

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE

AMENDMENT 2  
AMENDEMENT 2

**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)**  
IEC 60825-2:2004/AMD2:2010  
https://standards.iteh.ai/catalog/standards/sist/49551cd7-5ccc-4192-bd1f-947ca436d703/iec-60825-2-2004-amd2-2010





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IEC 60825-2

Edition 3.0 2010-09

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INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

PRICE CODE  
CODE PRIX

J

ICS 31.260; 33.180.01

ISBN 978-2-88912-176-2

## FOREWORD

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

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

Enquiry draft	Report on voting
76/409/CDV	76/419/RVC

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

The committee has decided that the contents of this amendment and the base 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- withdrawn,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.

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### Foreword

[IEC 60825-2:2004/AMD2:2010](https://standards.iteh.ai/catalog/standards/sist/4533fed7-5ec8-4192-bd1f-3b57e5cc2e16/iec-60825-2-2004-amd2-2010)

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*In the list of parts of the IEC 60825 series, delete the following:*

Part 6: Safety of products with optical sources, exclusively used for visible information transmission to the human eye

Part 7: Safety of products emitting infrared optical radiation, exclusively used for wireless 'free air' data transmission and surveillance

*Replace the title of Part 8 as follows:*

Part 8: Guidelines for the safe use of laser beams on humans

*Add the title of the following new part:*

Part 13: Measurements for classification of laser products

## 1 Scope and object

*Add, after the sixth paragraph ("Throughout this part of IEC 60825..., (LEDs) and optical amplifiers.") the following new note:*

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.).

*Renumber the existing note as Note 1.*

## 2 Normative references

*Replace the existing reference and its amendments by the following:*

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

### 3.5 hazard level 1

*Add to the end of the definition:*

“. 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

*Delete the final phrase of the existing definition as follows:* “. . . whereby the level of radiation is measured with the measurement conditions for Class 1M laser products (see IEC 60825-1)”.

*Add to the end of the definition (before the note):*

“. 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)”

### 3.7 hazard level 2

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*Add to the end of the definition (before the note):*

“. 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)”

### 3.8 hazard level 2M

*Delete the final phrase of the existing definition as follows:* “. . . whereby the level of radiation is measured with the measurement conditions for Class 2M laser products (see IEC 60825-1)”.

*Add to the end of the definition (before the note):*

“. 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)”

### 3.9 hazard level 3R

*Add to the end of the definition (before the note):*

“. 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)”

### 3.10 hazard level 3B

Add to the end of the definition:

". 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

Add to the end of the definition (before the note):

".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)"

### 4.5.4 Disabling of the APR

Add, after item 6), the following new text:

- 7) it shall not be possible to disable the APR permanently – the APR must automatically re-enable (see also note 3);
- 8) it shall only be possible to disable APR at the transmitting equipment (i.e. remote disabling of the APR is not normally permitted), except when in direct communication with persons (possibly at remote locations) likely to be exposed to higher levels of radiation than before the APR is disabled.  
NOTE 1 Consideration should be given to the fact that Raman systems may also emit high power from the receive termination.
- 9) a clear and unambiguous warning shall be displayed continuously while the APR remains disabled;
- 10) manual start-up or re-start of high power systems with APR disabled

It is recognised that systems utilising high optical powers (by their very nature) must use high powers to ensure continuity - otherwise no signal will be received at the far end. Therefore it is permitted to use high powers (class 4) at initial system start-up, provided this is done by trained personnel under defined conditions.

Every effort must be made to ensure system continuity (i.e. OTDR continuity testing from both ends of the system) and to ensure personnel are not exposed to class 3B or class 4 radiation. This can also be done by rigorous administrative controls.

Renumber existing Notes 1 and 2 as Notes 2 and 3 respectively.

Add, after existing Note 2, the following new note:

NOTE 4 One hour is suggested as a suitable time after which the APR should re-enable.

### 4.6 Labelling or marking

**Table 1 – Marking in unrestricted locations (added in Amendment 1 (2006))**

In table footnote b, change "Figure 14" to read "Figure 1".

In table footnote e, change "Figure 15" to read "Figure 2" and "Figure 14" to read "Figure 1".

**Table 2 – Marking in restricted locations** (added in Amendment 1 (2006))

*Delete Note 1 and renumber the remaining notes.*

*Replace the existing text of table footnote a by the following:*

Warning label according to Figure 1 of IEC 60825-1.

*In table footnote d, change “Figure 15” to read “Figure 2” and “Figure 14” to read “Figure 1”.*

**Table 3 – Marking in controlled locations** (added in Amendment 1 (2006))

*Replace the existing text of table footnote a by the following:*

Warning label according to Figure 1 of IEC 60825-1.

*In table footnote d, change “Figure 15” to read “Figure 2” and “Figure 14” to read “Figure 1”.*

**4.8.1**

*Add, after the second sentence of the first paragraph, the following new paragraphs:*

For wavelengths above 1 400 nm, condition 2 measurements to establish hazard levels shall be made with a 7 mm aperture at a distance of 28 mm from the end of the fibre (this simulates a x18 magnifier).

For all other wavelengths, condition 2 measurements to establish hazard levels shall be made with a 7 mm aperture at a distance of 70 mm from the end of the fibre (this simulates a x7 magnifier).

In addition to the above, and for all wavelengths, the total emission from the fibre for HL 3B systems shall not exceed the AEL of class 3B.

*Retain the remaining sentence in the first paragraph as a separate paragraph.*

**Annex A – Rationale**

*In the first sentence of the first paragraph, replace “...are covered by IEC 60825-1” by “...are covered by IEC 60825-1 and IEC/TR 60825-14.”*

*In the last sentence of the first paragraph, change “...included in the scope of IEC 60825-1.)” to read “excluded from the scope of IEC 60825-1.)”*

*Add after the final paragraph, a new paragraph as follows:*

The changes to IEC 60825-2:2004 and its amendment are

- a) a revision of the references to IEC 60825-1 made necessary by the re-ordering of the latest version of IEC 60825-1, and
- b) changes in the measurements made to ensure that safety is retained when fibre ends are examined through medium to high power magnifiers and/or microscopes, as sometimes used in the telecommunications industry.

## Annex D – Application notes for the safe use of OFCS

### D.3 OFCS power limits

Add, after the existing text (between the existing note and Table D.1,) the following new text:

The following aperture diameter and measuring distances are to be used:

- 7 mm at 70 mm for wavelengths < 1 400 nm
- 7 mm at 28 mm for wavelengths > 1 400 nm

NOTE 2 In the latter case for wavelengths > 1 400 nm, for the vast majority of cases this condition will measure all the emission from the fibre, and will therefore account for any level of magnification.

NOTE 3 An alternative to the latter condition for wavelengths > 1 400 nm is simply to measure the total emission from the fibre while recognising that in certain cases this may result in an over estimate of the actual hazard.

NOTE 4 For HL 3B systems the total emission from the fibre shall be limited to be less than the AEL of class 3B (thus effectively capping the optical power in the fibre at 500 mW for exposures in excess of 0,25 s, and at the appropriate level for shorter exposures including e.g. system restart pulses).

Renumber the existing note as Note 1.

**Table D.1 – OFCS power limits for 11 µm single mode (SM) fibres and 0,18 numerical aperture multimode (MM) fibres (core diameter < 150 µm)**

Replace the existing ten rows of data by the following:

Wavelength and fibre type	Hazard Level					
	1	1M	2	2M	3R	3B
633 nm (MM)	1,95 mW (+3 dBm)	3,9 mW (+5,9 dBm)	4,99 mW (+7 dBm)	10 mW (+10 dBm)	24,9 mW (+14 dBm)	500 mW
780 nm (MM)	2,81 mW (+4,5 dBm)	5,6 mW (+7,5 dBm)	–	–	14,4 mW (+11,6 dBm)	500 mW
850 nm (MM)	3,88 mW (+5,9 dBm)	7,8 mW (+8,9 dBm)	–	–	19,9 mW (+13 dBm)	500 mW
980 nm (MM)	7,06 mW (+8,5 dBm)	14,1 mW (+11,5 dBm)	–	–	36,2 mW (+15,6 dBm)	500 mW
980 nm (SM)	1,8 mW (+2,6 dBm)	2,66 mW (+4,2 dBm)	–	–	9,21 mW (+9,6 dBm)	500 mW
1310 nm (MM)	77,8 mW (+18,9 dBm)	156 mW (+21,9 dBm)	–	–	399 mW (+26 dBm)	500 mW
1310 nm (SM)	25,8 mW (+14,1 dBm)	42,8 mW (+16,3 dBm)	–	–	129 mW (+21,1 dBm)	500 mW
1 400 nm 1 600 nm (MM)	13,3 mW (+11,2 dBm)	384 mW (+25,8 dBm)	–	–	See note to 3.9	500 mW
1 420 nm (SM)	10,1 mW (+10 dBm)	115 mW (+20,6 dBm)	–	–	See note to 3.9	500 mW
1 550 nm (SM)	10,2 mW (+10,1 dBm)	136 mW (+21,3 dBm)	–	–	See note to 3.9	500 mW

In Note 3 of the table, delete the final sentence (“For other MFD values...example A.6.3.”).

Add an additional note:

NOTE 9 **Multimode fibres with core diameters between 52,5 µm and 150 µm.**

The fibres can (optionally) be evaluated using the measurement criteria specified in 9.3.3 of IEC 60825-1, which may result in a higher allowable power limit.



*The other existing notes are to remain unchanged.*

#### **D.4.1.1 Multi-wavelength example**

*In the third paragraph, replace “(see 8.4 e) of IEC 60825-1)” by “(see 8.3 e) of IEC 60825-1)”.*

*In the fourth paragraph, first line, replace “Table 5 of IEC 60825-1 indicates...” by “Table 2 of IEC 60825-1 indicates...”*

*Amend the fourth paragraph, third line, to read “...at that wavelength (see 8.3 b) of IEC 60825-1).”*

*Replace the existing eighth paragraph with the following:*

The measurement specifications given in 9.3 of IEC 60825-1 require the most restrictive condition in Table 11 of IEC 60825-1 to be applied. For a divergent beam from an optical fibre the most restrictive condition is 2. Using Table 11 of IEC 60825-1 as modified by clause 4.8.1 of this standard (IEC 60825-2), the aperture diameter is 7 mm and the measuring distance is 70 mm for thermal limits.

*In the ninth paragraph, delete the reference to “(equation (1) in A.6 of IEC 60825-1)”.*

*In the ninth paragraph correct the equation to read:*

$$d_{63} = \frac{2r \cdot \text{NA}}{1,7} = \frac{2 \times 70 \text{ mm} \times 0,18}{1,7} = 15,0 \text{ mm}$$

#### **D.4.5 Ribbon cable**

*In the last sentence of the first paragraph, replace “(see 8.4 c) of IEC 60825-1)” by “(see 8.3 c) of IEC 60825-1)”.*

#### **D 4.5.1 Ribbon fibre example calculation**

*In the third paragraph, first line, replace “C6” by “C<sub>6</sub>”.*

#### **D.4.7 General considerations and examples**

*Modify, in item b), first line, “Service conditions often result in ....” to read “Service conditions may result in ...”.*

*In item b), first line, replace “...see Clause 5...” by “...see 4.5.4...”.*

#### **D.7 Maximum output power during shutdown**

*In the second paragraph replace “Table D.6” by “Table D.14”.*

### **Annex E – Guidance for service and maintenance**

#### **E.1.2**

*In the second paragraph, third line, modify “...in 5.2 and its associated subclauses...” to read “...in 4.5 and its associated subclauses...”.*

#### **E.2.1.4**

*In the first dashed item, replace “Figure 14” and “Figure 15” by “Figure 1” and “Figure 2” respectively.*

### **Annexe F – Clarification of the meaning of “hazard level”**

#### **F.4 Rationale to 4.8.1 and 4.8.2**

*In the second sentence of item a), replace “Table 10” by “Table 11”.*

### **Bibliography**

*Add the following new title:*

IEC/TR 60825-14, *Safety of laser products – Part 14: A user’s guide*

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