

LUXEON[®] S

Photobiological Safety Report

Introduction

Light Emitting Diodes (LEDs) are incoherent, broad-band optical light sources that span the visible wavelength from 400nm to 780nm. Lasers, unlike LEDs, are coherent, monochromatic light sources. In the past, LEDs were included in the laser eye safety standards (IEC 60825), but with new LED-based applications, LEDs are now included in the Photobiological Safety of Lamps and Lamp Systems, CEI/IEC 62471, 2006-07 lamp standard.

Philips Lumileds does not recommend staring directly into any LED lamp or luminaire.

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Photobiological Safety Standards

The European standard, IEC 62471:2006 for Photobiological Safety of Lamps and Lamp Systems, is used to evaluate LED photobiological safety. The scope of this standard applies to lamps and lamp systems safety, including the safety of luminaires. The following information is provided by Philips Lumileds to assist manufacturers who use LUXEON LEDs in their end products. The information in this report can be used to help manufacturers evaluate component level safety and provide manufacturers some indication of the risk factor classification of standalone LUXEON LED emitters. It is still the lamp system and luminaire manufacturer's responsibility to ensure that the final product is fully assessed for photobiological safety as required by local or national regulatory requirements.

In the USA, the ANSI/IESNA RP-27 standard, parts 1 to 3 are used to evaluate the photobiological safety of lamps and lamps systems. The IEC 62471:2006 standard was based largely on the ANSI/IESNA RP-27 standard.

LUXEON S product was evaluated in this report according to the IEC 62471:2006 standard.

Measurement and Sample Preparation

In assessing the safety of a LUXEON LED, it is necessary to determine the spectral distribution of the LEDs at maximum irradiance ($\text{W}\cdot\text{m}^{-2}$) or radiance ($\text{W}\cdot\text{m}^{-2}\cdot\text{sr}^{-1}$). The wavelength measurement must cover 200 nm to 3000 nm.

Continuous wave (DC) emission was tested when the LUXEON S device under test was operating at its maximum permissible current (according to Philips Lumileds' product specification) and according to the IEC 62471 guidelines.

Philips Lumileds commissioned an independent accredited laboratory (Underwriters Laboratories Inc.) to perform the measurement analysis and to issue IEC 62471 standards reports.

Test Results for LUXEON S LXS8-PW30

Table 1. LUXEON S LXS8-PW30 LED Sample Tested by Philips Lumileds (for information only)

LED Type	LXS8-PW30
Luminous flux at 700 mA, 85°C*	1315 lm
Radiant flux at 700 mA, 85°C	4113 mW
1931 CIE color points at 700 mA, 85°C	(0.4304, 0.4030)
CCT at 700 mA, 85°C	3105 K

* Measurements at 85°C junction temperature with 20ms current pulse.

Testing Summary Result Based on IEC 62471:2006 Testing

Testing Laboratory: Underwriters Laboratories Inc., 12 Laboratory Drive, Research Triangle Park, NC 27709-3995, USA

Date of issue: 16th Feb 2011

Report Reference No.: 10SC04985

Distance to detector: 200 mm

Small Source: NO

Risk Group Classification: Risk Group I (Low Risk)

Table 2. Risk Group Categories for 700 mA Continuous Wave (DC) Testing*

RISK Factor	RISK Group Result
Actinic UV, E_s (200 – 400 nm)	Exempt
Near UV, E_{UVA} (315 – 400 nm)	Exempt
Blue Light, L_b (300 – 700 nm)	Risk Group I (Low risk)
Blue Light Small Source, E_b (300 – 700 nm)	Exempt (N/A)
Retinal Thermal, L_R (380 – 1400 nm)	Exempt
Retinal Thermal Weak Stimulus, L_{IR} (780 – 1400 nm)	Exempt
IR Radiation, Eye, E_{IR} (780 – 3000 nm)	Exempt

* Based on the pad temperature measurement provided by UL, the LED junction temperature during measurement was approximately 85.8°C. This is for information only. Note that IEC 62471 does not request LED junction temperature to be reported or recorded.

This sample is categorized as Risk Group I based on the measurement of blue light hazard (L_b). The maximum permissible exposure time is 1981 seconds (when the user is looking at the light source). This applies in the test conditions described above, in which the sample unit was operated at 700 mA.

Spectral Result

The chart below (for information purposes only) provided by UL shows the spectral distribution of the LED during photobiological testing.

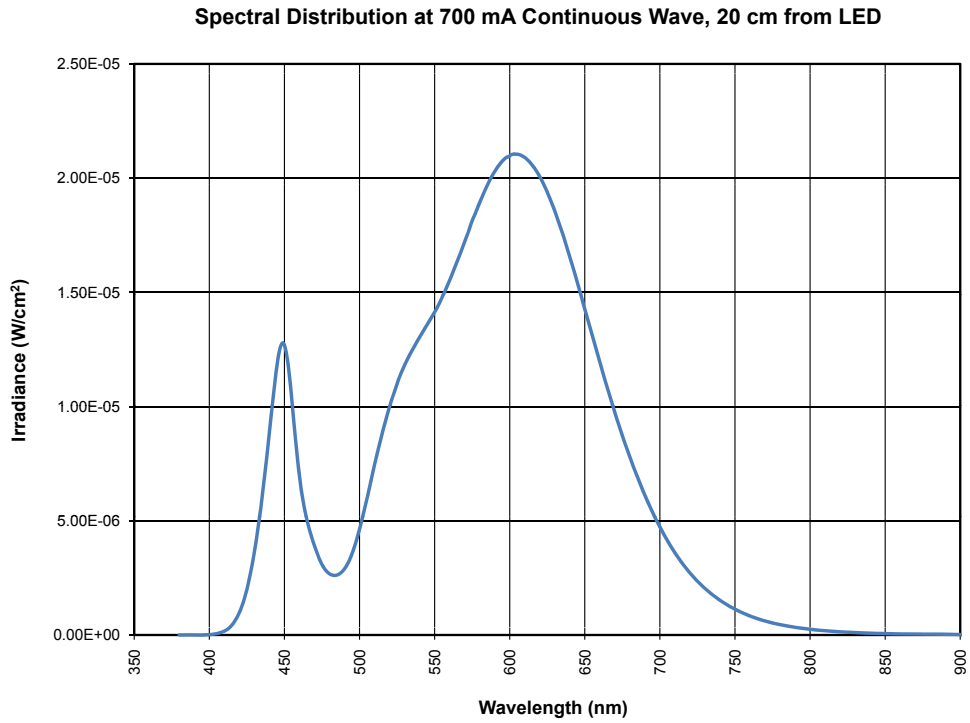


Figure I. Spectral Distribution at 700 mA Continuous Wave, 20 cm from LED.

Explanation of Risk Groups

The following IEC table¹ describes the control measures taken for each hazard type by risk group factor during lamp and lamps systems manufacturing.

Table 3. Explanation of Labelling Information and Guidance on Control Measures

Hazard	Exempt Risk	Risk Group 1	Risk Group 2	Rick Group 3
Ultraviolet hazard 200 nm to 400 nm	Not required	Minimize exposure to eyes or skin. Use appropriate shielding.	Eye or skin irritation may result from exposure. Use appropriate shielding.	Avoid eye and skin exposure to unshielded product.
Retinal blue light hazard 300 nm to 400 nm	Not required	Not required	Do not stare at operating lamp. May be harmful to the eyes.	Do not look at operating lamp. Eye injury may result.
Retinal blue light or thermal hazard 400 nm to 780 nm	Not required	Not required	Do not stare at operating lamp. May be harmful to the eyes.	Do not look at operating lamp. Eye injury may result.
Cornea/lens infrared hazard 780 nm to 3000 nm	Not required	Use appropriate shielding or eye protection.	Avoid eye exposure. Use appropriate shielding or eye protection.	Avoid eye exposure. Use appropriate shielding or eye protection.
Retinal thermal hazard, weak visual stimulus 780 nm to 1400 nm	Not required	Do not stare at operating lamp.	Do not stare at operating lamp.	Do not look at operating lamp.

Notes:

1. International Electrotechnical Commission, IEC 62471-2/TR (1st edition, 2009), Table 2 page 17.

Company Information

Philips Lumileds is a leading provider of LEDs for everyday lighting applications. The company's records for light output, efficacy and thermal management are direct results of the ongoing commitment to advancing solid-state lighting technology and enabling lighting solutions that are more environmentally friendly, help reduce CO₂ emissions and reduce the need for power plant expansion. Philips Lumileds LUXEON® LEDs are enabling never before possible applications in outdoor lighting, shop lighting, home lighting, consumer electronics, and automotive lighting.

Philips Lumileds is a fully integrated supplier, producing core LED material in all three base colors, (Red, Green, Blue) and white. Philips Lumileds has R&D centers in San Jose, California and in the Netherlands, and production capabilities in San Jose, Singapore and Penang, Malaysia. Founded in 1999, Philips Lumileds is the high flux LED technology leader and is dedicated to bridging the gap between solid-state technology and the lighting world. More information about the company's LUXEON LED products and solid-state lighting technologies can be found at www.philipslumileds.com.

Disclaimer

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