



**TEST REPORT**  
**On Behalf of**

**Mid Ocean Brands B.V.**

**Book light**

**Model No.: MO9460**

**Prepared for :** Mid Ocean Brands B.V.

**Address:** 7/F, Kings Tower, 111 King Lam Street, Cheung Sha Wan, Kowloon, Hong Kong

**Prepared by :** Shenzhen Alpha Product Testing Co., Ltd.

**Address:** Building i, No.2, Lixin Road, Fuyong Street, Bao'an District, 518103, Shenzhen, Guangdong, China

**Date of Test:** October 16, 2024

**Date of Report:** October 18, 2024

**Report Number:** A2410069-C01-R02

**Version Number:** V0

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

**Report Reference No.**.....: A2410069-C01-R02

**Tested by (name + signature)** .....: Max Peng

**Approved by (name + signature)**.....: Winston Chen

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**Testing Laboratory** .....: Shenzhen Alpha Product Testing Co., Ltd.

**Address** .....: Building i, No.2, Lixin Road, Fuyong Street, Bao'an District,  
518103, Shenzhen, Guangdong, China

**Testing location/ procedure** .....: TL ☒ RMT ☐ SMT ☐ WMT ☐ TMP ☐

**Applicant's name**.....: Mid Ocean Brands B.V.

**Address** .....: 7/F, Kings Tower, 111 King Lam Street, Cheung Sha Wan, Kowloon,  
Hong Kong

**Test specification:**

**Standard** .....: IEC 62471:2006 (First Edition)

**Test procedure** .....: Type-test report

**Non-standard test method**.....: N/A

**Test Report Form No.**.....: IEC62471B

**TRF Originator**.....: VDE Testing and Certification Institute

**Master TRF**.....: Dated 2018-08-16

**Test item description** .....: Book light

**Model/Type reference** .....: MO9460

**Model difference**.....: N/A

**Manufacturer** .....: Mid Ocean Brands B.V.

**Address** .....: 7/F, Kings Tower, 111 King Lam Street, Cheung Sha Wan, Kowloon,  
Hong Kong

**Trademark** .....: N/A

**Ratings** .....: 5V ==

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Test item particulars .....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                            |
| 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 .....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | N/A                                                                                                                                        |
| Bulb .....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | --                                                                                                                                         |
| Rated of the lamp .....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | DC 5V                                                                                                                                      |
| Furthermore marking on the lamp.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | --                                                                                                                                         |
| Seasoning of lamps according IEC standard .....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | --                                                                                                                                         |
| Used measurement instrument.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | OST-500 system                                                                                                                             |
| Temperature by measurement.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 23 ± 2 °C                                                                                                                                  |
| Information for safety use .....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | --                                                                                                                                         |
| <b>Possible test case verdicts:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                            |
| – test case does not apply to the test object ..... : N/A (Not applicable)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                            |
| – 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.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | : October 15, 2024                                                                                                                         |
| Date (s) of performance of tests.....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | : October 16, 2024                                                                                                                         |
| <b>General remarks:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                            |
| <p>The test results presented in this report relate only to the object tested.</p> <p>This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.</p> <p>"(See Enclosure #)" refers to additional information appended to the report.</p> <p>"(See appended table)" refers to a table appended to the report.</p> <p>Throughout this report a <del>comma</del> (point) is used as the decimal separator.</p> <p>Decision rules for the conclusion of this test report: decision by actual test data without considering measurement uncertainty.</p> <p>List of test equipment must be kept on file and available for review.</p> |                                                                                                                                            |
| <b>Summary of the test report</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                            |
| The complete report including following parts:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                            |
| <ol style="list-style-type: none"> <li>1. All clauses of IEC 62471:2006;</li> <li>2. Differences between IEC 62471:2006 and EN 62471:2008, see the ATTACHMENT;</li> <li>3. Appendix 1: Photo Documentation.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                            |
| <b>Summary of compliance with National Differences:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                            |
| List of countries addressed:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                            |
| EU Group Differences                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                            |
| <input checked="" type="checkbox"/> The product fulfils the requirements of EN 62471:2008.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                            |
| <b>General product information:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                            |
| <ol style="list-style-type: none"> <li>1. Product: <u>Book light</u>.</li> <li>2. This product is a single model, but has two different colored appearances.</li> <li>3. The unit classification is the <u>Exempt Group</u>.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                            |

| IEC 62471 |                                                                                                                                                                                                                                                                                                                                                                |                                                           |         |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|---------|
| Clause    | Requirement + Test                                                                                                                                                                                                                                                                                                                                             | Result – Remark                                           | Verdict |
| <b>4</b>  | <b>EXPOSURE LIMITS</b>                                                                                                                                                                                                                                                                                                                                         |                                                           | P       |
| 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                                            | N/A     |
| 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       |
|           | $E_s \cdot t = \sum_{200}^{400} \sum_t E_\lambda(\lambda, t) \cdot S_{UV}(\lambda) \cdot \Delta t \cdot \Delta \lambda \leq 30 \quad \text{J}\cdot\text{m}^{-2}$                                                                                                                                                                                               |                                                           | P       |
|           | The permissible time for exposure to ultraviolet radiation incident upon the unprotected eye or skin shall be computed by:                                                                                                                                                                                                                                     |                                                           | P       |
|           | $t_{\max} = \frac{30}{E_s} \quad \text{s}$                                                                                                                                                                                                                                                                                                                     |                                                           | 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, $E_{UVA}$ , 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       |
|           | $t_{\max} \leq \frac{10\,000}{E_{UVA}} \quad \text{s}$                                                                                                                                                                                                                                                                                                         |                                                           | P       |
| 4.3.3     | Retinal blue light hazard exposure limit                                                                                                                                                                                                                                                                                                                       |                                                           | P       |
|           | To protect against retinal photochemical injury from chronic blue-light exposure, the integrated spectral radiance of the light source weighted against the blue-light hazard function, $B(\lambda)$ , i.e., the blue-light weighted radiance, $L_B$ , shall not exceed the levels defined by:                                                                 |                                                           | P       |
|           | $L_B \cdot t = \sum_{300}^{700} \sum_t L_\lambda(\lambda, t) \cdot B(\lambda) \cdot \Delta t \cdot \Delta \lambda \leq 10^6 \quad \text{J} \cdot \text{m}^{-2} \cdot \text{sr}^{-1}$                                                                                                                                                                           | for $t \leq 10^4 \text{ s}$ $t_{\max} = \frac{10^6}{L_B}$ | P       |

| IEC 62471 |                                                                                                                                                                                                                                                                                              |                                       |         |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------|
| Clause    | Requirement + Test                                                                                                                                                                                                                                                                           | Result – Remark                       | Verdict |
|           | $L_B = \sum_{300}^{700} L_\lambda \cdot B(\lambda) \cdot \Delta\lambda \leq 100 \quad W \cdot m^{-2} \cdot sr^{-1}$                                                                                                                                                                          | for $t > 10^4$ s                      | N/A     |
| 4.3.4     | Retinal blue light hazard exposure limit - small source                                                                                                                                                                                                                                      |                                       | N/A     |
|           | Thus the spectral irradiance at the eye $E_\lambda$ , weighted against the blue-light hazard function $B(\lambda)$ shall not exceed the levels defined by:                                                                                                                                   | See table 4.2                         | N/A     |
|           | $E_B \cdot t = \sum_{300}^{700} \sum_t E_\lambda(\lambda, t) \cdot B(\lambda) \cdot \Delta\lambda \leq 100 \quad J \cdot m^{-2}$                                                                                                                                                             | for $t \leq 100$ s                    | N/A     |
|           | $E_B = \sum_{300}^{700} E_\lambda \cdot B(\lambda) \cdot \Delta\lambda \leq 1 \quad W \cdot m^{-2}$                                                                                                                                                                                          | for $t > 100$ s                       | N/A     |
| 4.3.5     | Retinal thermal hazard exposure limit                                                                                                                                                                                                                                                        |                                       | P       |
|           | To protect against retinal thermal injury, the integrated spectral radiance of the light source, $L_\lambda$ , weighted by the burn hazard weighting function $R(\lambda)$ (from Figure 4.2 and Table 4.2), i.e., the burn hazard weighted radiance, shall not exceed the levels defined by: |                                       | P       |
|           | $L_R = \sum_{380}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \leq \frac{50\,000}{\alpha \cdot t^{0.25}} \quad W \cdot m^{-2} \cdot sr^{-1}$                                                                                                                                       | $(10 \mu s \leq t \leq 10 \text{ s})$ | N/A     |
| 4.3.6     | Retinal thermal hazard exposure limit – weak visual stimulus                                                                                                                                                                                                                                 |                                       | P       |
|           | For an infrared heat lamp or any near-infrared source where a weak visual stimulus is inadequate to activate the aversion response, the near infrared (780 nm to 1400 nm) radiance, $L_{IR}$ , as viewed by the eye for exposure times greater than 10 s shall be limited to:                |                                       | P       |
|           | $L_{IR} = \sum_{780}^{1400} L_\lambda \cdot R(\lambda) \cdot \Delta\lambda \leq \frac{6\,000}{\alpha} \quad W \cdot m^{-2} \cdot sr^{-1}$                                                                                                                                                    |                                       | P       |
| 4.3.7     | Infrared radiation hazard exposure limits for the eye                                                                                                                                                                                                                                        |                                       | P       |
|           | The avoid thermal injury of the cornea and possible delayed effects upon the lens of the eye (cataractogenesis), ocular exposure to infrared radiation, $E_{IR}$ , over the wavelength range 780 nm to 3000 nm, for times less than 1000 s, shall not exceed:                                |                                       | P       |
|           | $E_{IR} = \sum_{780}^{3000} E_\lambda \cdot \Delta\lambda \leq 18\,000 \cdot t^{-0.75} \quad W \cdot m^{-2}$                                                                                                                                                                                 | $t \leq 1000$ s                       | N/A     |
|           | For times greater than 1000 s the limit becomes:                                                                                                                                                                                                                                             |                                       | P       |
|           | $E_{IR} = \sum_{780}^{3000} E_\lambda \cdot \Delta\lambda \leq 100 \quad W \cdot m^{-2}$                                                                                                                                                                                                     | $t > 1000$ s                          | P       |
| 4.3.8     | Thermal hazard exposure limit for the skin                                                                                                                                                                                                                                                   |                                       | P       |
|           | Visible and infrared radiant exposure (380 nm to 3000 nm) of the skin shall be limited to:                                                                                                                                                                                                   |                                       | P       |

| IEC 62471 |                                                                                                                                                                                        |                 |         |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------|
| Clause    | Requirement + Test                                                                                                                                                                     | Result – Remark | Verdict |
|           | $E_H \cdot t = \sum_{380}^{3000} \sum_i E_{\lambda}(\lambda, t) \cdot \Delta\lambda \cdot \Delta t \leq 20\,000 \cdot t^{0,25} \quad \text{J} \cdot \text{m}^{-2}$                     |                 | P       |
| <b>5</b>  | <b>MEASUREMENT OF LAMPS AND LAMP SYSTEMS</b>                                                                                                                                           |                 | P       |
| 5.1       | Measurement conditions                                                                                                                                                                 |                 | P       |
|           | Measurement conditions shall be reported as part of the evaluation against the exposure limits and the assignment of risk classification.                                              |                 | P       |
| 5.1.1     | Lamp ageing (seasoning)                                                                                                                                                                | Not lamps       | N/A     |
|           | Seasoning of lamps shall be done as stated in the appropriate IEC lamp standard.                                                                                                       |                 | N/A     |
| 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                                                                                                                                                                         |                 | N/A     |
|           | Operation of the test lamp shall be provided in accordance with:                                                                                                                       |                 | N/A     |
|           | – the appropriate IEC lamp standard, or                                                                                                                                                |                 | N/A     |
|           | – the manufacturer's recommendation                                                                                                                                                    |                 | N/A     |
| 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/A     |
|           | – 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       |
|           | 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/A     |
|           | The measurements made with an optical system.                                                                                                                                          |                 | N/A     |
|           | 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/A     |

| IEC 62471 |                                                                                                                                                                                                                               |                         |         |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|---------|
| Clause    | Requirement + Test                                                                                                                                                                                                            | Result – Remark         | Verdict |
| 5.2.2.2   | Alternative method                                                                                                                                                                                                            |                         | N/A     |
|           | Alternatively to an imaging radiance set-up, an irradiance measurement set-up with a circular field stop placed at the source can be used to perform radiance measurements.                                                   |                         | N/A     |
| 5.2.3     | Measurement of source size                                                                                                                                                                                                    |                         | P       |
|           | The determination of $\alpha$ , 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/A     |
|           | The determination of $\Delta t$ , the nominal pulse duration of a source, requires the determination of the time during which the emission is > 50% of its peak value.                                                        |                         | N/A     |
| 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.                                                                    | See table 4.1           | P       |
| 5.3.2     | Calculations                                                                                                                                                                                                                  |                         | P       |
|           | The calculation of source hazard values shall be performed by weighting the spectral scan by the appropriate function and calculating the total weighted energy.                                                              |                         | P       |
| 5.3.3     | Measurement uncertainty                                                                                                                                                                                                       |                         | P       |
|           | The quality of all measurement results must be quantified by an analysis of the uncertainty.                                                                                                                                  | See Annex C in the norm | P       |
| <b>6</b>  | <b>LAMP CLASSIFICATION</b>                                                                                                                                                                                                    |                         | P       |
|           | For the purposes of this standard it was decided that the values shall be reported as follows:                                                                                                                                | See table 6.1           | P       |
|           | – for lamps intended for general lighting service, the hazard values shall be reported as either irradiance or radiance values at a distance which produces an illuminance of 500 lux, but not at a distance less than 200 mm |                         | P       |
|           | – for all other light sources, including pulsed lamp sources, the hazard values shall be reported at a distance of 200 mm                                                                                                     |                         | N/A     |
| 6.1       | Continuous wave lamps                                                                                                                                                                                                         |                         | P       |
| 6.1.1     | Exempt Group                                                                                                                                                                                                                  |                         | P       |
|           | In the exempt group are lamps, which don't 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       |

| IEC 62471 |                                                                                                                                                                    |                 |         |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------|
| Clause    | Requirement + Test                                                                                                                                                 | Result – Remark | Verdict |
|           | – a retinal blue-light hazard ( $L_B$ ) within 10000 s (about 2,8 h), nor                                                                                          |                 | P       |
|           | – a retinal thermal hazard ( $L_R$ ) within 10 s, nor                                                                                                              |                 | P       |
|           | – an infrared radiation hazard for the eye ( $E_{IR}$ ) within 1000 s                                                                                              |                 | P       |
| 6.1.2     | Risk Group 1 (Low-Risk)                                                                                                                                            |                 | N/A     |
|           | In this group are lamps, which exceeds the limits for the except group but that does not pose:                                                                     |                 | N/A     |
|           | – an actinic ultraviolet hazard ( $E_S$ ) within 10000 s, nor                                                                                                      |                 | N/A     |
|           | – a near ultraviolet hazard ( $E_{UVA}$ ) within 300 s, nor                                                                                                        |                 | N/A     |
|           | – a retinal blue-light hazard ( $L_B$ ) within 100 s, nor                                                                                                          |                 | N/A     |
|           | – a retinal thermal hazard ( $L_R$ ) within 10 s, nor                                                                                                              |                 | N/A     |
|           | – an infrared radiation hazard for the eye ( $E_{IR}$ ) within 100 s                                                                                               |                 | N/A     |
|           | 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/A     |
| 6.1.3     | Risk Group 2 (Moderate-Risk)                                                                                                                                       |                 | N/A     |
|           | This requirement is met by any lamp that exceeds the limits for Risk Group 1, but that does not pose:                                                              |                 | N/A     |
|           | – an actinic ultraviolet hazard ( $E_S$ ) within 1000 s exposure, nor                                                                                              |                 | N/A     |
|           | – a near ultraviolet hazard ( $E_{UVA}$ ) within 100 s, nor                                                                                                        |                 | N/A     |
|           | – a retinal blue-light hazard ( $L_B$ ) within 0,25 s (aversion response), nor                                                                                     |                 | N/A     |
|           | – a retinal thermal hazard ( $L_R$ ) within 0,25 s (aversion response), nor                                                                                        |                 | N/A     |
|           | – an infrared radiation hazard for the eye ( $E_{IR}$ ) within 10 s                                                                                                |                 | N/A     |
|           | 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/A     |
| 6.1.4     | Risk Group 3 (High-Risk)                                                                                                                                           |                 | N/A     |
|           | Lamps which exceed the limits for Risk Group 2 are in Group 3.                                                                                                     |                 | N/A     |
| 6.2       | Pulsed lamps                                                                                                                                                       |                 | N/A     |
|           | Pulse lamp criteria shall apply to a single pulse and to any group of pulses within 0,25 s.                                                                        |                 | N/A     |
|           | A pulsed lamp shall be evaluated at the highest nominal energy loading as specified by the manufacturer.                                                           |                 | N/A     |
|           | The risk group determination of the lamp being tested shall be made as follows:                                                                                    |                 | N/A     |



| IEC 62471 |                                                                                                                                                                                                                                                          |                 |         |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------|
| Clause    | Requirement + Test                                                                                                                                                                                                                                       | Result – Remark | Verdict |
|           | – a lamp that exceeds the exposure limit shall be classified as belonging to Risk Group 3 (High-Risk)                                                                                                                                                    |                 | N/A     |
|           | – for single pulsed lamps, a lamp whose weighted radiant exposure or weighted radiance does is below the EL shall be classified as belonging to the Exempt Group                                                                                         |                 | N/A     |
|           | – for repetitively pulsed lamps, a lamp whose weighted radiant exposure or weighted radiance dose is below the EL, shall be evaluated using the continuous wave risk criteria discussed in clause 6.1, using time averaged values of the pulsed emission |                 | N/A     |

| IEC 62471 |                    |                 |         |
|-----------|--------------------|-----------------|---------|
| 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                                |   |
| 308                                                                                                                                                                                                | 0,026                                   | 395                                                                            | 0,000036                                |   |
| 310                                                                                                                                                                                                | 0,015                                   | 400                                                                            | 0,000030                                |   |
| <sup>1</sup> Wavelengths chosen are representative: other values should be obtained by logarithmic interpolation at intermediate wavelengths.<br>* Emission lines of a mercury discharge spectrum. |                                         |                                                                                |                                         |   |

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

| <b>Table 4.2</b> | Spectral weighting functions for assessing retinal hazards from broadband optical sources |                                         | N/A |
|------------------|-------------------------------------------------------------------------------------------|-----------------------------------------|-----|
| Wavelength<br>nm | Blue-light hazard function<br>B ( $\lambda$ )                                             | Burn hazard function<br>R ( $\lambda$ ) |     |
| 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                                    |     |

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

| Table 5.4               | Summary of the ELs for the surface of the skin or cornea (irradiance based values) |                     |                       |                             |                                                     | P |
|-------------------------|------------------------------------------------------------------------------------|---------------------|-----------------------|-----------------------------|-----------------------------------------------------|---|
| Hazard Name             | Relevant equation                                                                  | Wavelength range nm | Exposure duration sec | Limiting aperture rad (deg) | EL in terms of constant irradiance $W \cdot m^{-2}$ |   |
| Actinic UV skin & eye   | $E_S = \sum E_\lambda \cdot S(\lambda) \cdot \Delta\lambda$                        | 200 – 400           | < 30000               | 1,4 (80)                    | 30/t                                                |   |
| Eye UV-A                | $E_{UVA} = \sum E_\lambda \cdot \Delta\lambda$                                     | 315 – 400           | $\leq 1000$<br>>1000  | 1,4 (80)                    | 10000/t<br>10                                       |   |
| Blue-light small source | $E_B = \sum E_\lambda \cdot B(\lambda) \cdot \Delta\lambda$                        | 300 – 700           | $\leq 100$<br>>100    | < 0,011                     | 100/t<br>1,0                                        |   |
| Eye IR                  | $E_{IR} = \sum E_\lambda \cdot \Delta\lambda$                                      | 780 – 3000          | $\leq 1000$<br>>1000  | 1,4 (80)                    | 18000/t <sup>0,75</sup><br>100                      |   |
| Skin thermal            | $E_H = \sum E_\lambda \cdot \Delta\lambda$                                         | 380 – 3000          | < 10                  | 2π sr                       | 20000/t <sup>0,75</sup>                             |   |

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

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

| Table 6.1                               |                     |                  |                                     | Emission limits for risk groups of continuous wave lamps |          |          |        |          |        | P |
|-----------------------------------------|---------------------|------------------|-------------------------------------|----------------------------------------------------------|----------|----------|--------|----------|--------|---|
| Risk                                    | Action spectrum     | Symbol           | Units                               | Emission Measurement                                     |          |          |        |          |        |   |
|                                         |                     |                  |                                     | Exempt                                                   |          | Low risk |        | Mod risk |        |   |
|                                         |                     |                  |                                     | Limit                                                    | Result   | Limit    | Result | Limit    | Result |   |
| Actinic UV                              | S <sub>UV</sub> (λ) | E <sub>s</sub>   | W•m <sup>-2</sup>                   | 0,001                                                    | 9.38e-06 | 0,003    | -      | 0,03     | -      |   |
| Near UV                                 |                     | E <sub>UVA</sub> | W•m <sup>-2</sup>                   | 10                                                       | 1.66e-03 | 33       | -      | 100      | -      |   |
| Blue light                              | B(λ)                | L <sub>B</sub>   | W•m <sup>-2</sup> •sr <sup>-1</sup> | 100                                                      | 1.12e+01 | 10000    | -      | 4000000  | -      |   |
| Blue light, small source                | B(λ)                | E <sub>B</sub>   | W•m <sup>-2</sup>                   | 1,0*                                                     | -        | 1,0      | -      | 400      | -      |   |
| Retinal thermal                         | R(λ)                | L <sub>R</sub>   | W•m <sup>-2</sup> •sr <sup>-1</sup> | 28000/α                                                  | 7.92e+02 | 28000/α  | -      | 71000/α  | -      |   |
| Retinal thermal, weak visual stimulus** | R(λ)                | L <sub>IR</sub>  | W•m <sup>-2</sup> •sr <sup>-1</sup> | 6000/α                                                   | 1.74e-01 | 6000/α   | -      | 6000/α   | -      |   |
| IR radiation, eye                       |                     | E <sub>IR</sub>  | W•m <sup>-2</sup>                   | 100                                                      | 2.47e-03 | 570      | -      | 3200     | -      |   |

\* Small source defined as one with α < 0,011 radian. Averaging field of view at 10000 s is 0.1 radian.

\*\* Involves evaluation of non-GLS source

| IEC 62471B ATTACHMENT |                    |                 |         |
|-----------------------|--------------------|-----------------|---------|
| Clause                | Requirement + Test | Result – Remark | Verdict |

| <b>ATTACHMENT TO TEST REPORT IEC 62471</b><br><b>EUROPEAN GROUP DIFFERENCES AND NATIONAL DIFFERENCES</b><br>Photobiological safety of lamps and lamps systems |                                                                                                                                                                                                                                                                                                                                                                                                   |                        |     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-----|
| <b>Differences according to</b> .....: EN 62471:2008                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                   |                        |     |
| <b>TRF template used</b> .....: IEC EE OD-2020-F2:2020, Ed. 1.1                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                   |                        |     |
| <b>Attachment Form No.</b> .....: EU_GD_IEC62471B                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                   |                        |     |
| <b>Attachment Originator</b> .....: OVE                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                   |                        |     |
| <b>Master Attachment</b> .....: Dated 2021-04-29                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                   |                        |     |
| Copyright © 2021 IEC System for Conformity Testing and Certification of Electrical Equipment (IECEE), Geneva, Switzerland. All rights reserved.               |                                                                                                                                                                                                                                                                                                                                                                                                   |                        |     |
|                                                                                                                                                               | <b>CENELEC COMMON MODIFICATIONS (EN)</b>                                                                                                                                                                                                                                                                                                                                                          |                        |     |
| <b>4</b>                                                                                                                                                      | <b>EXPOSURE LIMITS</b>                                                                                                                                                                                                                                                                                                                                                                            |                        | P   |
|                                                                                                                                                               | Contents of the whole Clause 4 of IEC 62471:2006 moved into a new informative Annex ZB                                                                                                                                                                                                                                                                                                            |                        | —   |
|                                                                                                                                                               | Clause 4 replaced by the following:                                                                                                                                                                                                                                                                                                                                                               |                        | P   |
|                                                                                                                                                               | The original Clause 4 of IEC 62471:2006 contains provisions governing limiting values for the exposure of persons falling within the area of the health and safety of workers. Within Europe those limiting values are already covered by the Artificial Optical Radiation Directive (2006/25/EC). Thus, the limits of the directive have to be applied instead of those fixed in IEC 62471:2006. | See appended Table 6.1 | P   |
|                                                                                                                                                               | There are no differences in EN 62471:2008 regarding the classification of lamps according Clause 6 of IEC 62471:2006.                                                                                                                                                                                                                                                                             |                        | —   |
| <b>4.1</b>                                                                                                                                                    | <b>General</b>                                                                                                                                                                                                                                                                                                                                                                                    |                        | N/A |
|                                                                                                                                                               | Delete the first paragraph.                                                                                                                                                                                                                                                                                                                                                                       |                        | —   |

| Table 6.1                               |                     | Emission limits for risk groups of continuous wave lamps<br>(based on EU Directive 2006/25/EC) |                                     |                                |          |          |        |          | P      |  |
|-----------------------------------------|---------------------|------------------------------------------------------------------------------------------------|-------------------------------------|--------------------------------|----------|----------|--------|----------|--------|--|
| Risk                                    | Action spectrum     | Symbol                                                                                         | Units                               | Emission Measurement           |          |          |        |          |        |  |
|                                         |                     |                                                                                                |                                     | Exempt                         |          | Low risk |        | Mod risk |        |  |
|                                         |                     |                                                                                                |                                     | Limit                          | Result   | Limit    | Result | Limit    | Result |  |
| Actinic UV                              | S <sub>UV</sub> (λ) | E <sub>s</sub>                                                                                 | W•m <sup>-2</sup>                   | 0,001                          | 9.38e-06 | -        | -      | -        | -      |  |
| Near UV                                 |                     | E <sub>UVA</sub>                                                                               | W•m <sup>-2</sup>                   | 0,33                           | 1.66e-03 | -        | -      | -        | -      |  |
| Blue light                              | B(λ)                | L <sub>B</sub>                                                                                 | W•m <sup>-2</sup> •sr <sup>-1</sup> | 100                            | 1.12e+01 | 10000    | -      | 4000000  | -      |  |
| Blue light, small source                | B(λ)                | E <sub>B</sub>                                                                                 | W•m <sup>-2</sup>                   | 0,01                           | -        | 1,0      | -      | 400      | -      |  |
| Retinal thermal                         | R(λ)                | L <sub>R</sub>                                                                                 | W•m <sup>-2</sup> •sr <sup>-1</sup> | 28000/α                        | 7.92e+02 | 28000/α  | -      | 71000/α  | -      |  |
| Retinal thermal, weak visual stimulus** | R(λ)                | L <sub>IR</sub>                                                                                | W•m <sup>-2</sup> •sr <sup>-1</sup> | 545000<br>0,0017≤<br>α ≤ 0,011 | -        |          |        |          |        |  |
|                                         |                     |                                                                                                |                                     | 6000/α<br>0,011≤ α<br>≤ 0,1    | 1.74e-01 |          |        |          |        |  |
| IR radiation, eye                       |                     | E <sub>IR</sub>                                                                                | W•m <sup>-2</sup>                   | 100                            | 2.47e-03 | 570      | -      | 3200     | -      |  |

\* Small source defined as one with α < 0,011 radian. Averaging field of view at 10000 s is 0.1 radian.

\*\* Involves evaluation of non-GLS source

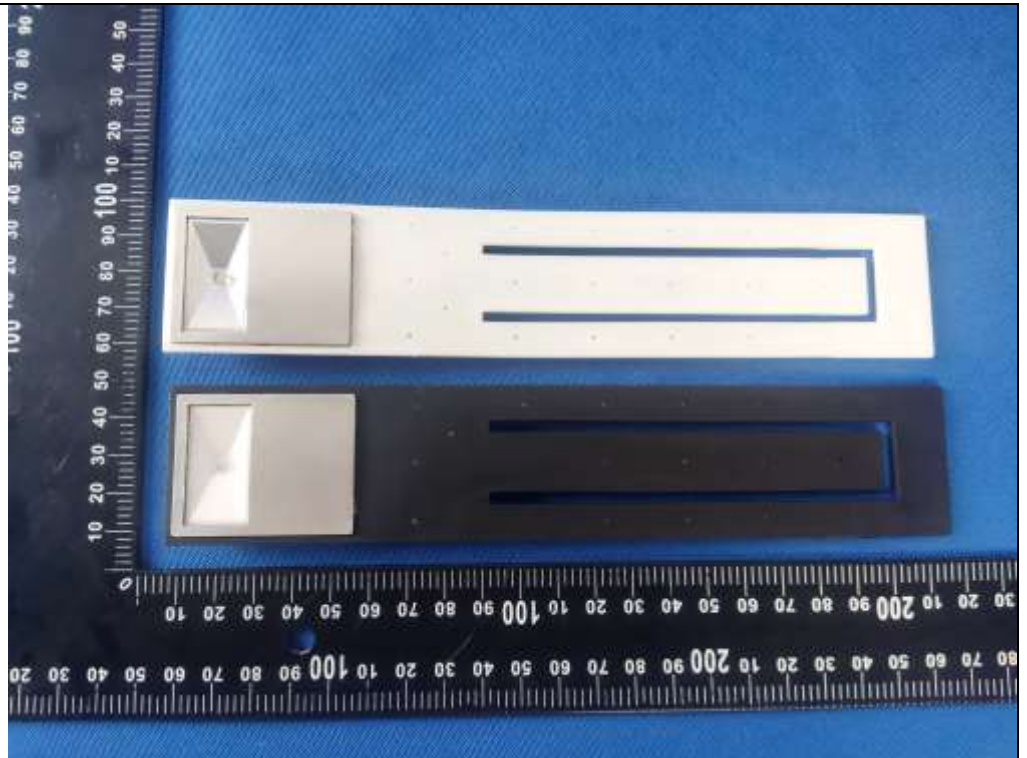
NOTE The action functions: see Table 4.1 and Table 4.2  
The applicable aperture diameters: see 4.2.1  
The limitations for the angular subtenses: see 4.2.2  
The related measurement condition 5.2.3 and the range of acceptance angles: see Table 5.5.  
α= 0.0245 radian.

**Appendix 1**  
**Photo Documentation**

**PHOTO 1**

View:

- ☒ front  
☐ rear  
☐ right side  
☐ left side  
☐ top  
☐ bottom  
☐ internal

**PHOTO 2**

View:

- ☒ front  
☐ rear  
☐ right side  
☐ left side  
☐ top  
☐ bottom  
☐ internal





**Photo Documentation****PHOTO 3**

View:

- ☐ front
- ☐ rear
- ☐ right side
- ☐ left side
- ☐ top
- ☐ bottom
- ☒ internal



-End of report-