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**Varnost strojev – Električno občutljiva zaščitna oprema – 3. del: Posebne zahteve za aktivne optoelektronske zaščitne elemente, ki se odzivajo na difuzni odboj (IEC 61496-3:2001)**

Safety of machinery – Electro-sensitive protective equipment – Part 3: Particular requirements for Active Opto-electronic Protective Devices responsive to Diffuse Reflection (AOPDDR) (IEC 61496-3:2001)

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English version

**Safety of machinery –  
Electro-sensitive protective equipment  
Part 3: Particular requirements for  
Active Opto-electronic Protective Devices  
responsive to Diffuse Reflection (AOPDDR)  
(IEC 61496-3:2001)**

Sécurité des machines –  
Equipements de protection  
électro-sensibles

Partie 3: Prescriptions particulières  
pour les équipements utilisant des  
dispositifs protecteurs opto-électroniques  
actifs sensibles aux réflexions diffuses  
(AOPDDR)  
(CEI 61496-3:2001)

Sicherheit von Maschinen –  
Berührungslos wirkende  
Schutzeinrichtungen

Teil 3: Besondere Anforderungen an  
aktive optoelektronische diffuse  
Reflektion nutzende Schutzeinrichtungen  
(AOPDDR)  
(IEC 61496-3:2001)

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This Technical Specification was approved by CENELEC on 2003-12-02.

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# CENELEC

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

**Central Secretariat: rue de Stassart 35, B - 1050 Brussels**

## Foreword

The text of the International Standard IEC 61496-3:2001, prepared by IEC TC 44, Safety of machinery - Electrotechnical aspects, was approved by CENELEC as CLC/TS 61496-3 on 2003-12-02 without any modification.

This Technical Specification supersedes EN 61496-3:2001.

The following date was fixed:

- latest date by which the existence of the CLC/TS  
has to be announced at national level (doa) 2004-02-01

Annex ZA has been added by CENELEC.

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## Endorsement notice

The text of the International Standard IEC 61496-3:2001 was approved by CENELEC as a Technical Specification without any modification.

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**Annex ZA**  
(normative)

**Normative references to international publications  
with their corresponding European publications**

This Technical Specification incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this Technical Specification only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

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 60068-2-14	1984	Environmental testing Part 2: Tests - Test N: Change of temperature	EN 60068-2-14 <sup>1)</sup>	1999
IEC 60068-2-75	1997	Part 2-75: Tests - Test Eh: Hammer tests	EN 60068-2-75	1997
IEC 60825-1	1993	Safety of laser products Part 1: Equipment classification, requirements and user's guide	EN 60825-1 + corr. February	1994 1995
IEC 61496-1	1997	Safety of machinery - Electro-sensitive protective equipment Part 1: General requirements and tests	EN 61496-1	1997
—	—	High-visibility warning clothing	EN 471	1994

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<sup>1)</sup> EN 60068-2-14 includes A1:1986 to IEC 60068-2-14.

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NORME  
INTERNATIONALE  
INTERNATIONAL  
STANDARD

CEI  
IEC

61496-3

Première édition  
First edition  
2001-02

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**Sécurité des machines –  
Équipements de protection électro-sensibles –**

**Partie 3:  
Prescriptions particulières pour les équipements  
utilisant des dispositifs protecteurs opto-  
électroniques actifs sensibles aux réflexions  
diffuses (AOPDDR)**

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**Safety of machinery –  
Electro-sensitive protective equipment –**

**Part 3:  
Particular requirements for Active Opto-  
electronic Protective Devices responsive  
to Diffuse Reflection (AOPDDR)**

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Commission Electrotechnique Internationale  
International Electrotechnical Commission  
Международная Электротехническая Комиссия

CODE PRIX  
PRICE CODE XA

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

**Part 3: Particular requirements for Active Opto-electronic  
Protective Devices responsive to  
Diffuse Reflection (AOPDDR)**

## FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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 the 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 National Committees.
- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
- 4) In order to promote international unification, IEC National Committees undertake to apply IEC International Standards transparently to the maximum extent possible in their national and regional standards. Any divergence between the IEC Standard and the corresponding national or regional standard shall be clearly indicated in the latter.
- 5) The IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with one of its standards.
- 6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61496-3 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 International Standard is to be used in conjunction with IEC 61496-1:1997.

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

FDIS	Report on voting
44/287/FDIS	44/293/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

Annexes A and B form an integral part of this standard.

Annexes C, AA and BB are for information only.

The committee has decided that the contents of this publication will remain unchanged until 2006. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

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

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## INTRODUCTION

An electro-sensitive protective equipment (ESPE) is applied to machinery presenting 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 supplements or modifies the corresponding clauses in IEC 61496-1 to specify 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 responsive to diffuse reflection (AOPDDRs) for the sensing function.

Where a particular clause or subclause of part 1 is not mentioned in this part 3, that clause or subclause applies as far as is reasonable. Where this part states "addition", "modification" or "replacement", the relevant text of part 1 should be adapted accordingly.

Supplementary annexes are entitled AA, BB, etc.

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/TR 12100.

NOTE Annex AA contains application examples providing general information and addressing specific characteristics relevant to the use of the ESPE described in this part of IEC 61496. An application standard for various types of ESPE is in preparation.

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

### Part 3: Particular requirements for Active Opto-electronic Protective Devices responsive to Diffuse Reflection (AOPDDR)

#### 1 Scope

##### *Replacement:*

This part of IEC 61496 specifies additional requirements for the design, construction and testing of electro-sensitive protective equipment (ESPE) for the safeguarding of machinery, employing active opto-electronic protective devices responsive to diffuse reflection (AOPDDRs) for the sensing function. Special attention is directed to requirements which ensure that an appropriate safety-related performance is achieved. An ESPE may include optional safety-related functions, the requirements for which are given both in annex A of this part and in annex A of IEC 61496-1.

This part 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.

AOPDDRs are devices that have a detection zone specified in two dimensions wherein radiation in the near infrared range is emitted by a transmitter element(s). When the emitted radiation impinges on an object (for example, a person or part of a person), a portion of the emitted radiation is reflected to a receiving element(s) by diffuse reflection whereby the presence of the object can be detected.

**NOTE** Under certain circumstances, limitations of the sensor in relation to its use need to be considered. For example:

- Objects that generate mirror-like (specular) reflections may not be detected if the diffuse reflectance value is less than that specified for the "black" test piece.
- The determination of the minimal reflection factors for the detection of obstacles is based on the clothing of a person. Objects having a reflectivity lower than that considered in this part may not be detected.

Excluded from this part are AOPDDRs employing radiation of wavelength outside the range 820 nm to 946 nm, and those employing radiation other than that generated by the AOPDDR itself. For sensing devices that employ radiation of wavelengths outside this range, this part may be used as a guide. Also excluded are AOPDDRs having a stated detection capability outside the range 50 mm to 100 mm.

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

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

Opto-electronic devices that perform only one-dimensional spot-like distance measurements, for example, proximity switches, are not covered by this part.

## 2 Normative references

*Addition:*

IEC 60068-2-14:1984, *Environmental testing – Part 2: Tests – Test N: Change of temperature*

IEC 60068-2-75:1997, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

IEC 60825-1:1993, *Safety of laser products – Part 1: Equipment classification, requirements and user's guide*

IEC 61496-1:1997, *Safety of machinery – Electro-sensitive protective equipment – Part 1: General requirements and tests*

EN 471:1994, *High-visibility warning clothing*

## 3 Definitions

*Addition:*

### 3.301

**active opto-electronic protective device responsive to diffuse reflection (AOPDDR)**

device, whose sensing function is performed by opto-electronic emitting and receiving elements, that detects the diffuse reflection of optical radiations generated within the device by an object present in a detection zone specified in two dimensions

### 3.302

**AOPDDR detection capability**

ability to detect the specified test pieces (see 4.2.13) in the detection zone

### 3.303

**tolerance zone**

zone outside the detection zone which is necessary to achieve the required probability of detection of the specified test piece(s) (see 4.2.13) within the detection zone

## 4 Requirements

This clause of part 1 is applicable except as follows:

### 4.1 Functional requirements

#### 4.1.3 Types of ESPE

*Replacement:*

In this part of IEC 61496 only a type 3 ESPE is considered. It is the responsibility of the machine supplier and/or the user to prescribe if this type is suitable for a particular application.

The type 3 ESPE shall fulfil the fault detection requirements of 4.2.2.4 of this part. In normal operation, the output circuit of each of at least two output signal switching devices (OSSDs) of the type 3 ESPE shall go to the OFF-state when the sensing device is actuated, or when the power is removed from the device.

*Additional functional requirements:*

#### **4.1.4 Zone with limited detection capability**

The nearest boundary of the detection zone shall not be further than 50 mm from the optical window in the plane of detection.

A zone between the optical window and the beginning of the detection zone is referred to as a zone with limited detection capability. In order to ensure no hazard can arise in a particular application due to the presence of this zone between the optical window and the detection zone, its dimensions and appropriate information for use shall be provided by the supplier.

## **4.2 Design requirements**

### **4.2.2 Fault detection requirements**

#### **4.2.2.2 Particular requirements for a type 1 ESPE**

This subclause of part 1 is not applicable.

#### **4.2.2.3 Particular requirements for a type 2 ESPE**

This subclause of part 1 is not applicable.

#### **4.2.2.4 Particular requirements for a type 3 ESPE**

*Replacement:*

A single fault in the sensing device resulting in a complete loss of the stated AOPDDR detection capability shall cause the ESPE to go to a lock-out condition within the specified response time.

NOTE 1 For AOPDDR using rotating mirrors for scanning the detection zone, this requirement can be fulfilled by scanning on a defined reference object located outside the detection zone and the tolerance zone.

A single fault resulting in a deterioration of the stated AOPDDR detection capability shall cause the ESPE to go to a lock-out condition within a time period of 5 s following the occurrence of that fault.

NOTE 2 Examples of deterioration of the AOPDDR detection capability include:

- increase of the minimum detectable object size;
- increase in the minimum detectable reflectance;
- decrease of measurement accuracy.

A single fault resulting in an increase in response time beyond the specified value or preventing at least one OSSD going to the OFF-state shall cause the ESPE to go to a lock-out condition immediately, i.e. within the response time, or immediately upon any of the following demand events where fault detection requires a change in state:

- on actuation of the sensing function;
- on switch off/on;
- on reset of the start interlock or the restart interlock, if available (see A.5 and A.6 of IEC 61496-1);
- on the application of an external test signal, if available.

NOTE 3 An external test signal may be required if, for example, in a particular application, the frequency of actuation of the sensing function is foreseeably low and the OSSDs are monitored only at the change of state.