

© Copyright SEK Svensk Elstandard. Reproduction in any form without permission is prohibited.

## Maskinsäkerhet – Elektriskt avkännande skyddsanordningar – Del 2: Särskilda fordringar på utrustning med aktiv optoelektronik (AOPD)

*Safety of machinery –*

*Electro-sensitive protective equipment –*

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

Som svensk standard gäller europastandarden EN IEC 61496-2:2020. Den svenska standarden innehåller den officiella engelska språkversionen av EN IEC 61496-2:2020.

### Nationellt förord

Europastandarden EN IEC 61496-2:2020

består av:

- **europastandardens ikraftsättningsdokument**, utarbetat inom CENELEC
- **IEC 61496-2, Fourth edition, 2020 - Safety of machinery - Electro-sensitive protective equipment - Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs)**

utarbetad inom International Electrotechnical Commission, IEC.

Standarden ska användas tillsammans med SS-EN IEC 61496-1, utgåva 4, 2020.

Tidigare fastställd svensk standard SS-EN 61496-2, utgåva 1, 2014, gäller ej fr o m 2023-08-19.

### *Standarder underlättar utvecklingen och höjer elsäkerheten*

Det finns många fördelar med att ha gemensamma tekniska regler för bl a mätning, säkerhet och provning och för utförande, skötsel och dokumentation av elprodukter och elanläggningar.

Genom att utforma sådana standarder blir säkerhetsfordringar tydliga och utvecklingskostnaderna rimliga samtidigt som marknadens acceptans för produkten eller tjänsten ökar.

Många standarder inom elområdet beskriver tekniska lösningar och metoder som åstadkommer den elsäkerhet som föreskrivs av svenska myndigheter och av EU.

### *SEK är Sveriges röst i standardiseringsarbetet inom elområdet*

SEK Svensk Elstandard svarar för standardiseringen inom elområdet i Sverige och samordnar svensk medverkan i internationell och europeisk standardisering. SEK är en ideell organisation med frivilligt deltagande från svenska myndigheter, företag och organisationer som vill medverka till och påverka utformningen av tekniska regler inom elektrotekniken.

SEK samordnar svenska intressenters medverkan i SEKs tekniska kommittéer och stödjer svenska experters medverkan i internationella och europeiska projekt.

### *Stora delar av arbetet sker internationellt*

Utformningen av standarder sker i allt väsentligt i internationellt och europeiskt samarbete. SEK är svensk nationalkommitté av International Electrotechnical Commission (IEC) och Comité Européen de Normalisation Electrotechnique (CENELEC).

Standardiseringsarbetet inom SEK är organiserat i referensgrupper bestående av ett antal tekniska kommittéer som speglar hur arbetet inom IEC och CENELEC är organiserat.

Arbetet i de tekniska kommittéerna är öppet för alla svenska organisationer, företag, institutioner, myndigheter och statliga verk. Den årliga avgiften för deltagandet och intäkter från försäljning finansierar SEKs standardiseringsverksamhet och medlemsavgift till IEC och CENELEC.

### *Var med och påverka!*

Den som deltar i SEKs tekniska kommittéarbete har möjlighet att påverka framtida standarder och får tidig tillgång till information och dokumentation om utvecklingen inom sitt teknikområde. Arbetet och kontakterna med kollegor, kunder och konkurrenter kan gynnsamt påverka enskilda företags affärsutveckling och bidrar till deltagarnas egen kompetensutveckling.

Du som vill dra nytta av dessa möjligheter är välkommen att kontakta SEKs kansli för mer information.

### **SEK Svensk Elstandard**

Box 1284  
164 29 Kista  
Tel 08-444 14 00  
[www.elstandard.se](http://www.elstandard.se)

English Version

Safety of machinery - Electro-sensitive protective equipment -  
Part 2: Particular requirements for equipment using active opto-  
electronic protective devices (AOPDs)  
(IEC 61496-2:2020)

Securité des machines - Equipements de protection électro-  
sensibles - Partie 2: Exigences particulières à un  
équipement utilisant des dispositifs protecteurs  
optoélectroniques actifs (AOPD)  
(IEC 61496-2:2020)

Sicherheit von Maschinen - Berührungslos wirkende  
Schutzeinrichtungen - Teil 2: Besondere Anforderungen an  
Einrichtungen, die aktive optoelektronische  
Schutzeinrichtungen (AOPD) verwenden  
(IEC 61496-2:2020)

This European Standard was approved by CENELEC on 2020-08-19. 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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



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

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

## **European foreword**

The text of document 44/875/FDIS, future edition 4 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 IEC 61496-2:2020.

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) 2021-05-19
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2023-08-19

This document supersedes EN 61496-2:2013 and all of its amendments and corrigenda (if any).

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

### **Endorsement notice**

The text of the International Standard IEC 61496-2:2020 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 are referred to in the text in such a way that some or all of their content constitutes requirements 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.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: [www.cenelec.eu](http://www.cenelec.eu).

*Annex ZA of Part 1 is applicable except as follows:*

*Add the following references:*

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60825-1	-	Safety of laser products - Part 1: Equipment classification and requirements	EN 60825-1	-
IEC 61496-1	2020	Safety of machinery - Electro-sensitive protective equipment - Part 1: General requirements and tests	EN IEC 61496-1	2020
IEC 62471	-	Photobiological safety of lamps and lamp systems	EN 62471	-
ISO 13855	-	Safety of machinery - Positioning of safeguards with respect to the approach speeds of parts of the human body	EN ISO 13855	-
ISO 20471	-	High-visibility clothing - Test methods and requirements	EN ISO 20471	-

## CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references .....	7
3 Terms and definitions .....	8
4 Functional, design and environmental requirements .....	9
5 Testing .....	14
6 Marking for identification and safe use.....	40
7 Accompanying documents .....	41
Annex A (normative) Optional functions of the ESPE .....	42
Annex AA (informative) Type 2 AOPD periodic test configurations .....	46
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° .....	18
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 – Example of optical subsystem .....	27
Figure 12 – Example of SMD LED Model .....	28
Figure 13 – Example of intensity distribution of emitting element .....	28
Figure 14 – Example of emitter model with beams internally blocked by aperture stop.....	29
Figure 15 – Example of receiving unit with off axis beam portion reflected internally on mechanical elements .....	29
Figure 16 – Example of test piece inside model of optical subsystem with passing radiation on the receiver .....	30
Figure 17 – Example of emitting unit adjusted at the limit.....	31
Figure 18 – Extraneous reflection test with mirror outside of limit area.....	32
Figure 19 – AOPD misalignment test .....	34
Figure 20 – Light interference test – Direct method.....	36
Figure 21 – Light interference test – Test set-up with incandescent light source .....	37
Figure 22 – Light interference test – Test set-up with fluorescent light source.....	38
Figure 23 – Light interference test – Test set-up with flashing beaconlight source .....	39
Figure AA.1 – Single beam sensing device .....	46
Figure AA.2 – Series connection of single beam sensing devices .....	46
Figure AA.3 – Assembly of multiple beams tested individually.....	46
Figure AA.4 – Example of type 2 AOPD with internal test.....	47

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 3 ESPE depending on the dimensions of the light curtain.....	33
Table 4 – Maximum permissible angle of misalignment (in degrees) for a type 4 ESPE depending on the dimensions of the light curtain.....	33

# INTERNATIONAL ELECTROTECHNICAL COMMISSION

## **SAFETY OF MACHINERY – ELECTRO-SENSITIVE PROTECTIVE EQUIPMENT –**

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

#### FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as “IEC Publication(s)”). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61496-2 has been prepared by IEC technical committee 44: Safety of machinery – Electrotechnical aspects, in collaboration with CENELEC technical committee 44X: Safety of machinery – Electrotechnical aspects.

This fourth edition cancels and replaces the third edition published in 2013. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) Requirements and test procedures in Part 2 that were found to be common to all ESPEs have been moved to Part 1. Test procedures that are dependent on the sensing technology remain in Part 2.



The text of this International Standard is based on the following documents:

FDIS	Report on voting
44/875/FDIS	44/878/RVD

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

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

This standard has the status of a product family standard and can be used as a normative reference in a dedicated product standard for the safety of machinery.

This standard is to be used in conjunction with IEC 61496-1:2020.

This part supplements or modifies the corresponding clauses in IEC 61496-1:2020.

Where a particular clause or subclause of IEC 61496-1:2020 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 IEC 61496-1:2020 is adapted accordingly.

Clauses and subclauses which are additional to those of Part 1 are numbered sequentially, following on the last available number in Part 1. Terminological entries (in Clause 3) which are additional to those in Part 1 are numbered starting from 3.201. Additional annexes are lettered from AA onwards.

A list of all parts in the IEC 61496 series, published under the general title *Safety of machinery – Electro-sensitive protective equipment*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document 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.**

## 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 document 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 document 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 can include optional safety-related functions, the requirements for which are given in Annex A of IEC 61496-1:2020 and of this document.

This document 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 document are AOPDs employing radiation at wavelengths outside the range 400 nm to 1 500 nm.

This document can 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 can be necessary, for example, when the materials that are to be recognized by the sensing function have different properties from those of persons.

This document does not deal with electromagnetic compatibility (EMC) emission requirements.

#### **2 Normative references**

This clause of Part 1 is applicable except as follows:

*Addition:*

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

IEC 61496-1:2020, *Safety of machinery – Electro-sensitive protective equipment – Part 1: General requirements and tests*<sup>1</sup>

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*

ISO 20471, *High-visibility clothing – Test methods and requirements*

---

<sup>1</sup> To be published.