of the MaxLO ± 5%; or

   2) The minimum dimming level claimed as a percentage of the MaxLO ± 5%.

G) Allow UUT to stabilize and verify by taking light output measurements every minute until consecutive measurements are no more than 0.5% apart, utilizing previously recorded UUT stabilization time or verify by mathematical means that the lamp is stabilized.

H) Verify that the UUT light output is still within the range in F).

   1) If not, repeat step A) and G).

   2) If light output is within range, record noise readings per Clause 6.1.E.1 from measurement equipment about the UUT to determine the peak sound level in dBA. This is the noise at MinLO.

I) Repeat steps 7.2A-H for each dimmer to be tested. A test setup that includes a device that allows hot switching between dimmers may be utilized to bypass stabilization time.

8 TEST REPORT

Lamp Noise on a Dimmer report data shall include the following test information and be submitted using the ENERGY STAR Dimming Data Sheet:

A) Manufacturer's name and product identification.

B) Name and location of testing facility.

C) Test date.

D) Lamp base orientation.

E) Test voltage (V).

F) Test frequency (Hz).

G) Stabilization time and method used.

H) Noise and light output reading at BLO.

I) Distance between the microphone and the UUT.

J) Noise and light output reading at MaxLO for each dimmer tested.

K) Noise and light output reading at MinLO for each dimmer tested.