

© Copyright SEK. Reproduction in any form without permission is prohibited.

Fotobiologisk säkerhet hos lampor och lampsystem – Del 5: Bildprojektorer

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

Som svensk standard gäller europastandarden EN 62471-5:2015. Den svenska standarden innehåller den officiella engelska språkversionen av EN 62471-5:2015.

Nationellt förord

Europastandarden EN 62471-5:2015

består av:

- **europastandardens ikraftsättningsdokument**, utarbetat inom CENELEC
- **IEC 62471-5, First edition, 2015 - Photobiological safety of lamps and lamp systems - Part 5: Image projectors**

utarbetad inom International Electrotechnical Commission, IEC.

Standarder underlättar utvecklingen och höjer elsäkerheten

Det finns många fördelar med att ha gemensamma tekniska regler för bl a mätning, säkerhet och provning och för utförande, skötsel och dokumentation av elprodukter och elanläggningar.

Genom att utforma sådana standarder blir säkerhetsfordringar tydliga och utvecklingskostnaderna rimliga samtidigt som marknadens acceptans för produkten eller tjänsten ökar.

Många standarder inom elområdet beskriver tekniska lösningar och metoder som åstadkommer den elsäkerhet som föreskrivs av svenska myndigheter och av EU.

SEK är Sveriges röst i standardiseringsarbetet inom elområdet

SEK Svensk Elstandard svarar för standardiseringen inom elområdet i Sverige och samordnar svensk medverkan i internationell och europeisk standardisering. SEK är en ideell organisation med frivilligt deltagande från svenska myndigheter, företag och organisationer som vill medverka till och påverka utformningen av tekniska regler inom elektrotekniken.

SEK samordnar svenska intressenters medverkan i SEKs tekniska kommittéer och stödjer svenska experters medverkan i internationella och europeiska projekt.

Stora delar av arbetet sker internationellt

Utformningen av standarder sker i allt väsentligt i internationellt och europeiskt samarbete. SEK är svensk nationalkommitté av International Electrotechnical Commission (IEC) och Comité Européen de Normalisation Electrotechnique (CENELEC).

Standardiseringsarbetet inom SEK är organiserat i referensgrupper bestående av ett antal tekniska kommittéer som speglar hur arbetet inom IEC och CENELEC är organiserat.

Arbetet i de tekniska kommittéerna är öppet för alla svenska organisationer, företag, institutioner, myndigheter och statliga verk. Den årliga avgiften för deltagandet och intäkter från försäljning finansierar SEKs standardiseringsverksamhet och medlemsavgift till IEC och CENELEC.

Var med och påverka!

Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

Du som vill dra nytta av dessa möjligheter är välkommen att kontakta SEKs kansli för mer information.

SEK Svensk Elstandard

Box 1284
164 29 Kista
Tel 08-444 14 00
www.elstandard.se

English Version

**Photobiological safety of lamps and lamp systems - Part 5:
Image projectors
(IEC 62471-5:2015)**

Sécurité photobiologique des lampes et des appareils
utilisant des lampes - Partie 5: Projecteurs d'images
(IEC 62471-5:2015)

Photobiologische Sicherheit von Lampen und
Lampensystemen - Teil 5: Photobiologische Sicherheit von
Lampensystemen für Bildprojektoren
(IEC 62471-5:2015)

This European Standard was approved by CENELEC on 2015-07-14. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

European Foreword

The text of document 76/519/FDIS, future edition 1 of IEC 62471-5, prepared by IEC/TC 76 "Optical radiation safety and laser equipment" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62471-5:2015.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2016-04-16
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2018-07-14

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 62471-5:2015 was approved by CENELEC as a European Standard without any modification.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u> <u>series</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u> <u>series</u>
IEC 60050		International Electrotechnical Vocabulary - -		
IEC 60065	-	Audio, video and similar electronic apparatus - Safety requirements	EN 60065	-
IEC 60825-1	2014	Safety of laser products -- Part 1: Equipment classification and requirements	EN 60825-1	2014
IEC 60950-1	-	Information technology equipment - Safety -- Part 1: General requirements	EN 60950-1	-
IEC 62471	-	Photobiological safety of lamps and lamp systems	EN 62471	-

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 $\alpha_{\max}$	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*

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