

This is a preview - click here to buy the full publication



IEC 62471-5

Edition 1.0 2015-06

INTERNATIONAL STANDARD



Photobiological safety of lamps and lamp systems – Part 5: Image projectors

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.140

ISBN 978-2-8322-2737-4

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

| | |
|--|----|
| FOREWORD..... | 5 |
| INTRODUCTION..... | 7 |
| 1 Scope..... | 8 |
| 2 Normative references..... | 8 |
| 3 Terms and definitions | 9 |
| 4 General | 15 |
| 4.1 Basis for risk groups | 15 |
| 4.2 Example applications | 16 |
| 4.2.1 RG0 / RG1 projectors..... | 16 |
| 4.2.2 RG2 projectors..... | 16 |
| 4.2.3 RG3 projectors..... | 16 |
| 4.3 Projector lamps..... | 16 |
| 4.4 Assessment criteria (background)..... | 16 |
| 5 Risk group determination | 17 |
| 5.1 Test conditions..... | 17 |
| 5.2 Measurement conditions for image projectors | 18 |
| 5.2.1 Measurement throw ratio | 18 |
| 5.2.2 Measurement distance | 18 |
| 5.3 The position and size of apparent source, the calculation of angular subtense..... | 18 |
| 5.4 Measurement of irradiance – specified apertures | 19 |
| 5.5 Measurement of radiance | 19 |
| 5.6 Accessible emission limits | 20 |
| 5.6.1 For CW emission..... | 20 |
| 5.6.2 For pulsed emission | 21 |
| 5.6.3 Spectral weighting functions..... | 22 |
| 5.7 Applying information from the lamp manufacturers | 23 |
| 5.7.1 General | 23 |
| 5.7.2 Limits provided in irradiance/radiant exposure | 24 |
| 5.7.3 Limits provided in radiance or radiance dose | 24 |
| 6 Manufacturer's requirements..... | 24 |
| 6.1 General..... | 24 |
| 6.2 Determination of HD (hazard distance) | 25 |
| 6.3 Safety feature "soft start" | 25 |
| 6.4 Optional safety features | 25 |
| 6.4.1 Projection of warning message..... | 25 |
| 6.4.2 Power reduction by sensor system | 25 |
| 6.5 Labelling on products | 25 |
| 6.5.1 General | 25 |
| 6.5.2 RG0 projector | 26 |
| 6.5.3 RG1 projector | 26 |
| 6.5.4 RG2 projector | 27 |
| 6.5.5 RG3 projector | 28 |
| 6.6 User information..... | 28 |
| 6.6.1 General | 28 |
| 6.6.2 Assessment of user accessible area | 29 |

| | | |
|-----------------------|--|----|
| 6.6.3 | User information (user manual) | 29 |
| 6.6.4 | User information for maintenance | 30 |
| 6.7 | Labelling and user information for image projectors where the risk group will be changed by interchangeable lens | 30 |
| 6.7.1 | General | 30 |
| 6.7.2 | Labelling on the projector | 30 |
| 6.7.3 | Mark on the interchangeable lens | 32 |
| 6.7.4 | The user information in the user manual of the projector | 32 |
| 6.7.5 | The user information in the user manual of the interchangeable lens | 32 |
| 7 | Information for service | 33 |
| Annex A (normative) | Test scheme for lamp types | 34 |
| Annex B (informative) | Example of calculations | 35 |
| B.1 | Radiance calculations | 35 |
| B.1.1 | General | 35 |
| B.1.2 | Calculation from measured irradiance | 35 |
| B.1.3 | Calculation from luminous output | 36 |
| B.2 | Calculation example of risk group (CW) | 37 |
| B.2.1 | Example of a 5 000 lm projector | 37 |
| B.2.2 | 10 000 lm professional-use projector with an apparent source of small subtense angle (CW) | 39 |
| B.2.3 | 2 000 lm projector with small apparent source (CW) | 40 |
| B.3 | Calculation example of risk group (pulsed emission) | 41 |
| B.3.1 | General | 41 |
| B.3.2 | 14 000 lm projector with one peak | 41 |
| B.3.3 | 14 000 lm projector with two peaks | 44 |
| Annex C (informative) | Example of intra-beam of projector sources with millimetre scale | 47 |
| Annex D (informative) | Measurement distance | 48 |
| Annex E (informative) | Hazard distance as a function of modifying optics | 50 |
| Bibliography | | 51 |
| Figure 1 | – Exit pupil in projector | 10 |
| Figure 2 | – Examples of the application of the definition of pulse duration | 13 |
| Figure 3 | – Definition of throw ratio | 15 |
| Figure 4 | – Diameter of the apparent source | 18 |
| Figure 5 | – RG1 label (optional) | 26 |
| Figure 6 | – RG2 label | 27 |
| Figure 7 | – RG2 caution symbol | 27 |
| Figure 8 | – Sample design of RG2 caution pictogram | 27 |
| Figure 9 | – RG3 label | 28 |
| Figure 10 | – Optical radiation warning symbol | 28 |
| Figure 11 | – "Not for household use" symbol | 28 |
| Figure 12 | – RG2 label with the caution for RG3 | 31 |
| Figure 13 | – RG2 caution label with the caution for RG3 | 31 |
| Figure 14 | – RG2 pictogram with the caution for RG3 | 32 |
| Figure B.1 | – Image of the apparent source and measurement condition | 37 |

| | |
|---|----|
| Figure B.2 – Picture of the apparent source of a projector at the exit pupil of the projection lenses with a scale..... | 37 |
| Figure B.3 – Example with one peak of pulsed emission | 42 |
| Figure B.4 – Example with two peaks of pulsed emission..... | 44 |
| Figure C.1 – Examples of intra-beam images of projector sources with millimetre scale..... | 47 |
| Figure E.1 – Hazard distance as a function of modifying optics (example)..... | 50 |
| | |
| Table 1 – Measurement criteria — field of view (angles of acceptance) for CW source | 19 |
| Table 2 – Measurement criteria — field of view (angles of acceptance) for pulsed source | 19 |
| Table 3 – AEL (accessible emission limits) for risk groups of lamps and lamp systems emitting CW optical radiation..... | 20 |
| Table 4 – Time base values associated with the risk groups and hazards..... | 20 |
| Table 5 – Basic retinal thermal emission limit | 20 |
| Table 6 – The values of C_5 and α for AEL calculation | 21 |
| Table 7 – Pulse duration dependent values of α_{\max} | 22 |
| Table 8 – Spectral weighting functions $B(\lambda)$ and $R(\lambda)$ for assessing retinal hazards | 23 |
| Table 9 – Labelling on products | 26 |
| Table 10 – User information in user manual..... | 29 |
| Table A.1 –Required evaluations..... | 34 |

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PHOTOBIOLOGICAL SAFETY OF LAMPS AND LAMP SYSTEMS –

Part 5: Image projectors

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 62471-5 has been prepared by IEC technical committee 76: Optical radiation safety and laser equipment.

The text of this standard is based on the following documents:

| FDIS | Report on voting |
|-------------|------------------|
| 76/519/FDIS | 76/521/RVD |

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

Most lamps and lamp systems are safe and do not pose photobiological risks except under unusual exposure conditions. This also is the case for optical image projectors where experience shows that even high power cinema projectors may be safe for accidental momentary viewing and can only under some conditions pose optical hazards at close distances or for intentional 'long-duration' staring into the source. The rapid development of solid-state and other lamps or lamp systems has permitted new projector products, and generated the need for a photobiological safety standard for this group of lamp systems.

Optical radiation hazards from all types of lamps and lamp systems are currently assessed by the application of IEC 62471:2006 (CIE S 009:2002), *Photobiological safety of lamps and lamp systems*. IEC 62471 covers LEDs, incandescent, low- and high-pressure gas-discharge, arc and other lamps. Following the concept of vertical standards, the risk group classification system in IEC 62471 for lamps is to be adapted for specific product groups such as image projectors.

This part of IEC 62471 provides a risk group classification system for image projectors, and measurement conditions for optical radiation emitted by image projectors. It includes manufacturing requirements that may be required as a result of an image projector system being assigned to a particular risk group. Therefore, this part of IEC 62471 provides safety requirements for lamp systems that are intended to produce projected visible optical radiation, such as theatre projectors, data projectors and home-use projectors. The assigned risk group of a projector product also may be used by projector manufacturers to assist with any risk assessments, e.g. for occupational exposure in workplaces. National requirements may exist for the assessment of products or occupational exposure.

The emission limits provided in this part of IEC 62471 are derived from the exposure limits specified by ICNIRP in their 2013 Guidelines for incoherent visible and infrared radiation [1]¹. These exposure limits are also the basis for the emission limits to be specified in the future International Standard IEC 62471-1².

¹ Numbers in square brackets refer to the Bibliography.

² Revision of IEC 62471:2006.

PHOTOBIOLOGICAL SAFETY OF LAMPS AND LAMP SYSTEMS –

Part 5: Image projectors

1 Scope

This part of IEC 62471 provides requirements regarding photobiological safety of the optical radiation emitted by image projectors. This part of IEC 62471 does not deal with other hazards such as electrical, mechanical or fire hazards.

This part of IEC 62471 provides requirements regarding:

- optical radiation safety assessment of image projectors;
- projector risk groups;
- testing conditions and measurement conditions;
- manufacturer's requirements including user information.

The scope of this part of IEC 62471 is photobiological safety of image projectors including the emissions from laser-illuminated projectors that fulfill the requirements as specified in IEC 60825-1:2014, 4.4 and for which visible light emission has been excluded from classification in IEC 60825-1.

This part of IEC 62471 does not address safety requirements for laser display products where collimated laser beams — generally scanned — are employed. It does address those laser-illuminated projectors that employ a laser source to illuminate, for example, a micro-electro-mechanical system (MEMS) without scanned beams or crystal-based display projector system.

NOTE Image projectors containing lasers are subject to those provisions of IEC 60825-1 applicable to the embedded laser. See IEC 60825-1:2014, 4.4 for which visible light emission has been excluded from the laser product classification.

This part of IEC 62471 includes projectors for only visible image projection and does not include ultraviolet (UV) projectors, infrared (IR) projectors, general lighting service (GLS) lamps (GLS; defined in IEC 62471) or projector lamp systems used for general lighting, which are treated in separate International Standards.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62471, *Photobiological safety of lamps and lamp systems*

IEC 60825-1:2014, *Safety of laser products – Part 1: Equipment classification and requirements*

IEC 60050 (all parts), *International Electrotechnical Vocabulary* (available at <http://www.electropedia.org>)

IEC 60950-1, *Information technology equipment – Safety – Part 1: General requirements*

[This is a preview - click here to buy the full publication](#)

IEC 62471-5:2015 © IEC 2015

– 9 –

IEC 60065, *Audio, video and similar electronic apparatus – Safety requirements*