# SSL Standards and Guidelines

Like traditional lighting equipment, solid-state lighting (SSL) products sold in the United States are subject to industry standards governing safety and performance. This fact sheet lists the key guidelines as well as performance and safety standards that are applicable to SSL products, including those utilizing light-emitting diodes (LEDs).

The use of national standards and test methods improves consistency of performance and facilitates product comparisons, thereby increasing consumer confidence and satisfaction. As the technology matures, standards and guidelines are created or revised as needed. The documents listed here are those applicable in North America and completed as of October 2011.[1]

## ANSI/ANSLG

American National Standards Institute/American National Standard Lighting Group | *www.ansi.org*

ANSI is responsible for establishing standards and conformity assessment systems within the United States. ANSLG was initially created through the ANSI organization to support development of appropriate and needed lighting standards through its own working group(s) or other organizations.

| | |
|---|---|
| C78.377-2008 | **Specifications for the Chromaticity of Solid State Lighting Products**<br>Specifies chromaticity (an attribute of color) tolerances for white light LEDs intended to be used indoors based on nominal correlated color temperature (CCT) values. |
| C82.77-2002 | **Harmonic Emission Limits – Related Power Quality Requirements for Lighting**<br>Summarizes harmonic limits and methods of measurement for all lighting equipment, including SSL drivers and power supplies. |
| C136.37-2011 | **Solid State Light Sources Used in Roadway and Area Lighting**<br>Establishes requirements for a variety of items including interchangeability, operating temperature range, chromaticity, mounting provisions, ingress protection, and wiring. |

## CIE

International Commission on Illumination | *www.cie.co.at*

The CIE is an international organization specializing in the advancement and standardization of lighting knowledge. Many national organizations consider information provided by the CIE in the development of standards and test methods. The documents listed here are specific to SSL.

| | |
|---|---|
| 127-2007 | **Measurements of LEDs**<br>Addresses the measurement of spectrum, luminous flux, and intensity distribution for individual low-power LED packages (chips). |
| 177-2007 | **Colour Rendering of White LED Light Sources**<br>Describes the application of existing color rendition metrics to LEDs and discusses the prospects for improved metrics. |

*1 A list of relevant standards can also be found at www.ssl.energy.gov/standards.html.*


## FCC

Federal Communications Commission | *www.fcc.gov*

The FCC is a federal organization that oversees specifications for electrical equipment that may affect communication signals.

| | |
|---|---|
| 47 CFR Part 15 | **Radio Frequency Devices**<br>Specifies FCC limits for unintended radio-frequency emissions from electronic components, including SSL drivers and power supplies. |

## FTC

Federal Trade Commission | *www.ftc.gov*

The FTC is a federal organization that provides consumer protection and prevents unfair business practices.

| | |
|---|---|
| 16 CFR Part 260 | **Guides for the Use of Environmental Marketing Claims**<br>Commonly known as the FTC Green Guides, these documents help marketers to avoid making inaccurate claims regarding environmental impact. |
| 16 CFR Part 305 | **Appliance Labeling Rule: Lighting Facts Label[2]**<br>Beginning January 1, 2012, new FTC labeling requirements for medium-based general service lamps and LED replacement products will take effect. |

## IES

Illuminating Engineering Society | *www.ies.org*

IES is the recognized technical authority on illumination for North America. It publishes a range of documents, including technical memorandums (TM), recommended practices (RP), application guides (G), and light measurement (LM) methods.

| | |
|---|---|
| G-2-10 | **Guideline for the Application of General Illumination ("White") Light-Emitting Diode (LED) Technologies**<br>Provides lighting professionals with a general understanding of LED lamps and luminaires and their use for interior and exterior applications. |
| LM-79-08 | **Approved Method: Electrical and Photometric Testing of Solid-State Lighting Devices**<br>Describes the procedures for performing standardized measurements of the power, light output, and color characteristics of SSL products. |

*2 The FTC Lighting Facts label is unrelated to the DOE LED Lighting Facts program. More information on the DOE LED Lighting Facts Program, including a comparison of the DOE and FTC labels, can be found at www.lightingfacts.com.*

## IES (continued)

| | |
|---|---|
| LM-80-08 | **Approved Method: Measuring Lumen Depreciation of LED Light Sources**<br>Specifies conditions for long-term testing of LED packages, arrays, and modules. |
| LM-82-12 | **Characterization of LED Light Engines and LED Lamps for Electrical and Photometric Properties as a Function of Temperature**<br>Similar to LM-79, except includes light engines and excludes luminaires, and requires testing at more than a single standardized temperature. |
| RP-16-10 | **Nomenclature and Definitions for Illuminating Engineering**<br>Provides ANSI standard definitions for lighting terminology. |
| TM-16-05 | **Light Emitting Diode (LED) Sources and Systems**<br>Provides an overview of LED technologies and product integration. |
| TM-21 -11 | **Projecting Long Term Lumen Maintenance of LED Light Sources**<br>Establishes a method for projecting lumen maintenance (and useful lifetime) of LED light sources from available LM-80 data (see Figure 1). |

## NEMA

National Electrical Manufacturers Association | *www.nema.org*

NEMA oversees the creation of a variety of industry norms and guidelines, including the following key documents of relevance to SSL products.

| | |
|---|---|
| SSL-1-2010 | **Electronic Drivers for LED Devices, Arrays, or Systems**<br>Establishes standards and provides specifications for and operating characteristics of non-integral electronic drivers intended for general lighting applications. |
| SSL-3-2010 | **High-Power White LED Binning for General Illumination**<br>Establishes standards and provides a consistent format for categorizing (binning) LEDs during their production and integration into lighting products. |
| SSL-4-2012 | **SSL Retrofit Lamps: Minimum Performance Requirements**<br>Specifies criteria for the performance of integrated LED lamps, including both lamps conforming to ANSI standards (e.g., A, PAR, R, B) and non-standard shapes. |
| SSL-6-2010 | **Solid State Lighting for Incandescent Replacement—Dimming**<br>Establishes standards for retrofitting SSL products into systems that previously dimmed incandescent screw-base lamps. |

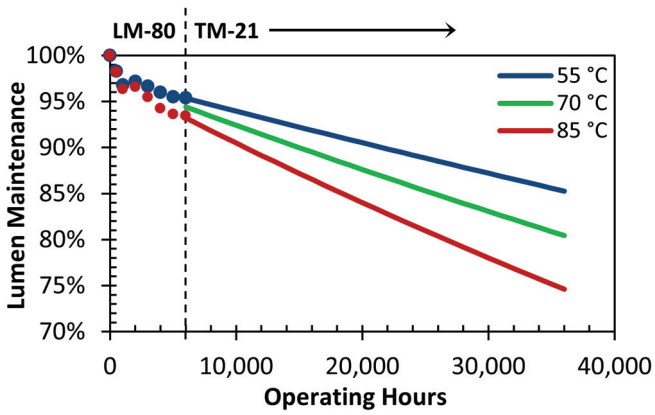


Figure 1. IES TM-21 extrapolation from IES LM-80 data

## NFPA

National Fire Protection Association | *www.nfpa.org*

NFPA develops and maintains a set of fire and safety related codes and standards that can affect the installation and operation of lighting systems.

| | |
|---|---|
| 70-2011 | **National Electrical Code (NEC)**<br>Dictates luminaire installation practices and requires that lighting equipment conform to safety standards considered acceptable by the local authority having jurisdiction. Local authorities generally require that products be listed to UL safety standards by an Occupational Safety and Health Administration (OSHA) Nationally Recognized Testing Laboratory. |

## UL

Underwriters Laboratories Inc. | *www.ul.com*

UL develops safety standards as well as test and certification methods for many types of products. ANSI has accredited UL to establish standards regarding the safety of lighting equipment in the United States.

| | |
|---|---|
| 8750[3] | **Light Emitting Diode (LED) Equipment for Use in Lighting Products**<br>Specifies the minimum safety requirements for SSL components, including LEDs and LED arrays, power supplies, and control circuitry. |
| 1598C | **Light Emitting Diode (LED) Retrofit Luminaire Conversion Kits**<br>Specifies safety requirements for LED products that are intended to replace the light sources in existing luminaires. Self-contained replacement lamps that use the existing socket are not covered. |

*3 In addition to UL 8750, SSL products must also meet the product-specific requirements—such as UL 1598 (Luminaires), UL 2108 (Low Voltage Lighting Systems), UL 1574 (Track Lighting Systems), UL 1993 (Self-Ballasted Lamps and Lamp Adapters), or UL 153 (Portable Electric Luminaires), among many others—as applicable. These requirements apply to all types of light sources.*

U.S. DEPARTMENT OF ENERGY
Energy Efficiency & Renewable Energy

For SSL Program information visit *www.ssl.energy.gov*
Direct fact sheet feedback to *SSL.Fact.Sheets@pnnl.gov*

PNNL-SA 57157 • April 2012
Printed with a renewable-source ink on paper containing at least 50% wastepaper, including 10% post consumer waste.