

**LASERTOODETE OHUTUS. OSA 1: SEADMETE
KLASSIFIKATSIOON JA NÕUDED**

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

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN 60825-1:2014 +A11:2021 sisaldab Euroopa standardi EN 60825-1:2014 ja selle muudatuste A11:2021 ja paranduse AC:2017 ja muudatuse A11 paranduse AC:2022 ingliskeelset teksti.	This Estonian standard EVS-EN 60825-1:2014 +A11:2021 consists of the English text of the European standard EN 60825-1:2014 and its amendment A11:2021 and its corrigendum AC:2017 and AC:2022.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas. Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 08.08.2014, muudatus A11 19.02.2021.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation and Accreditation. Date of Availability of the European standard is 08.08.2014, for A11 19.02.2021.
Muudatusega A11 lisatud või muudetud teksti algus ja lõpp on tekstis tähistatud sümbolitega A11 A11 . Parandusega AC:2017 lisatud või muudetud teksti algus ja lõpp on tekstis tähistatud sümbolitega AC AC . Parandusega AC:2022 lisatud või muudetud teksti algus ja lõpp on tekstis tähistatud sümbolitega AC2 AC2 . Standard on kättesaadav Eesti Standardimis-ja Akrediteerimiskeskusest.	The start and finish of text introduced or altered by amendment A11 is indicated in the text by tags A11 A11 . The start and finish of text introduced or altered by corrigendum AC:2017 is indicated in the text by tags AC AC . The start and finish of text introduced or altered by corrigendum AC:2022 is indicated in the text by tags AC2 AC2 . The standard is available from the Estonian Centre for Standardisation and Accreditation.

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English Version

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

Sécurité des appareils à laser - Partie 1: Classification des matériels et exigences
(CEI 60825-1:2014)

Sicherheit von Lasereinrichtungen - Teil 1: Klassifizierung von Anlagen und Anforderungen
(IEC 60825-1:2014)

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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Foreword

The text of document 76/502/FDIS, future edition 3 of IEC 60825-1, 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 60825-1:2014.

The following dates are fixed:

- latest date by which the document has to be implemented (dop) 2015-03-19
at national level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with (dow)  2019-06-19 
the document have to be withdrawn

This document supersedes EN 60825-1:2007.

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Endorsement notice

The text of the International Standard IEC 60825-1:2014 was approved by CENELEC as a European Standard without any modification.

IEC 60027-1	NOTE	Harmonised in EN 60027-1.
IEC 60065	NOTE	Harmonised as EN 60065.
IEC 60079 (Series)	NOTE	Harmonised as EN 60079 (Series).
IEC 60204-1	NOTE	Harmonised as EN 60204-1.
IEC 60601-2-22	NOTE	Harmonised as EN 60601-2-22.
IEC 60825-2	NOTE	Harmonised as EN 60825-2.
IEC 60825-4	NOTE	Harmonised as EN 60825-4.
IEC 60825-12	NOTE	Harmonised as EN 60825-12.
IEC 60950 (Series)	NOTE	Harmonised as EN 60950 (Series).
IEC 61010-1	NOTE	Harmonised as EN 61010-1.
IEC 61508 (Series)	NOTE	Harmonised as EN 61508 (Series).
IEC 62115	NOTE	Harmonised as EN 62115.
IEC 62368-1	NOTE	Harmonised as EN 62368-1.
IEC/ISO 11553 (Series)	NOTE	Harmonised as EN ISO 11553 (Series).
ISO 11146-1	NOTE	Harmonised as EN ISO 11146-1.
ISO 12100	NOTE	Harmonised as EN ISO 12100.
ISO 13694	NOTE	Harmonised as EN ISO 13694.
ISO 13849 (Series)	NOTE	Harmonised as EN ISO 13849 (Series).
ISO 15004-2:2007	NOTE	Harmonised as EN ISO 15004-2:2007.
ISO 80000-1	NOTE	Harmonised as EN ISO 80000-1.

A11 Amendment A11 European foreword

This document (EN 60825-1:2014/A11:2021) has been prepared by CLC/TC 76 “Optical radiation safety and laser equipment”.

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2022-01-18
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2024-01-18

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This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For the relationship with EU Directive(s) see informative Annex ZZ, which is an integral part of this document.

This document is expected to be read in conjunction with EN 50689¹ ‘Safety of laser products - Particular Requirements for Consumer Laser Products’, when available. **A11**

¹ Under preparation. Stage at the time of publication: prEN 50689:2019.

CONTENTS

FOREWORD.....	7
1 Scope and object.....	9
2 Normative references	11
3 Terms and definitions	11
4 Classification principles	25
4.1 General.....	25
4.2 Classification responsibilities	25
4.3 Classification rules.....	26
4.4 Laser products designed to function as conventional lamps	31
5 Determination of the accessible emission level and product classification	31
5.1 Tests	31
5.2 Measurement of laser radiation	33
5.3 Determination of the class of the laser product.....	33
5.4 Measurement geometry.....	42
5.4.1 General	42
5.4.2 Default (simplified) evaluation	43
5.4.3 Evaluation condition for extended sources	44
6 Engineering specifications	47
6.1 General remarks and modifications	47
6.2 Protective housing	47
6.2.1 General	47
6.2.2 Service	47
6.2.3 Removable laser system.....	48
6.3 Access panels and safety interlocks.....	48
6.4 Remote interlock connector.....	49
6.5 Manual reset.....	49
6.6 Key control	49
6.7 Laser radiation emission warning	49
6.8 Beam stop or attenuator.....	50
6.9 Controls	50
6.10 Viewing optics.....	50
6.11 Scanning safeguard	50
6.12 Safeguard for Class 1C products	50
6.13 "Walk-in" access	50
6.14 Environmental conditions	51
6.15 Protection against other hazards.....	51
6.15.1 Non-optical hazards.....	51
6.15.2 Collateral radiation	51
6.16 Power limiting circuit	51
7 Labelling.....	52
7.1 General.....	52
7.2 Class 1 and Class 1M	54
7.3 Class 1C	55
7.4 Class 2 and Class 2M	56
7.5 Class 3R	56
7.6 Class 3B	57

7.7	Class 4	57
7.8	Aperture label	58
7.9	Radiation output and standards information	58
7.10	Labels for access panels.....	59
7.10.1	Labels for panels	59
7.10.2	Labels for safety interlocked panels	60
7.11	Warning for invisible laser radiation	60
7.12	Warning for visible laser radiation	60
7.13	Warning for potential hazard to the skin or anterior parts of the eye	60
8	Other informational requirements.....	61
8.1	Information for the user	61
8.2	Purchasing and servicing information	62
9	Additional requirements for specific laser products	63
9.1	Other parts of the standard series IEC 60825.....	63
9.2	Medical laser products	63
9.3	Laser processing machines.....	63
9.4	Electric toys	63
9.5	Consumer electronic products.....	63
Annex A (informative)	Maximum permissible exposure values.....	65
A.1	General remarks	65
A.2	Limiting apertures	70
A.3	Repetitively pulsed or modulated lasers	71
A.4	Measurement conditions	72
A.4.1	General	72
A.4.2	Limiting aperture.....	72
A.4.3	Angle of acceptance	72
A.5	Extended source lasers.....	73
Annex B (informative)	Examples of calculations	74
B.1	Symbols used in the examples of this annex	74
B.2	Classification of a laser product – Introduction.....	75
B.3	Examples	79
Annex C (informative)	Description of the classes and potentially associated hazards	84
C.1	General.....	84
C.2	Description of classes.....	84
C.2.1	Class 1	84
C.2.2	Class 1M	84
C.2.3	Class 1C.....	85
C.2.4	Class 2	85
C.2.5	Class 2M	85
C.2.6	Class 3R.....	86
C.2.7	Class 3B.....	86
C.2.8	Class 4	86
C.2.9	Note on nomenclature.....	87
C.3	Limitations of the classification scheme	88
C.4	References	89
Annex D (informative)	Biophysical considerations	90
D.1	Anatomy of the eye	90
D.2	The effects of laser radiation on biological tissue	91

D.2.1	General	91
D.2.2	Hazards to the eye	93
D.2.3	Skin hazards.....	97
D.3	MPEs and irradiance averaging	97
D.4	Reference documents	98
Annex E (informative)	MPEs and AELs expressed as radiance	99
E.1	Background.....	99
E.2	Radiance values	99
E.3	Rationale	100
Annex F (informative)	Summary tables.....	103
Annex G (informative)	Overview of associated parts of IEC 60825.....	106
Annex ZA (normative)	Normative references to international publications with their corresponding European publications	108
A11 Annex ZB (informative)	Information for the Interpretation of 4.3, 4.4 and 6.3.2 A11	109
ZB.1	General remarks	109
ZB.2	Subclause 4.3 Classification rules (IEC 60825-1:2014/ISH1:2017)	109
ZB.2.1	General remarks.....	109
ZB.2.2	Subclause 4.3 c) (Radiation from extended sources)	109
ZB.2.3	Subclause 4.3 d) (Non-uniform, non-circular or multiple apparent sources).....	109
ZB.2.4	Subclause 4.3 f) 3); determination of α	111
ZB.2.5	Subclause 4.3 f) 3); groups of pulses with group duration longer than T_i	112
ZB.2.6	Subclause 4.3 f); simplifications.....	114
ZB.3	Subclause 4.4 conventional lamp replacement (IEC 60825-1:2014/ISH2:2017)	117
ZB.4	Subclause 6.3.2 – safety interlocks	118
A11 Annex ZZ (informative)	Relationship between this European standard and the safety objectives of Directive 2014/35/EU [2014 OJ L96] aimed to be covered A11	120
Bibliography.....		121
Figure 1 – Measurement set-up to limit angle of acceptance by imaging the apparent source onto the plane of the field stop		45
Figure 2 – Measurement set-up to limit angle of acceptance by placing a circular aperture or a mask (serving as field stop) close to the apparent source		46
Figure 3 – Warning label – Hazard symbol.....		53
Figure 4 – Explanatory label		54
Figure 5 – Alternative label for Class 1		55
Figure 6 – Alternative label for Class 1M.....		55
Figure 7 – Alternative label for Class 1C.....		55
Figure 8 – Alternative label for Class 2		56
Figure 9 – Alternative label for Class 2M.....		56
Figure 10 – Alternative label for Class 3R		57
Figure 11 – Alternative label for Class 3B		57
Figure 12 – Alternative label for Class 4		58
Figure 13 – Alternative label for laser aperture		58

Figure B.1 – Flowchart guide for the classification of laser products from supplied output parameters.....	76
Figure B.2 – Flowchart guide for the classification of Class 1M and Class 2M laser products.....	77
Figure B.3 – AEL for Class 1 ultra-violet laser products for selected emission durations from 10^{-9} s to 10^3 s	78
Figure B.4 – AEL for Class 1 ultra-violet laser products for emission durations from 10^{-9} s to 10^3 s at selected wavelengths.....	78
Figure B.5 – AEL for Class 1 visible and selected infra-red laser products (case $C_6 = 1$)	79
Figure D.1 – Anatomy of the eye.....	90
Figure D.2 – Diagram of laser-induced damage in biological systems	92
Figure E.1 – Radiance as a function of wavelength	99
Figure ZB.1 — Retinal image of a source pattern for the example of 20 emitters. Two possible groupings are defined by the respective angle of acceptance γ_x and γ_y	110
Figure ZB.2 — Example of three groups of pulses (each group duration is longer than T_i) where each group is considered as one “effective” pulse and C_5 is applied to the AEL that applies to the group duration, where C_5 is determined with the number of pulse groups within the evaluation duration (in the example of the figure $N = 3$).....	113
Figure ZB.3 — Example of a train of pulses consisting of pulses with a duration of 3 μ s and 7 μ s	115
Figure ZB.4 — Flow diagram to illustrate the interpretation of subclause 6.3.2.....	119
Table 1 – Additivity of effects on eye and skin of radiation of different spectral regions	27
Table 2 – Times below which pulse groups are summed	30
Table 3 – Accessible emission limits for Class 1 and Class 1M laser products and $C_6 = 1$	36
Table 4 – Accessible emission limits for Class 1 and Class 1M laser products in the wavelength range from 400 nm to 1 400 nm (retinal hazard region): extended sources	37
Table 5 – Accessible emission limits for Class 2 and Class 2M laser products	38
Table 6 – Accessible emission limits for Class 3R laser products and $C_6 = 1$	39
Table 7 – Accessible emission limits for Class 3R laser products in the wavelength range from 400 nm to 1 400 nm (retinal hazard region): extended sources	40
Table 8 – Accessible emission limits for Class 3B laser products	41
Table 9 – Correction factors and breakpoints for use in AEL and MPE evaluations	41
Table 10 – Measurement aperture diameters and measurement distances for the default (simplified) evaluation	44
Table 11 – Reference points for Condition 3	44
Table 12 – Limiting angle of acceptance γ_{ph}	46
Table 13 – Requirements for safety interlocking.....	48
Table A.1 – Maximum permissible exposure (MPE) for $C_6 = 1$ at the cornea expressed as irradiance or radiant exposure.....	66
Table A.2 – Maximum permissible exposure (MPE) at the cornea for extended sources in the wavelength range from 400 nm to 1 400 nm (retinal hazard region) expressed as irradiance or radiant exposure ^d	67

Table A.3 – Maximum permissible exposure (MPE) of Table A.1 ($C_6 = 1$) for the wavelength range from 400 nm to 1 400 nm expressed as power or energy ^{a, b}	68
Table A.4 – Maximum permissible exposure (MPE) of Table A.2 (extended sources) for the wavelength range from 400 nm to 1 400 nm expressed as power or energy ^{a, b, c, d, e, f, g}	69
Table A.5 – Maximum permissible exposure (MPE) of the skin to laser radiation	70
Table A.6 – Aperture diameters for measuring laser irradiance and radiant exposure	71
Table D.1 – Summary of pathological effects associated with excessive exposure to light	94
Table D.2 – Explanation of measurement apertures applied to the eye MPEs	97
Table E.1 – Maximum radiance of a diffused source for Class 1	100
Table F.1 – Summary of the physical quantities used in this Part 1	103
Table F.2 – Summary of manufacturer's requirements (1 of 2)	104
Table G.1 – Overview of additional data in associated parts of IEC 60825	107
Table ZZ.1 — Correspondence between this European standard and Annex I of Directive 2014/35/EU [2014 OJ L96]	120

INTERNATIONAL ELECTROTECHNICAL COMMISSION

SAFETY OF LASER PRODUCTS –

Part 1: Equipment classification and requirements

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.
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International Standard IEC 60825-1 has been prepared by IEC technical committee 76: Optical radiation safety and laser equipment.

This third edition of IEC 60825-1 cancels and replaces the second edition published in 2007. It constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a new class, Class 1C, was introduced;
- the measurement condition 2 ("eye loupe" condition) was removed;
- classification of the emission of laser products below a certain radiance level that are intended to be used as replacement for conventional light sources can, as an option, be based on the IEC 62471 series;

- the accessible emission limits (AELs) for Class 1, 1M, 2, 2M and 3R of pulsed sources, particularly of pulsed extended sources, were updated to reflect the latest revision of the ICNIRP guidelines on exposure limits (accepted for publication in Health Physics 105 (3): 271 – 295; 2013, see also www.icnirp.org).

This part of IEC 60825 has the status of a Group Safety Publication, in accordance with IEC Guide 104²⁾, for aspects of laser radiation pertaining to human safety.

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

FDIS	Report on voting
76/502/FDIS	76/506/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 list of all parts of the IEC 60825 series, published under the title *Safety of laser products*, can be found on the IEC website.

This part of IEC 60825 is also referred to as "Part 1" in this publication.

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.

The contents of the corrigendum of the interpretation sheets 1 (December 2017) and 2 (December 2017) have been included in this copy.

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.

²⁾ IEC Guide 104:2010, *The preparation of safety publications and the use of basic safety publications and group safety publications*
It gives guidance to IEC technical committees and to writers of specifications concerning the manner in which safety publications should be drafted.
This guide does not constitute a normative reference and reference to it is given for information only.

SAFETY OF LASER PRODUCTS –

Part 1: Equipment classification and requirements

1 Scope and object

IEC 60825-1 is applicable to safety of laser products emitting laser radiation in the wavelength range 180 nm to 1 mm.

Although lasers exist which emit at wavelengths less than 180 nm (within the vacuum ultraviolet), these are not included in the scope of the standard since the laser beam normally has to be enclosed in an evacuated enclosure, and, therefore, the potential optical radiation hazards are inherently minimal.

A laser product may consist of a single laser with or without a separate power supply or may incorporate one or more lasers in a complex optical, electrical, or mechanical system. Typically, laser products are used for demonstration of physical and optical phenomena, materials processing, data reading and storage, transmission and display of information, etc. Such systems have found use in industry, business, entertainment, research, education, medicine and consumer products.

Laser products that are sold to other manufacturers for use as components of any system for subsequent sale are not subject to IEC 60825-1, since the final product will itself be subject to this standard. Laser products that are sold by or for manufacturers of end products for use as repair parts for the end products are also not subject to IEC 60825-1. However, if the laser system within the laser product is operable when removed from the end product, the requirements of this Part 1 apply to the removable laser system.

NOTE 1 Operable equipment does not require a tool to prepare for operation.

Any laser product is exempt from all further requirements of this Part 1 if classification by the manufacturer of that product according to Clauses 4 and 5 shows that the emission level does not exceed the AEL (accessible emission limit) of Class 1 under all conditions of operation, maintenance, service and failure. Such a laser product may be referred to as an exempt laser product.

NOTE 2 The above exemption is to ensure that inherently safe laser products are exempt from Clauses 6,7,8 and 9.

In addition to the adverse effects potentially resulting from exposure to laser radiation, some laser equipment may also have other associated hazards, such as electricity, chemicals and high or low temperatures. Laser radiation may cause temporary visual impairment, such as dazzle and glare. Such effects depend on the task and ambient lighting level and are beyond the scope of this Part 1. The classification and other requirements of this standard are intended to address only the laser radiation hazards to the eyes and skin. Other hazards are not included within its scope.

A11 **AC2** This Part 1 describes requirements that are considered sufficient to achieve the required level of product safety for general laser products with respect to hazards to the eye and skin posed by laser radiation, provided that consumer laser products comply with EN 50689¹ (see 9.5 in this amendment EN 60825 1:2014/A11:2021). **AC2** Also, as required in 5.3 b) of EN 60825-1, that laser products classified as Class 1C comply with the respective applicable part of either the EN 60601 series or the EN 60335 series that contains requirements for the safe exposure of the skin (note that the exposure of the skin is not necessarily limited to the MPE values of the skin), if applicable, as well as specific requirements for the performance and testing of the safeguard that prevents hazardous emission towards the eye. Depending on the type of the product, laser products such as for example medical lasers, machines or toys can be required to conform to the applicable performance and testing requirements of their relevant product safety standards.

NOTE 3 See 3.92 for “general laser product”.

Where a laser system forms a part of equipment which is subject to another IEC product safety standard, e.g. for medical equipment (IEC 60601-2-22), IT equipment (IEC 60950 series), audio and video equipment (IEC 60065), audio-video and IT equipment (IEC 62368-1), electrical equipment for measurement, control, and laboratory use (IEC 61010-1), equipment for use in hazardous atmospheres (IEC 60079), or electric toys (IEC 62115), this Part 1 will apply in accordance with the provisions of IEC Guide 104² for hazards resulting from laser radiation. **A11**

For ophthalmic instruments, to ensure patient safety, ISO 15004-2 should be consulted and the principles of the limits provided there should be applied for laser radiation (see also Annex C and D).

In previous editions, light-emitting diodes (LEDs) were included in the scope of IEC 60825-1, and they may be still included in other parts of the IEC 60825 series. However, with the development of lamp safety standards, optical radiation safety of LEDs in general can be more appropriately addressed by lamp safety standards. The removal of LEDs from the scope of this Part 1 does not preclude other standards from including LEDs whenever they refer to lasers. IEC 62471 may be applied to determine the risk group of an LED or product incorporating one or more LEDs. Some other (vertical) standards may require the application of the measurement, classification, engineering specifications and labelling requirements of this standard (IEC 60825-1) to LED products.

Laser products with accessible radiance below the criteria specified in 4.4, designed to function as conventional light sources, and which satisfy the requirements specified in 4.4 may alternatively be evaluated under the IEC 62471 series of standards, "Photobiological safety of lamps and lamp systems". Such a product remains within the scope of this part of IEC 60825, except that the above-described optical radiation emission need not be considered for classification.

The MPE (maximum permissible exposure) values provided in Annex A were developed for laser radiation and do not apply to collateral radiation. However, if a concern exists that accessible collateral radiation might be hazardous, the laser MPE values may be applied to conservatively evaluate this potential hazard, or the exposure limit values in IEC 62471 should be consulted.

The MPE values in Annex A are not applicable to intentional human exposure to laser radiation for the purpose of medical or cosmetic/aesthetic treatment.

NOTE 4 Informative Annexes A to G have been included for purposes of general guidance and to illustrate many typical cases. However, the annexes are not regarded as definitive or exhaustive.

The objectives of this part of IEC 60825 are the following:

- to introduce a system of classification of lasers and laser products emitting radiation in the wavelength range 180 nm to 1 mm according to their degree of optical radiation hazard in order to aid hazard evaluation and to aid the determination of user control measures;
- to establish requirements for the manufacturer to supply information so that proper precautions can be adopted;
- to ensure, through labels and instructions, adequate warning to individuals of hazards associated with accessible radiation from laser products;
- to reduce the possibility of injury by minimizing unnecessary accessible radiation and to give improved control of the laser radiation hazards through protective features.

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

IEC 62471 (all parts), *Photobiological safety of lamps and lamp systems*

3 Terms and definitions

For the purposes of this document, the definitions given in IEC 60050-845 as well as the following apply.

NOTE For convenience here, the definitions have been arranged in English alphabetical order. Departures from IEC 60050-845 are intentional and are indicated. In such cases, reference is made, between brackets, to the definition of Part 845 of IEC 60050, with the mention "modified".

3.1

access panel

part of the protective housing which provides access to laser radiation when removed or displaced

3.2

accessible emission

level of radiation determined at a position and with aperture stops (when the AEL is given in units of Watts or Joules) or limiting apertures (when the AEL is given in units of $W \cdot m^{-2}$ or $J \cdot m^{-2}$) as described in Clause 5

Note 1 to entry: The accessible emission is determined where human access is considered, as specified in Definition 3.40. The accessible emission (determined during operation) is compared with the accessible emission limit (Entry 3.3) in order to determine the class of the laser product. In the body of the standard, whenever the term "emission level" is used, it is to be understood as accessible emission.

Note 2 to entry: When the beam is larger than the aperture stop, the accessible emission when given in units of watts or joules is less than the total emitted power or energy of the laser product. When the beam is smaller than the limiting aperture, the accessible emission when given in units of $W \cdot m^{-2}$ or $J \cdot m^{-2}$, i.e. as irradiance or radiant exposure averaged over the limiting aperture, is smaller than the actual irradiance or radiant exposure of the beam. See also aperture stop (3.9) and limiting aperture (3.55).

3.3

accessible emission limit

AEL

maximum accessible emission permitted within a particular class