



SLOVENSKI STANDARD

SIST EN 60825-1:1999

01-julij-1999

Safety of laser products -- Part 1: Equipment classification, requirements and user's guide (IEC 60825-1:1993)

Safety of laser products -- Part 1: Equipment classification, requirements and user's guide

Sicherheit von Lasereinrichtungen -- Teil 1: Klassifizierung von Anlagen, Anforderungen und Benutzer-Richtlinien

Sécurité des appareils à laser -- Partie 1: Classification des matériels, prescriptions et guide de l'utilisateur

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13.280	Varstvo pred sevanjem	Radiation protection
31.260	Optoelektronika, laserska oprema	Optoelectronics. Laser equipment

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EUROPEAN STANDARD

EN 60825-1

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Descriptors: Laser products, radiation safety, equipment classification,
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ENGLISH VERSION

Safety of laser products
Part 1: Equipment classification, requirements
and user's guide
(IEC 825-1:1993)

Sécurité des appareils à laser
Partie 1: Classification des
matériels, prescriptions et
guide de l'utilisateur

(CEI 825-1:1993)

Sicherheit von
Laser-Einrichtungen
Teil 1: Klassifizierung von
Anlagen, Anforderungen und
Benutzer-Richtlinien

(IEC 825-1:1993)

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This European Standard was approved by CENELEC on 1993-09-22.
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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
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This European Standard exists in three official versions (English, French, German).
A version in any other language made by translation under the responsibility of
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Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg,
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CENELEC

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

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Ref. No. EN 60825-1:1994 E

INTERNATIONAL ELECTROTECHNICAL COMMISSION

Foreword

The text of documents 76(CO)28 & 28B, as prepared by IEC Technical Committee 76, Laser equipment, was submitted to the IEC-CENELEC parallel vote in November 1992 and was approved by CENELEC as amendment A2 to EN 60825:1991 on 1993-09-22.

In November 1993, IEC published the first edition of IEC 825-1.

Upon confirmation by CLC/TC 76 that

- IEC 825-1:1993 is equivalent to IEC 825:1984 + A1:1990 + documents 76(CO)28 & 28B,
 - the common modifications accepted for EN 60825:1991 (IEC 825:1984 + A1:1990) are covered by this new IEC publication,
- the Permanent Delegates of the Technical Board of CENELEC have confirmed the ratification of IEC 825-1:1993 as EN 60825-1.

The following dates were fixed:

- latest date of publication of an identical national standard (dop) 1995-03-01
- latest date of withdrawal of conflicting national standards (dow) 1995-03-01

For products which have complied with EN 60825:1991 before 1995-03-01, as shown by the manufacturer or by a certification body, this previous standard may continue to apply for production until 2000-03-01.

Annexes designated "normative" are part of the body of the standard. Annexes designated "informative" are given only for information. In this standard, annex ZA is normative and annexes A, B, C, D, E and F are informative.

Endorsement notice

The text of the International Standard IEC 825-1:1993 was approved by CENELEC as a European Standard without any modification.

In the official version, for annex F, Related IEC Standards, the following information has to be added:

Add after the first paragraph:

NOTE: When the international publication has been modified by CENELEC common modifications, the relevant EN/HD applies.

Add:

EN 41003:1993, Particular safety requirements for equipment to be connected to telecommunication networks

Add the following notes for the standards indicated:

IEC 65 NOTE: Harmonized as EN 60065:1993 (modified).

IEC 204-1 NOTE: Harmonized as EN 60204-1:1992 (modified).
Although the title of IEC 204 indicates that its use is restricted to "industrial machines", the scope of EN 60204 has been broadened to include those machines covered by the EEC Directives relating to safety of machinery. This change is reflected in the title of EN 60204.
<https://standards.itec.ai/en/standards/IEC-60204-1-1992/EN-60204-1-1999>

IEC 601-2-22 NOTE: Harmonized as EN 60601-2-22:1992 (not modified).

IEC 950 NOTE: Harmonized as EN 60950:1992 + A1:1993 + A2:1993 (modified).

IEC 1010-1 NOTE: Harmonized as EN 61101-1:1993 (modified).

Annex ZA (normative)

Other international publications quoted in this standard
with the references of the relevant European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

NOTE: When the international publication has been modified by CENELEC common modifications, indicated by (mod), the relevant EN/HD applies.

IEC Publication	Date	Title	EN/HD	Date
27-1	1992*	Letter symbols to be used in electrical technology - Part 1: General	-	-
50(845)	1987	International Electrotechnical Vocabulary (IEV) - Chapter 845: Lighting	-	-
601-2-22	1992	Medical electrical equipment Part 2: Particular requirements for the safety of diagnostic and therapeutic laser equipment https://standards.iteh.ai/standards/sist/cf5a8f0e-cb12-4526-8511-7be9e300264b/sist-en-60825-1-1999	EN 60601-2-22	1992
825-2	1993	Safety of laser products Part 2: Safety of optical fibre communication systems	EN 60825-2	1994
1010-1 A1 (mod)	1990 1992	Safety requirements for electrical equipment for measurements, control and laboratory use Part 1: General requirements	EN 61010-1	1993
1040	1990	Power and energy measuring detectors, instruments and equipment for laser radiation	EN 61040	1992

Other publications

ISO 1000	1992	SI units and recommendations for the use of their multiples and of certain other units	-	-
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* IEC 27-1:1971 + A1:1974 + A2:1977 was harmonized as HD 245.1 S3:1979.

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Sécurité des appareils à laser –

Partie 1:

Classification des matériels, prescriptions
et guide de l'utilisateur

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Safety of laser products –

Part 1:

Equipment classification, requirements
and user's guide

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

SAFETY OF LASER PRODUCTS –

Part 1: Equipment classification, requirements
and user's guide

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international cooperation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. 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. The 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 the IEC on technical matters, prepared by technical committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
- 3) They have the form of recommendations for international use published in the form of standards, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.

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International Standard IEC 825-1 has been prepared by IEC technical committee 76: Laser equipment.

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

DIS	Reports on voting	Amendment to DIS	Report on voting
76(CO)6 76(CO)15 76(CO)28 & 28B	76(CO)7 76(CO)16 76(CO)34	76(CO)8	76(CO)11

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

This first edition of IEC 825-1 cancels and replaces the first edition of IEC 825 published in 1984, and its amendment 1, of which it constitutes a technical revision. It also cancels and replaces IEC 820 published in 1986.

IEC 825-1 has the status of a Group Safety publication for laser radiation aspects pertaining to human safety in accordance with IEC Guide 104.

IEC 825-1 is also referred to as "part 1" in this publication.

Annexes A, B, C, D, E and F are given for information only.

SAFETY OF LASER PRODUCTS –

Part 1: Equipment classification, requirements and user's guide

Section One – General

1 Scope and object

1.1 Scope

IEC 825-1 is applicable to safety of laser products. For convenience it is divided into three separate sections: Section One (General) and the annexes; Section Two (Manufacturing requirements); and Section Three (User's guide*).

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 and medicine. However, laser products which are sold to other manufacturers for use as components of any system for subsequent sale are not subject to IEC 825-1, since the final product will itself be subject to this standard.

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Throughout this part 1 light emitting diodes (LED) are included whenever the word "laser" is used.

Any laser product or LED product is exempt from all further requirements of this part 1 if

- classification by the manufacturer according to clauses 3, 8 and 9 shows that the emission level does not exceed the AEL of Class 1 under all conditions of operation, maintenance, service and failure, and
- it does not contain an embedded laser or embedded LED.

In addition to the hazards resulting from laser radiation, laser equipment may also give rise to other hazards such as fire and electric shock.

This part 1 describes the minimum requirements.

Where a laser system forms a part of equipment which is subject to another IEC standard for safety (e.g. for medical equipment (IEC 601-2-22), office machines (IEC 950), audio and video equipment (IEC 65), equipment for use in hazardous atmospheres), this part 1

* Some countries have requirements which differ from Section Three of this part 1. Therefore, contact the appropriate national agency for these requirements.

for the safety of laser products will apply in addition to the product safety standard. However, if the laser system is operable when removed from the equipment, the requirements of this part 1 will apply to the removed unit.

If no product safety standard is applicable, then IEC 1010-1 shall apply.

The MPE (maximum permissible exposure) values of this part 1 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 risk.

The MPE values shall not be applicable to patient exposure to laser radiation for the purpose of medical treatment.

NOTE – Annexes A to D have been included for purposes of general guidance and to illustrate many typical cases. However, the annexes must not be regarded as definitive or exhaustive and reference should always be made to the appropriate clause(s) in Sections One to Three.

1.2 Object

1.2.1 To protect persons from laser radiation in the wavelength range 180 nm to 1 mm* by indicating safe working levels of laser radiation and by introducing a system of classification of lasers and laser products according to their degree of hazard.

1.2.2 To lay down requirements for both user and manufacturer to establish procedures and supply information so that proper precautions can be adopted.

1.2.3 To ensure adequate warning to individuals of hazards associated with accessible radiation from laser products through signs, labels and instructions.

1.2.4 To reduce the possibility of injury by minimizing unnecessary accessible radiation and to give improved control of the laser radiation hazards through protective features and provide safe usage of laser products by specifying user control measures.

1.2.5 To protect persons against other hazards resulting from the operation and use of laser products.

2 Normative references

The following standards contain provisions which through reference in this text, constitute provisions of this part of IEC 825. At the time of publication, the editions indicated were

* In this part 1, the wavelength range λ_1 to λ_2 means $\lambda_1 \leq \lambda < \lambda_2$ (e.g. 180 nm to 1 mm means $180 \text{ nm} \leq \lambda < 1 \text{ mm}$).

valid. All standards are subject to revision, and parties to agreements based on this part of IEC 825 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 27-1: 1992, *Letter symbols to be used in electrical technology – Part 1: General*

IEC 50(845): 1987, *International Electrotechnical Vocabulary – Chapter 845: Lighting*

IEC 601-2-22: 1992, *Medical electrical equipment – Part 2: Particular requirements for the safety of diagnostic and therapeutic laser equipment*

IEC 825-2: 1993, *Safety of laser products – Part 2: Safety of optical fibre communication systems*

IEC 1010-1: 1990, *Safety requirements for electrical equipment for measurement, control and laboratory use – Part 1: General requirements*
Amendment 1, 1992

IEC 1040: 1990, *Power and energy measuring detectors, instruments and equipment for laser radiation*

ISO 1000: 1992, *SI units and recommendations for the use of their multiples and of certain other units.*

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3 Definitions* <https://standards.iteh.ai/catalog/standards/sist/cf5a8f0e-cb12-4526-8511-7be9e300264b/sist-en-60825-1-1999>

For the purposes of this standard, the following definitions apply.

3.1 access panel: A part of the protective housing or enclosure which provides access to laser radiation when removed or displaced.

3.2 accessible emission limit (AEL): The maximum accessible emission level permitted within a particular class.

3.3 administrative control: Safety measures of a non-engineering type such as: key supervision, safety training of personnel, warning notices, count-down procedures, and range safety controls.

3.4 alignment laser product: The laser product designed, manufactured, intended or promoted for one or more of the following uses:

- a) determining and delineating the form, extent or position of a point, body or area by taking angular measurements,

* Arranged here for convenience in English alphabetical order. Departures from IEC 50(845) are intentional and are indicated. Reference is made to the definition number in Chapter 845 of IEC 50.

- b) positioning or adjusting parts in relation to one another,
- c) defining a plane, level, elevation or straight line.

3.5 **alpha min.** (α_{\min}): See angular subtense (3.6)

3.6 **angular subtense** (α): The visual angle subtended by the apparent source (including diffuse reflections) at the eye of an observer or at the point of measurement (see also maximum angular subtense (3.49) and minimum angular subtense (3.53)). This concept is discussed in clause A.3 of annex A.

3.7 **aperture, aperture stop**: An aperture is any opening in the protective housing or other enclosure of a laser product through which laser radiation is emitted, thereby allowing human access to such radiation.

An aperture stop is an opening serving to define the area over which radiation is measured.

3.8 **apparent source**: The real or virtual object that forms the smallest possible retinal image.

NOTE – This definition is used to determine the location of the apparent origin of laser radiation in the wavelength range of 400 nm to 1400 nm, with the assumption of the apparent source being located in the eye's range of accommodation (≥ 100 mm). In the limit of vanishing divergence, i.e. in the case of an ideally collimated beam, the location of the apparent source goes to infinity.

The concept of an apparent source is used in the extended wavelength region 302,5 nm to 4 000 nm since focusing by conventional lenses might be possible in that region.

3.9 **beam attenuator**: A device which reduces the laser radiation to or below a specified level.

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3.10 **beam diameter (beam width)**: The beam diameter d_u at a point in space is the diameter of the smallest circle which contains u % of the total laser power (or energy). For the purpose of this standard d_{63} is used.

NOTE – In the case of a Gaussian beam, d_{63} corresponds to the point where the irradiance (radiant exposure) falls to 1/e of its central peak value.

3.11 **beam divergence**: The beam divergence is the far field plane angle of the cone defined by the beam diameter. If the beam diameters (see 3.10) at two points separated by a distance L are d_{63} and d'_{63} the divergence is given by:

$$\arctan \left[(d_{63} - d'_{63}) / L \right]$$

SI unit: radian

3.12 **beam expander**: A combination of optical elements which will increase the diameter of a laser beam.

3.13 **beam path component**: An optical component which lies on a defined beam path (e.g. a beam steering mirror or a focusing lens).

3.14 **beam stop**: A device which terminates a laser beam path.