TEST REPORT

EN 62471

Photobiological safety of lamps and lamp systems

Report reference No......:	LCS200907002BS
Tested by .....:	Zero Huang (Project Engineer)
Check by .....:	Ian Luo (Director)
Approved by.....:	Jesse Liu (Manager)
Date of issue .....:	September 08, 2020
Contents.....:	13 pages

Testing laboratory

Name .....:	Shenzhen Southern LCS Compliance Testing Laboratory Ltd.
Address .....:	101-201, No.39 Buliding, Xialang Industrial Zone, Heshuikou Community, Matian Street, Guangming District, Shenzhen, China
Testing location .....:	As above

Client

Name .....:	
Address.....:	

Manufacturer

Name .....:	
Address.....:	

Test specification

Standard.....:	EN 62471: 2008
Test procedure .....:	Compliance with EN 62471: 2008
Non-standard test method .....:	N/A

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Test item Description ……..:	UV-C sterilizer vacuum stainless steel bottle
Trademark ……..:	XD COLLECTION
Model and/or type reference ……..:	P436.64
Rating(s)……..:	Input：DC5V, 300mA Output：DC7.1V, 120mA
Test item particulars	
Lamp Type……..…..:	Others
Emission Condition.....:	☒ Continuous wave emission ☐ Pulse emission
Test case verdicts	
Test case does not apply to the test object .:	N (N/A)
Test item does meet the requirement .....:	P(Pass)
Test item does not meet the requirement ... :	F(Fail)
Testing	
Date of receipt of test item .....:	September 07, 2020
Date(s) of performance of test .....:	September 08, 2020
Lamp classification group……:	☒ Exempt ☐ Risk 1 ☐ Risk 2 ☐ Risk 3

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General remarks

This report shall not be reproduced except in full without the written approval of the testing laboratory.
The test results presented in this report relate only to the item tested.
"(see remark #)" refers to a remark appended to the report.
"(see Annex #)" refers to an annex appended to the report.
Throughout this report a comma is used as the decimal separator.

Modified Information

Version	Report No.	Revision Data	Summary
V1.0	LCS200907002BS	/	Original Version

Remark

1. Measurement was conducted at voltage DC5V and a stable ambient temperature 25±1℃.
2. The report includes: Attachment 1(S) of product photos.

Model list

Model	**Rating**	**LED lamp bead**	**CCT.**
P436.64	Input：DC5V, 300mA Output：DC7.1V, 120mA	-	-

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EN 62471			
Clause	Requirement - Test	Result - Remark	Verdict
4	**EXPOSURE LIMITS**		**P**
4.1	General		P
	The exposure limits in this standard apply to continuous sources where the exposure duration 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. The values should not be regarded as precisely defined lines between safe and unsafe levels.		P
	Detailed spectral data of a light source are generally required only if the luminance of the source exceeds 10^4 cd•m-2.		P
4.2	Specific factors involved in the determination and application of retinal exposure limits		P
4.2.1	Pupil diameter		P
4.2.2	Angular subtense of source and measurement field-of-view		P
4.3	Hazard exposure limits		P
4.3.1	Actinic UV hazard exposure limit for the skin and eye		P
	The limits for exposure to ultraviolet radiation incident upon the unprotected skin or eye apply to exposure 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
	$E_s \cdot t = \sum_{200}^{400} \sum_{t} E_\lambda(\lambda,t) \cdot S_{UV}(\lambda) \cdot \Delta t \cdot \Delta\lambda \le 30$ J•m^{-2}		P
	The permissible time for exposure to ultraviolet radiation incident upon the unprotected eye or skin shall be computed by:		P
	$t_{max} = \frac{30}{E_s}$ S		P
4.3.2	Near-UV hazard exposure limit for the eye		P
	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

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	$E_{UVA} \cdot t = \sum_{315}^{400} \sum_{t} E_{\lambda}(\lambda,t) \cdot \Delta t \cdot \Delta\lambda \le 10000$ J•m^{-2}	t < 1000 s	P
	The permissible time for exposure to ultraviolet radiation incident upon the unprotected eye fortimes less than 1000 s, shall be computed by:		P
	$t_{max} \le \frac{10000}{E_{UVA}}$ 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(λ)*, i.e., the blue light weighted radiance, *L*B, shall not exceed the levels defined by:		P
	$L_B \bullet t = \sum_{300}^{700} \sum_{t} L_{\lambda}(\lambda,\ t) \bullet B_{(\lambda)} \bullet \Delta t \bullet \Delta\lambda \le 10^6$ J•m^{-2}•sr^{-1}	for $t \le 10^4 s$	N
	$L_B = \sum_{300}^{700} L_{\lambda} \bullet B_{(\lambda)} \bullet \Delta\lambda \le 100$ W•m^{-2}•sr^{-1}	for t>10^{4}s	P
4.3.4	Retinal blue light hazard exposure limit - small source		N
	Thus the spectral irradiance at the eye *E*λ, weighted against the blue-light hazard function *B(λ)* (see Table 4.2) shall not exceed the levels defined by:		N
	$E_B \bullet t = \sum_{300}^{700} \sum_{t} E_{\lambda}(\lambda,\ t) \bullet B(\lambda) \bullet \Delta t \bullet \Delta\lambda \le 100$ J•m^{-2}	for t≤100s	N
	$E_B = \sum_{300}^{700} E_{\lambda} \bullet B(\lambda) \bullet \Delta\lambda \le 1$ W•m^{-2}	for t ＞100s	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 λ , 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
	$L_R = \sum_{380}^{1400} L_{\lambda} \cdot R(\lambda) \cdot \Delta\lambda \le \frac{50000}{\alpha \cdot t^{0,25}}$ W•m^{-2}•sr^{-1}	(10μs ≤ t ≤ 10s)	P
4.3.6	Retinal thermal hazard exposure limit – weak visual stimulus		P

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	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
	$L_{IR} = \sum_{780}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \le \frac{6000}{\alpha}$ W•m^{-2}•sr^{-1}	t >10s	P
4.3.7	Infrared radiation hazard exposure limits for the eye		P
	To 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:		N
	$E_{IR} = \sum_{780}^{3000} E_\lambda \cdot \Delta\lambda \le 18000 \cdot t^{-0,75}$ W•m^{-2}	t≤1000s	N
	For times greater than 1000 s the limit becomes:		P
	$E_{IR} = \sum_{780}^{3000} E_\lambda \bullet \Delta\lambda \le 100$ W•m^{-2}	t>1000s	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•m^{-2}	t≤10s	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)……..:		P
	Seasoning of lamps shall be done as stated in the appropriate IEC lamp standard.		P
5.1.2	Test environment……:		P

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	For specific test conditions, see the appropriate IEC lamp standard or in the absence of such standards, the appropriate national standards or manufacturer's recommendations.		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.		P
5.1.4	Lamp operation……:		P
	Operation of the test lamp shall be provided in accordance with:		P
	--the appropriate IEC lamp standard.		P
	--the lamp manufacturer's recommendation		N
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.		P
	-- the lamp manufacturer's recommendation		N
5.2	Measurement procedure		P
5.2.1	Irradiance measurements……..:		P
	minimum input aperture diameter of 7 mm		P
	maximum input aperture diameter of 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…….. :		P
5.2.2.1	Standard method……:		P
	The measurement made with an optical system		P
	The instrument shall be calibrated to read in absolute incident radiant power per unit receiving area and per unit solid angle of acceptance averaged over the field of view (FOV) of the instrument.		P
5.2.2.2	Alternative method……..:		N
	Alternative 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
5.2.3	Measurement of source size……..:		P

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Clause	Requirement - Test	Result - Remark	Verdict
	The determination of a, the angle subtended ba a source, requires the determination of the 50% emission point of the source		P
5.2.4	Pulse width measurement for pulsed sources……:		N
	The determination of Δ*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
5.3	Analysis methods		P
5.3.1	Weighting curve interpolations……..:		P
	The standardize interpolated values, use linear interpolation on the log of given values to obtion intermediate point at the wavelength internals de-sired.		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.		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 (GLS), the hazard values shall be reported as either irradiance or radiance values at a distance which produces an illu-minance 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	See table 6.1(a)	P
	The exempt group are lamps, which does not pose any photobiological. This 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

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Clause	Requirement - Test	Result - Remark	Verdict
	--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
	In this group are lamps, which exceeds the limited for the except group but that does not pose:		N
	--an actinic ultraviolet hazard (*E*s) within 10000 s, nor		N
	--a near ultraviolet hazard (*E*UVA) within 300 s, nor		N
	--a retinal blue-light hazard (*L*B) within 100 s, nor		N
	--a retinal thermal hazard (*L*R) within 10 s, nor		N
	--an infrared radiation hazard for the eye (*E*IR) within 100 s.		N
	lamps that emit infrared radiation without a strong visual stimulus (i.e., less than 10 $cd•m^{-2}$) and do not pose a near-infrared retinal hazard (*L*IR), within 100 s are in Risk Group 1 (Low-Risk).		N
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 (*E*s) within 1000 s exposure, nor		N
	--a near ultraviolet hazard (*E*UVA) within 100 s, nor		N
	--a retinal blue-light hazard (*L*B) within 0,25 s (aversion response), nor		N
	--a retinal thermal hazard (*L*R) within 0,25 s (aversion response), nor		N
	--an infrared radiation hazard for the eye (*E*IR) within 10 s.		N
	lamps that emit infrared radiation without a strong visual stimulus (i.e., less than 10 $cd•m^{-2}$) and do not pose a near infrared retinal hazard (*L*IR) within 10 s are in Risk Group 2 (Moderate-Risk).		N
6.1.4	Risk Group 3 (High-Risk)		N
	Lamps which exceed the limits for Risk Group 2 (Moderate-Risk) are in Risk Group3 (High-Risk).		N
6.2	Pulsed lamps		N

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Clause	Requirement - Test	Result - Remark	Verdict
	Pulsed lamp criteria shall apply to a single pulse and to any group of pulses within 0.25 second.		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 dose 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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Tables

Table 4.1	**Spectral weighting function for assessing ultraviolet hazards for skin and eye.**		**P**
Wavelength[1] λ, nm	**UV hazard function *SUV(λ)***	**Wavelength λ, nm**	**UV hazard function *SUV(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	0,960	350	0,00020
285	0,880	355	0,00016
290	0,770	360	0,00013
295	0,540	370	0,00009
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 bylogarithmic interpolation at intermediate wavelengths. * Emission lines of a mercury discharge spectrum.			

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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 irradiance $W \cdot m^{-2} \cdot sr^{-1}$**
Blue light	$L_B = \sum L_\lambda \cdot B(\lambda) \cdot \Delta\lambda$	300 – 700	0,25 – 10 10-100 100-10000 ≥10000	$0{,}011 \cdot \sqrt{(t/10)}$ 0,011 $0{,}0011 \cdot \sqrt{t}$ 0,1	$106/t$ $106/t$ $106/t$ 100
Retinal thermal	$L_R = \sum L_\lambda \cdot R(\lambda) \cdot \Delta\lambda$	380 – 1400	< 0,25 0,25 – 10	0,0017 $0{,}011 \cdot \sqrt{(t/10)}$	$50000/(\alpha \cdot t^{0,25})$ $50000/(\alpha \cdot t^{0,25})$
Retinal thermal (weak visual stimulus)	$L_{IR} = \sum L_\lambda \cdot R(\lambda) \cdot \Delta\lambda$	780 – 1400	> 10	0,011	$6000/\alpha$

Table 6.1(a)	Emission limits for risk groups of continuous wave lamps(based on EU directive 2006/25/EC)								P
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	4.6e-06	0.003	-	0.03	-
Near UV		E_{UVA}	$W \cdot m^{-2}$	0.33	2.6e-05	33	-	100	-
Blue light	B(λ)	L_B	$W \cdot m^{-2} \cdot sr^{-1}$	100	1.65e-02	10000	-	4000000	-
Blue light, small source	B(λ)	E_B	$W \cdot m^{-2}$	0.01*	-	1,0	-	400	-
Retinal thermal	R(λ)	L_R	$W \cdot m^{-2} \cdot sr^{-1}$	28000/α	8.1e-03	28000/α	-	71000/α	-
Retinal thermal, weak visual stimulus**	R(λ)	L_{IR}	$W \cdot m^{-2} \cdot sr^{-1}$	6000/α	5.6e-02	6000/α	-	6000/α	-
IR radiation, eye		E_{IR}	$W \cdot m^{-2}$	100	1.4e-04	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

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ATTACHMENT 1(S)

Photos of P436.64

----- End of test report-----

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