SLOVENSKI STANDARD
SIST EN 60825-4:2008/A2:2011

01-september-2011

Varnost laserskih izdelkov - 4. del: Zaščitna oprema za laserje - Dopolnilo A2

Safety of laser products - Part 4: Laser guards

Sicherheit von Lasereinrichtungen - Teil 4: Laserschutzwände

Sécurité des appareils à laser - Partie 4: Protecteurs pour lasers

Ta slovenski standard je istoveten z: **EN 60825-4:2006/A2:2011**

ICS:

31.260	Optoelektronika, laserska oprema	Optoelectronics. Laser equipment

SIST EN 60825-4:2008/A2:2011 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 60825-4/A2

May 2011

ICS 31.260

English version

Safety of laser products - Part 4: Laser guards (IEC 60825-4:2006/A2:2011)

Sécurité des appareils à laser - Partie 4: Protecteurs pour lasers (CEI 60825-4:2006/A2:2011)

Sicherheit von Lasereinrichtungen - Teil 4: Laserschutzwände (IEC 60825-4:2006/A2:2011)

This amendment A2 modifies the European Standard EN 60825-4:2006; it was approved by CENELEC on 2011-05-03. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this amendment the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This amendment exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

CENELEC

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Ref. No. EN 60825-4:2006/A2:2011 E

Foreword

The text of document 76/428/CDV, future amendment 2 to IEC 60825-4:2006, prepared by IEC TC 76, Optical radiation safety and laser equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as amendment A2 to EN 60825-4:2006 on 2011-05-03.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN and CENELEC shall not be held responsible for identifying any or all such patent rights.

The following dates were fixed:

– latest date by which the amendment has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2012-02-03
– latest date by which the national standards conflicting with the amendment have to be withdrawn	(dow)	2014-05-03

Endorsement notice

The text of amendment 2:2011 to the International Standard IEC 60825-4:2006 was approved by CENELEC as an amendment to the European Standard without any modification.

IEC 60825-4

Edition 2.0 2011-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

AMENDMENT 2
AMENDEMENT 2

Safety of laser products – Part 4: Laser guards

Sécurité des appareils à laser – Partie 4: Protecteurs pour lasers

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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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
76/428/CDV	76/442/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 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.

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.

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Replace the existing Annex D with the following new Annex D:

Annex D
(normative)

Proprietary laser guard testing

D.1 General

This annex contains details of the test conditions to be adhered to and the documentation to be supplied by manufacturers of proprietary laser guards.

It should be noted that it is inappropriate to use higher power lasers to simulate low power laser parameters or use low powered lasers to simulate high powered, by changing irradiance or by adjustment of the distance from the focal point, because beam quality and other characteristics of the laser beam are likely to be different or unexpected. Manipulating characteristics of lasers of a certain power level to make or extrapolate estimates of a laser in a different level (higher or lower power) is not permitted.

The evidence of the tests described herein is relevant only for, and is limited to, the laser parameters used. Thus the results of these tests should serve only for comparison of laser guards.

The protective exposure limit (PEL $W \cdot m^{-2}$) shall be applicable only for the beam dimensions at the guard used in the tests. These dimensions at the guard shall be stated by the laser guard manufacturer because the PEL, which indicates protection, decreases as the laser beam dimensions increase. If the PEL is exceeded, the guard can be damaged and eventually disintegrates. For the purposes of this annex the protection time is the time interval from initial irradiation of the front surface until the laser radiation emitting beyond the rear surface exceeds the accessible emission limit (AEL) for Class 1 as defined in IEC 60825-1.

D.2 Test conditions

A variety of exposure limit tests with different materials and different lasers may cause non-reproducible results that can lead to false interpretations for the protective exposure limit and overestimated lifetime predictions of laser guards. Thus equal and comparable conditions for repeated tests must be ensured to maintain the integrity of the results.

As part of ensuring the integrity of the results, effort shall be made to eliminate or at least minimise systematic or other errors that may also result in false interpretations for the PEL or overestimation of the guard lifetime. Such errors may arise from:

a) material: reflecting surfaces, where reflectivity changes through oxidation or contamination;

b) laser: with high power lasers (e.g. multi-kilowatt lasers), especially those with good beam quality (i.e. fibre lasers and disk lasers), reactions have been seen that have considerable influence on the actual irradiance on the surface of the laser guards.

Thus during testing, it is important that no mechanical or physical effects (such as described below) occur between the beam aperture and the point of incidence on the guard material that adversely affect any optical properties. It is important to note that testing conditions should be accurately replicated, otherwise the resultant PEL or protection times may not be reliably reproduced.

Examples of effects that influence test results include but are not limited to:

- generation of fine metallic fume, whereby laser radiation is absorbed (e.g. thermal blooming) or scattered (e.g. Mie effect) in the metallic fume;

- change of the focal point (thermal induced focal shift), whereby there is a change of the power density at the surface of the laser guard. These effects may reduce the laser power on the sample under test;
- establishment of an equilibrium (i.e. thermal equilibrium or balance between, incident and reflected or reemitted radiation) leading to a practically infinite PEL or protection time in one test, while a repeated test under assumed equal conditions leads to a finite PEL or protection time.

The tested exposure limit ($W \cdot m^{-2}$ for CW lasers or $J \cdot m^{-2}$ for pulsed lasers) shall be determined by tests performed when irradiating at least six samples by irradiating one surface of each sample. Each sample shall be of representative thickness and composition, having a front test surface prepared to give worst case absorption to laser radiation. Dimensions of these samples shall be not less than 3 times the beam diameter measured at the points where the intensity distribution has decreased to a value of $1/e^2$ of the peak at the exposure location (thereby guaranteeing that the radiant heat flow is taken into account). Structural connecting elements shall only be included in the tests if they are necessary to ensure the construction and integrity of the guard. In the case of non-circular beams, the geometry of the beam used in the test shall be specified. Non-circular beams are those where the difference between the major and the minor dimension is greater than 10 %. The tests shall be performed in both pulsed and CW mode where pulsed and CW laser operation is possible as the pulsed radiation may lead to different results.

NOTE 1 The parameters of pulsed radiation used in these tests should be representative of the parameters to be used in any specified application.

NOTE 2 The geometry of the test beam is required to be specified because it affects the distribution of heat in the sample.

NOTE 3 Particular care should be taken in the preparation of samples when testing laser guards using aluminium, copper, stainless steel and materials with zinc coated surfaces. It has been observed for these and other similar materials, the PEL and protection time is highly dependant on sample preparation and experimental setup that affects the repeatability of the PEL and protection time measurements.

NOTE 4 The worst case absorption should take into account the reflectivity of the guard material and the changes to the surface of the laser guard material over the foreseeable lifetime of the laser guard. However, the test plate should not have been treated beforehand, in any possible way that could alter absorption conditions artificially, except for accelerated natural reflectivity change of the guard material and the accelerated natural changes to the surface of the laser guard material reasonably expected over the foreseeable lifetime of the laser guard. Qualification test should be done in normal conditions for the laser shielding."

If a sample holder is necessary for the tests, then its maximum overlap on the sample edge shall not exceed 3 mm from the edge of the sample. The holding arrangement in contact with the sample shall be thermally insulating (e.g. ceramic, etc.) compatible with use at the temperatures generated.

The sample shall be normal (or tilted no more than ±3° to avoid retro-reflections) to the laser beam with the beam axis centred on the sample at a distance 'F1' as shown in Figure D.1. The distance F1 past the focal point shall be not greater than 3 times the focal length (F) of the focusing lens. If for a specific application the guard is to be positioned at a distance less than 3 times the focal length (F) away from the focal point, the minimum distance between the focal point and the guard has to be taken as the distance F1.

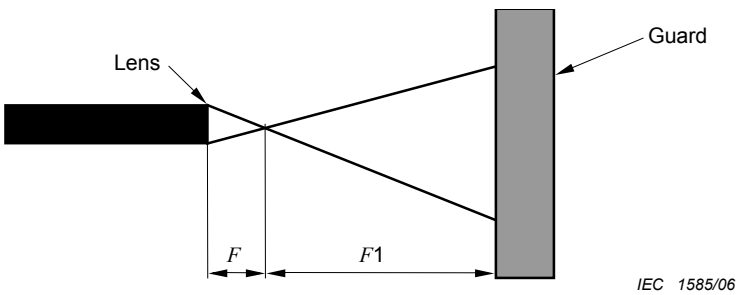

Figure D.1 – Simplified diagram of the test arrangement

NOTE 5 Test should be performed with horizontally directed beam as shown in Figure D.1. If different beam direction were used, mention the test arrangement regarding the beam direction in the qualification report.

The surface of the sample under test shall be sufficiently ventilated (e.g. by using a cross jet) to ensure that the test surface and the space between the test sample and the beam shaping optics remain clear of debris, fume, etc. during the period of the test. The ventilation shall have the same effect as the air circulation in the intended application.

In addition, where there are multiple layers to the sample guard, all internal surfaces and internal spaces shall be sufficiently ventilated (e.g. by using a cross jet) to ensure that all surfaces remain clear of debris, fume etc. during the period of the test.

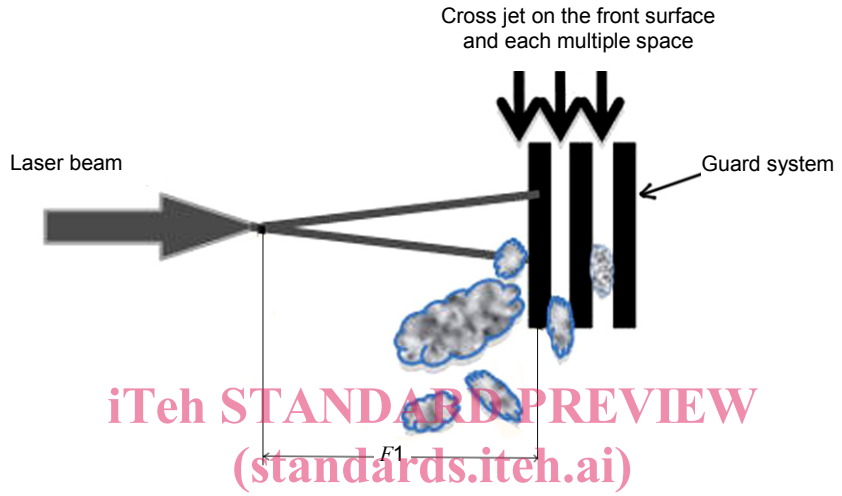

Figure D.2 – Simplified diagram of the ventilation for the guard under test

For passive guards: the accessible laser radiation at the rear surface of the sample shall not exceed Class 1 AEL during the test exposure, the duration of which is dependant on the period of exposure set by the manufacturer of the proprietary guard. The protection time of the guard must exceed the maintenance inspection interval as defined in Table D.1 subject to the intended laser guard usage.

Maintenance inspection intervals of proprietary laser guards should be specified by their manufacturer using test classifications T1, T2 or T3 as defined in Table D.1. Maintenance inspection intervals represent the time interval after which the guard is completely inspected and verified as not damaged or deteriorated. This is to ensure that the guard is in a state that can tolerate exposure to laser radiation for a further maintenance interval.

Table D.1 – Laser guard test classification

Test classification	Maintenance inspection intervals	Suggested laser guard usage
T1	30 000	For automated machine usage
T2	100	For short cycle operation and intermittent inspection
T3	10	For continuous inspection by observation

For active guards the following shall be required:

a) If the active guard is a part of a safety-related control system of a machine, the relevant and appropriate standard for safety-related control systems shall be applied.