Solid State Lighting

The Current State of Standards

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Why do we need standards for SSL products?

There is a lot of interest (and hype) surrounding this product

- Energy conservation (efficacy)
- Rated Life
- Operating Temperature

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Why do we need standards for SSL products?

- Difficulty evaluating product quality
- Choice of application
- Potential for misuse of existing standards
- Comparisons between conventional lighting sources and SSL sources may not be “apples-to-apples”

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Why do we need standards for SSL products?

To avoid poor public perception of the technology

- Expectations of quantity of light
- …Life
- …Color

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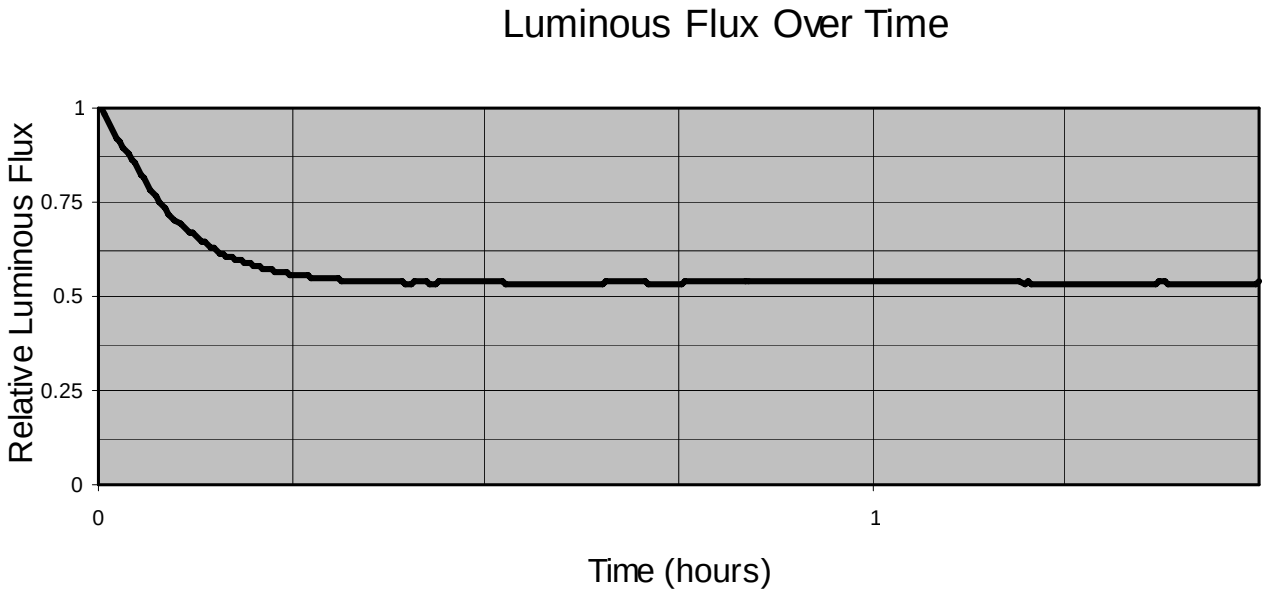
Why do we need standards for SSL products?

To encourage proper use of the technology



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Standards for SSL Products

Building Technologies Program

LED Measurement Series:

Solid State Lighting Standards

Like traditional lighting products, LED-based luminaires sold in the US are subject to industry standards governing safety and performance. To accommodate LEDs, some existing standards and test procedures are being modified, while in other cases, new standards are under development. This fact sheet lists the key performance and safety standards applicable to LED-based lighting products.

Product Performance and Measurement Standards

ANSI Standards

ANSI oversees the creation, promulgation and use of thousands of industry norms and guidelines, including the following key standards of relevance to SSL products.

C78.377†	Specifications for the Chromaticity of Solid State Lighting Products • Will specify the recommended chromaticity (color) ranges for white light LEDs with various correlated color temperatures (CCTs) and ensure communication of chromaticities to consumers.
C82.SSL1†	Power Supply • Will specify operational characteristics and electrical safety of SSL power supplies and drivers.
C82.77-2002	Harmonic Emission Limits – Related Power Quality Requirements for Lighting • Specifies the maximum allowable harmonic emission of SSL power supplies.

IESNA Documents

IESNA is the recognized North American technical authority on illumination.

TM-16-05	IESNA Technical Memorandum on Light Emitting Diode (LED) Sources and Systems • This technical memorandum provides a general description of LED devices and systems, and answers common questions about the use of LEDs.
RP-16†	Nomenclature and Definitions for Illuminating Engineering Addendum† • This document provides industry standard definitions of lighting terms, including all lighting technologies. The document is currently being updated to include definitions of solid state lighting terms.
LM-79†	IESNA Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products • Will specify procedures for measuring total luminous flux, electrical power, luminous efficacy, and chromaticity of SSL luminaires and replacement lamp products.
LM-80†	IESNA Approved Method for Measuring Lumen Depreciation of LED Light Sources • Will specify procedures for determining lumen depreciation of LEDs and LED modules (but not luminaires) related to effective useful life of the product.

† These documents are currently under development. LM-79, LM-80, and C78.377 are expected to be completed and published in early 2008.

Ulbsphere

Standards Organizations

ANSI - American National Standards Institute, *www.ansi.org*

CIE - International Commission on Illumination, *www.cie.co.at*

FCC - Federal Communications Commission, *www.fcc.gov*

IEC - International Electrotechnical Commission, *www.iec.ch*

IESNA - Illuminating Engineering Society of North America, *www.iesna.org*

NFPA - National Fire Protection Association, *www.nfpa.org*

UL - Underwriters Laboratories Inc., *www.ul.com*

CIE Reference Publications

13.3-1995
Method of Measuring and Specifying Colour Rendering Properties of Light Sources
• The official document defining the CRI metric. Will be referenced by ANSI C78.377.

15:2004
Colorimetry, Third Edition
• The official document defining various CIE chromaticity and C.C.T. metrics. Will be referenced by ANSI C78.377.

127:2007
Measurements of LEDs
• The only document to date addressing LED luminous intensity measurement; applies only to individual LEDs, not to arrays or luminaires.

S 009/E:2002
Photobiological Safety of Lamps and Lamp Systems
• Specifies measurement techniques to evaluate optical radiation hazards and eye safety risks of LEDs and LED clusters.

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LED Measurement Series: Solid State Lighting Standards — Research that Works!

Safety, Installation, and Other Requirements

NFPA Requirements

70-2005	National Electrical Code • Most SSL products must be installed in accordance with the National Electrical Code.

FCC Requirements

47 CFR Part 15	Radio Frequency Devices • Specifies FCC requirements for maximum allowable unintended radio-frequency emissions from electronic components, including SSL power supplies and electronic drivers.

UL Standards

UL is currently developing a safety standard for "Light-Emitting Diode (LED) Light Sources for Use in Lighting Products," which will be designated UL standard 8750. Currently, UL has in place an "Outline of Investigation" (also numbered 8750) that references all existing UL standards applicable to LED lighting products. The purpose of the outline is to provide a comprehensive approach and listing of applicable standards for UL treatment of lighting products based on LEDs. The Outline will be used until the full LED specific document is completed. The table below lists the key UL standards referenced in the Outline.

8750	Outline of Investigation for Light-Emitting Diode (LED) Light Sources for Use in Lighting Products • Will specify the minimum safety requirements for SSL components, including LEDs and LED arrays, power supplies, and control circuitry.
1598	Luminaires • Specifies the minimum safety requirements for luminaires. The requirements in this document may be referenced in other documents such as UL 8750 or separately used as part of the requirements for SSL products.
1012	Power Units Other Than Class 2 • Specifies the minimum safety requirements for Class 2 power supplies (as defined in NFPA 70-2005).
1310	Class 2 Power Units • Specifies the minimum safety requirements for power supplies other than Class 2 (as defined in NFPA 70-2005).
1574	Track Lighting Systems • Specifies the minimum safety requirements for track lighting systems.
2108	Low Voltage Lighting Systems • Species the minimum safety requirements for low-voltage lighting systems.
60950-1	Information Technology Equipment – Safety – Part 1: General Requirements • Species the minimum safety requirements for electronic hardware.

Disclaimer: This list is not comprehensive, as other existing and future industry standards, recommended practices, and regulatory requirements may apply to specific solid state lighting products.

A Strong Energy Portfolio for a Strong America
Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

For more information contact:
EERE Information Center
1-877-EERE-INF
(1-877-337-3463)
www.eere.energy.gov

Acknowledgement:
U.S. DOE acknowledges the assistance of Ian Ashdown in the development of this document.

For Program Information on the Web:
http://www.buildings.gov
http://www.netl.doe.gov/ssl

Click on CALiPER in the left menu for further information on performance of commercially available LED products.

For Information on the Next Generation Lighting Industry Alliance:
www.nglia.org

For Program Information:
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http://www.netl.doe.gov/ssl/usingLEDs/measurement-series-standards.htm

Standards for SSL Products

ENERGY STAR® Criteria for SSL Luminaires

- Final draft released September 2007
- Target Effective date September 2008

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Standards for SSL Products

Key Standards Organizations

- ANSI (American National Standards Institute)
- IESNA (Illuminating Engineering Society of North America)
- NFPA (National Fire Protection Agency) Requirements
- FCC (Federal Communications Commission) Requirements
- UL (Underwriters Laboratories Inc.) Standards

Standards for SSL Products

ANSI (American National Standards Institute)

- C78.377* - Specifications for the Chromaticity of Solid State Lighting Products
- C82.SSL1* - Power Supply
- C82.77-2002 - Harmonic Emission Limits – Related Power Quality Requirements for Lighting

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Standards for SSL Products

IESNA (Illuminating Engineering Society of North America)

TM-16-05 - IESNA Technical Memorandum on Light Emitting Diode (LED) Sources

- RP-16 - Nomenclature and Definitions for Illuminating Engineering (Addendum)
- LM-79* - IESNA Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products
- LM-80* - IESNA Approved Method for Measuring Lumen Depreciation of LED Light Sources

Standards for SSL Products

NFPA (National Fire Protection Association) Requirements

- 70-2005 - National Electrical Code

Standards for SSL Products

FCC (Federal Communications Commission) Requirements

- 47 CFR Part 15 - Radio Frequency Devices

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Standards for SSL Products

UL (Underwriters Laboratories Inc.)

- 8750 - Outline of Investigation for Light-Emitting Diode (LED) Light Sources for Use in Lighting Products
- 1598 - Luminaires
- 1012 - Power Units Other Than Class 2
- 1310 - Class 2 Power Units
- 1574 - Track Lighting Systems
- 2108 - Low Voltage Lighting Systems
- 60950-1 - Information Technology Equipment - Safety - Part 1: General Requirements

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Contact Information for SSL Standards

- ANSI - *www.ansi.org*
- IESNA - *www.iesna.org*
- NFPA - *www.nfpa.org*
- FCC - *www.fcc.gov*
- UL - *www.ul.com*

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