

## Joint Appendix JA8 – 2008

# Appendix JA8 – Testing of Light Emitting Diode Lighting Systems Sources

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### JA8.1 Scope

The testing methods in this appendix shall be used to determine wattage, luminous flux, and efficacy for all light emitting diode (LED) Luminaires-lighting systems, also known as solid state lighting (SSL), and LED Engine with Integral Heat Sink. Each LED lighting system device tested shall produce the same quantity and quality of light. LED lighting systems Luminaires or LED Light Engines with Integral Heat Sink producing different Correlated Color Temperature (CCT), Color Rendering Index (CRI), total flux (per linear foot for linear systems) or other quantitative and qualitative differences in light shall be separately tested.

The power (wattage) of luminaires and integral trims containing only LED lighting systems light sources shall be determined in accordance with JA 8.1.2 8.2. For luminaires containing LED lighting systems light sources in addition to one or more other lighting technologies (i.e., Hybrid LED Luminaires), the power of the LED lighting system Light Engine with Integral Heat Sink shall be determined in accordance with JA 8.1.2 8.2, and the power of non-LED lighting components shall be determined in accordance with Title 24, Part 6, Section 130(d)(1, 2, 3, 4, or 6) as appropriate.

The light output (luminous flux) of the luminaires and integral trims containing only LED light sources shall be determined in accordance with JA 8.3. For luminaires containing LED light source in addition to one or more other lighting technologies (i.e., Hybrid LED Luminaires), the light output of the LED Light Engine with Integral Heat Sink shall be determined in accordance with JA 8.3.

The efficacy of luminaires and integral trims containing only LED lighting systems light sources shall be determined in accordance with JA 8.1.3 8.4. For luminaires containing LED lighting systems Light Engine with Integral Heat Sink in addition to one or more other lighting technologies (i.e., Hybrid LED Luminaires), the efficacy of the LED lighting system Light Engine with Integral Heat Sink shall be determined in accordance with JA 8.1.3 8.4, and the efficacy of non-LED lighting components shall be determined in accordance with Title 24, Part 6, Section 150(k)(1 and 2).

### JA8.2 Determining the Wattage of Light Emitting Diode (LED) lighting Systems-Luminaires or LED Light Engine with Integral Heat Sink.

The wattage of LED lighting system- Luminaire or LED Light Engine with Integral Heat Sink shall be determined measured as follows, or by a method approved by the Executive Director:

- a. The wattage shall be the maximum rated input wattage of the LED lighting system device under test, including power used by fans, transformers and power supply devices, and
- b. The wattage shall be listed on a permanent, pre-printed, factory-installed label on the luminaire housing, or on the integral LED trim when applicable, and
- c. The LED lighting system device under test shall be tested in a Underwriters Laboratory (UL) 1598 testing apparatus in a testing laboratory accredited to ISO/IEC 17025 by the National Voluntary Laboratory Accreditation Program (NVLAP) or International Standards Organization (ISO) 17025 accredited lab as specified by UL other laboratory accreditation body operating in accordance with ISO/IEC 17011 and produced under an ongoing inspection program carried out by a Type A inspection body in accordance with ISO/IEC 17020, accredited to ISO/IEC 17020 by an accreditation body operating in accordance with ISO/IEC 17011; and

- d. The ~~LED lighting system- device under test~~ shall be tested according to all of the following conditions:
1. The ambient temperature in which measurements are being taken shall be maintained at  $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$ .
  2. The AC power supply shall have a frequency of 60 Hz, and a sinusoidal voltage wave shape.
  3. The voltage of an AC or DC power supply shall be regulated to within  $\pm 0.2$  percent.
  4. The ~~LED lighting system- device~~ under test shall be burned-in for 100 hours before testing.
  5. The ~~LED lighting system- device~~ under test shall be operated and stabilized before testing at ambient temperature and burning position as specified until the LED product reaches thermal equilibrium. Stability is reached when the variation of light output remains within 1% for a period of 10 minutes at constant ambient temperature and constant electrical input.
  6. The ~~LED lighting system- device~~ under test shall be measured at the burning position in which it will be installed in the luminaire.
  7. The ~~LED lighting system- device~~ under test shall be operated at the rated voltage (AC or DC) according to the specification of the ~~LED lighting system- Luminaire or LED Light Engine with Integral Heat Sink~~ for its normal use.
  8. Testing using pulsed operation of the ~~LED lighting system- Light Engine with Integral Heat Sink~~ shall not be acceptable.

### **JA8.3 Determining the Efficacy of Light Emitting Diode (LED) Lighting Systems Luminous Flux Measurement of LED Luminaires or LED Light Engine with Integral Heat Sink**

The ~~efficacy of LED lighting systems shall be determined- luminous flux of the LED Luminaire or LED Light Engine with Integral Heat Sink shall be measured~~ as follows, or by a method approved by the Executive Director:

- a. Luminous flux shall be measured after the ~~system- device under test~~ has stabilized in accordance with JA 8.1.2(d)5; and
- b. The total luminous flux of the ~~LED lighting system- device~~ under test shall be measured with an integrating sphere photometer or a goniophotometer by a lab accredited by Underwriters Laboratory (UL) under their ~~Data Acceptance Program (DAP) client test data program;~~ and
- c. The total luminous flux of the ~~LED lighting system- device under test~~ shall be permanently pre-printed on the LED circuit board, on a permanent pre-printed factory installed label on an integral LED trim or luminaire housing, or published in manufacturer's catalogs based on independent testing lab reports; ~~and~~

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### **JA8.4 Efficacy Calculation of LED Luminaires or LED Light Engine with Integral Heat Sink**

The ~~efficacy of LED Luminaire or LED Light Engine with Integral Heat Sink shall be determined as follows, or by a method approved by the Executive Director;~~

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~~d.a. The luminous efficacy (lumens per watt) of the LED lighting system- The efficacy of the device under test shall be the quotient of measured total luminous flux (lumens) of the device under test when tested in accordance with JA 8.3 and the measured electrical input power (watts) of the LED lighting system- device under test when tested in accordance with JA8.2(a); and~~

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~~e.b. The LED lighting system under test shall be equal to the LED lighting system in the installed luminaire. The efficacy of the installed luminaire can be assumed to be equal to the device under test.~~