TEST REPORT

IEC 62471:2006

Photobiological safety of lamps and lamp systems

Report reference No ..... :	SZ2231010-58976E-SF
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Date of issue ..... :	2023-10-17
Testing laboratory ..... :	Bay Area Compliance Laboratories Corp. (Dongguan)
Address ..... :	No.12, Pulong East 1st Road, Tangxia Town, Dongguan, Guangdong, China
Testing location ..... :	Same as above
Applicant ..... :	Hongli Zhihui Group Co.,Ltd. Guangzhou Branch
Address ..... :	Room 316, Building 2, No.1, Xianke Yi Road, Huadong Town, Huadu District, Guangzhou, China
Standard ..... :	IEC 62471:2006
Test sample(s) received..... :	2023-10-11
Test in period..... :	2023-10-16
Procedure deviation ..... :	N.A.
Non-standard test method ..... :	N.A.
Type of test object ..... :	LED package
Trademark ..... :	N.A.
Model/type reference ..... :	HL-LM105H384W-12B5C12 (Ra2)-S
Manufacturer..... ..... :	Hongli Zhihui Group Co.,Ltd. Guangzhou Branch Room 316, Building 2, No.1, Xianke Yi Road, Huadong Town, Huadu District, Guangzhou, China
Rating ..... :	Input: 34-40Vdc,0.500A

Copy of marking plate:

None

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Clause	Requirement – Test	Result - Remark	Verdict
4.3.3	Retinal blue light hazard exposure limit		P
	To protect against retinal photochemical injury fromchronic blue-light exposure, the integrated spectralradiance of the light source weighted against theblue-light hazard function, B(_), i.e., the blue-lightweighted radiance , LB, shall not exceed the levelsdefined by:		P
	$LB \cdot t = \sum_{300}^{700} \sum_{t} L\lambda(\lambda,t) \cdot B(\lambda) \cdot \triangle t \cdot \triangle \lambda \leq 10^6 \ J \cdot m^{-2} \cdot sr^{-1}$		N
	$LB = \sum_{300}^{700} L\boldsymbol{\lambda} \cdot B(\lambda) \cdot \triangle \lambda \leq 100 W \cdot m^{-2} \cdot sr^{-1}$	See Table 6.1	P
4.3.4	Retinal blue light hazard exposure limit - small source	α= 0.0390	N
	Thus the spectral irradiance at the eye E_, weighted against the blue-light hazard function B(_) shall not exceed the levels defined by: see table 4.2		N
	$E\mathbf{B} \cdot t = \sum_{300}^{700} \sum_{t} E\boldsymbol{\lambda}(\lambda,t) \cdot B(\lambda) \cdot \triangle t \cdot \triangle \lambda \leq 100 \ J \cdot m^{-2}$		N
	$EB = \sum_{300}^{700} E\boldsymbol{\lambda} \cdot B(\lambda) \cdot \triangle \lambda \leq 1 \quad W \cdot m^{-2}$		N
4.3.5	Retinal thermal hazard exposure limit		P
	To protect against retinal thermal injury, the integrated spectral radiance of the light source, L_, weighted by the burn hazard weighting function R(_) (from Figure 4.2 and Table 4.2), i.e., the burn hazard weighted radiance, shall not exceed the levels defined by:		P
	$L_R = \sum_{380}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \leq \frac{50000}{\alpha \cdot t^{0.75}} \ W \cdot m^{-2} \cdot sr^{-1}$	See Table 6.1	P
4.3.6	Retinal thermal hazard exposure limit – weak visual stimulus		P
	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:		P

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	$L_{IR} = \sum_{780}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \le \frac{6000}{\alpha}$ $W \cdot m^{-2} \cdot sr^{-1}$	See Table 6.1	P
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, EIR,over the wavelength range 780 nm to 3000 nm, for times less than 1000 s, shall not exceed:		N
	$E_{IR} = \sum_{780}^{3000} E_\lambda \cdot \Delta\lambda \le 18000 \cdot t^{-0,75}$ $W \cdot m^{-2}$		N
	For times greater than 1000 s the limit becomes:		P
	$E_{IR} = \sum_{780}^{3000} E_\lambda \cdot \Delta\lambda \le 100$ $W \cdot m^{-2}$	See Table 6.1	P
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
	$E_H \cdot t = \sum_{380}^{3000} \sum_{t} E_\lambda(\lambda,t) \cdot \Delta t \cdot \Delta\lambda \le 20000 \cdot t^{0,25}$ $J \cdot m^{-2}$	$E_H \cdot t = 4.121x10x10$ $= 4.121x10^2 J \cdot m^{-2}$	P
5	MEASUREMENT OF LAMPS AND LAMP SYSTEMS		P
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
	Seasoning of lamps shall be done as stated in the AppropriateEN lamp standard.		N
5.1.2	Test environment	24.1	P
	For specific test conditions, see the appropriateEN lamp standard or in absence of such standards, the appropriate national standards or manufacturer's recommendations.		P
5.1.3	Extraneous radiation		P

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	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		P
	Operation of the test lamp shall be provided in accordance with:		P
	– the appropriateEN lamp standard, or		N

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	To standardize interpolated values, use linear interpolation on the log of given values to obtain intermediate points at the wavelength intervals desired.		N
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.		P
6	LAMP CLASSIFICATION		P
	For the purposes of this standard it was decided that the values shall be reported as follows:		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		N
	– for all other light sources, including pulsed lamp sources, the hazard values shall be reported at a distance of 200 mm		P
6.1	Continuous wave lamps		P
6.1.1	Exempt Group		N
	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
	– an actinic ultraviolet hazard (ES) within 8-hours exposure (30000 s), nor		N
	– a near-UV hazard (EUVA) within 1000 s, (about 16 min), nor		N
	– a retinal blue-light hazard (LB) within 10000 s (about 2,8 h), nor		N
	– a retinal thermal hazard (LR) within 10 s, nor		N
	– an infrared radiation hazard for the eye (EIR) within 1000 s		N
6.1.2	Risk Group 1 (Low-Risk)		P
	In this group are lamps, which exceeds the limits for the except group but that does not pose:		P
	– an actinic ultraviolet hazard (ES) within 10000 s, nor		P
	– a near ultraviolet hazard (EUVA) within 300 s, nor		P
	– a retinal blue-light hazard (LB) within 100 s, nor		P
	– a retinal thermal hazard (LR) within 10 s, nor		P
	– an infrared radiation hazard for the eye (EIR) within 100 s		P

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	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.		P
6.1.3	Risk Group 2 (Moderate-Risk)		N
	This requirement is met by any lamp that exceeds the limits for Risk Group 1, but that does not pose:		N
	– an actinic ultraviolet hazard (ES) within 1000 s exposure, nor		N
	– a near ultraviolet hazard (EUVA) within 100 s, nor		N
	– a retinal blue-light hazard (LB) within 0,25 s (aversion response), nor		N
	– a retinal thermal hazard (LR) within 0,25 s (aversion response), nor		N
	– an infrared radiation hazard for the eye (EIR) within 10 s		N
	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
6.1.4	Risk Group 3 (High-Risk)		N
	Lamps which exceed the limits for Risk Group 2 are in Group 3.		N
6.2	Pulsed lamps		N
	Pulse lamp criteria shall apply to a single pulse andto any group of pulses within 0,25 s.		N
	A pulsed lamp shall be evaluated at the highest nominal energy loading as specified by the manufacturer.		N
	The risk group determination of the lamp being tested shall be made as follows:		N
	– a lamp that exceeds the exposure limit shall be classified as belonging to Risk Group 3 (High-Risk)		N
	– 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
	– 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

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Table 4.1	Spectral weighting function for assessing ultraviolet hazards for skin and eye		-
Wavelength[1] Ɍ	**UV hazard function S_{UV}**	**Wavelength Ɍ**	**UV hazard function S_{UV}**
200	0,030	313*	0,006
205	0,051	315	0,003

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Table 4.2	Spectral weighting functions for assessing retinal hazards from broadband opticalsources	-

Wavelength nm	**Blue-light hazard function B()**	**Burn hazard function R()**
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	$10^{l(450-}$	

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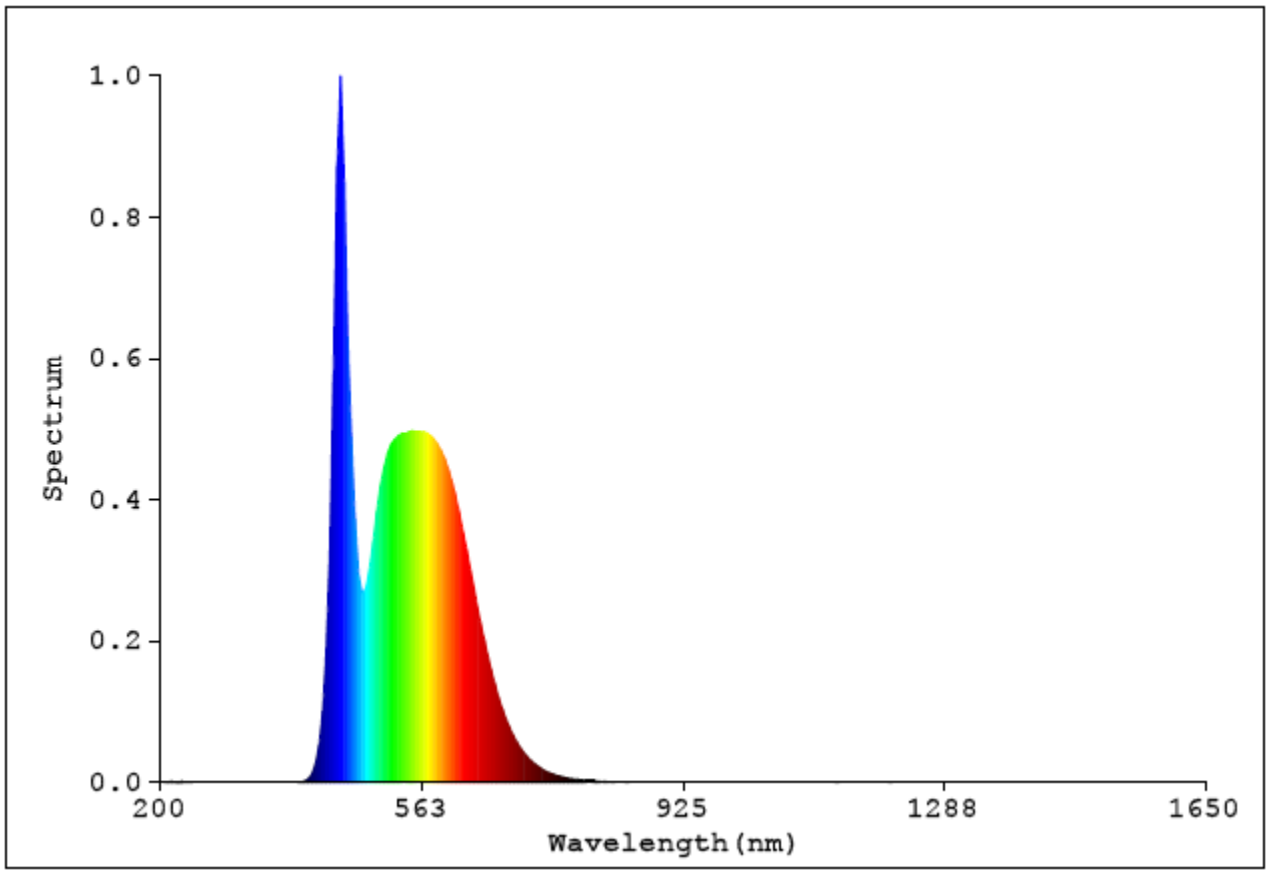
Table 6.1	Emission limits for risk groups of continuous wave lamps								P
Risk	Action spectrum	Units	Symbol	Exempt		Low risk		Mod risk	
				Limit	Result	Limit	Result	Limit	Result
Actinic UV	Suv(λ)	$W.m^{-2}$	E_S	0.001	-	0.003	9.653×10^{-4}	0.03	-
Near UV		$W.m^{-2}$	E_{UVA}	10	-	33	4.103×10^{-3}	100	-
Blue light	B(λ)	$W.m^{-2}.sr^{-1}$	L_B	100	-	10000	9.298×10^{3}	4000000	-
Blue light,small source	B(λ)	$W.m^{-2}$	E_B	1.0	-	1.0	-	400	-
Retinal thermal	R(λ)	$W.m^{-2}.sr^{-1}$	L_R	28000/α (α=0.0390)	-	28000/α (α=0.0390)	$1.130x10^{5}$	71000/α (α=0.0390)	-
Retinal thermal, Weak visual stimulus**	R(λ)	$W.m^{-2}.sr^{-1}$	L_{IR}	6000/α (α=0.0390)	-	6000/α (α=0.0390)	$1.168x10^{1}$	6000/α (α=0.0390)	-
IR radiation Eye		$W.m^{-2}$	E_{IR}	100	-	570	$4.613x10^{0}$	3200	-

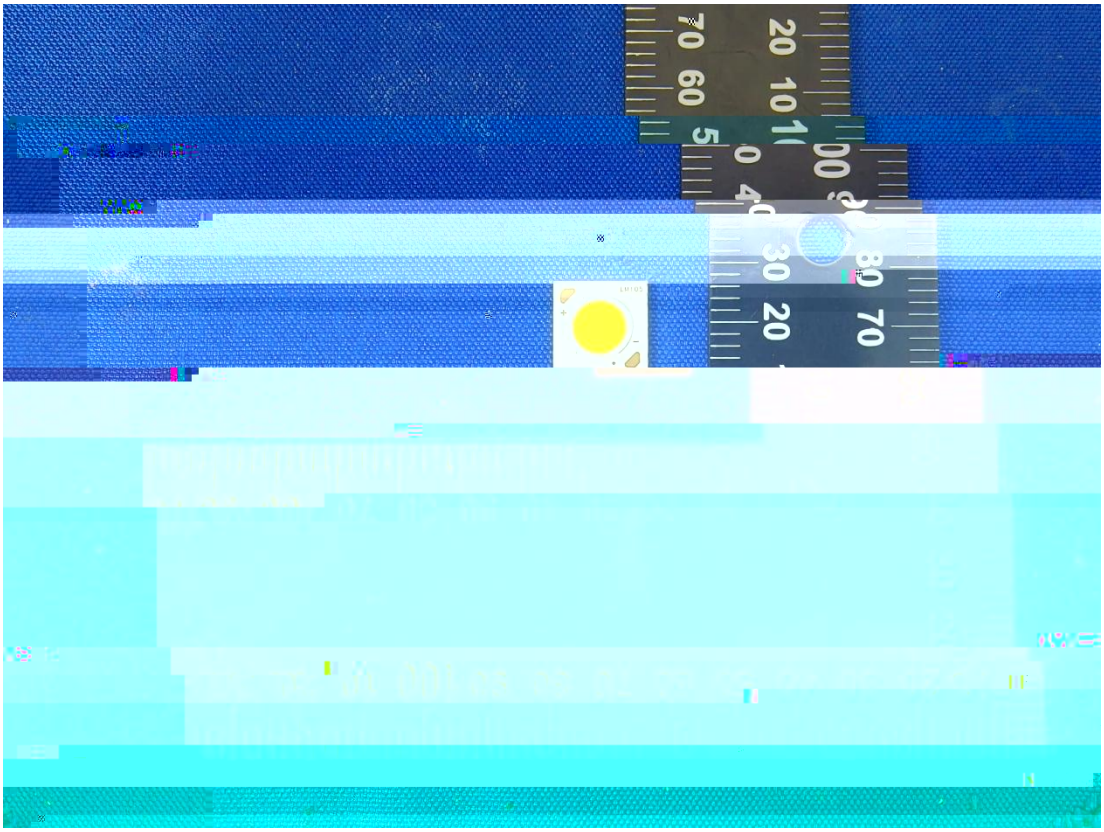
* Small source defined as one withα< 0,011 radian. Averaging field of view at 10000 s is 0,1 radian.
** Involves evaluation of non-GLS source
NOTE The action functions: see Table 4.1 and Table 4.2
The applicance apertuer diameters: see 4.2.1
The limitations for the angular subtenses: see 4.2.2
The related measurement condition 5.2.3 and the range of acceptance angles: see Table 5.5

Figure of Spectral distribution



Appendix A - EUT Photos

The overall view of EUT



Directions

1.The information marked # is provided by the applicant, the laboratory is not responsible for its authenticity and this information can affect the validity of the result in the test report.

2.Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

3.Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

4.The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.

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7.For the difference between the tested model and the multiple models, the applicant had provided a statement and promised to be responsible for its authenticity. The laboratory has confirmed the difference of relevant samples before testing.

*****End of report*****