

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

GROUP SAFETY PUBLICATION  
PUBLICATION GROUPEE DE SÉCURITÉ

**Safety of laser products –  
Part 1: Equipment classification and requirements**

**Sécurité des appareils à laser –  
Partie 1: Classification des matériels et exigences**



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# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

GROUP SAFETY PUBLICATION

PUBLICATION GROUPEE DE SECURITE

**Safety of laser products –**

**Part 1: Equipment classification and requirements**

**Sécurité des appareils à laser –**

**Partie 1: Classification des matériels et exigences**

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

**SAFETY OF LASER PRODUCTS –****Part 1: Equipment classification and requirements**

## FOREWORD

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

This second edition of IEC 60825-1 cancels and replaces the first edition published in 1993, its Amendment 1 (1997) and its Amendment 2 (2001). It constitutes a technical revision. The user's guide has been removed from this part of the IEC 60825 series and is now a separate document (Part 14). Light emitting diodes (LEDs) have been removed from the scope of this part of IEC 60825, but may still be included in other parts.

This part of IEC 60825 has the status of a Group Safety Publication, in accordance with IEC Guide 104<sup>1)</sup>, for aspects of laser radiation pertaining to human safety.

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

CDV	Report on voting
76/338/CDV	76/357/RVC

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 maintenance result 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- withdrawn;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 August 2008 have been included in this copy.

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1) IEC Guide 104:1997, *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.

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. However, if the laser system within the laser product is operable when removed from the equipment, the requirements of this Part 1 apply to the removable unit.

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 3, 8 and 9 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.

NOTE 2 The above exemption is to ensure that inherently safe laser products are not unnecessarily subject to the standard.

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

NOTE 3 However, 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.

This Part 1 describes the minimum requirements. Compliance with this Part 1 may not be sufficient to achieve the required level of product safety. Laser products must conform to the applicable performance and testing requirements of the applicable product safety standards.

NOTE 4 Other standards may contain additional requirements. Consideration should also be given to the intended application and user group. For example, a class 3B or class 4 laser product may not be suitable for use as a consumer 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), audio and video equipment (IEC 60065), 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 104<sup>2)</sup> for hazards resulting from laser radiation. If no product safety standard is applicable, then IEC 61010-1 applies.

In previous editions, 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. CIE S009 may be applied to determine the risk group class of an LED or product incorporating one or more LEDs.

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 potential hazard.

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

NOTE 5 Annexes A to H have been included for purposes of general guidance and to illustrate many typical cases. However, the annexes are not regarded as definitive or exhaustive and reference should always be made to the appropriate clause(s) in the normative part of this document.

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

- to introduce a system of classification of lasers and laser products 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.

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<sup>2)</sup> IEC Guide 104:1997, *The preparation of safety publications and the use of basic safety publications and group safety publications*

## 2 Normative references

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

IEC 60050-845:1987, *International Electrotechnical Vocabulary (IEV) – Chapter 845: Lighting*

IEC 60601-2-22, *Medical electrical equipment – Part 2: Particular requirements for the safety of diagnostic and therapeutic laser equipment*

IEC 61010-1, *Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements*

## 3 Terms and definitions

For the purposes of this document, the definitions of 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 or enclosure 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  $\text{W}\cdot\text{m}^{-2}$  or  $\text{J}\cdot\text{m}^{-2}$ ) as described in Clause 9

The accessible emission is determined where human access is considered, as specified in Definition 3.37. The accessible emission is compared with the accessible emission limit (Definition 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 When the beam diameter 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 diameter is smaller than the diameter of the limiting aperture, the accessible emission when given in units of  $\text{W}\cdot\text{m}^{-2}$  or  $\text{J}\cdot\text{m}^{-2}$ , 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 (3.52).

### 3.3

#### **accessible emission limit**

##### **AEL**

the maximum accessible emission permitted within a particular class

NOTE Wherever the text refers to “emission level not exceeding the AEL” or similar wording, it is implicit that the accessible emission is determined following the measurement criteria specified in Clause 9.