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REDLINE VERSION

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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)

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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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)

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.
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International Standard IEC 61496-3 has been prepared by IEC technical committee 44: Safety of machinery – Electrotechnical aspects.

This third edition cancels and replaces the second edition published in 2008. This edition constitutes a technical revision.

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

a) extension of the scope from AOPDDR-2D to AOPDDR-3D;
b) extension of the scope from Type 3 ESPE to Type 2 ESPE;
c) implementation of requirements and test procedures for AOPDDR-3D and Type 2 ESPE;
d) listing of reference boundary monitoring as an optional function of the ESPE;
e) implementation of instructions for positioning of AOPDDR-3D in respect of parts of the human body;
f) revised requirement for combinations of single faults with conditions for no failure to danger, see for example 4.2.2.4, last paragraph.

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

FDIS	Report on voting
44/831/FDIS	44/837/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 2.

This document is to be used in conjunction with IEC 61496-1:2012.

Where a particular clause or subclause of IEC 61496-1:2012 is not mentioned in this document, that clause or subclause applies as far as is reasonable. Where this document states "addition" or "replacement", the relevant text of IEC 61496-1:2012 is adapted accordingly. Clauses and subclauses which are additional to those of IEC 61496-1:2012 are numbered sequentially, following on the last available number in IEC 61496-1:2012. Where no available number exist, the additional subclauses are numbered starting from 101. Supplementary Annexes are entitled AA and BB.

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.

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- 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

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 of IEC 61496 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 document to recommend the manner of application of the ESPE ~~should be~~ is 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, IEC 62046 and ISO ~~/TR~~ 12100.

Due to the complexity of the technology, 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 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 ~~non-contact~~ electro-sensitive protective equipment (ESPE) designed specifically to detect persons or parts of persons as part of a safety-related system, 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~~ can include optional safety-related functions, the requirements for which are given both in Annex A of this document and in Annex A of IEC 61496-1:2012.

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.

AOPDDRs are devices that have ~~a~~ either

– one or more detection zone(s) specified in two dimensions (AOPDDR-2D), or
– one or more detection zone(s) specified in three dimensions (AOPDDR-3D)

wherein radiation in the near infrared range is emitted by ~~a transmitter~~ an emitting 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~~. This reflection is used to determine the position of the object.

~~NOTE 1 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.~~

Opto-electronic devices that perform only a single one-dimensional spot-like distance measurement~~s~~, for example, optical proximity switches, are not covered by this document.

This document does not address those aspects required for complex classification or differentiation of the object detected.

This document does not address requirements and tests for outdoor application.

Excluded from this document are AOPDDRs employing radiation with the peak of wavelength outside the range 820 nm to ~~946~~ 950 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 document ~~may~~ can be used as a guide. This document is relevant for AOPDDRs having a ~~stated detection capability~~ minimum detectable object size in the range

from 30 mm to 200 mm. ~~AOPDDRs intended for use as trip device using whole-body detection with normal approach to the detection zone and having a stated detection capability not exceeding 200 mm shall meet the requirements of Clause A.12. AOPDDRs intended for a direction of approach normal to the detection zone and having a stated detection capability in the range from 30 mm to 70 mm shall meet the requirements of Clause A.13.~~

~~NOTE 2 According to ISO 13855 (EN 999), 6.3 foreseeable angles of approach greater than 30" should be considered normal approach and foreseeable angles of approach less than 30" should be considered parallel approach.~~

~~NOTE 3 According to ISO 13855 (EN 999), 6.2 when electro-sensitive protective equipment employing active opto-electronic protective devices is used for direction of approach parallel to the detection zone the device should have a detection capability in the range from 50 mm to 117 mm.~~

This document ~~may~~ can 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 those applications, different requirements ~~may~~ can be ~~necessary~~ appropriate, for example when the materials that have to be recognized by the sensing function have different properties from those of persons and their clothing.

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

2 Normative references

Clause 2 of IEC 61496-1:2012 applies, except as follows.

Addition:

IEC 60068-2-14~~:1984~~, ~~*Basic*~~ *Environmental testing* ~~*procedures*~~ *– Part 2-14: Tests – Test N: Change of temperature*
~~Amendment 1 (1986)~~

IEC 60068-2-75~~:1997-08~~, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

IEC TR 60721-4-5, *Classification of environmental conditions – Part 4-5: Guidance for the correlation and transformation of environmental condition classes of IEC 60721-3 to the environmental tests of IEC 60068 – Ground vehicle installations*

IEC 60825-1:2014, *Safety of laser products – Part 1: Equipment classification and requirements* ~~*and user's guide*~~

IEC 61496-1:~~2004~~ 2012, *Safety of machinery – Electro-sensitive protective equipment – Part 1: General requirements and tests*

~~IEC 62046[1], *Safety of machinery – Application of protective equipment to detect the presence of persons*~~

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

ISO 13855:~~2002~~ 2010, *Safety of machinery – Positioning of* ~~*protective equipment*~~ *safeguards with respect to the approach speeds of parts of the human body*

~~EN 471:2003-09~~ ISO 20471:2013, *High-visibility* ~~*warning*~~ *clothing* ~~*for professional use*~~ *– Test methods and requirements*

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~~[1] To be published.~~

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Edition 3.0 2018-12

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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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)

Sécurité des machines – Équipements de protection électro-sensibles – Partie 3: Exigences particulières pour les équipements utilisant des dispositifs protecteurs optoélectroniques actifs sensibles aux réflexions diffuses (AOPDDR)

IEC 61496-3:2018-12(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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Part 3: Particular requirements for active opto-electronic protective devices responsive to diffuse reflection (AOPDDR)

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e) implementation of instructions for positioning of AOPDDR-3D in respect of parts of the human body;

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Part 3: Particular requirements for active opto-electronic protective devices responsive to diffuse reflection (AOPDDR)

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ISO 20471:2013, *High-visibility clothing – Test methods and requirements*

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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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SÉCURITÉ DES MACHINES – ÉQUIPEMENTS DE PROTECTION ÉLECTRO-SENSIBLES –

Partie 3: Exigences particulières pour les équipements utilisant des dispositifs protecteurs optoélectroniques actifs sensibles aux réflexions diffuses (AOPDDR)

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La Norme internationale IEC 61496-3 a été établie par le comité d'études 44 de l'IEC: Sécurité des machines – Aspects électrotechniques.

Cette troisième édition annule et remplace la deuxième édition parue en 2008. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) extension du domaine d'application de l'AOPDDR-2D à l'AOPDDR-3D;
b) extension du domaine d'application de l'ESPE de type 3 à l'ESPE de type 2;

c) mise en œuvre des exigences et des procédures d'essai pour l'AOPDDR-3D et l'ESPE de type 2;

d) énumération de la surveillance des limites de référence comme fonction facultative de l'ESPE;

e) mise en œuvre des instructions pour le positionnement de l'AOPDDR-3D par rapport aux parties du corps;

f) revue des exigences pour la combinaison des défauts uniques avec les conditions concernant l'absence de défaillance dangereuse, voir par exemple le dernier alinéa de 4.2.2.4.

Le texte de cette norme est issu des documents suivants:

FDIS	Rapport de vote
44/831/FDIS	44/837/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette norme.

Cette publication a été rédigée selon les Directives ISO/IEC, Partie 2.

Le présent document doit être utilisé conjointement avec l'IEC 61496-1:2012.

Lorsqu'un article ou un paragraphe particulier de l'IEC 61496-1:2012 n'est pas mentionné dans ce document, cet article ou ce paragraphe s'applique pour autant que cela soit raisonnable. Lorsque le présent document indique «addition» ou «remplacement», le texte correspondant de l'IEC 61496-1:2012 est adapté en conséquence. Les articles et les paragraphes complémentaires à ceux de l'IEC 61496-1:2012 sont numérotés dans l'ordre, à partir du dernier numéro disponible dans l'IEC 61496-1:2012. Lorsqu'aucun numéro disponible n'existe, les paragraphes complémentaires sont numérotés à partir de 101. Les Annexes complémentaires sont appelées AA et BB.

Une liste de toutes les parties de la série IEC 61496, publiées sous le titre général *Sécurité des machines – Équipements de protection électro-sensibles*, peut être consultée sur le site web de l'IEC.

Le comité a décidé que le contenu de cette publication ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous "http://webstore.iec.ch" dans les données relatives à la publication recherchée. À cette date, la publication sera

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INTRODUCTION

Un équipement de protection électrosensible (ESPE – *electro-sensitive protective equipment*) est appliqué aux machines qui présentent un risque de préjudice corporel. Il offre une protection en permettant à la machine de recouvrer un état de sécurité avant qu'un individu ne puisse se retrouver dans une situation dangereuse.

Cette partie de l'IEC 61496 complète ou modifie les articles correspondants de l'IEC 61496-1 pour définir des exigences particulières de conception, de construction et d'essais d'équipements de protection électrosensibles (ESPE) pour la sécurité des machines, utilisant pour la fonction de détection des dispositifs protecteurs optoélectroniques actifs sensibles aux réflexions diffuses (AOPDDR – *active opto-electronic protective devices responsive to diffuse reflection*).

Chaque type de machine présente ses propres dangers (phénomènes dangereux), et l'objectif du présent document n'est pas de recommander la méthode d'application de l'ESPE à une machine particulière. L'application de L'ESPE fait l'objet d'un accord entre le fournisseur de l'équipement, l'utilisateur de la machine et l'organisme de sécurité. Dans ce contexte, l'attention est attirée sur les recommandations internationales concernées, par exemple l'IEC 62046 et l'ISO 12100.

En raison de la complexité de la technologie déployée, de nombreuses questions dépendent dans une large mesure de l'analyse et de l'expertise en matière de techniques d'essai et de mesure spécifiques. Une revue indépendante par une expertise adaptée est recommandée pour garantir un niveau de confiance élevé.

SÉCURITÉ DES MACHINES – ÉQUIPEMENTS DE PROTECTION ÉLECTRO-SENSIBLES –

Partie 3: Exigences particulières pour les équipements utilisant des dispositifs protecteurs optoélectroniques actifs sensibles aux réflexions diffuses (AOPDDR)

1 Domaine d'application

La présente partie de l'IEC 61496 définit les exigences complémentaires de conception, de construction et d'essai d'équipements de protection électrosensibles (ESPE) conçus spécialement pour détecter des personnes ou des parties de personnes, comme partie d'un système relatif à la sécurité, utilisant pour la fonction de détection des dispositifs protecteurs optoélectroniques actifs sensibles aux réflexions diffuses (AOPDDR). Une attention particulière est portée aux exigences assurant qu'une performance appropriée relative à la sécurité est atteinte. Un ESPE peut comprendre des fonctions relatives à la sécurité facultatives, leurs exigences étant indiquées dans l'Annexe A du présent document et dans l'Annexe A de l'IEC 61496-1:2012.

Le présent document ne définit ni les dimensions, ni la configuration de la zone de détection, ni son emplacement par rapport aux parties dangereuses dans une application quelconque, ni, enfin, ce qui constitue un état dangereux pour une machine donnée. Elle se limite au fonctionnement de l'ESPE, et à son interface avec la machine.

Les AOPDDR sont des dispositifs qui comportent soit

– une ou plusieurs zones de détection bidimensionnelles (AOPDDR-2D), ou
– une ou plusieurs zones de détection tridimensionnelles (AOPDDR-3D)

dans laquelle ou lesquelles le rayonnement dans le champ proche infrarouge est émis par un ou des émetteurs. Lorsque le rayonnement émis rencontre un objet (une personne par exemple ou une partie de son corps), une partie du rayonnement émis est réfléchi par réflexion diffuse sur un ou des récepteurs. Cette réflexion permet de déterminer la position de l'objet.

Les équipements optoélectroniques qui réalisent un seul mesurage de distances unidimensionnelles ponctuelles, par exemple, les détecteurs de proximité optiques, ne sont pas couverts par le présent document.

Le présent document ne traite pas des aspects exigés pour une classification complexe ou une différenciation de l'objet détecté.

Le présent document ne traite pas des exigences et des essais pour une application extérieure.

Les AOPDDR utilisant des longueurs d'onde de crête de rayonnement hors de la plage de 820 nm à 950 nm ainsi que ceux dont les longueurs d'onde de rayonnement sont différentes de celles générées par l'AOPDDR lui-même sont exclus du présent document. Ce dernier peut servir de guide pour les dispositifs de détection qui utilisent des longueurs d'onde de rayonnement hors de cette plage. Le présent document est approprié pour les AOPDDR disposant d'une taille minimale de l’objet détectable dans la plage comprise entre 30 mm et 200 mm.

Le présent document peut se révéler approprié pour des applications autres que la protection des personnes, par exemple la protection des machines ou des produits contre des dommages mécaniques. Dans ces applications, des exigences différentes peuvent être appropriées, par exemple lorsque les matières qui doivent être reconnues par la fonction de détection possèdent des propriétés différentes de celles des personnes et de leurs vêtements.

Le présent document ne traite pas des exigences d'émission concernant la compatibilité électromagnétique (CEM).

2 Références normatives

L'Article 2 de l'IEC 61496-1:2012 s'applique, à l'exception de ce qui suit.

Addition:

IEC 60068-2-14, *Essais d'environnement – Partie 2-14: Essais – Essai N: Variation de température*

IEC 60068-2-75, *Essais d'environnement – Partie 2-75: Essais – Essai Eh: Essais au marteau*

IEC TR 60721-4-5, *Classification des conditions d'environnement – Partie 4-5: Guide pour la corrélation et la transformation des classes de conditions d'environnement de la CEI 60721-3 en essais d'environnement de la CEI 60068 – Installations des véhicules terrestres*

IEC 60825-1:2014, *Sécurité des appareils à laser – Partie 1: Classification des matériels et exigences*

IEC 61496-1:2012, *Sécurité des machines – Équipements de protection électro-sensibles – Partie 1: Prescriptions générales et essais*

IEC 62471, *Sécurité photobiologique des lampes et des appareils utilisant des lampes*

ISO 13855:2010, *Sécurité des machines – Positionnement des moyens de protection par rapport à la vitesse d'approche des parties du corps*

ISO 20471:2013, *Vêtements à haute visibilité – Méthodes d'essai et exigences*