

Joint Appendix JA8

Appendix JA8 – ~~Testing of Light Emitting Diode Light Sources~~ Qualification Requirements for Residential Luminaires Using LED Light Source

~~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, and LED light Engines with Integral Heat Sink. Each device tested shall produce the same quantity and quality of light. LED 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 light sources shall be determined in accordance with JA8. 2. For luminaires containing LED light sources in addition to one or more other lighting technologies (i.e., Hybrid LED Luminaires), the power of the LED Light Engines with Integral Heat Sink shall be determined in accordance with JA8. 2, and the power of non-LED lighting components shall be determined in accordance with Title 24, Part 6, §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 JA8.3.~~

~~The efficacy of luminaires and integral trims containing only LED light sources shall be determined in accordance with JA8. 4. For luminaires containing LED Light Engines with Integral Heat Sink in addition to one or more other lighting technologies, the efficacy of the LED Light Engines with Integral Heat Sink shall be determined in accordance with JA8. 4, and the efficacy of non-LED lighting components shall be determined in accordance with Title 24, Part 6, §150(k)1 and 2.~~

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

~~The wattage of LED Luminaire or LED Light Engines with Integral Heat Sink shall be measured as follows, or by a method approved by the Executive Director:~~

- ~~a. The wattage shall be the maximum rated input wattage of the 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 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 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 device under test shall be tested according to all of the following conditions:~~

The ambient temperature in which measurements are being taken shall be maintained at $25^{\circ}\text{C} \pm 1^{\circ}\text{C}$.

The AC power supply shall have a frequency of 60 Hz, and a sinusoidal voltage wave shape.

The voltage of an AC or DC power supply shall be regulated to within ± 0.2 percent.

The device under test shall be burned-in for 100 hours before testing.

The 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 percent for a period of 10 minutes at constant ambient temperature and constant electrical input.

The device under test shall be measured at the burning position in which it will be installed in the luminaire.

The device under test shall be operated at the rated voltage (AC or DC) according to the specification of the LED luminaires or LED Light Engines with Integral Heat Sink for its normal use.

Testing using pulsed operation of the LED luminaires or LED light engines with integral heat sink shall not be acceptable

JA8.3 Luminous Flux Measurement of LED Luminaires or LED Light Engine with Integral Heat Sink

The Luminous flux of the LED luminaire or LED Light Engines 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 device under test has stabilized in accordance with JA 8.2;
- b. The total luminous flux of the 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); and
- c. The total luminous flux of the 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.

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:

- a. 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 JA8.3 and the measured electrical input power (watts) of device under test when tested in accordance with JA8.2; and

The efficacy of the installed luminaire can be assumed to be equal to the device under test.

To qualify as a residential high efficacy luminaire using Light Emitting Diode (LED) as the light source (as defined in IES LM-80-2008), the LED light engine (as defined in ANSI/IES RP-16-2010) used in the luminaire shall be certified to the Energy Commission according to all of the following requirements, or by a method approved by the Executive Director. If the LED light engine is inseparable from the luminaire (integral LED luminaire) then the entire luminaire shall meet the same requirements. LED light engine(s) and integral LED luminaire(s) are referred to as LED luminaire(s) below.

- a. Shall be manufactured for use in residential applications. LED luminaires not intended for use in residential applications, LED landscape luminaires, and luminaire housings not containing a light engine shall not be certified to the Energy Commission for the purpose of complying with Joint Appendix JA-8.
- b. The efficacy of the integral LED luminaire or LED light engine, when tested in accordance with IES LM-79-2008, shall be equal to or greater than the efficacies contained in TABLE JA-8.

c. When designed or rated for indoor use shall be capable of providing a nominal Correlated Color Temperature (CCT) that includes at least one point within the range of 2700K to 4000K; when designed or rated for outdoor use shall be capable of providing a nominal CCT that includes at least one point within the range of 2700K to 5000K; with tolerance defined as in ANSI C78-377-2008.

Exception to Section (c): Monochromatic LEDs that are only for decorative purposes

d. Shall be capable of providing a minimum Color Rendering Index (CRI) of 90.

Exception to Section (d): Monochromatic LEDs that are only for decorative purposes

e. An LED light engine shall be capable of being installed in luminaire housing without using any type of base or socket used for incandescent lamps; it may include a GU-24 or modular quick connect, but shall not include screw base sockets or adaptors of type and size E12 through E39.

f. An LED lamp, integrated or non-integrated type in accordance with the definition in ANSI/IES RP-16-2010, shall not be certified to the Energy Commission as a high efficacy luminaire or high efficacy light engine, and shall not be classified as a high efficacy luminaire for compliance with Title 24, Part 6 of the CCR.

g. The integral LED luminaire or LED light engine under test shall be tested in a Underwriters Laboratory (UL) 1598 testing apparatus in a testing laboratory participating in the ISO/IEC 17025, by the National Voluntary Laboratory Accreditation Program (NVLAP) or 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.

h. Each integral LED luminaire or LED light engine tested shall produce the same quantity and quality of light. An integral LED luminaire or LED light engine under test 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 and separately certified to the Energy Commission.

i. A worst case test may be used to certify a group of integral LED luminaires or LED light engines having the same quantity and quality of light in accordance with section (h).

j. For determining efficacy, the input wattage of the integral LED luminaire or LED light engine under test shall be determined as follows:

1. For single LED luminaires, use the maximum rated input wattage of the luminaire.

2. When multiple LED light engines are connected to a single power supply, all possible combinations shall be tested to determine the various input wattages and efficacies for the power supply under test. The combination providing the worst case efficacy shall be the system efficacy.

3. LED luminaires, installed on lighting track that is capable of being used with multiple lighting technologies, shall be treated as single LED luminaires in accordance with section (j) 1. Lighting track capable of accommodating multiple lighting technologies shall not be certified as LED lighting.

k. For single LED luminaires, maximum rated input wattage, total luminous flux, CCT, and CRI of the integral LED luminaire or LED light engine under test shall be listed on a permanent, pre-printed, factory-installed label on the circuit board, light engine, or luminaire housing.

l. For LED systems in accordance with section (j) 2, all possible wattage combinations, luminous flux, CCT, CRI, and efficacies of each of possible combination of the integral LED luminaire or LED light engine under test shall be listed on a permanent, pre-printed, factory-installed label on the power supply, or published in manufacturer's catalogs.

TABLE JA-8 HIGH EFFICACY QUALIFICATION REQUIREMENTS FOR LUMINAIRES OR LIGHT ENGINES USING LED LIGHT SOURCES

<u>Power Rating per Integral LED Luminaire, or per LED Light Engine Under Test</u>	<u>Minimum Efficacy (Lumens Per Watt)</u>
<u>5 watts or less</u>	<u>30</u>
<u>over 5 watts to 15 watts</u>	<u>45</u>
<u>over 15 watts to 40 watts</u>	<u>60</u>
<u>over 40 watts</u>	<u>90</u>