

Navigating the Safety Certification Process for LED Lighting Products



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Identifying Product Safety Requirements for Your Target Markets

As solid-state lighting technology continues to rapidly evolve, the acceptance of LED Lighting Products into global markets will continue to increase, presenting manufacturers with significant business opportunities. Before any business opportunity can be realized however, it is imperative that manufacturers first conduct due diligence to identify applicable product safety certification requirements pertaining to their specific targeted global markets.

For example, in the United States, 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 (commonly referred to as a NRTL). NRTLs are qualified, 3rd party organizations that meet the requirements mandated by OSHA under 29 CFR section 1910.7 to perform independent safety testing and product certification.

Basic Steps to Product Safety Certification

The Product Safety Certification process can be broken down into a few 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).

Steps to Certification:

1. *Review of products construction & design*
2. *Product testing phase (test to applicable standards)*
3. *Creation & issuance of Test Report & Authorization to Mark (ATM)*
4. *Participate in NRTL's follow-up services*

Next is 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, environmental (wet location), and mechanical tests, among others. Once the product has successfully completed all Construction Review and Testing requirements, step three includes the creation and issuance of the formal Test Report &



Authorization to Mark (ATM), which grants the manufacturer permission to label the product with the applicable safety mark from the contracted NRTL (such as the ETL Listed mark from Intertek).

As a final step, 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 ongoing manufacturing facility inspections on a pre-determined frequency (quarterly or monthly), 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.

North American Product Safety Standards for Solid-State Lighting

In North America, product safety standards are published by organizations such as the American National Standards Institute (ANSI), the National Fire Protection Association (NFPA), Underwriters Laboratories (UL) and Canadian Standards Association (CSA) respectively, after gaining industry-wide consensus. NRTLs (such as Intertek, UL, CSA) are authorized to evaluate and certify products according to these standards. Each NRTL issues its own safety certification mark, and each such mark is an equally valid indication of compliance with the standard(s).

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).

UL 8750 is a newly published standard, which 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 in before the end of 2009.

Other lighting standards are in the process of being updated to accommodate LED products. For example, UL 1993 covers Self-Ballasted Lamps and Lamp Adapters, and now includes a provision for replacement LED lamps. The third edition, published in August 2009, added requirements covering LED driver circuitry, and also added requirements and limits for LED light sources. UL 1993 is now also harmonized with ANCE (Mexico) and CSA (Canada). The most common lighting standards for North America include:

Standard	Product Type
Fixed Luminaires	
UL 1598 CSA C22.2 # 250	Luminaires
UL 1573 CSA C22.2 # 166	Stage & Studio Lighting
UL 1574 CSA C22.2 # 9	Track Lighting
Portable Luminaires	
UL 153 CSA C22.2 # 12	Portable Electric Lamps
UL 1993 CSA C22.2 # 250 CSA TIL # B-64	Self-Ballasted Lamps and Lamp Adapters
Specialty Luminaires	
UL 48 CSA C22.2 # 207	Electric Signs
UL 676 CSA C22.2 # 89	Underwater Lighting Fixtures
UL 844 CSA C22.2 # 137	Fixtures for Use in Hazardous (Classified) Locations
UL 924 CSA C22.2 # 250 CSA C22.2 #107.1	Emergency Lighting and Power Equipment
UL 1786 CSA C22.2 # 12	Nightlights
UL 1838 CSA TIL # B-58A	Low Voltage Landscape Lighting Systems
UL 1994	Low-level Path Marking and Lighting Systems
UL 2108	Low Voltage Lighting Systems
UL 2388 CSA C22.2 # 250	Flexible Lighting Products
Power Supplies	
UL 1012 CSA C22.2 # 107.1	Power Units Other Than Class 2
UL 1310 CSA C22.2 # 223	Class 2 Power Units

European Product Safety Standards for Solid-State Lighting

In Europe, solid-state lighting products must conform with the applicable European Directives and CE Marking guidelines. To achieve compliance for CE Marking, manufacturers must first construct a Technical File which includes all of the supporting documentation that verifies that the product meets the applicable European Directives. Then the manufacturer issues a Declaration of Conformity, stating that their products fulfill all requirements.

For solid-state lighting products, the two main Directives utilized in CE Evaluations include the Low Voltage Directive (73/23/EEC) and the EMC Directive (89/336/EEC). The most common lighting standards utilized in Europe include:

Safety	
EN 60598-1	Luminaire General Requirements and Tests
EN 60598-2	Luminaire Part 2 Requirements*
EN 61347-1	Lamp Control Gear
EN 60570	Electrical Track Systems for Luminaires
EN 61347-1	LED Power Supply
EN 61347-2-13	LED Power Supply
EN 62031	LED Module
EMC	
EN 55015	EMC Emission
EN 61547	EMC Immunity
EN 61000-3-2/3	Harmonics
Luminaire Part II Requirements	
EN 60598-2-1	Fixed luminaires
EN 60598-2-2	Recessed luminaires
EN 60598-2-3	Road and street lighting
EN 60598-2-4	Portable luminaires
EN 60598-2-5	Floodlights
EN 60598-2-6	Luminaires with built-in transformers or convertors for filament lamps
EN 60598-2-7	Portable luminaires for garden use
EN 60598-2-8	Handlamps
EN 60598-2-9	Photo and film luminaires (non-professional)
EN 60598-2-10	Portable luminaires for children
EN 60598-2-11	Aquarium luminaires
EN 60598-2-12	Mains socket-outlet mounted nightlights
EN 60598-2-13	Ground recessed luminaires

Luminaire Part II Requirements (continued)	
EN 60598-2-14	Luminaires for neon tubes (under preparation)
EN 60598-2-17	Luminaires for stage lighting, television, film and photographic studios (outdoor and indoor)
EN 60598-2-18	Luminaires for swimming pools and similar applications
EN 60598-2-19	Air-handling luminaires (safety requirements)
EN 60598-2-20	Lighting chains
EN 60598-2-22	Luminaires for emergency lighting
EN 60598-2-23	Extra low voltage lighting systems for filament lamps
EN 60598-2-24	Luminaires with limited surface temperatures
EN 60598-2-25	Luminaires for use in clinical areas of hospitals and health care buildings

Photobiological Testing Required for Europe

In terms of biological hazards, exposure to ultraviolet wavelengths (100–400 nm) is a concern. Additionally in Europe, LEDs are classified as Lasers and are subject to meet specific test requirements. A new standard, IEC/EN 62471 replaces the previous EN 60825-1, and includes specific performance requirements and thresholds for Photobiological Safety of Lamps & Lamp Systems.

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 for future consideration.

Efficiently Navigating the Certification Process

When beginning the safety certification process, it is important to first strategically consider and identify your target markets. Thinking globally from the outset may save a considerable amount of time and cost 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. By doing so, it may be possible to minimize potential compliance issues and re-testing, ultimately improving your product’s 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 biological hazards.

Regarding the risk of electric shock, UL 1310 covers class 2 power supplies, which operate at 24V or below. Class 2 power supplies offer a reduced shock and fire hazard due to their current and voltage limitation. 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 the 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 the enclosure flame ratings and the installation scenario.

As previously mentioned, biological hazards and exposure to ultraviolet wavelengths (100–400 nm) is a concern. Europe has taken steps to address these concerns through the implementation of EN 62471 and the U.S. and Canada are continuing to actively research and evaluate these possible effects.

Another way to ensure that you are handling your product safety certifications in the most efficient manner possible is to identify as many product variations as possible right at the outset of the process. 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.



The product safety certification process doesn't need to be a daunting or painful experience. Advance preparation and planning for your LED lighting product's safety certification will undoubtedly provide you with a more cost-efficient, time-efficient, and rewarding certification experience.



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