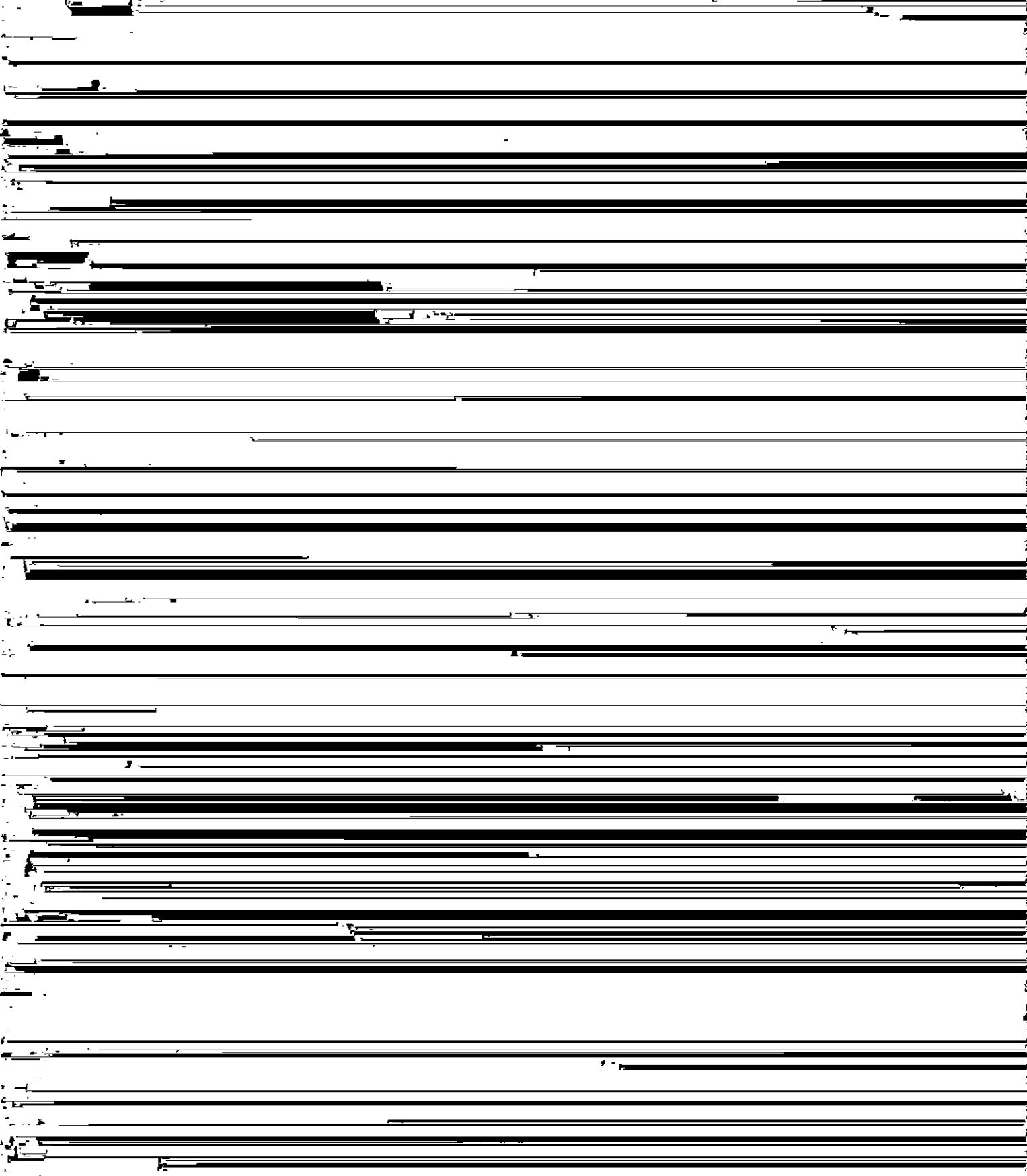




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|------------------------------------------------------------------------------------------------------------|
| <p><b>TEST REPORT</b><br/><b>IEC 62471</b><br/><b>Photobiological safety of lamps and lamp systems</b></p> |
| <p>Report Reference No. .... <b>GZES100600108901</b></p>                                                   |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Summary of testing:</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                            |
| <p><b>Tests performed (name of test and test clause):</b></p> <p>These tests fulfil the requirements of standard ISO/IEC 17025.</p> <p>When determining the test conclusion, the Measurement Uncertainty of test has been considered.</p> <p>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.</p> <p>The tests were conducted under 60 mA.</p> | <p><b>Testing location:</b></p> <p>SGS-CSTC Standards Technical Services Co., Ltd.<br/>GuangZhou Branch Testing Center<br/>No.198, Kezhu Road, Sciencetech Park, Guangzhou Economic &amp; Technology Development District, Guangzhou, Guangdong, CHINA</p> |
| <p><b>Summary of compliance with National Differences:</b></p> <p>--</p>                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                            |
| <p><b>Copy of marking plate:</b></p> <p>--</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                            |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Test item particulars</b> .....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                            |
| Tested lamp .....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <input checked="" type="checkbox"/> continuous wave lamps <input type="checkbox"/> pulsed lamps                                            |
| Tested lamp system .....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | --                                                                                                                                         |
| Lamp classification group .....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <input checked="" type="checkbox"/> exempt <input type="checkbox"/> risk 1 <input type="checkbox"/> risk 2 <input type="checkbox"/> 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.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | --                                                                                                                                         |
| <b>Possible test case verdicts:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                            |
| – 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)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                            |
| <b>Testing:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                            |
| Date of receipt of test item.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | : June 21, 2010                                                                                                                            |
| Date (s) of performance of tests.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | : June 21, 2010 – June 28, 2010                                                                                                            |
| <b>General remarks:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                            |
| <p>The test results presented in this report relate only to the object tested.<br/>           This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.<br/>           "(See Enclosure #)" refers to additional information appended to the report.<br/>           "(See appended table)" refers to a table appended to the report.<br/>           Throughout this report a comma is used as the decimal separator.<br/>           List of test equipment must be kept on file and available for review.</p> <p>This document is issued by the Company subject to its General Conditions of Service, available on request or accessible at <a href="http://www.sgs.com/terms_and_conditions.htm">www.sgs.com/terms_and_conditions.htm</a> and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at <a href="http://www.sgs.com/terms_e-document.htm">www.sgs.com/terms_e-document.htm</a>.</p> <p>Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be produced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law.</p> |                                                                                                                                            |
| <b>General product information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                            |
| The product can emit white light when powered.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                            |

| IEC 62471 |                                                                                                                                                                                                                                                                                                                                                                       |                 |         |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------|
| Clause    | Requirement + Test                                                                                                                                                                                                                                                                                                                                                    | Result – Remark | Verdict |
| <b>4</b>  | <b>EXPOSURE LIMITS</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 broad-band source, the effective integrated spectral irradiance, $E_s$ , of the light source shall not exceed the levels defined by:                                                                                                                                   |                 | P       |
|           | $E_s \cdot t = \sum_{315}^{400} \sum_{\lambda} E_{\lambda}(\lambda) \cdot \lambda \cdot \lambda^{-1}$                                                                                                                                                                                                                                                                 |                 | P       |
|           | The permissible time for exposure to ultraviolet radiation incident upon the unprotected eye or skin shall be computed by:                                                                                                                                                                                                                                            |                 | P       |
|           | $t_{\max} = \frac{30}{E_s} \quad \text{s}$                                                                                                                                                                                                                                                                                                                            |                 | 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, $E_{\text{UVA}}$ , 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       |
|           | $10000 \text{ J}\cdot\text{m}^{-2}$                                                                                                                                                                                                                                                                                                                                   |                 | 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:                                                                        | see table 4.2   | P       |

| IEC 62471 |                                                                                                                                                                                      |                                                         |         |
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| Clause    | Requirement + Test                                                                                                                                                                   | Result – Remark                                         | Verdict |
|           | $L_B \cdot t = \sum_{300}^{700} \sum_t L_\lambda(\lambda, t) \cdot B(\lambda) \cdot \Delta t \cdot \Delta \lambda \leq 10^6 \quad \text{J} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$ | for t = 10 <sup>4</sup> s $t_{\max} = \frac{10^6}{L_B}$ | P       |
|           |                                                                                                                                                                                      |                                                         | N       |
| 4.3.4     | Retinal blue light hazard exposure limit - small source                                                                                                                              |                                                         | N       |
|           | Thus the spectral irradiance at the eye E <sub>λ</sub> , weighted against the blue-light hazard function B( ) shall not exceed the levels defined by:                                |                                                         | N       |
|           | $E_B \cdot t = \sum_{300}^{700} \sum_t E_\lambda(\lambda, t) \cdot B(\lambda) \cdot \Delta t \cdot \Delta \lambda \leq 100 \quad \text{J} \cdot \text{m}^{-2}$                       |                                                         | N       |

$$E_B = \sum_{300}^{700} E_\lambda \cdot B(\lambda)$$

N

| IEC 62471 |                                                                                                                                                                            |                 |         |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------|
| Clause    | Requirement + Test                                                                                                                                                         | Result – Remark | Verdict |
|           | $E_{IR} = \sum_{780}^{3000} E_{\lambda} \cdot \Delta\lambda \leq 100 \quad W \cdot m^{-2}$                                                                                 |                 | N       |
| 4.3.8     | Thermal hazard exposure limit for the skin                                                                                                                                 |                 | N       |
|           | Visible and infrared radiant exposure (380 nm to 3000 nm) of the skin shall be limited to:                                                                                 |                 | N       |
|           | $E_{H \cdot t} = \sum_{380}^{3000} \sum_t E_{\lambda}(\lambda, t) \cdot \Delta t \cdot \Delta\lambda \leq 20\,000 \cdot t^{0,25} \quad J \cdot m^{-2}$                     |                 | N       |
| <b>5</b>  | <b>MEASUREMENT OF LAMPS AND LAMP SYSTEMS</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       |
|           | Seasoning of lamps shall be done as stated in the appropriate IEC lamp standard.                                                                                           |                 | N       |
| 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. |                 | 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, or                                                                                                                                    |                 | N       |
|           | – the manufacturer' s recommendation                                                                                                                                       |                 | P       |
| 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       |
|           | – 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       |

| IEC 62471 |                                                                                                                                                                                        |                 |         |
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| Clause    | Requirement + Test                                                                                                                                                                     | Result – Remark | Verdict |
|           | 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 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 $\theta$ , 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                                                                                                                                             |                 | N       |
|           | The determination of $t$ , 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       |
|           | To standardize interpolated values, use linear interpolation on the log of given values to obtain intermediate points at the wavelength intervals desired.                             |                 | P       |
| 5.3.2     | Calculations                                                                                                                                                                           |                 | P       |

| IEC 62471 |                                                                                                                                                                                                                               |                 |         |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------|
| Clause    | Requirement + Test                                                                                                                                                                                                            | Result – Remark | Verdict |
|           | – 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                                                                                                                                                                                                                  |                 | P       |
|           | In the exempt 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                                                                                                                                                         |                 | N       |
| 6.1.2     | Risk Group 1 (Low-Risk)                                                                                                                                                                                                       |                 | N       |
|           | In this group are lamps, which exceeds the limits for the exempt 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 and do not pose a near-infrared retinal hazard ( $L_{IR}$ ), within 100 s are in Risk Group 1.                                                            |                 | 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                                                                                                                                                                       |                 |         |



| IEC 62471 |                                                                                                                                                                   |                 |         |
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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       |

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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 <sup>1</sup><br>$\lambda$ , nm                                                | UV hazard function<br>$S_{uv}(\lambda)$ | Wavelength<br>$\lambda$ , nm | UV hazard function<br>$S_{uv}(\lambda)$ |
| 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                                |

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| 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                                                                        | $E_S = E \cdot S(\ ) \cdot$ | 200 – 400           | < 30000               | 1,4 (80)                    | 30/t                                                |   |
| Eye UV-A                                                                                     | $E_{UVA} = E \cdot$         | 315 – 400           | 1000<br>>1000         | 1,4 (80)                    | 10000/t<br>10                                       |   |
| Blue-light small source                                                                      | $E_B = E \cdot B(\ ) \cdot$ | 300 – 700           | 100<br>>100           | < 0,011                     | 100/t<br>1,0                                        |   |
| Eye IR                                                                                       | $E_{IR} = E \cdot$          | 780 – 3000          | 1000<br>>1000         | 1,4 (80)                    | 18000/t <sup>0,75</sup><br>100                      |   |
| Skin thermal                                                                                 | $E_H = E \cdot$             | 380 – 3000          | < 10                  | 2 sr                        | 20000/t <sup>0,75</sup>                             |   |

| Table 5.5 Summary of the ELs for the retina (radiance based values) |  |  |  |  |  | P |
|---------------------------------------------------------------------|--|--|--|--|--|---|
|---------------------------------------------------------------------|--|--|--|--|--|---|

**Hazard Name =**

| IEC 62471 |                    |                 |         |
|-----------|--------------------|-----------------|---------|
| 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                              | $S_{UV}(\ )$                                             | $E_s$     | $W \cdot m^{-2}$               | 0,001                | 0      | 0,003    | --     | 0,03     | --     |
| Near UV                                 | --                                                       | $E_{UVA}$ | $W \cdot m^{-2}$               | 10                   | 0,0002 | 33       | --     | 100      | --     |
| Blue light                              | $B(\ )$                                                  | $L_B$     | $W \cdot m^{-2} \cdot sr^{-1}$ | 100                  | 5,8    | 10000    | --     | 4000000  | --     |
| Blue light, small source                | $B(\ )$                                                  | $E_B$     | $W \cdot m^{-2}$               | 1,0*                 | --     | 1,0      | --     | 400      | --     |
| Retinal thermal                         | $R(\ )$                                                  | $L_R$     | $W \cdot m^{-2} \cdot sr^{-1}$ | 28000/               | 8722,2 | 28000/   | --     | 71000/   | --     |
| Retinal thermal, weak visual stimulus** | $R(\ )$                                                  | $L_{IR}$  | $W \cdot m^{-2} \cdot sr^{-1}$ | 6000/                | --     | 6000/    | --     | 6000/    | --     |
| IR radiation, eye                       | --                                                       | $E_{IR}$  | $W \cdot m^{-2}$               | 100                  | --     | 570      | --     | 3200     | --     |

\* Small source defined as one with  $\omega < 0,011$  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:<br>2010-04-08<br>Next cal. date:<br>2011-04-08 |
| 5      | Irradiance and Radiance measurements | HP 34401A multimeter                          | --           | Last cal. date:<br>2009-09-24<br>Next cal. date:<br>2010-09-24 |

**Photo documentation**

Details of: .....

View:

general

front

rear

right

left

top

bottom

Internal

--- END OF REPORT ---