

INTERNATIONAL STANDARD

NORME INTERNATIONALE



Safety of laser products –
Part 2: Safety of optical fibre communication systems (OFCS)
(standards.iteh.ai)

Sécurité des appareils à laser –
Partie 2: Sécurité des systèmes de télécommunication par fibres optiques
(STFO)

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Safety of laser products – Part 2: Safety of optical fibre communication systems (OFCS)

INTERPRETATION SHEET 1

This interpretation sheet has been prepared by TC 76: Optical radiation safety and laser equipment.

The text of this interpretation sheet is based on the following documents:

ISH	Report on voting
76/376/ISH	76/380/RVD

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

Due to the inconsistency between the new IEC 60825-1:2007 and the current IEC 60825-2, the previous edition of IEC 60825-1 (IEC 60825-1:1993 and its amendment 1 (1997) and amendment 2 (2001)) should be used for calculating or measuring hazard levels of optical fibre communication systems using IEC 60825-2:2004, incorporating amendment 1:2006.

This instruction will remain valid until a new version of IEC 60825-2 is published.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

IEC 60825-2
Edition 3.0 2004-06

SAFETY OF LASER PRODUCTS –

Part 2: Safety of optical fibre communication systems (OFCS)

INTERPRETATION SHEET 2

This interpretation sheet has been prepared by IEC technical committee 76: Optical radiation safety and laser equipment.

The text of this interpretation sheet is based on the following documents:

FDIS	Report on voting
76/599/FDIS	76/606/RVDISH

[IEC 60825-2:2004+AMD1:2006+AMD2:2010 CSV](#)

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

IEC 60825-1 Ed. 3.0 (2014) introduced a new formula for C_7 between 1 200 nm and 1 400 nm. This formula significantly increases the AEL of class 1 in this wavelength range.

The new formula for C_7 in IEC 60825-1 Ed. 3.0 should not be used within IEC 60825-2 Ed. 3.2 (2010) because it may lead to excessive power limits, for example within Hazard Level 1. Note e) to Table A.1 of IEC 60825-1 Ed. 3.0 states that: “In the wavelength range between 1 250 nm and 1 400 nm, the limits to protect the retina given in this table may not adequately protect the anterior parts of the eye (cornea, iris) and caution needs to be exercised. There is no concern for the anterior parts of the eye if the exposure does not exceed the skin MPE values.”

IEC 60825-2 Ed. 3.2 Clause 2 (normative references) contains a dated reference to IEC 60825-1:2007 in which the correction factor C_7 was set equal to 8 within the wavelength range of 1 200 nm to 1 400 nm. This dated reference in the normative references section is technically sufficient for the correct interpretation of IEC 60825-2 Ed. 3.2, even though undated references to IEC 60825-1 occur in other clauses. This interpretation sheet is therefore provided as an additional warning and prompt for users of IEC 60825-2 Ed. 3.2. Accordingly, within the wavelength range 1 200 nm to 1 400 nm the formula $C_7 = 8$ is still to be used within all affected clauses of IEC 60825-2 Ed. 3.2.

This interpretation sheet will remain valid until a new edition of IEC 60825-2 is published.

NOTE Exposure limits for the eye and the skin of employees in the workplace and the general public are in many countries specified in national laws. These legally-binding national exposure limits might differ from the MPEs given in the informative Annex A of IEC 60825-1 Ed. 3.0.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

SAFETY OF LASER PRODUCTS –

Part 2: Safety of optical fibre communication systems (OFCS)

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International Standard IEC 60825-2 has been prepared by IEC technical committee 76: Optical radiation safety and laser equipment

This consolidated version of IEC 60825-2 consists of the third edition (2004) [documents 76/288/FDIS and 76/293/RVD], its amendment 1 (2006) [documents 76/346/FDIS and 76/353/RVD] and its amendment 2 (2010) [documents 76/409/CDV and 76/419/RVC], and the Interpretation sheets 1 (April 2008) and 2 (June 2018).

The technical content is therefore identical to the base edition and its amendments and has been prepared for user convenience.

It bears the edition number 3.2.

A vertical line in the margin shows where the base publication has been modified by amendments 1 and 2.

The French version of this standard has not been voted upon.

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

IEC 60825 consists of the following parts, under the general title *Safety of laser products*:

- Part 1: Equipment classification, requirements and user's guide
- Part 2: Safety of optical fibre communication systems (OFCS)
- Part 3: Guidance for laser displays and shows
- Part 4: Laser guards
- Part 5: Manufacturer's checklist for IEC 60825-1

- Part 8: Guidelines for the safe use of laser beams on humans
- Part 9: Compilation of maximum permissible exposure to incoherent optical radiation
- Part 10: Application guidelines and explanatory notes to IEC 60825-1
- Part 12: Safety of free space optical communication systems used for transmission of information

- Part 13: Measurements for classification of laser products

- Part 14: A user's guide

The committee has decided that the contents of the base publication and its amendments 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.

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SAFETY OF LASER PRODUCTS –

Part 2: Safety of optical fibre communication systems (OFCS)

1 Scope and object

This Part 2 of IEC 60825 provides requirements and specific guidance for the safe operation and maintenance of optical fibre communication systems (OFCS). In these systems optical power may be accessible outside the confinements of transmitting equipment or at great distance from the optical source.

This Part 2 requires the assessment of hazard levels at accessible locations as a replacement for classification according to IEC 60825-1. It applies to the complete installed end-to-end OFCS, including its components and subassemblies that generate or amplify optical radiation. Individual components and subassemblies that are sold only to OEM vendors for incorporation into a complete installed end-to-end OFCS need not be assessed to this standard, since the final OFCS should itself be assessed according to this standard.

NOTE 1 The above statement is not intended to prevent manufacturers of such components and subassemblies from using this standard if they wish to do so, or are required to do so by contract.

This standard does not apply to optical fibre systems primarily designed to transmit optical power for applications such as material processing or medical treatment.

In addition to the hazards resulting from laser radiation, OFCS may also give rise to other hazards, such as fire.

This standard does not address safety issues associated with explosion or fire with respect to OFCS deployed in explosive atmospheres.

Throughout this part of IEC 60825, a reference to 'laser' is taken to include light-emitting diodes (LEDs) and optical amplifiers.

NOTE 2 The optical hazard of light emerging from a fibre is determined by the wavelength and power emerging from the fibre and the optical characteristics of the fibre. (See Annex A.)

The objective of this Part 2 of IEC 60825 is to:

- protect people from optical radiation resulting from OFCS;
- provide requirements for manufacturers, installation organizations, service organizations and operating organizations in order to establish procedures and supply information so that proper precautions can be adopted;
- ensure adequate warnings are provided to individuals regarding the potential hazards associated with OFCS through the use of signs, labels and instructions.

Annex A gives a more detailed rationale for this part of IEC 60825.

The safety of an OFCS depends to a significant degree on the characteristics of the equipment forming that system. Depending on the characteristics of the equipment, it may be necessary to mark safety relevant information on the product or include it within the instructions for use.

Where required by the level of potential hazard, it places the responsibility for the safe deployment and use of these systems on the installer or end-user / operating organization or both. This standard places the responsibility for adherence to safety instructions during installation and service operations on the installation organization and service organizations as appropriate, and operation and maintenance functions on the end-user or operating organization. It is recognised that the user of this standard may fall into one or more of the aforementioned categories of manufacturer, installation organization, end-user or operating organization.

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 60825-1:2007, *Safety of laser products – Part 1: Equipment classification and requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions contained in IEC 60825-1 as well as the following terms and definitions apply.

3.1

accessible location

any part or location within an OFCS at which, under reasonably foreseeable events, human access to laser radiation is possible without the use of a tool

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3.2

automatic power reduction (APR)

a feature of an OFCS by which the accessible power is reduced to a specified level within a specified time, whenever there is an event which could result in human exposure to radiation, e.g. a fibre cable break

NOTE The term “automatic power reduction” (APR) used in this standard encompasses the following terms used in recommendations of the International Telecommunication Union ITU:

- automatic laser shutdown (ALS);
- automatic power reduction (APR);
- automatic power shutdown (APSD).

3.3

end-user

person or organization using the OFCS in the manner the system was designed to be used

NOTE 1 The end-user cannot necessarily control the power generated and transmitted within the system.

NOTE 2 If the person or organization is using the OFCS for a communications application in a manner other than as designed by the manufacturer, then that person/organization assumes the responsibilities of a manufacturer or installation organization.

3.4

hazard level

the potential hazard at any accessible location within an OFCS. It is based on the level of optical radiation which could become accessible in a reasonably foreseeable event, e.g. a fibre cable break. It is closely related to the laser classification procedure in IEC 60825-1

3.5

hazard level 1

hazard level 1 is assigned to any accessible location within an OFCS at which, under reasonably foreseeable events, human access to laser radiation in excess of the accessible emission limits of Class 1 for the applicable wavelengths and emission duration will not occur. The level of radiation is measured with the conditions for Class 1 laser products (see IEC 60825-1), but with condition 2 being as defined in clause 4.8.1 of this standard (IEC 60825-2)

3.6

hazard level 1M

hazard level 1M is assigned to any accessible location within an OFCS at which, under a reasonably foreseeable event, human access to laser radiation in excess of the accessible emission limits of Class 1 for the applicable wavelengths and emission duration will not occur. The level of radiation is measured with the conditions for Class 1M laser products (see IEC 60825-1), but with condition 2 being as defined in clause 4.8.1 of this standard (IEC 60825-2)

NOTE If the applicable limit of hazard level 1M is larger than the limit of 2 or 3R and less than the limit of 3B, hazard level 1M is allocated.

3.7

hazard level 2

hazard level 2 is assigned to any accessible location within an OFCS at which, under a reasonably foreseeable event, human access to laser radiation in excess of the accessible emission limits of Class 2 for the applicable wavelengths and emission duration will not occur. The level of radiation is measured with the conditions for Class 2 laser products (see IEC 60825-1), but with condition 2 being as defined in clause 4.8.1 of this standard (IEC 60825-2)

NOTE If the applicable limit of hazard level 2M is larger than the limit of 2 and less than the limit of 3B, hazard level 1M is allocated.

3.8

hazard level 2M

hazard level 2M is assigned to any accessible location within an OFCS at which, under a reasonably foreseeable event, human access to laser radiation in excess of the accessible emission limits of Class 2 for the applicable wavelengths and emission duration will not occur. The level of radiation is measured with the conditions for Class 2M laser products (see IEC 60825-1), but with condition 2 being as defined in clause 4.8.1 of this standard (IEC 60825-2)

NOTE If the applicable limit of hazard level 2M is larger than the limit of 3R and less than the limit of 3B, hazard level 2M is allocated.

3.9

hazard level 3R

hazard level 3R is assigned to any accessible location within an OFCS at which, under a reasonably foreseeable event, human access to laser radiation in excess of the accessible emission limits of Class 3R for the applicable wavelengths and emission duration will not occur. The level of radiation is measured with the conditions for Class 3R laser products (see IEC 60825-1), but with condition 2 being as defined in clause 4.8.1 of this standard (IEC 60825-2)

NOTE If the applicable limit of hazard level 1M or 2M is larger than the limit of 3R and less than the limit of 3B, hazard level 1M or 2M is allocated.

3.10

hazard level 3B

hazard level 3B is assigned to any accessible location within an OFCS at which, under a reasonably foreseeable event, human access to laser radiation in excess of the accessible emission limits of Class 3B for the applicable wavelengths and emission duration will not occur. The level of radiation is measured with the conditions for Class 3B laser products (see IEC 60825-1), but with condition 2 being as defined in clause 4.8.1 of this standard (IEC 60825-2)

3.11

hazard level 4

hazard level 4 is assigned to any accessible location within an OFCS at which, under a reasonably foreseeable event, human access to laser radiation in excess of the accessible emission limits of Class 3B for the applicable wavelengths and emission duration may occur. The level of radiation is measured with the conditions for Class 3B laser products (see IEC 60825-1), but with condition 2 being as defined in clause 4.8.1 of this standard (IEC 60825-2)

NOTE This standard is applicable for the operation and maintenance of OFCS. In order to achieve an adequate level of safety for persons who may come into contact with the optical transmission path, hazard level 4 is not permitted within this standard. It is permitted to use protection systems, such as automatic power reduction, to achieve the required hazard level where the transmitted power under normal operating conditions (e.g. no fault exists in the fibre path) exceeds that permitted for a particular location type. For instance, it is possible for accessible parts of an OFCS to be hazard level 1 even though the power transmitted down the fibre under normal operating conditions is Class 4.

3.12

installation organization

an organization or individual that is responsible for the installation of an OFCS

3.13

location with controlled access; controlled location

an accessible location where an engineering or administrative control is present to make it inaccessible, except to authorized personnel with appropriate laser safety training

NOTE For examples see D.2.1 a).

3.14

location with restricted access; restricted location

an accessible location that is normally inaccessible by the general public by means of any administrative or engineering control measure but that is accessible to authorized personnel who may not have laser safety training

NOTE For examples see D.2.1 b).

3.15

location with unrestricted access; unrestricted location

an accessible location where there are no measures restricting access to members of the general public

NOTE For examples see D.2.1 c).

3.16

manufacturer

organization or individual that assembles optical devices and other components in order to construct or modify an OFCS

3.17

operating organization

organization or individual that is responsible for the operation of an OFCS