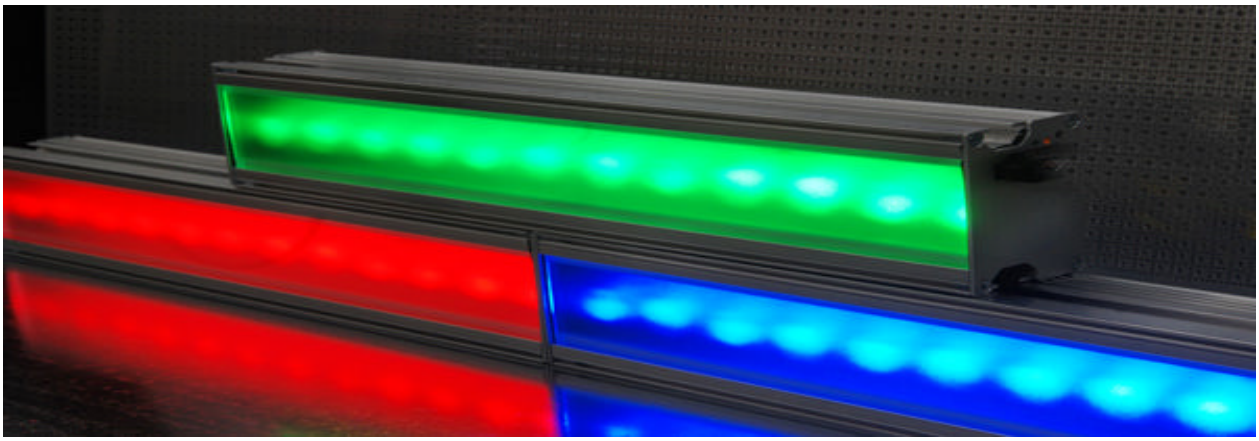
IEC/EN 62471 for LED Lighting Products

Standards for Eye and Skin Safety



Standard: IEC/EN 62471

As LEDs become widely used in many LED lights, assessment of the unique “Blue Light” hazard is critical. As of September 1, 2009, IEC/EN 62471, Photobiological Safety of Lamps and Lamp Systems, was fully applied to all LED lighting products.

STANDARD SCOPE

IEC/EN 62471 gives guidance for evaluating the photobiological safety of lamps and lamp systems including luminaries. Specifically it defines exposure limits, references measurement techniques and the classification scheme for the evaluation and control of photobiological hazards from all electrically powered incoherent broadband sources of optical radiation, including LEDs (but excluding lasers), in the wavelength range from 200 nm through 3000 nm. This standard was prepared as Standard CIE S 009:2002 by the International Commission on Illumination.

ANSI/IESNA RP-27

Created by Underwriters Laboratories, ANSI/IESNA RP-27 is the original photobiological safety standard for lamp systems in the United States. This set of regulations was the basis for the IEC/EN 62471. Similarities between the two documents include:

- Associated risk
- Exposure limits for spectral distribution of optical radiation
- Representative radiometric magnitudes
- Methods of measurements

The ANSI/IESNA RP-27 and the IEC/EN 62471 contain minor differences including:

- Weighting functions for calculations of radiance
- Labeling requirements (only specified in ANSI/IESNA RP-27)

Hazardous Considerations

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 the eyes and skin are considered.

Hazard	Wavelength Range (nm)	Quantity	Eye	Skin
Actinic UV skin and eye	200-400 (weighted)	Irradiance	Photokeratitis[1] Conjunctivitis[2] Cataracts	Erythema[4] Elastosis[5]
UVA eye	315-400	Irradiance	Cataracts	--
Retinal Blue-light	300-700 (weighted)	Radiance	Photoretinitis[3]	--
Retinal Blue-light-small source	300-700 (weighted)	Irradiance	Photoretinitis[3]	--
Retinal thermal	380-1400 (weighted)	Radiance	Retinal burn	--
Retinal thermal-weak visual stimulus	780-1400 (weighted)	Radiance	Retinal burn	--
Infrared radiation eye	780-3000	Irradiance	Corneal burn Cataracts	--
Thermal skin	380-3000	Irradiance	--	Skin burn

1 sunburn of the cornea-symptoms include pain, swelling, and increased tear production
2 swelling of inner eyelid
3 damage of the retina
4 reddening of the skin
5 degeneration of elastic skin

Classification

According to EN 62471:2008 sources of optical radiation are classified into risk groups subject to their potential photobiological hazard. This classification takes place through a risk assessment, which is conducted on the either individual components or the final product based on information obtained from the manufacturer. If a source is assigned to a “safe” group (Exempt Group), or to a low risk group (Risk Group 1), it would not be needed for a detailed workplace evaluation, since there is no photobiological safety hazard issue.

Sources are classified into the following four groups according to hazard, based on the emission limit as well as permissible exposure time before hazard exceeded.

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

Permissible Exposure Time (Cl. 6)

In order to determine the risk group of a source, its spectral irradiance or radiance has to be measured at a specified distance, weighted with action spectra and maximum allowed exposure time, which is compared to different exposure limits. For continuous sources, the exposure time limits are as follows:

	Exposure time before hazard exceeded (in seconds)			
Hazard	**Exempt**	**Group 1**	**Group 2**	**Group 3**
Actinic UV	30000	10000	1000	--
UVA Hazard	1000	300	100	--
Blue Light Radiance	10000	100	.25	--
Blue Light Small Source	10000	100	.25	--
Retinal Thermal	10	10	.25	--
Retinal Thermal Weak Visual	1000	100	10	--
IR Eye	1000	100	10	--

Labeling Requirements – IEC62471-2

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.

Hazard	Exempt	Group 1	Group 2	Group 3
Actinic UV	--	NOTICE UV emitted from this product. Minimize exposure to eyes and skin. Use appropriate shielding.	CAUTION. UV emitted from this product. Eye or skin irritation may result from exposure. Use appropriate shielding.	WARNING. UV emitted from this product. Avoid eye and skin exposure to unshielded products.
UVA	--	NOTICE UV emitted from this product. Minimize exposure to eyes and skin. Use appropriate shielding.	CAUTION. UV emitted from this product. Eye or skin irritation may result from exposure. Use appropriate shielding.	WARNING. UV emitted from this product. Avoid eye and skin exposure to unshielded products.
Blue Light Radiance	--	--	CAUTION. Possibly hazardous optical radiation emitted from this product. Do not stare at operating lamp. May be harmful to the eye.	WARNING. Possibly hazardous optical radiation emitted from this product. Do not look at operating lamp. Eye injury may result.
Retinal Thermal Hazard	--	--	CAUTION. Possibly hazardous optical radiation emitted from this product. Do not stare at operating lamp. May be harmful to the eye.	WARNING. Possibly hazardous optical radiation emitted from this product. Do not look at operating lamp. Eye injury may result.
IR Radiation Eyes		NOTICE IR emitted from this product. Use appropriate shielding or eye protection.	CAUTION. IR emitted from this product. Do not stare at operating lamp.	WARNING. IR emitted from this product. Avoid eye exposure. Use appropriate shielding or eye protection.
Retinal Thermal Hazard Weak Visual		WARNING IR emitted from this product. Do not stare at operating lamp	CAUTION. IR emitted from this product. Do not stare at operating lamp.	WARNING. IR emitted from this product. Do not look at operating lamp.

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