



<b>TEST REPORT</b> <b>IEC 62471</b> <b>Photobiological safety of lamps and lamp systems</b>	
<b>Report Reference No.</b> .....	<b>4788192776.4</b>
Date of issue.....	2018-04-11
Total number of pages .....	27 including attachments
<b>Testing Laboratory</b> .....	UL International Italia S.r.l.
Address .....	Via Delle Industrie 5 & 6, 20061 Carugate (MI) - Italy
<b>Applicant's name</b> .....	<b>NERI S.p.A.</b>
Address .....	<b>SS Emilia, 1622 – Longiano (FC) 47020 - Italy</b>
<b>Test specification:</b>	
Standard.....	IEC 62471:2006 (First Edition)
Test procedure .....	Informative
Non-standard test method.....	N/A
<b>Test Report Form No.</b> .....	IEC62471A
TRF Originator.....	VDE Testing and Certification Institute
Master TRF.....	Dated 2009-05
<b>Copyright © 2009 IEC System for Conformity Testing and Certification of Electrical Equipment (IECEE), Geneva, Switzerland. All rights reserved.</b> This publication may be reproduced in whole or in part for non-commercial purposes as long as the IECEE is acknowledged as copy-right owner and source of the material. IECEE takes no responsibility for and will not assume liability for damages resulting from the reader's interpretation of the reproduced material due to its placement and context. If this Test Report Form is used by non-IECEE members, the IECEE/IEC logo and the reference to the CB Scheme procedure shall be removed.	
<b>This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.</b>	
<b>Test item description</b> .....	LED luminaire
Trade Mark .....	<b>NERI</b>
Manufacturer :	Same as Applicant
Model name/Model Number.....	<b>Light Milos MNMILL203G802</b>
Ratings .....	230 V ~ 50/60 Hz 116 W 4000 K Class II IEC/EN 62471 Risk Group Exempt

Testing procedure and testing location:	
<input checked="" type="checkbox"/> <b>Testing Laboratory:</b> Testing location/ address.....:	UL International Italia S.r.l. Via Delle Industrie 5 & 6, 20061 Carugate (MI) - Italy
<input type="checkbox"/> <b>Associated CB Laboratory:</b> Testing location/ address.....:	
Tested by (name + signature) .....:	Fausto Pedroni 
Approved by (+ signature) .....:	Luca Nobile 
<input type="checkbox"/> Testing procedure: TMP Tested by (name + signature) .....: Approved by (+ signature) .....: Testing location/ address.....:	
<input type="checkbox"/> Testing procedure: WMT Tested by (name + signature) .....: Witnessed by (+ signature).....: Approved by (+ signature) .....: Testing location/ address.....:	
<input type="checkbox"/> Testing procedure: SMT Tested by (name + signature) .....: Approved by (+ signature) .....: Supervised by (+ signature) .....: Testing location/ address..... :	
<input type="checkbox"/> Testing procedure: RMT Tested by (name + signature) .....: Approved by (+ signature) .....: Supervised by (+ signature) .....: Testing location/ address.....:	

<b>List of Attachments (including a total number of pages in each enclosure):</b>				
<b>This report consists of:</b>				
<b>Test results:</b>	16 pages			
<b>European Group Differences</b>	(Enclosure 1): 2 pages			
<b>Components List</b>	(Enclosure 2): 1 page			
<b>Measured wavelength curves</b>	(Enclosure 3): 1 page			
<b>Labelling according to IEC/TR 62471-2</b>	(Enclosure 4): 4 pages			
<b>Photographs</b>	(Enclosure 5): 2 pages			
<b>Test and Measuring Equipment</b>	(Enclosure 6): 1 page			
<b>Summary of testing:</b>				
<b>Tests performed (name of test and test clause):</b>				<b>Testing location:</b>
5.2.1	Irradiance measurement	Applicable	Pass	UL International Italia S.r.l Via Delle Industrie 5 & 6, 20061 Carugate (MI) - Italy
5.2.2	Radiance measurement	Applicable	Pass	
The lamp system has been classified as <b>“Risk Group Exempt”</b>				
The measurement uncertainties stated in this Test Report are estimated according to the Quality Procedure 23-CL-G0025.				
If requested, UL International Italia S.r.l. will be able to estimate the uncertainty contribution for all the quantities stated in this Test Report.				
<b>Summary of compliance with National Differences:</b>				
List of countries addressed:				
<ul style="list-style-type: none"> <li>• <b>European Group Differences</b> (see Enclosure 1)</li> </ul>				
<input checked="" type="checkbox"/> The product fulfils the requirements of <b>EN 62471:2008 (based on EU Directive 2006/25/EC)</b> .				

Copy of marking plate:

<b>Light Milos</b>	<b>MNMILL203G802</b>
<b>Product by NERI</b>	
Lotto 0001	Data 04/2018    Seriale 00001
Input: 230V	50/60Hz    116W    PF > 0,9
Output: 32LED740 13500lm Ottica NLG20	
Apparecchio: classe II	IP66 IK09 Ta 25°
Temperatura di funzionamento: -35°C - +40°C	
    	Neri s.p.A. Via Emilia, 1622 47020 (FC) Longiano - Italy

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

<p><b>Test item particulars</b> .....</p> <p>Tested lamp .....: <input checked="" type="checkbox"/> continuous wave lamps      <input type="checkbox"/> pulsed lamps</p> <p>Tested lamp system .....: see "Component List" in Enclosure 2</p> <p>Lamp classification group.....: <input checked="" type="checkbox"/> exempt      <input type="checkbox"/> risk 1      <input type="checkbox"/> risk 2      <input type="checkbox"/> risk 3</p> <p>Lamp cap .....: LED Chip</p> <p>Bulb .....: —</p> <p>Rated of the lamp .....: 32 x LED Chip</p> <p>Furthermore marking on the lamp.....: —</p> <p>Seasoning of lamps according IEC standard .....: N/A – LED</p> <p>Used measurement instrument.....: see "Test and Measuring Equipment" in Enclosure 6</p> <p>Temperature by measurement.....: 25,6 °C</p> <p>Information for safety use.....: —</p>			
<p><b>Possible test case verdicts:</b></p> <ul style="list-style-type: none"> <li>– test case does not apply to the test object .....: N/A</li> <li>– test object does meet the requirement .....: P (Pass)</li> <li>– test object does not meet the requirement .....: F (Fail)</li> </ul>			
<p><b>Testing:</b></p> <p>Date of receipt of test item.....: 15 December 2017</p> <p>Date (s) of performance of tests.....: 10 April 2018</p>			
<p><b>General remarks:</b></p> <p>The test results presented in this report relate only to the object tested.                  This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.                  "(See Enclosure #)" refers to additional information appended to the report.                  "(See appended table)" refers to a table appended to the report.                  Throughout this report a comma is used as the decimal separator.                  List of test equipment must be kept on file and available for review.</p>			

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

**General product information:**  
 LED Luminaire equipped with electronic control gear. The luminaire optic is composed by lens in plastic material and transparent flat glass.  
 The supply voltage during the test has been adjusted to 230 V 50/60 Hz.  
 Model under test has been provided with LEDs having a rated CCT of 4000 K and it has been tested (according to manufacturer's request) at a distance of 2250 mm from the detector in the direction of maximum luminous intensity.

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
<b>4</b>	<b>EXPOSURE LIMITS</b>		<b>P</b>
4.1	General		P
	The exposure limits in this standard is not less than 0,01 ms and not more than any 8-hour period and should be used as guides in the control of exposure		P
	Detailed spectral data of a light source are generally required only if the luminance of the source exceeds $10^4 \text{ cd}\cdot\text{m}^{-2}$	see clause 4.3	P
4.3	Hazard exposure limits		P
4.3.1	Actinic UV hazard exposure limit for the skin and eye		P
	The exposure limit for effective radiant exposure is $30 \text{ J}\cdot\text{m}^{-2}$ within any 8-hour period		P
	To protect against injury of the eye or skin from ultraviolet radiation exposure produced by a broadband source, the effective integrated spectral irradiance, $E_s$ , of the light source shall not exceed the levels defined by:		P
	$E_s \cdot t = \sum_{200}^{400} \sum_t E_\lambda(\lambda, t) \cdot S_{UV}(\lambda) \cdot \Delta t \cdot \Delta \lambda \leq 30 \quad \text{J}\cdot\text{m}^{-2}$		P
	The permissible time for exposure to ultraviolet radiation incident upon the unprotected eye or skin shall be computed by:		P
	$t_{\max} = \frac{30}{E_s} \quad \text{s}$	$t_{\max} > 30\,000 \text{ s}$	P
4.3.2	Near-UV hazard exposure limit for eye		P
	For the spectral region 315 nm to 400 nm (UV-A) the total radiant exposure to the eye shall not exceed $10000 \text{ J}\cdot\text{m}^{-2}$ for exposure times less than 1000 s. For exposure times greater than 1000 s (approximately 16 minutes) the UV-A irradiance for the unprotected eye, $E_{UVA}$ , shall not exceed $10 \text{ W}\cdot\text{m}^{-2}$ .		P
	The permissible time for exposure to ultraviolet radiation incident upon the unprotected eye for time less than 1000 s, shall be computed by:		P
	$t_{\max} \leq \frac{10\,000}{E_{UVA}} \quad \text{s}$	$t_{\max} > 30\,000 \text{ s}$	P
4.3.3	Retinal blue light hazard exposure limit		P
	To protect against retinal photochemical injury from chronic blue-light exposure, the integrated spectral radiance of the light source weighted against the blue-light hazard function, $B(\lambda)$ , i.e., the blue-light weighted radiance, $L_B$ , shall not exceed the levels defined by:		P

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	$L_B \cdot t = \sum_{300}^{700} \sum_{\lambda} L_{\lambda}(\lambda, t) \cdot B(\lambda) \cdot \Delta\lambda \leq 10^6 \quad \text{J} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	for $t \leq 10^4 \text{ s}$ $t_{\text{max}} = \frac{10^6}{L_B}$	N/A
	$L_B = \sum_{300}^{700} L_{\lambda} \cdot B(\lambda) \cdot \Delta\lambda \leq 100 \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	for $t > 10^4 \text{ s}$	P
4.3.4	Retinal blue light hazard exposure limit - small source		N/A
	Thus the spectral irradiance at the eye $E_{\lambda}$ , weighted against the blue-light hazard function $B(\lambda)$ shall not exceed the levels defined by:	Angular Subtense determined to be over 11mrad.	N/A
	$E_B \cdot t = \sum_{300}^{700} \sum_{\lambda} E_{\lambda}(\lambda, t) \cdot B(\lambda) \cdot \Delta\lambda \leq 100 \quad \text{J} \cdot \text{m}^{-2}$	for $t \leq 100 \text{ s}$	N/A
	$E_B = \sum_{300}^{700} E_{\lambda} \cdot B(\lambda) \cdot \Delta\lambda \leq 1 \quad \text{W} \cdot \text{m}^{-2}$	for $t > 100 \text{ s}$	N/A
4.3.5	Retinal thermal hazard exposure limit		P
	To protect against retinal thermal injury, the integrated spectral radiance of the light source, $L_{\lambda}$ , weighted by the burn hazard weighting function $R(\lambda)$ (from Figure 4.2 and Table 4.2), i.e., the burn hazard weighted radiance, shall not exceed the levels defined by:		P
	$L_R = \sum_{380}^{1400} L_{\lambda} \cdot R(\lambda) \cdot \Delta\lambda \leq \frac{50\,000}{\alpha \cdot t^{0,25}} \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	( $10 \mu\text{s} \leq t \leq 10 \text{ s}$ )	P
4.3.6	Retinal thermal hazard exposure limit – weak visual stimulus		N/A
	For an infrared heat lamp or any near-infrared source where a weak visual stimulus is inadequate to activate the aversion response, the near infrared (780 nm to 1400 nm) radiance, $L_{IR}$ , as viewed by the eye for exposure times greater than 10 s shall be limited to:		N/A
	$L_{IR} = \sum_{780}^{1400} L_{\lambda} \cdot R(\lambda) \cdot \Delta\lambda \leq \frac{6\,000}{\alpha} \quad \text{W} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$	$t > 10 \text{ s}$	N/A
4.3.7	Infrared radiation hazard exposure limits for the eye		P
	The avoid thermal injury of the cornea and possible delayed effects upon the lens of the eye (cataractogenesis), ocular exposure to infrared radiation, $E_{IR}$ , over the wavelength range 780 nm to 3000 nm, for times less than 1000 s, shall not exceed:		P
	$E_{IR} = \sum_{780}^{3000} E_{\lambda} \cdot \Delta\lambda \leq 18\,000 \cdot t^{-0,75} \quad \text{W} \cdot \text{m}^{-2}$	$t \leq 1000 \text{ s}$	N/A
	For times greater than 1000 s the limit becomes:		P
	$E_{IR} = \sum_{780}^{3000} E_{\lambda} \cdot \Delta\lambda \leq 100 \quad \text{W} \cdot \text{m}^{-2}$	$t > 1000 \text{ s}$	P

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
4.3.8	Thermal hazard exposure limit for the skin		P
	Visible and infrared radiant exposure (380 nm to 3000 nm) of the skin shall be limited to:		P
	$E_H \cdot t = \sum_{380}^{3000} \sum_t E_\lambda(\lambda, t) \cdot \Delta t \cdot \Delta \lambda \leq 20\,000 \cdot t^{0,25} \quad \text{J} \cdot \text{m}^{-2}$	3,82E+00 W m-2	P
<b>5</b>	<b>MEASUREMENT OF LAMPS AND LAMP SYSTEMS</b>		<b>P</b>
5.1	Measurement conditions		P
	Measurement conditions shall be reported as part of the evaluation against the exposure limits and the assignment of risk classification.		P
5.1.1	Lamp ageing (seasoning)		N/A
	Seasoning of lamps shall be done as stated in the appropriate IEC lamp standard.	LED source	N/A
5.1.2	Test environment		P
	For specific test conditions, see the appropriate IEC lamp standard or in absence of such standards, the appropriate national standards or manufacturer's recommendations.	Ambient temperature during test 25,6 °C	P
5.1.3	Extraneous radiation		P
	Careful checks should be made to ensure that extraneous sources of radiation and reflections do not add significantly to the measurement results.	Dark room	P
5.1.4	Lamp operation		N/A
	Operation of the test lamp shall be provided in accordance with:		N/A
	– the appropriate IEC lamp standard, or		N/A
	– the manufacturer' s recommendation		N/A
5.1.5	Lamp system operation		P
	The power source for operation of the test lamp shall be provided in accordance with:		P
	– the appropriate IEC standard, or		N/A
	– the manufacturer' s recommendation		P
5.2	Measurement procedure		P
5.2.1	Irradiance measurements		P
	Minimum aperture diameter 7mm.		P
	Maximum aperture diameter 50 mm.		P
	The measurement shall be made in that position of the beam giving the maximum reading.		P
	The measurement instrument is adequate calibrated.		P

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
5.2.2	Radiance measurements		P
5.2.2.1	Standard method		P
	The measurements made with an optical system.		P
	The instrument shall be calibrated to read in absolute radiant power per unit receiving area and per unit solid angle to acceptance averaged over the field of view of the instrument.	11 mrad FOV	P
5.2.2.2	Alternative method		P
	Alternatively to an imaging radiance set-up, an irradiance measurement set-up with a circular field stop placed at the source can be used to perform radiance measurements.		P
5.2.3	Measurement of source size		P
	The determination of $\alpha$ , the angle subtended by a source, requires the determination of the 50% emission points of the source.	Source dimensions: 148,86 mm x 72,46 mm Av. angular subtense 49,7 mrad	P
5.2.4	Pulse width measurement for pulsed sources		N/A
	The determination of $\Delta t$ , the nominal pulse duration of a source, requires the determination of the time during which the emission is > 50% of its peak value.		N/A
5.3	Analysis methods		P
5.3.1	Weighting curve interpolations		P
	To standardize interpolated values, use linear interpolation on the log of given values to obtain intermediate points at the wavelength intervals desired.	see table 4.1	P
5.3.2	Calculations		P
	The calculation of source hazard values shall be performed by weighting the spectral scan by the appropriate function and calculating the total weighted energy.		P
5.3.3	Measurement uncertainty		P
	The quality of all measurement results must be quantified by an analysis of the uncertainty.	see Annex C in the norm	P
<b>6</b>	<b>LAMP CLASSIFICATION</b>		<b>P</b>
	For the purposes of this standard it was decided that the values shall be reported as follows:	see table 6.1	P
	– for lamps intended for general lighting service, the hazard values shall be reported as either irradiance or radiance values at a distance which produces an illuminance of 500 lux, but not at a distance less than 200 mm	The luminaire has been tested at a distance of 2250 mm as manufacturer's request.	P
	– for all other light sources, including pulsed lamp sources, the hazard values shall be reported at a distance of 200 mm		N/A

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
6.1	Continuous wave lamps		P
6.1.1	Exempt Group		P
	In the except group are lamps, which does not pose any photobiological hazard. The requirement is met by any lamp that does not pose:		P
	– an actinic ultraviolet hazard ( $E_S$ ) within 8-hours exposure (30000 s), nor		P
	– a near-UV hazard ( $E_{UVA}$ ) within 1000 s, (about 16 min), nor		P
	– a retinal blue-light hazard ( $L_B$ ) within 10000 s (about 2,8 h), nor		P
	– a retinal thermal hazard ( $L_R$ ) within 10 s, nor		P
	– an infrared radiation hazard for the eye ( $E_{IR}$ ) within 1000 s		P
6.1.2	Risk Group 1 (Low-Risk)		N/A
	In this group are lamps, which exceeds the limits for the except group but that does not pose:		N/A
	– an actinic ultraviolet hazard ( $E_S$ ) within 10000 s, nor		N/A
	– a near ultraviolet hazard ( $E_{UVA}$ ) within 300 s, nor		N/A
	– a retinal blue-light hazard ( $L_B$ ) within 100 s, nor		N/A
	– a retinal thermal hazard ( $L_R$ ) within 10 s, nor		N/A
	– an infrared radiation hazard for the eye ( $E_{IR}$ ) within 100 s		N/A
	Lamps that emit infrared radiation without a strong visual stimulus and do not pose a near-infrared retinal hazard ( $L_{IR}$ ), within 100 s are in Risk Group 1.		N/A
6.1.3	Risk Group 2 (Moderate-Risk)		N/A
	This requirement is met by any lamp that exceeds the limits for Risk Group 1, but that does not pose:		N/A
	– an actinic ultraviolet hazard ( $E_S$ ) within 1000 s exposure, nor		N/A
	– a near ultraviolet hazard ( $E_{UVA}$ ) within 100 s, nor		N/A
	– a retinal blue-light hazard ( $L_B$ ) within 0,25 s (aversion response), nor		N/A
	– a retinal thermal hazard ( $L_R$ ) within 0,25 s (aversion response), nor		N/A
	– an infrared radiation hazard for the eye ( $E_{IR}$ ) within 10 s		N/A
	Lamps that emit infrared radiation without a strong visual stimulus and do not pose a near-infrared retinal hazard ( $L_{IR}$ ), within 10 s are in Risk Group 2.		N/A
6.1.4	Risk Group 3 (High-Risk)		N/A

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
	Lamps which exceed the limits for Risk Group 2 are in Group 3.		N/A
6.2	Pulsed lamps		N/A
	Pulse lamp criteria shall apply to a single pulse and to any group of pulses within 0,25 s.		N/A
	A pulsed lamp shall be evaluated at the highest nominal energy loading as specified by the manufacturer.		N/A
	The risk group determination of the lamp being tested shall be made as follows:		N/A
	– a lamp that exceeds the exposure limit shall be classified as belonging to Risk Group 3 (High-Risk)		N/A
	– for single pulsed lamps, a lamp whose weighted radiant exposure or weighted radiance does is below the EL shall be classified as belonging to the Exempt Group		N/A
	– for repetitively pulsed lamps, a lamp whose weighted radiant exposure or weighted radiance dose is below the EL, shall be evaluated using the continuous wave risk criteria discussed in clause 6.1, using time averaged values of the pulsed emission		N/A

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 4.1		Spectral weighting function for assessing ultraviolet hazards for skin and eye		P
Wavelength <sup>1</sup> λ, nm	UV hazard function S <sub>uv</sub> (λ)	Wavelength λ, nm	UV hazard function S <sub>uv</sub> (λ)	
200	0,030	313*	0,006	
205	0,051	315	0,003	
210	0,075	316	0,0024	
215	0,095	317	0,0020	
220	0,120	318	0,0016	
225	0,150	319	0,0012	
230	0,190	320	0,0010	
235	0,240	322	0,00067	
240	0,300	323	0,00054	
245	0,360	325	0,00050	
250	0,430	328	0,00044	
254*	0,500	330	0,00041	
255	0,520	333*	0,00037	
260	0,650	335	0,00034	
265	0,810	340	0,00028	
270	1,000	345	0,00024	
275	0,960	350	0,00020	
280*	0,880	355	0,00016	
285	0,770	360	0,00013	
290	0,640	365*	0,00011	
295	0,540	370	0,000093	
297*	0,460	375	0,000077	
300	0,300	380	0,000064	
303*	0,120	385	0,000053	
305	0,060	390	0,000044	
308	0,026	395	0,000036	
310	0,015	400	0,000030	
<sup>1</sup> Wavelengths chosen are representative: other values should be obtained by logarithmic interpolation at intermediate wavelengths. * Emission lines of a mercury discharge spectrum.				

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 4.2	Spectral weighting functions for assessing retinal hazards from broadband optical sources	P
Wavelength nm	Blue-light hazard function B (λ)	Burn hazard function R (λ)
300	0,01	
305	0,01	
310	0,01	
315	0,01	
320	0,01	
325	0,01	
330	0,01	
335	0,01	
340	0,01	
345	0,01	
350	0,01	
355	0,01	
360	0,01	
365	0,01	
370	0,01	
375	0,01	
380	0,01	0,1
385	0,013	0,13
390	0,025	0,25
395	0,05	0,5
400	0,10	1,0
405	0,20	2,0
410	0,40	4,0
415	0,80	8,0
420	0,90	9,0
425	0,95	9,5
430	0,98	9,8
435	1,00	10,0
440	1,00	10,0
445	0,97	9,7
450	0,94	9,4
455	0,90	9,0
460	0,80	8,0
465	0,70	7,0
470	0,62	6,2
475	0,55	5,5
480	0,45	4,5
485	0,40	4,0
490	0,22	2,2
495	0,16	1,6
500-600	$10^{[(450-\lambda)/50]}$	1,0
600-700	0,001	1,0
700-1050		$10^{[(700-\lambda)/500]}$
1050-1150		0,2
1150-1200		$0,2 \cdot 10^{0,02(1150-\lambda)}$
1200-1400		0,02

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 5.4 Summary of the ELs for the surface of the skin or cornea (irradiance based values)					P
Hazard Name	Relevant equation	Wavelength range nm	Exposure duration sec	Limiting aperture rad (deg)	EL in terms of constant irradiance $W \cdot m^{-2}$
Actinic UV skin & eye	$E_S = \sum E_\lambda \cdot S(\lambda) \cdot \Delta\lambda$	200 – 400	< 30000	1,4 (80)	30/t
Eye UV-A	$E_{UVA} = \sum E_\lambda \cdot \Delta\lambda$	315 – 400	≤1000 >1000	1,4 (80)	10000/t 10
Blue-light small source	$E_B = \sum E_\lambda \cdot B(\lambda) \cdot \Delta\lambda$	300 – 700	≤100 >100	< 0,011	100/t 1,0
Eye IR	$E_{IR} = \sum E_\lambda \cdot \Delta\lambda$	780 – 3000	≤1000 >1000	1,4 (80)	18000/t <sup>0.75</sup> 100
Skin thermal	$E_H = \sum E_\lambda \cdot \Delta\lambda$	380 – 3000	< 10	2π sr	20000/t <sup>0.75</sup>

Table 5.5 Summary of the ELs for the retina (radiance based values)					P
Hazard Name	Relevant equation	Wavelength range nm	Exposure duration sec	Field of view radians	EL in terms of constant radiance $W \cdot m^{-2} \cdot sr^{-1}$
Blue light	$L_B = \sum L_\lambda \cdot B(\lambda) \cdot \Delta\lambda$	300 – 700	0,25 – 10 10-100 100-10000 ≥ 10000	0,011•√(t/10) 0,011 0,0011•√t 0,1	10 <sup>6</sup> /t 10 <sup>6</sup> /t 10 <sup>6</sup> /t 100
Retinal thermal	$L_R = \sum L_\lambda \cdot R(\lambda) \cdot \Delta\lambda$	380 – 1400	< 0,25 0,25 – 10	0,0017 0,011•√(t/10)	50000/(α•t <sup>0.25</sup> ) 50000/(α•t <sup>0.25</sup> )
Retinal thermal (weak visual stimulus)	$L_{IR} = \sum L_\lambda \cdot R(\lambda) \cdot \Delta\lambda$	780 – 1400	> 10	0,011	6000/α

Table 6.1 Emission limits for risk groups of continuous wave lamps									P
Risk	Action spectrum	Symbol	Units	Emission Measurement					
				Exempt		Low risk		Mod risk	
				Limit	Result	Limit	Result	Limit	Result
Actinic UV	$S_{UV}(\lambda)$	$E_s$	$W \cdot m^{-2}$	0,001	<b>1,26E-05</b>	0,003	—	0,03	—
Near UV		$E_{UVA}$	$W \cdot m^{-2}$	10	<b>2,59E-04</b>	33	—	100	—
Blue light	$B(\lambda)$	$L_B$	$W \cdot m^{-2} \cdot sr^{-1}$	100	<b>83,5913</b>	10000	—	4000000	—
Blue light, small source	$B(\lambda)$	$E_B$	$W \cdot m^{-2}$	1,0*	<b>N/A</b>	1,0	—	400	—
Retinal thermal	$R(\lambda)$	$L_R$	$W \cdot m^{-2} \cdot sr^{-1}$	$28000/\alpha = 563168,65$	<b>3,81E+03</b>	$28000/\alpha$	—	$71000/\alpha$	—
Retinal thermal, weak visual stimulus**	$R(\lambda)$	$L_{IR}$	$W \cdot m^{-2} \cdot sr^{-1}$	$6000/\alpha$	<b>N/A</b>	$6000/\alpha$	—	$6000/\alpha$	—
IR radiation, eye		$E_{IR}$	$W \cdot m^{-2}$	100	<b>0,0088</b>	570	—	3200	—

\* Small source defined as one with  $\alpha < 0,011$  radian. Averaging field of view at 10000 s is 0,1 radian.  
 \*\* Involves evaluation of non-GLS source

	<b>ENCLOSURE 1: European Group Differences</b>	
--	--	--

IEC62471A - ATTACHMENT			
Clause	Requirement + Test	Result - Remark	Verdict

<p><b>ATTACHMENT TO TEST REPORT IEC 62471</b>  <b>EUROPEAN GROUP DIFFERENCES AND NATIONAL DIFFERENCES</b>                  Photobiological safety of lamps and lamps systems</p>
<p><b>Differences according to</b>.....: EN 62471:2008</p>
<p><b>Attachment Form No.</b>.....: EU_GD_IEC62471A</p>
<p><b>Attachment Originator</b> .....: IMQ S.p.A.</p>
<p><b>Master Attachment</b> .....: 2009-07</p>
<p><b>Copyright © 2009 IEC System for Conformity Testing and Certification of Electrical Equipment (IECEE), Geneva, Switzerland. All rights reserved.</b></p>

	CENELEC COMMON MODIFICATIONS (EN)	P
<b>4</b>	<b>EXPOSURE LIMITS</b>	<b>P</b>
	Contents of the whole Clause 4 of IEC 62471:2006 moved into a new informative Annex ZB	—
	Clause 4 replaced by the following:	P
	Limits of the Artificial Optical Radiation Directive (2006/25/EC) have been applied instead of those fixed in IEC 62471:2006	P
	See appended Table 6.1	
4.1	General	P
	First paragraph deleted	—

<b>Table 6.1</b>		Emission limits for risk groups of continuous wave lamps (based on EU Directive 2006/25/EC)							<b>P</b>	
Risk	Action spectrum	Symbol	Units	Emission Measurement						
				Exempt		Low risk		Mod risk		
				Limit	Result	Limit	Result	Limit	Result	
Actinic UV	$S_{UV}(\lambda)$	$E_s$	$W \cdot m^{-2}$	0,001	<b>1,26E-05</b>	—	—	—	—	
Near UV		$E_{UVA}$	$W \cdot m^{-2}$	0,33	<b>2,59E-04</b>	—	—	—	—	
Blue light	$B(\lambda)$	$L_B$	$W \cdot m^{-2} \cdot sr^{-1}$	100	<b>83,5913</b>	10000	—	4000000	—	
Blue light, small source	$B(\lambda)$	$E_B$	$W \cdot m^{-2}$	0,01*	<b>N/A</b>	1,0	—	400	—	
Retinal thermal	$R(\lambda)$	$L_R$	$W \cdot m^{-2} \cdot sr^{-1}$	$28000/\alpha = 563168,65$	<b>3,81E+03</b>	$28000/\alpha$	—	$71000/\alpha$	—	
Retinal thermal, weak visual stimulus**	$R(\lambda)$	$L_{IR}$	$W \cdot m^{-2} \cdot sr^{-1}$	$545000$	<b>N/A</b>					
				$0,0017 \leq \alpha \leq 0,011$						
				$6000/\alpha$	<b>N/A</b>					
				$0,011 \leq \alpha \leq 0,1$						
IR radiation, eye		$E_{IR}$	$W \cdot m^{-2}$	100	<b>0,0088</b>	570	—	3200	—	

\* Small source defined as one with  $\alpha < 0,011$  radian. Averaging field of view at 10000 s is 0,1 radian.  
 \*\* Involves evaluation of non-GLS source

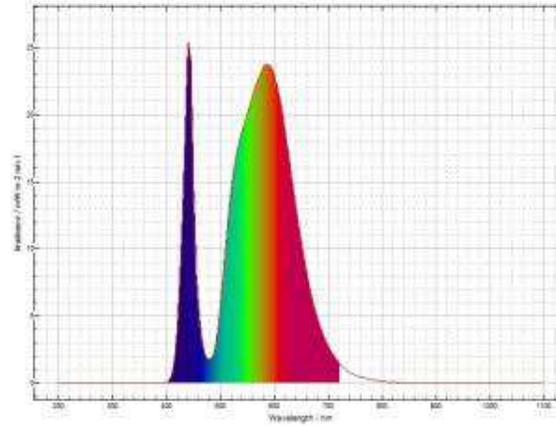
NOTE The action functions: see Table 4.1 and Table 4.2  
 The applicable aperture diameters: see 4.2.1  
 The limitations for the angular subtenses: see 4.2.2  
 The related measurement condition 5.2.3 and the range of acceptance angles: see Table 5.5.

	<b>ENCLOSURE 2: Components List</b>	
--	-------------------------------------	--

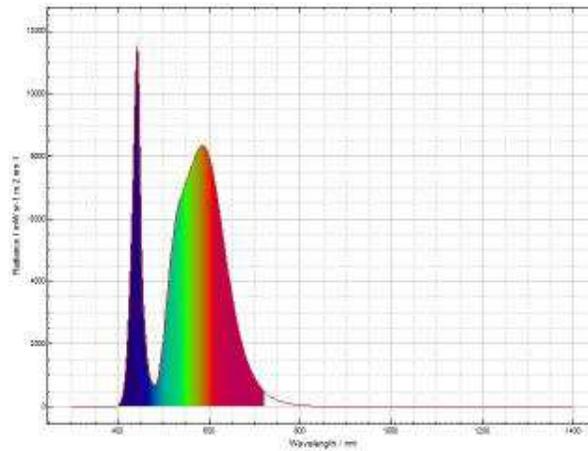
object/part No.	Nr.	manufacturer/ trademark	type/model	Ratings / technical data
LED CHIP	32	CREE	XP-G3	Led Chip current: 110 mA Rated CCT 4000 K
Electronic ballast	1	Any	Constant Current	Output ratings: 1100 mA
Glass plane	1	Any	Extra-clear	Finishing transparent
Secondary optic	8	LEDIL	STRADA 2x2	Plastic material

<b>ENCLOSURE 3: Measured wavelength curves</b>
--

**IRRADIANCE RESULT (200-1100 nm) no aperture**



**RADIANCE RESULT (300-1400 nm) with a FOV of 11 mrad**



	<b>ENCLOSURE 4: Labelling according to IEC/TR 62471-2</b>	
--	---	--

Clause	Requirement + Test	Result – Remark	Verdict
--------	--------------------	-----------------	---------

<b>5.4</b>	<b>Labelling</b>		—
	<b>Not Required</b>		
	Lamp systems shall be marked by the manufacturer in accordance with the requirements of Table 1		N/A
	Except for an Exempt Risk Group and a Risk Group 1 lamp system emitting only in the wavelength range 400 nm to 780 nm, the risk group shall be marked on the product.		N/A
	If the size or design of the product makes labelling impractical, the label shall be included in the packaging and included in the user manual.		N/A
	Warning symbols should be in accordance with IEC 60417-1.		N/A
	Labels on the housing shall be permanently fixed, legible, and clearly visible during maintenance and service.		N/A
	Labels shall be positioned so that they can be read without the necessity for human exposure to optical radiation in excess of the applicable ELVs		N/A
	Text and borders shall be black on a yellow background.		N/A
	The label size shall be adapted to the size of the product.		N/A
	Reproductions of all required labels shall be included in the user manual.		N/A

	<b>ENCLOSURE 4: Labelling according to IEC/TR 62471-2</b>	
--	---	--

Clause	Requirement + Test	Result – Remark	Verdict
--------	--------------------	-----------------	---------

<b>5.5</b>	<b>Other information provisions</b>		—
	For lamps and lamp systems in excess of the Exempt Risk Group the following information should be provided in the user information:		—
	a) a clear statement that the lamp or lamp system is in excess of the Exempt Group and that the viewer-related risk is dependent upon how the users install and use the product		N/A
	b) the most restrictive optical radiation hazard and other optical radiation hazards in excess of Exempt Group (see Table 1)		N/A
	c) exposure hazard values (EHVs) and the hazard distances with optional graphical presentation of distant-dependent EHV		N/A
	d) Hazard distances (HD) for all relevant viewer-related risk groups below the assigned one (for relevance see Tables 1 and 2);		N/A
	e) adequate instructions for proper assembly, installation, maintenance and safe use, including clear warnings concerning precautions to avoid possible exposure to hazardous optical radiation;		N/A
	f) advice on safe operating procedures and warnings concerning reasonably foreseeable malpractices, malfunctions and hazardous failure modes. Where maintenance procedures are detailed, they should, wherever possible, include explicit instructions on safe procedures to be followed		N/A

	<b>ENCLOSURE 4: Labelling according to IEC/TR 62471-2</b>	
--	---	--

Clause	Requirement + Test	Result – Remark	Verdict
--------	--------------------	-----------------	---------

<b>Table 1 – Hazard-related risk group labelling of lamps systems</b>				
Hazard	Exempt Risk Group	Risk Group 1	Risk Group 2	Risk Group 3
Ultraviolet hazard 200-400 nm	<input checked="" type="checkbox"/> <b>Not required</b>	<input type="checkbox"/> NOTICE UV emitted from this product	<input type="checkbox"/> CAUTION UV emitted from this product	<input type="checkbox"/> WARNING UV emitted from this product
Retinal blue light hazard 300-400 nm	<input checked="" type="checkbox"/> <b>Not required</b>	<input type="checkbox"/> Not required	<input type="checkbox"/> CAUTION Possibly hazard- ous optical radi- ation emitted from this product	<input type="checkbox"/> WARNING Possibly hazard- ous optical radi- ation emitted from this product
Retinal blue light or thermal hazard 400-780 nm	<input checked="" type="checkbox"/> <b>Not required</b>	<input type="checkbox"/> Not required	<input type="checkbox"/> CAUTION Possibly hazard- ous optical radi- ation emitted from this product	<input type="checkbox"/> WARNING Possibly hazard- ous optical radi- ation emitted from this product
Cornea/Lens infra- red hazard 780-3000 nm	<input checked="" type="checkbox"/> <b>Not required</b>	<input type="checkbox"/> NOTICE IR emitted from this product	<input type="checkbox"/> CAUTION IR emitted from this product	<input type="checkbox"/> WARNING IR emitted from this product
Retinal/thermal hazard, weak vis- ual stimulus 780-1400 nm	<input checked="" type="checkbox"/> <b>Not required</b>	<input type="checkbox"/> WARNING IR emitted from this product	<input type="checkbox"/> WARNING IR emitted from this product	<input type="checkbox"/> WARNING IR emitted from this product

	<b>ENCLOSURE 4: Labelling according to IEC/TR 62471-2</b>	
--	---	--

Clause	Requirement + Test	Result – Remark	Verdict
--------	--------------------	-----------------	---------

<b>Table 2 – Explanation of labelling information and guidance on control measures</b>				
Hazard	Exempt Risk Group	Risk Group 1	Risk Group 2	Risk Group 3
Ultraviolet hazard 200-400 nm	<input checked="" type="checkbox"/> <b>Not required</b>	<input type="checkbox"/> Minimise exposure to eyes or skin. Use appropriate shielding	<input type="checkbox"/> Eye or skin irritation may result from exposure. Use appropriate shielding	<input type="checkbox"/> Avoid eye and skin exposure to unshielded product
Retinal blue light hazard 300-400 nm	<input checked="" type="checkbox"/> <b>Not required</b>	<input type="checkbox"/> Not required	<input type="checkbox"/> Do not stare at operating lamp. May be harmful to the eye	<input type="checkbox"/> Do not look at operating lamp. Eye injury may result
Retinal blue light or thermal hazard 400-780 nm	<input checked="" type="checkbox"/> <b>Not required</b>	<input type="checkbox"/> Not required	<input type="checkbox"/> Do not stare at operating lamp. May be harmful to the eye	<input type="checkbox"/> Do not look at operating lamp. Eye injury may result
Cornea/Lens infra-red hazard 780-3000 nm	<input checked="" type="checkbox"/> <b>Not required</b>	<input type="checkbox"/> Use appropriate shielding or eye protection	<input type="checkbox"/> Avoid eye exposure. Use appropriate shielding or eye protection	<input type="checkbox"/> Avoid eye exposure. Use appropriate shielding or eye protection
Retinal/thermal hazard, weak visual stimulus 780-1400 nm	<input checked="" type="checkbox"/> <b>Not required</b>	<input type="checkbox"/> Do not stare at operating lamp	<input type="checkbox"/> Do not stare at operating lamp	<input type="checkbox"/> Do not look at operating lamp

	<b>ENCLOSURE 5: Photographs</b>	
--	---------------------------------	--

**Photograph No. 1 – Product overview**



**Photograph No. 2 – Product overview.**



	<b>ENCLOSURE 5: Photographs</b>	
--	---------------------------------	--

**Photograph No. 3 – View of Glass plane and Lens and LED Chip.**



**Photograph No. 4 – View of LED Chip and Lens.**



	<b>ENCLOSURE 6: Measurement Equipment</b>	
--	---	--

Type	Manufacturer	Model	Serial Number	Calibration (mm/yy)	
				Last date	Due date
Double-monochromator	Bentham	IDR300-PSL	13871	N/A	N/A
Radiance standard lamp	Bentham	SRS12	14036/1	04/17	04/18
Irradiance standard UV lamp	Bentham	CL7	13844/4	04/17	04/18
Irradiance standard VIS-IR lamp	Bentham	CL6	13873/3	04/17	04/18
Telescope	Bentham	TEL 309	14033/1	N/A	N/A
CCD Camera	Bentham	PSL Profiler	1403871	N/A	N/A
Thermo hygrometer	OMEGA	iBTHX-W	2060986	05/17	05/18
Ruler	BETA	1691BG	T10075 0122	07/15	07/18
Power Supply	Chroma	61603	616030000 844	N/A	N/A
Digital power meter	YOKOGAWA	WT 210	91M534934	08/17	08/18
Lux meter	Bentham	DH 400_VL	13796/4	03/15	04/18