Niezależne Laboratorium Fotometryczne

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Protokół pomiarowy NR 2020/05/19-1

Badanie fotometryczne oprawy: Octagon UV
Data pomiaru: 2020.05.19

Badanie wykonano zgodnie z najnowszą wiedzą inżynierską oraz normami:
PN-EN 13032-4:2015-09 - Światło i oświetlenie -- Pomiar i prezentacja danych fotometrycznych lamp i opraw oświetleniowych
PN-EN 60598-1:2015-04 – Wymagania ogólne i badania
IES LM-79-08 – Electrical and Photometric Measurements of Solid-State Lighting Products
PN-EN 62471 - Bezpieczeństwo fotobiologiczne lamp i systemów lampowych
IEC/TR 62471-2:2009 - Photobiological safety of lamps and lamp systems – Part 2: Guidance on manufacturing requirements relating to non-laser optical radiation safety
IEC TR 62778-2014 - Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires

WYNIKI BADAŃ

Wymiary oprawy/modułu

Średnica	**300**	**mm**
Wysokość	**935**	**mm**

Parametry środowiskowe

Temperatura otoczenia To	**25 ±1,2**	**°C**

Parametry elektryczne

Napięcie znamionowe U	**230**	**V AC**
Moc znamionowa P	**1 020**	**W**
Współczynnik mocy cos φ	**0,98**	

Czas wygrzewania

Czas	**00:00:10**	**g:m:s**

Test Report
EN 62471 Photobiological safety of lamps and lamp systems
IEC TR 62778 Application of IEC 62471 for the assessment of blue light hazard to light sources and luminaires

Testing Laboratory	Niezależne Laboratorium Fotometryczne ViTom
Date of issue	2020.05.19
Test report number	2020/05/19-1
Number of pages	15

Test performed by	Tomasz Przytarski
Autorised by	Tomasz Przytarski
Applicant	

Test method according to standard	EN 62471:2008

Test object	
Manufacturer	Ecol Light LED
Model	Octagon UV
Parameters	
Descripton	

Test item particulars	
Tested lamp	☒ continuous wave lamps ☐ pulsed lamps
Tested lamp system	
Lamp classification group	[ ] exempt [ ] risk 1 [ ] risk 2 [x] risk 3
Lamp cap	
Bulb	
Rated of the lamp	
Furthermore marking on the lamp	
Seasoning of lamps according IEC standard	
Used measurement instrument	GL Optic PSM System 200-800
Temperature by measurement	
Information for safety use	

Possible test case verdicts:	
– test case does not apply to the test object	N/A
– test object does meet the requirement	P (Pass)
– test object does not meet the requirement	F (Fail)

Testing:	
Date of receipt of test item	
Date (s) of performance of tests	

General remarks
1. The test results presented in this report relate only to the object tested. 2. This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory. 3. "(See Enclosure #)" refers to additional information appended to the report. 4. "(See appended table)" refers to a table appended to the report. 5. Throughout this report a comma (point) is used as the decimal separator.

General product information

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
4	EXPOSURE LIMITS		
4.1	General		
	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 cd*m^{-2}	see clause 4.3	P
4.3	Hazard exposure limits		
4.3.1	Actinic UV hazard exposure limit for the skin and eye		
	The exposure limit for effective radiant exposure is 30 J*m^{-2} within any 8-hour period		P
	To protect against injury of the eye or skin from ultraviolet radiation exposure produced by a broad-band source, the effective integrated spectral irradiance , ES, of the light source shall not exceed the levels defined by: $E_s \cdot t = \sum_{200}^{400} \sum_{t} E_\lambda(\lambda,t) \cdot S_{UV}(\lambda) \cdot \Delta t \cdot \Delta\lambda \le 30$ J·m^{-2}		P
	The permissible time for exposure to ultraviolet radiation incident upon the unprotected eye or skin shall be computed by: $t_{max} = \frac{30}{E_s}$ s		P
4.3.2	Near-UV hazard exposure limit for eye		
	For the spectral region 315 nm to 400 nm (UV-A) the total radiant exposure to the eye shall not exceed 10000 J*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, EUVA, shall not exceed 10 W*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: $t_{max} \le \frac{10\,000}{E_{UVA}}$ s		P
4.3.3	Retinal blue light hazard exposure limit		
	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(λ), i.e., the blue-light weighted radiance , LB, shall not exceed the levels defined by:	see table 4.2	P
	$L_B \cdot t = \sum_{300}^{700} \sum_{t} L_\lambda(\lambda,t) \cdot B(\lambda) \cdot \Delta t \cdot \Delta\lambda \le 10^6$ J · m^{-2} · sr^{-1}	for t ≤ 10^4 s $t_{max} = \frac{10^6}{L_B}$	P
	$L_B = \sum_{300}^{700} L_\lambda \cdot B(\lambda) \cdot \Delta\lambda \le 100$ W · m^{-2} · sr^{-1}	for t > 10^4 s	P

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
4.3.4	Retinal blue light hazard exposure limit - small source		
	Thus the spectral irradiance at the eye Eλ, weighted against the blue-light hazard function B(λ) shall not exceed the levels defined by:	see table 4.2	N/A
	$E_B \cdot t = \sum_{300}^{700} \sum_{t} E_\lambda(\lambda,t) \cdot B(\lambda) \cdot \Delta t \cdot \Delta\lambda \le 100 \quad J \cdot m^{-2}$	for t ≤ 100 s	N/A
	$E_B = \sum_{300}^{700} E_\lambda \cdot B(\lambda) \cdot \Delta\lambda \le 1 \quad W \cdot m^{-2}$	for t > 100 s	N/A
4.3.5	Retinal thermal hazard exposure limit		
	To protect against retinal thermal injury, the integrated spectral radiance of the light source, Lλ, weighted by the burn hazard weighting function R(λ) (from Figure 4.2 and Table 4.2), i.e., the burn hazard weighted radiance, shall not exceed the levels defined by:		P
	$L_R = \sum_{380}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \le \frac{50\,000}{\alpha \cdot t^{0,25}} \quad W \cdot m^{-2} \cdot sr^{-1}$	(10 µs ≤ t ≤ 10 s)	P
4.3.6	Retinal thermal hazard exposure limit – weak visual stimulus		
	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, LIR, as viewed by the eye for exposure times greater than 10 s shall be limited to:		«4361»
	$L_{IR} = \sum_{780}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \le \frac{6\,000}{\alpha} \quad W \cdot m^{-2} \cdot sr^{-1}$	t > 10 s	P
4.3.7	Infrared radiation hazard exposure limits for the eye		
	The avoid thermal injury of the cornea and possible delayed effects upon the lens of the eye (cataractogenesis), ocular exposure to infrared radiation, EIR, over the wavelength range 780 nm to 3000 nm, for times less than 1000 s, shall not exceed:		N/A
	$E_{IR} = \sum_{780}^{3\,000} E_\lambda \cdot \Delta\lambda \le 18\,000 \cdot t^{-0,75} \quad W \cdot m^{-2}$	t ≤ 1000 s	N/A
	For times greater than 1000 s the limit becomes:		
	$E_{IR} = \sum_{780}^{3\,000} E_\lambda \cdot \Delta\lambda \le 100 \quad W \cdot m^{-2}$	t > 1000 s	N/A
4.3.8	Thermal hazard exposure limit for the skin		
	Visible and infrared radiant exposure (380 nm to 3000 nm) of the skin shall be limited to $E_H \cdot t = \sum_{380}^{3\,000} \sum_{t} E_\lambda(\lambda,t) \cdot \Delta t \cdot \Delta\lambda \le 20\,000 \cdot t^{0,25} \quad J \cdot m^{-2}$		P

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
5	MEASUREMENT OF LAMPS AND LAMP SYSTEMS		
5.1	Measurement conditions		
	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)		
	Seasoning of lamps shall be done as stated in the appropriate IEC lamp standard.		N/A
5.1.2	Test environment		
	For specific test conditions, see the appropriate IEC lamp standard or in absence of such standards, the appropriate national standards or manufacturer's recommendations.		P
5.1.3	Extraneous radiation		
	Careful checks should be made to ensure that extraneous sources of radiation and reflections do not add significantly to the measurement results.		P
5.1.4	Lamp operation		
	Operation of the test lamp shall be provided in accordance with:		
	– the appropriate IEC lamp standard, or		N/A
	– the manufacturer's recommendation		P
5.1.5	Lamp system operation		
	The power source for operation of the test lamp shall be provided in accordance with:		
	– the appropriate IEC standard, or		N/A
	– the manufacturer' s recommendation		P
5.2	Measurement procedure		
5.2.1	Irradiance measurements		
	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
5.2.2	Radiance measurements		
5.2.2.1	Standard method		
	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.		P
5.2.2.2	Alternative method		
	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.		N/A

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
5.2.3	Measurement of source size		
	The determination of α, the angle subtended by a source, requires the determination of the 50% emission points of the source.		P
5.2.4	Pulse width measurement for pulsed sources		
	The determination of Δt, 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		
5.3.1	Weighting curve interpolations		
	To standardize interpolated values, use linear interpolation on the log of given values to obtain intermediate points at the wavelength intervals de-sired.	see table 4.1	P
5.3.2	Calculations		
	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		
	The quality of all measurement results must be quantified by an analysis of the uncertainty.	see Annex C in the norm	P
6	Lamp classification		
	For the purposes of this standard it was decided that the values shall be reported as follows:	see table 6.1	
	– 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		N/A
	– for all other light sources, including pulsed lamp sources, the hazard values shall be reported at a distance of 200 mm		P

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

6.1	Continuous wave lamps		
6.1.1	Except Group		
	In the except group are lamps, which does not pose any photobiological hazard. The requirement is met by any lamp that does not pose:		N/A
	– an actinic ultraviolet hazard (ES) within 8-hours exposure (30000 s), nor		N/A
	– a near-UV hazard (EUVA) within 1000 s, (about 16 min), nor		P
	– a retinal blue-light hazard (LB) within 10000 s (about 2,8 h), nor		P
	– a retinal thermal hazard (LR) within 10 s, nor		P
	– an infrared radiation hazard for the eye (EIR) within 1000 s		P
6.1.2	Risk Group 1 (Low-Risk)		
	In this group are lamps, which exceeds the limits for the except group but that does not pose:		N/A
	– an actinic ultraviolet hazard (ES) within 10000 s, nor		N/A
	– a near ultraviolet hazard (EUVA) within 300 s, nor		N/A
	– a retinal blue-light hazard (LB) within 100 s, nor		N/A
	– a retinal thermal hazard (LR) within 10 s, nor		N/A
	– an infrared radiation hazard for the eye (EIR) within 100 s		N/A
	Lamps that emit infrared radiation without a strong visual stimulus and do not pose a near-infrared retinal hazard (LIR), within 100 s are in Risk Group 1.		N/A

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict
6.1.3	Risk Group 2 (Moderate-Risk)		
	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 (ES) within 1000 s exposure, nor		N/A
	– a near ultraviolet hazard (EUVA) within 100 s, nor		N/A
	– a retinal blue-light hazard (LB) within 0,25 s (aversion response), nor		N/A
	– a retinal thermal hazard (LR) within 0,25 s (aversion response), nor		N/A
	– an infrared radiation hazard for the eye (EIR) within 10 s		N/A
	Lamps that emit infrared radiation without a strong visual stimulus and do not pose a near-infrared retinal hazard (LIR), within 10 s are in Risk Group 2.		N/A
6.1.4	Risk Group 3 (High-Risk)		
	Lamps which exceed the limits for Risk Group 2 are in Group 3.		P
6.2	Pulsed lamps		
	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 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 TR 62778			
Clause	Requirement + Test	Result – Remark	Verdict

7	MEASUREMENT INFORMATION FLOW		
7.1	Basic flow		
	'Law of conservation of luminance' applied		N/A
	Use of only true luminance/radiance values		P
	In case of luminaire: The light source is operated in the luminaire under similar conditions as when tested as a component		N/A
	In case Ethr value for RG2 was established the peak value was derived from angular light distribution		N/A
7.2	Conditions for the radiance measurement		
	Standard condition applied (200mm distance, 0,011rad field of view)		P
	Non-standard condition applied		N/A
7.3	Special cases (I): Replacement by a lamp or LED module of another type		N/A
	Light source is a white light source		N/A
	Evaluation done based on highest luminance		N/A
	Evaluation done based on CCT value		N/A
7.4	Special cases (II): Arrays and clusters of primary light sources		N/A
	LED package is evaluated as ..... :	RG0 unlimited ☐ RG1 unlimited ☐	N/A
	Ethr of LED package applies to array		N/A

8	RISK GROUP CLASSIFICATION		
	Risk group achieved:		
	- .. Risk Group 0 unlimited		N/A
	- .. Risk Group 1 unlimited		N/A
	- Ethr ..... (lx) : - Distance to reach RG1 ..... (m) :	0,15 45040,3	

Table 4.1	Spectral weighting function for assessing ultraviolet hazards for skin and eye		
Wavelength[1] λ, nm	**UV hazard function $S_{UV}(\lambda)$**	**Wavelength λ, nm**	**UV hazard function $S_{UV}(\lambda)$**
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

[1] Wavelengths chosen are representative: other values should be obtained by logarithmic interpolation at intermediate wavelengths.

* Emission lines of a mercury discharge spectrum.

Table 4.2	Spectral weighting functions for assessing retinal hazards from broadband optical sources	
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		0,2.100,02(1150-λ)
1200-1400		0,02

Table 5.4	Summary of the ELs for the surface of the skin or cornea (irradiance based values)				
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	$ES = \Sigma E\lambda \cdot S(\lambda) \cdot \Delta\lambda$	200 – 400	< 30000	1,4 (80)	30/t
Eye UV-A	$EUVA = \Sigma E\lambda \cdot \Delta\lambda$	315 – 400	≤1000 >1000	1,4 (80)	10000/t 10
Blue-light small source	$EB = \Sigma E\lambda \cdot B(\lambda) \cdot \Delta\lambda$	300 – 700	≤100 >100	< 0,011	100/t 1,0
Eye IR	$EIR = \Sigma E\lambda \cdot \Delta\lambda$	780 –3000	≤1000 >1000	1,4 (80)	$18000/t^{0,75}$ 100
Skin thermal	$EH = \Sigma E\lambda \cdot \Delta\lambda$	380 – 3000	< 10	2π sr	$20000/t^{0,75}$

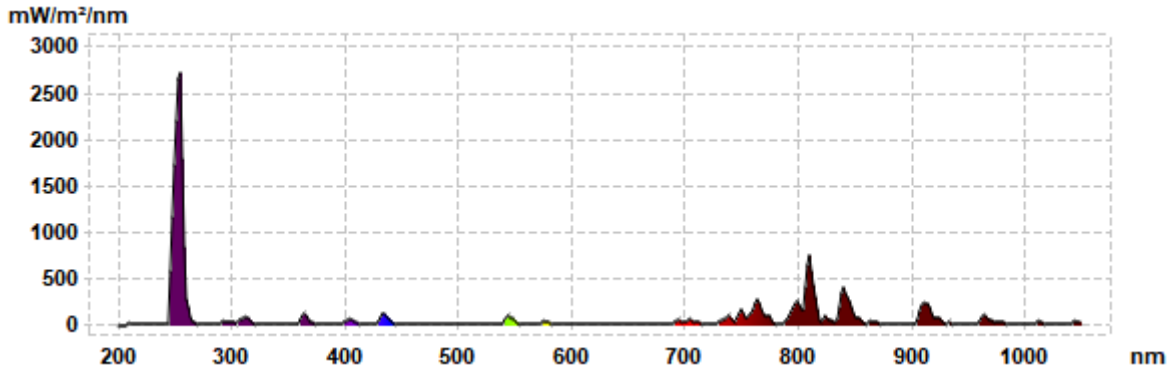
Table 5.5	Summary of the ELs for the retina (radiance based values)				
Hazard Name	**Relevant equation**	**Wavelength range nm**	**Exposure duration sec**	**Field of view radians**	**EL in terms of constant radiance $W \cdot m^{-2} \cdot sr^{-1}$)**
Blue light	$LB = \Sigma L\lambda \cdot B(\lambda)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

IEC 62471			
Clause	Requirement + Test	Result – Remark	Verdict

Table 6.1	Emission limits for risk groups of continuous wave lamps								
Risk	Action spectrum	Symbol	Units	Emission Measurement					
				Exempt		Low risk		Mod risk	
				Limit	Result	Limit	Result	Limit	Result
Actinic UV	SUV(λ)	Es	$W \cdot m^{-2}$	0,001		0,003		0,03	**12,63**
Near UV		EUVA	$W \cdot m^{-2}$	10	**0,87**	33		100	
Blue light	B(λ)	LB	$W \cdot m^{-2} \cdot sr^{-1}$	100	**13,51**	10000		4000000	
Blue light, small source	B(λ)	EB	$W \cdot m^{-2}$	1,0*	**-**	1,0	**-**	400	**-**
Retinal thermal	R(λ)	LR	$W \cdot m^{-2} \cdot sr^{-1}$	28000/α	**234,91**	28000/α		71000/α	
Retinal thermal, weak visual stimulus**	R(λ)	LIR	$W \cdot m^{-2} \cdot sr^{-1}$	6000/α	**-**	6000/α	**-**	6000/α	**-**
IR radiation, eye		EIR	$W \cdot m^{-2}$	100	**17,52**	570		3200	
* Small source defined as one with α < 0,011 radian. Averaging field of view at 10000 s is 0,1 radian. ** Involves evaluation of non-GLS source									

Thresholds	
t_{max}	**-** s
D_{min}	**45040,3** mm
E_{thr}	**0,15** lx

Spectrum



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