



*Where Innovation and Lighting Begin*

# Are Your LED Products Safe?

Manufacturers of products containing LED lights know that governments around the world require their products to be tested to guarantee that ultraviolet (UV) and infrared (IR) light output does not exceed safety levels outlined in IEC62471. What they may not know is that products bearing CE, UL, CCC, or other national marks that do not have documented proof of IEC62471 compliance can be confiscated and excluded from sale, and the manufacturer fined.

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Solid-state lights, also called light-emitting diodes (LEDs), have benefited from exponential performance improvements during the past 20 years due to their better efficiency and lower operating costs compared to incandescent and gas-discharge lamps. Because LED lights are made of a monolithic semiconductor material, they also are inherently more rugged than filament- or ballast-based lights, which have endeared LED lights to industrial markets where uptime is a primary concern. Finally, LED lights also can be designed to generate almost any wavelength or color of light from the UV through the IR spectral band.

Most white LED lights manufactured today start as a blue LED with additional phosphor coating to create a broadband white light source. This has led to the development of brighter and brighter blue LEDs. Unfortunately, as the white LED becomes more prevalent, it also increases the danger of UV damage to human eyes. Above certain luminosities, UV, visible, and IR light can cause considerable photobiological damage to eyes.

In response, the International Electrotechnical Commission (IEC), with input from IEEE and other industrial groups, developed an international standard – IEC62471 “Photobiological Safety of Lamps and Lamp Systems” – in 2009 to protect people from photobiological damage caused by LED light. The standard requires that all lamp designs, including LED and all luminaires, have their output tested and

documented from 200 nm to 3000 nm by a certified laboratory to prove the light does not exceed safety output thresholds defined by a certain luminosity at a given distance. Based on these tests, LED lights are classified within one of four risk categories and must be labeled accordingly (see tables on page 3).

**“Electrical equipment may be placed on the market in the EU only if the basic requirements of the relevant European directives (transposed into national law) are observed. Photobiological safety is one such product requirement.”**

*From the European Lamp Companies Federation's Annex A to joint CELMA/ELC Guide on LED related standards: Photobiological safety of LED lamps and lamp systems*

Today, Europe, Canada, and parts of Asia require that all lights be tested and documented to the IEC62471 standard. Unfortunately, many manufacturers are unaware of this requirement. Believing their products comply with all relevant standards, these OEMs routinely apply CE marks for products to be sold in Europe, for example. However, should a problem or lawsuit arise, and the OEM does not have certified test documents, these products will be removed and prohibited from sale and raise the potential of fines, regardless of

whether the product actually complies with IEC62471. In other words, testing and documentation are a requirement, not an option when it comes to “safe for sale” marks in most developed markets around the world.

## THE IECEE SCHEME, AND WHAT IT MEANS TO YOU

While many countries require compliance with IEC62471, each country has the right to alter it as necessary. To help global manufacturers comply with the different requirements, the International Electrotechnical Commission for Electrical Equipment Safety (IECEE) developed a Certification Body (CB) Scheme. The CB Scheme allows for mutual recognition of LED test reports and IEC62471 compliance certificates among 53 different countries, including Argentina, Australia, Austria, Belarus, Belgium, Brazil, Canada, China, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, India, Indonesia, Ireland, Israel, Italy, Japan, Republic of Korea, Kenya, Malaysia, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Serbia and Montenegro, Singapore, Slovakia, Slovenia, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, Ukraine, United Kingdom, and the U.S.

In September 2013, after two years of acquiring equipment and proving competency, Smart Vision Lights started testing its own LED products as part of the process for legally applying marks of conformity, such as Europe’s CE mark, to Smart Vision Lights’ products for sales and operation in the countries listed above.

Today, Smart Vision Lights only designs and manufactures LED lights that fully comply with all IEC standards, including photobiological damage standard IEC62471.

Smart Vision Lights’ LED testing lab includes a new Gooch & Housego Spectroradiometric system consisting of an OL 750-M-D double monochromator with integrating sphere, including germanium, lead sulfide, and silicon high-sensitivity detectors for performing highly accurate optical radiation measurements. Smart Vision Lights’ test equipment is regularly calibrated and verified by Intertek to meet the minimum accuracy requirements published in CTL Decision Sheet 251B — Measurement Accuracy. The new equipment enables Smart Vision Lights’ lab technicians to independently measure and validate IEC62471 data, including radiance and irradiance of optical radiation from 200 nm through 3000 nm wavelengths.

TABLE 1

Bioeffect				
Hazard	Wavelength Range (nm)	Quantity	Eye	Skin
Actinic UV skin and eye	200-400 (weighted)	Irradiance	<i>Cornea</i> – photokeratitis <i>Conjunctiva</i> – conjunctivitis <i>Lens</i> – cataractogenesis	Erythema Elastosis
UVA eye	315-400	Irradiance	<i>Lens</i> – cataractogenesis	—
Retinal blue light	300-700 (weighted)	Radiance	<i>Retina</i> – photoreinitis	—
Reginal blue light small source	300-700 (weighted)	Irradiance	<i>Retina</i> – photoreinitis	—
Retinal thermal	380-1400 (weighted)	Radiance	<i>Retina</i> – retinal burn	—
Retinal thermal-weak visual stimulus	780-1400 (weighted)	Radiance	<i>Retina</i> – retinal burn	—
Infrared radiation eye	780-3000	Irradiance	<i>Cornea</i> – corneal burn <i>Lens</i> – cataractogenesis	—
Thermal skin	380-3000	Irradiance	—	Skin burn

There are various biological hazards that are considered within different wavelength ranges in accordance with the standard IEC/EN 62471. The biological effects on both eyes and skin are considered.

TABLE 2

Risk Group	Philosophical Basis
Exempt	No photobiological hazard
GROUP 1 (Low Risk)	No photobiological hazard under normal behavioral limitations
GROUP 2 (Moderate Risk)	Does not pose a hazard due to aversion response to bright light or thermal discomfort
GROUP 3 (High Risk)	Hazardous even for momentary exposure

IEC62471 classifies light sources into the above four groups according to hazard, based on the emission limit as well as permissible exposure time before hazard exceeded.

TABLE 3

Labeling — IEC62471-2 (Cl. 5.4)				
Hazard	Exempt	GROUP 1	GROUP 2	GROUP 3
Actinic UV	—	<b>NOTICE</b> UV emitted from this product. Minimize exposure to eyes or skin. Use appropriate shielding.	<b>CAUTION</b> UV emitted from this product. Eye or skin irritation may result from exposure. Use appropriate shielding.	<b>WARNING</b> UV emitted from this product. Avoid eye and skin exposure to unshielded product.
UVA	—	<b>NOTICE</b> UV emitted from this product. Minimize exposure to eyes or skin. Use appropriate shielding.	<b>CAUTION</b> UV emitted from this product. Eye or skin irritation may result from exposure. Use appropriate shielding.	<b>WARNING</b> UV emitted from this product. Avoid eye and skin exposure to unshielded product.
Blue light radiance	—	—	<b>CAUTION</b> Possibly hazardous optical radiation emitted from this product. Do not stare at operating lamp. May be harmful to the eye.	<b>WARNING</b> Possibly hazardous optical radiation emitted from this product. Do not look at operating lamp. Eye injury may result.
Retinal thermal hazard	—	—	<b>CAUTION</b> Possibly hazardous optical radiation emitted from this product. Do not stare at operating lamp. May be harmful to the eye.	<b>WARNING</b> Possibly hazardous optical radiation emitted from this product. Do not look at operating lamp. Eye injury may result.
IR radiation eyes	—	<b>NOTICE</b> IR emitted from this product. Use appropriate shielding or eye protection.	<b>CAUTION</b> IR emitted from this product. Do not stare at operating lamp.	<b>WARNING</b> IR emitted from this product. Avoid eye exposure. Use appropriate shielding or eye protection.
Retinal thermal hazard-weak visual	—	<b>WARNING</b> IR emitted from this product. Do not stare at operating lamp.	<b>WARNING</b> IR emitted from this product. Do not stare at operating lamp.	<b>WARNING</b> IR emitted from this product. Do not look at operating lamp.

IEC 62471-2 “Photobiological safety of lamps and lamp systems - Part 2: Guidance on manufacturing requirements relating to non-laser optical radiation safety” provides further guidance on the measurement and labeling of sources and is a useful supplement to IEC/EN 62471.



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**“Cognex products needed to have a UL certification, and in order to obtain this, UL required Cognex to have our products IEC62471/RP27 compliant. Smart Vision Lights provided this proof of compliancy, further demonstrating their value as a lighting supplier in the machine vision industry.”**

**Nathan Caughel, Product Marketing Specialist at Cognex Corporation**

## **WHAT DOES THIS MEAN TO LED CUSTOMERS?**

What IEC62471 compliance means to you, the LED customer, is that any product or system you design using IEC62471-compliant LED lights is safe to operate and sell in any country around the world. While not every company around the world is aware of the need for IEC62471 compliance, large companies and governmental agencies are well aware of the need to comply with IEC safety standards. Cognex Corporation (Natick, MA), one of Smart Vision Lights’ largest customers, recently secured a contract based on presenting IEC62471 documented compliance of Smart Vision Lights LEDs used

in a proposed postal sorting system. And whether customers or regulators are aware of the standard or not, ignorance is not a legal defense.

So, are your customers safe from photobiological harm from your lighting systems? Is your company protected against regulatory non-compliance? To find out more about Smart Vision Lights and its industry-leading line of LED lighting solutions for industrial, scientific, and hazardous applications, including laboratory testing files and technical datasheets, visit [SmartVisionLights.com](http://SmartVisionLights.com), or call 231-722-1199. 



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