# TEST REPORT
# IEC 62471
# Photobiological safety of lamps and lamp systems

| | | |
|---|---|---|
| **Report Reference No**. ..... : | GZES101200390931 | |
| Tested by (name + signature)..... : | Bica Chen | Bica Chen |
| Approved by (name + signature) ..... : | Ryan Li | Ryan Li |
| Date of issue ..... : | 2010-12-20 | |
| Total number of pages ..... : | 14 pages | |
| **Testing Laboratory** ..... : | SGS-CSTC Standards Technical Services Co., Ltd. GuangZhou Branch Testing Center | |
| Address..... : | No.198, Kezhu Road, Scientech Park, Guangzhou Economic & Technology Development District, Guangzhou, Guangdong, CHINA | |
| **Applicant's name** ..... : | EA SRL | |
| Address..... : | St Degli Angariari, 25 47891 Falciano, Rep, San Marino | |
| **Test specification:** | | |

**Summary of testing:**

Due to the physical properties of the Lamp, this product does not contain any radiation above 800nm. Therefore the measured spectral range has been limited from 200nm up to and including 800nm.

The tests were conducted under 500 mA.

| **Tests performed (name of test and test clause):** | **Testing location:** |
|---|---|
| These tests fulfil the requirements of standard ISO/IEC 17025.<br>When determining the test conclusion, the Measurement Uncertainty of test has been considered. | SGS-CSTC Standards Technical Services Co., Ltd. GuangZhou Branch Testing Center<br>No.198, Kezhu Road, Scientech Park, Guangzhou Economic & Technology Development District, Guangzhou, Guangdong, CHINA |

**Summary of compliance with National Differences:**

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**Copy of marking plate:**

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| | |
|---|---|
| **Test item particulars** ..... : | |
| Tested lamp ..... : | ☒ continuous wave lamps ☐ pulsed lamps |
| Tested lamp system ..... : | -- |
| Lamp classification group ..... : | ☐ exempt ☒ risk 1 ☐ risk 2 ☐ risk 3 |
| Lamp cap ..... : | -- |
| Bulb ..... : | -- |
| Rated of the lamp ..... : | -- |
| Furthermore marking on the lamp ..... : | -- |
| Seasoning of lamps according IEC standard ..... : | -- |
| Used measurement instrument ..... : | Ref. to List of test equipment used |
| Temperature by measurement ..... : | 25 ± 5 °C |
| Information for safety use ..... : | -- |

**Possible test case verdicts:**

– test case does not apply to the test object ..... : N (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 ..... : 2010-12-08

Date (s) of performance of tests ..... : 2010-12-09 – 2010-12-16

**General remarks:**

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.



**General product information:**

The product can emit white light when powered.

| IEC 62471 | | | |
|---|---|---|---|
| Clause | Requirement + Test | Result – Remark | Verdict |
| **4** | **EXPOSURE LIMITS** | | -- |
| 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 $10^4$ cd·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 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 , $E_S$, 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 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, $E_{UVA}$, 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: | | P |
| | $t_{max} \le \frac{10\,000}{E_{UVA}}$ 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: | see table 4.2 | P |

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| | 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 | | N |
| | The measurements made with an optical system. | | N |
| | 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. | | N |
| 5.2.2.2 | Alternative method | | P |
| | Alternatively to an imaging radiance set-up, an ir-radiance 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 α, the angle subtended by a source, requires the determination of the 50% emis-sion points of the source. | | P |

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| | – 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 | r = 200 mm | P |
| 6.1 | Continuous wave lamps | | P |
| 6.1.1 | Exempt Group | | N |
| | In the exempt 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 ($E_S$) within 8-hours exposure (30000 s), nor | | N |
| | – a near-UV hazard ($E_{UVA}$) within 1000 s, (about 16 min), nor | | N |
| | – a retinal blue-light hazard ($L_B$) within 10000 s (about 2,8 h), nor | | N |
| | – a retinal thermal hazard ($L_R$) within 10 s, nor | | N |
| | – an infrared radiation hazard for the eye ($E_{IR}$) within 1000 s | | N |
| 6.1.2 | Risk Group 1 (Low-Risk) | | P |
| | In this group are lamps, which exceeds the limits for the exempt group but that does not pose: | | P |
| | – an actinic ultraviolet hazard ($E_S$) within 10000 s, nor | | P |
| | – a near ultraviolet hazard ($E_{UVA}$) within 300 s, nor | | P |
| | – a retinal blue-light hazard ($L_B$) within 100 s, nor | | P |
| | – a retinal thermal hazard ($L_R$) within 10 s, nor | | P |
| | – an infrared radiation hazard for the eye ($E_{IR}$) within 100 s | | N |
| | 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 |

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| Clause | Requirement + Test | Result – Remark | Verdict |
| | – 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 and do not pose a near-infrared retinal hazard ($L_{IR}$), 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 and to 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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|---|---|---|---|
| Clause | Requirement + Test | Result – Remark | Verdict |

| **Table 4.1** | Spectral weighting function for assessing ultraviolet hazards for skin and eye | | P |
|---|---|---|---|
| **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.

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|---|---|---|
| | Result – Remark | Verdict |
| nctions for assessing retinal hazards from broadband optical | | P |

| | Blue-light hazard function B (λ) | Burn hazard function R (λ) |
|---|---|---|
| | 0,01 | -- |
| | 0,01 | -- |
| | 0,01 | -- |
| | 0,01 | -- |
| | 0,01 | -- |
| | 0,01 | -- |
| | 0,01 | -- |
| | 0,01 | -- |
| | 0,01 | -- |
| | 0,01 | -- |
| | 0,01 | -- |
| | 0,01 | -- |
| | 0,01 | -- |
| | 0,01 | -- |
| | 0,01 | -- |
| | 0,01 | -- |
| | 0,01 | 0,1 |
| | 0,013 | 0,13 |
| | 0,025 | 0,25 |
| | 0,05 | 0,5 |
| | 0,10 | 1,0 |
| | 0,20 | 2,0 |
| | 0,40 | 4,0 |
| | 0,80 | 8,0 |
| | 0,90 | 9,0 |
| | 0,95 | 9,5 |
| | 0,98 | 9,8 |
| | 1,00 | 10,0 |
| | 1,00 | 10,0 |
| | 0,97 | 9,7 |
| | 0,94 | 9,4 |
| | 0,90 | 9,0 |
| | 0,80 | 8,0 |
| 465 | 0,70 | 7,0 |

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| 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<br>>1000 | 1,4 (80) | 10000/t<br>10 |
| Blue-light small source | $E_B = \sum E_\lambda \cdot B(\lambda) \cdot \Delta\lambda$ | 300 – 700 | ≤100<br>>100 | < 0,011 | 100/t<br>1,0 |
| Eye IR | $E_{IR} = \sum E_\lambda \cdot \Delta\lambda$ | 780 –3000 | ≤1000<br>>1000 | 1,4 (80) | $18000/t^{0,75}$<br>100 |
| Skin thermal | $E_H = \sum E_\lambda \cdot \Delta\lambda$ | 380 – 3000 | < 10 | 2π sr | $20000/t^{0,75}$ |

| **Table 5.5** | Summary of the ELs for the retina (radiance based values) | 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<br>10-100<br>100-10000<br>≥ 10000 | 0,011•√(t/10)<br>0,011<br>0,0011•√t<br>0,1 | $10^6/t$<br>$10^6/t$<br>$10^6/t$<br>100 |
| Retinal thermal | $L_R = \sum L_\lambda \cdot R(\lambda) \cdot \Delta\lambda$ | 380 – 1400 | < 0,25<br>0,25 – 10 | 0,0017<br>0,011•√(t/10) | $50000/(\alpha \cdot t^{0,25})$<br>$50000/(\alpha \cdot t^{0,25})$ |
| Retinal thermal (weak visual stimulus) | $L_{IR} = \sum L_\lambda \cdot R(\lambda) \cdot \Delta\lambda$ | 780 – 1400 | > 10 | 0,011 | 6000/α |

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

| **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 | 0,0003 | 0,003 | -- | 0,03 | -- | |
| Near UV | -- | $E_{UVA}$ | $W \cdot m^{-2}$ | 10 | 0,0017 | 33 | -- | 100 | -- | |
| Blue light | B(λ) | $L_B$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 100 | 363,9 | 10000 | 2724,6 | 4000000 | -- | |
| Blue light, small source | B(λ) | $E_B$ | $W \cdot m^{-2}$ | 1,0* | -- | 1,0 | -- | 400 | -- | |
| Retinal thermal | R(λ) | $L_R$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 28000/α | 30053,8 | 28000/α | -- | 71000/α | -- | |
| Retinal thermal, weak visual stimulus** | R(λ) | $L_{IR}$ | $W \cdot m^{-2} \cdot sr^{-1}$ | 6000/α | -- | 6000/α | -- | 6000/α | -- | |
| IR radiation, eye | -- | $E_{IR}$ | $W \cdot m^{-2}$ | 100 | -- | 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

**List of test equipment used:**

| Clause | Measurement / testing | Testing / measuring equipment / material used | Range used | Calibration date |
|---|---|---|---|---|
| 5 | Irradiance and Radiance measurements | Spectroradiometer | 200 – 800 nm | Last cal. date: 2010-04-08<br>Next cal. date: 2011-04-08 |
| 5 | Irradiance and Radiance measurements | HP 34401A multimeter | -- | Last cal. date: 2010-09-09<br>Next cal. date: 2011-09-09 |

**Photo documentation**

Details of: ----------

View:

[ x ] general

[ ] front

[ ] rear

[ ] right

[ ] left

[ ] top

[ ] bottom

[ ] Internal


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