

Navigating the product safety certification process for solid-state lighting products

With proper planning, it is possible to efficiently navigate the testing and certification waters and launch high-quality LED products into the rapidly changing lighting market, writes **TODD STRAKA**.

Product safety compliance is a legal requirement worldwide, and is a necessity when introducing new solid-state lighting products into different markets. In the USA, according to the requirements of the Occupational Safety & Health Administration (OSHA), electronic equipment is deemed to be safe for use in the workplace if it is listed by a Nationally Recognized Testing Laboratory (NRTL; see www.osha.gov/dts/otpc/nrtl/index.html). NRTLs are qualified, third-party organizations that meet the requirements mandated by OSHA under 29 CFR section 1910.7 to perform independent safety testing and product certification.

The process of conducting product certification can be broken down into several steps. First, a review of the product's construction and design is performed, which includes careful evaluation of specific product information, including the bill of materials, applicable ratings of the individual components and materials, product design drawings, and spacing and dimensional requirements. From the review of all submitted information, it is then possible to determine the appropriate testing that will be required to sufficiently satisfy the requirements stated in the applicable standard(s).

Next comes the actual product testing phase, which is performed in accordance with the requirements of the applicable standard(s). Such tests may include temperature, electrical, dielectric, strain relief,

Standard	Product Type
Fixed Luminaires	
UL 1598 CSA C22.2 # 250	Luminaires
UL 1573	Stage & studio lighting
UL 1574	Track lighting
Portable Luminaires	
UL 153	Portable electric lamps
UL 1993	Self-ballasted lamps and lamp adapters
Specialty Luminaires	
UL 48	Electric signs
UL 676	Underwater lighting fixtures
UL 844	Fixtures for use in hazardous locations
UL 924	Emergency lighting and power equipment
UL 1786	Nightlights
UL 1838	Low-voltage landscape lighting systems
UL 1994	Low-level path marking and lighting systems
UL 2108	Low-voltage lighting systems
UL 2388	Flexible lighting products
Power Supplies	
UL 1012	Power units other than Class 2
UL 1310	Class 2 power units

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environmental (wet location), and mechanical tests, among others. Step three includes the creation and issuance of the formal test report and “authorization to mark” (ATM), which grants the manufacturer permission to label the product with the applicable safety mark from an NRTL (an example would be the ETL Listed mark from Intertek).

Finally, the manufacturer must agree to

participate in the NRTL's follow-up services program. This typically involves an initial audit of the manufacturing facility, as well as periodic manufacturing facility inspections to ensure consistent design, production, and labeling of the product. It is also necessary to maintain and update files to remain current with the latest revision of the applicable standards.

Product safety standards

Existing lighting safety standards still apply for LED lighting, but evaluations are now conducted incorporating UL 8750 Safety Standard for LED Lighting. The requirements found in UL 8750 are intended to supplement those found in the existing standards that relate to lighting (see table). For example, UL 1993 covers self-ballasted lamps and lamp adapters, and now includes replacement LED lamps. The third edition, published in August 2009, added requirements covering LED driver circuitry, and added requirements and limits for LED light sources. UL 1993 is now harmonized with ANCE (Mexico) and CSA (Canada).

UL 8750 covers LED equipment that is an integral part of a luminaire, including LED drivers, controllers, arrays, modules and packages. The first edition of UL 8750 was released in May 2009, and a revised version was published in September. After a further comment period, the final standard is expected to be published before the end of 2009.

In North America, product safety standards are published by organizations such as the American National Standards Insti-

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tute (ANSI), the National Fire Protection Association (NFPA), Underwriters Laboratories (UL) and Canadian Standards Association (CSA), after gaining industry-wide consensus. NTRLs (such as Intertek, UL, and CSA) are authorized to evaluate and certify products according to these standards. Each NTRL issues its own safety certification mark, which is an equally valid indication of compliance with the standard(s).

Efficiently navigating the process

When beginning the safety certification process, it is important to first consider where you intend to sell your products. Thinking globally from the outset may save a considerable amount of time and cost for the manufacturer in the long run. Another tip is to design with compliance in mind, which means involving your certification partner at the R&D and design phases of your product's life cycle. Doing so may minimize potential compliance issues and improve time to market. During the product design phase, it is necessary to be mindful of the main safety concerns with LED lighting, which include the risk of electric shock, risk of fire, and also biological hazards. For electric shock, UL 1310 covers Class 2 power supplies, which operate at 24V or below and offer reduced shock and fire hazard. UL 1012 covers power supplies other than Class 2, which must comply with standard insulation and accessibility requirements. Generally, it is necessary to enclose (or create a barrier to) live parts to prevent physical contact. It is also necessary to insulate live parts with appropriately rated materials, and to utilize appropriate spacings for live and accessible parts.

The risk of fire arises because of heat production within LEDs. Thermal dissipation is dependent on the ambient temperature and the thermal path design. It is necessary to take into account the proximity and spacing of LEDs, the material and design of the diffuser if appropriate, the type of enclosure utilized and its flame ratings, and the installation scenario.

In terms of biological hazards, exposure to ultraviolet wavelengths (100–400 nm) is a concern. The US and Canada currently do not have mandatory standards or regulations in this respect. However, organizations such as IESNA, ANSI, CIE, and IEC are

actively evaluating these effects.

Another consideration is to identify as many product variations as possible. This will allow products of similar design and construction to be grouped into product families, which may help to minimize the total number of samples required for evaluation and testing, and in turn lower the total project certification and testing fees.

Finally, as LED technology continues to advance rapidly, it is advisable to tap into industry resources to help you keep pace with ever-changing product safety and performance standards. There are many valuable educational resources available, including industry meetings and events, standards development committees, trade publications and online resources.

Performance testing

As LED products continue to seek widespread adoption in the marketplace, it is also important to remain mindful of your specific product's performance levels. Some NTRLs have the capability to also carry out product performance testing. Three major standards related to LED lighting were released in 2008: IESNA LM-79-08, ANSI C78.377-2008, and IESNA LM-80-08.

IESNA LM-79-08 covers electrical and photometric testing of SSL devices, and applies to both LED luminaires and LED light sources to be used in retrofit or replacement scenarios. It does not cover LED modules, LED packages, or individual LEDs. LM-79 is based on absolute, rather than relative, photometry, and includes the measurement of total luminous flux (lumens), luminaire efficacy (lm/W), color (chromaticity, CCT, CRI), and intensity distribution. ANSI C78.377-2008 applies to general indoor lighting applications. It covers the chromaticity of SSL products and specifies recommended chromaticity (color) ranges for white LEDs, including correlated color temperature (CCT) values for SSL products such as LED



A Type C high-speed mirror goniophotometer for luminaire testing.

luminaires and integrated LED lamps.

IESNA LM-80-08 covers the measurement of lumen maintenance for LED light sources and applies to LED arrays, packages, and modules only. It does not apply to luminaires. LM-80 provides a test method to measure L70, the time taken for the light output to fall to 70% of its original value. Testing is carried out at three different case temperatures over a minimum of 6,000 hours with lumen measurements taken at 1,000-hour intervals. However, it is important to note that this standard does not provide guidance regarding predictive estimations or extrapolation of product life; this will be addressed by IES TM-21-xx, which is currently under development.

Another example of performance testing might include Ingress Protection (IP) testing according to IEC 60529. This ensures that the product's enclosure will withstand varying degrees of moisture and dust intrusion should it be placed in an environment where it will be exposed to such elements (see page 23). ◀



LINKS

“Solid-State Lighting: Safety Certification Process and Performance Testing Measurement Techniques” Originally broadcast: September 2009 www.ledsmagazine.com/features/6/9/1

LED lighting standards and guidelines are now building on a firm foundation www.ledsmagazine.com/features/6/6/7