

Safety of machinery - Electro-sensitive protective equipment -- Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs)

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN 61496-2:2013 sisaldab Euroopa standardi EN 61496-2:2013 inglisekeelset teksti.	This Estonian standard EVS-EN 61496-2:2013 consists of the English text of the European standard EN 61496-2:2013.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas.	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 13.12.2013.	Date of Availability of the European standard is 13.12.2013.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 13.110, 29.260.99

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:
Aru 10, 10317 Tallinn, Eesti; www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:
Aru 10, 10317 Tallinn, Estonia; www.evs.ee; phone 605 5050; e-mail info@evs.ee

English version

**Safety of machinery -
Electro-sensitive protective equipment -
Part 2: Particular requirements for equipment
using active opto-electronic protective devices (AOPDs)
(IEC 61496-2:2013)**

Sécurité des machines -
Équipements de protection électro-sensibles -
Partie 2: Exigences particulières à un
équipement utilisant des appareils protecteurs
optoélectroniques actifs (AOPD)
(CEI 61496-2:2013)

Sicherheit von Maschinen -
Berührungslos wirkende Schutzeinrichtungen -
Teil 2: Besondere Anforderungen an
Einrichtungen, welche nach dem aktiven opto-
elektronischen Prinzip arbeiten
(IEC 61496-2:2013)

This European Standard was approved by CENELEC on 2013-07-12. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations 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 may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard 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 CEN-CENELEC Management Centre 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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

CENELEC

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B - 1000 Brussels

Foreword

The text of document 44/651/CDV, future edition 3 of IEC 61496-2, prepared by IEC/TC 44 "Safety of machinery - Electrotechnical aspects" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61496-2:2013.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2014-06-13
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2016-07-12

This document supersedes CLC/TS 61496-2:2006.

EN 61496-2:2013 includes the following significant technical changes with respect to CLC/TS 61496-2:2006:

- requirements have been corrected and made easier to understand;
- test procedures have been revised to make them easier to perform and to improve repeatability;
- guidance is provided for the evaluation and verification of AOPDs using design techniques for which the test procedures of this part are not sufficient.

This standard is to be used in conjunction with EN 61496-1:2013.

This part supplements or modifies the corresponding clauses in EN 61496-1.

Where a particular clause or subclause of Part 1 is not mentioned in this Part 2, that clause or subclause applies as far as is reasonable. Where this part states "addition", "modification" or "replacement", the relevant text of Part 1 is adapted accordingly.

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

Endorsement notice

The text of the International Standard IEC 61496-2:2013 was approved by CENELEC as a European Standard without any modification.

Annex ZA

(normative)

Normative references to international publications with their corresponding European publications

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

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

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60825-1	2007	Safety of laser products - Part 1: Equipment classification and requirements	EN 60825-1	2007
IEC 61496-1	2012	Safety of machinery - Electro-sensitive protective equipment Part 1: General requirements and tests	EN 61496-1	2013
IEC 62471	-	Photobiological safety of lamps and lamp systems	EN 62471	-
ISO 13855	-	Safety of machinery - Positioning of protective equipment with respect to the approach speeds of parts of the human body	EN ISO 13855	-
-	-	High-visibility warning clothing for professional use - Test methods and requirements	EN 471	2003

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	8
4 Functional, design and environmental requirements	9
4.1 Functional requirements	9
4.2 Design requirements	11
4.3 Environmental requirements	14
5 Testing	14
5.1 General	14
5.2 Functional tests	17
5.4 Environmental tests	34
6 Marking for identification and safe use.....	42
6.1 General	42
7 Accompanying documents	42
Annex A (normative) Optional functions of the ESPE	44
Annex B (normative) Catalogue of single faults affecting the electrical equipment of the ESPE, to be applied as specified in 5.3.....	48
Annex AA (informative) Type 2 AOPD periodic test configurations	49
Bibliography.....	51
Index	52
Figure 1 – Limit area for the protection against the risk of beam bypass	12
Figure 2 – Limit of vertical and horizontal misalignment	13
Figure 3 – Test piece at 45°	18
Figure 4 – Test piece at 90°	19
Figure 5 – Verifying sensing function by moving the test piece (TP) through the detection zone near the emitter, near the receiver/retro-reflector target and at the midpoint.....	19
Figure 6 – Limit values for the effective aperture angle (EAA).....	21
Figure 7 – Determination of the minimum detection capability	22
Figure 8 – Measuring method for EAA (direction)	23
Figure 9 – Prism test to measure EAA of each beam	25
Figure 10 – EAA test using prism	26
Figure 11 – Design calculations for a wedge prism	27
Figure 12 – Example of optical subsystem: Emitter on left – Receiver on right	27
Figure 13 – Example of SMD LED Model	28
Figure 14 – Example of intensity distribution of emitting element	28
Figure 15 – Example of emitter model with beams internally blocked by aperture stop	28
Figure 16 – Example of receiving unit with off axis beam portion reflected internally on mechanical elements	29
Figure 17 – Example of test piece inside model of optical subsystem with passing radiation on the receiver	30

Figure 18 – Example of emitting unit adjusted at the limit.....	31
Figure 19 – Extraneous reflection test with mirror outside of limit area.....	32
Figure 20 – AOPD misalignment test	33
Figure 21 – Light interference test – Direct method	35
Figure 22 – Light interference test – Test set-up with incandescent light source	36
Figure 23 – Light interference test – Test set-up with fluorescent light source	37
Figure 24 – Light interference test – Test set-up with flashing beacon light source	38
Figure 25 – Light interference test – Test set-up with stroboscopic light source	39
Figure AA.1 – Single beam sensing device	49
Figure AA.2 – Series connection of single beam sensing devices	49
Figure AA.3 – Assembly of multiple beams tested individually.....	49
Figure AA.4 – Example of type 2 AOPD with internal test.....	50
Table 1 – Correspondences of requirements/testing and AOPD designs	15
Table 2 – Maximum permissible angle of misalignment (in degrees) for a type 2 ESPE depending on the dimensions of the light curtain.....	32
Table 3 – Maximum permissible angle of misalignment (in degrees) for a type 4 ESPE depending on the dimensions of the light curtain.....	32

preview generated by EVS

INTRODUCTION

Electro-sensitive protective equipment (ESPE) is applied to machinery that presents a risk of personal injury. It provides protection by causing the machine to revert to a safe condition before a person can be placed in a hazardous situation.

This part of IEC 61496 provides particular requirements for the design, construction and testing of electro-sensitive protective equipment (ESPE) for the safeguarding of machinery, employing active opto-electronic protective devices (AOPDs) for the sensing function.

Each type of machine presents its own particular hazards, and it is not the purpose of this standard to recommend the manner of application of the ESPE to any particular machine. The application of the ESPE should be a matter for agreement between the equipment supplier, the machine user and the enforcing authority; in this context, attention is drawn to the relevant guidance established internationally, for example, ISO 12100.

Due to the complexity of the technology of ESPEs there are many issues that are highly dependent on analysis and expertise in specific test and measurement techniques. In order to provide a high level of confidence, independent review by relevant expertise is recommended.

SAFETY OF MACHINERY – ELECTRO-SENSITIVE PROTECTIVE EQUIPMENT –

Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs)

1 Scope

This clause of Part 1 is replaced by the following:

This part of IEC 61496 specifies requirements for the design, construction and testing of electro-sensitive protective equipment (ESPE) designed specifically to detect persons as part of a safety-related system, employing active opto-electronic protective devices (AOPDs) for the sensing function. Special attention is directed to features which ensure that an appropriate safety-related performance is achieved. An ESPE may include optional safety-related functions, the requirements for which are given in Annex A of IEC 61496-1:2012 and of this part.

This part of IEC 61496 does not specify the dimensions or configurations of the detection zone and its disposition in relation to hazardous parts for any particular application, nor what constitutes a hazardous state of any machine. It is restricted to the functioning of the ESPE and how it interfaces with the machine.

Excluded from this part are AOPDs employing radiation at wavelengths outside the range 400 nm to 1500 nm.

This part of IEC 61496 may be relevant to applications other than those for the protection of persons, for example, the protection of machinery or products from mechanical damage. In those applications, additional requirements may be necessary, for example, when the materials that are to be recognized by the sensing function have different properties from those of persons.

This part of IEC 61496 does not deal with EMC emission requirements.

2 Normative references

This clause of Part 1 is applicable except as follows:

Additional references:

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

IEC 61496-1:2012, *Safety of machinery – Electro-sensitive protective equipment – Part 1: General requirements and tests*

IEC 62471, *Photobiological safety of lamps and lamp systems*

ISO 13855, *Safety of machinery – Positioning of safeguards with respect to the approach speeds of parts of the human body*

EN 471:2003, *High-visibility warning clothing for professional use – Test methods and requirements*.