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Safety of machinery — Electro-sensitive protective equipment

Part 4-3: Particular requirements for equipment using vision based protective devices (VBPD) — Additional requirements when using stereo vision techniques (VBPDST)

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee MCE/3, Safeguarding of machinery.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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SAFETY OF MACHINERY – ELECTRO-SENSITIVE PROTECTIVE EQUIPMENT –

Part 4-3: Particular requirements for equipment using vision based protective devices (VBPD) – Additional requirements when using stereo vision techniques (VBPDST)

FOREWORD

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IEC TS 61496-4-3 has been prepared by IEC technical committee TC 44: Safety of machinery – Electrotechnical aspects. It is a Technical Specification.

This second edition cancels and replaces the first edition published in 2015-05. This edition constitutes a technical revision.

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

a) Some requirement clauses and test procedures have been adapted or removed because they have been consolidated in IEC 61496-1:2020 (e.g. 5.4.6.2 Light sources or Clause A.9).

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

Draft	Report on voting
44/934/DTS	44/957A/RVDTS

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

The language used for the development of this document is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at https://www.iec.ch/publications.

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

This document supplements or modifies the corresponding clauses in IEC 61496-1:2020 to specify particular requirements for the design, construction and testing of electro-sensitive protective equipment (ESPE) for the safeguarding of machinery, employing vision based protective devices (VBPD) using stereo vision techniques (VBPDST) for the sensing function.

Where a particular clause or subclause of IEC 61496-1:2020 is not mentioned in this document, that clause or subclause applies as far as is reasonable. Where this document 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 IEC 61496-1:2020 are numbered sequentially, following on the last available number in IEC 61496-1:2020. Terminological entries (in Clause 3) which are additional to those in IEC 61496-1:2020 are numbered starting from 3.4301. Additional annexes are lettered from AA onwards and additional tables are numbered with prefix 43.

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 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 document 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.

The working group responsible for drafting this document was concerned that, 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. They considered that if this high level of confidence could not be established these devices would not be suitable for use in safety related applications.

SAFETY OF MACHINERY – ELECTRO-SENSITIVE PROTECTIVE EQUIPMENT –

Part 4-3: Particular requirements for equipment using vision based protective devices (VBPD) – Additional requirements when using stereo vision techniques (VBPDST)

1 Scope

Replacement:

This document specifies 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 vision-based protective devices (VBPDs) using stereo vision techniques (VBPDST) 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 this document.

NOTE "Non-contact" means that physical contact is not required for sensing.

Where this document does not contain all necessary provisions, IEC TS 62998-1 applies.

It is also possible, for those aspects not considered in this document, to use provisions from IEC TS 62998-1 additionally.

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.

The detection principle is based on the evaluation of images from different viewing points (stereoscopic view) for the determination of distance information. This distance information is used to determine the position of an object(s).

– This document is limited to vision based ESPEs with fixed distances (stereo base) and fixed directions of the optical axes using a fixed focal length.
– It is limited to vision based ESPEs that do not require human intervention for detection.
– It is limited to vision based ESPEs that detect objects entering into or being present in a detection zone(s).
– It is limited to VBPDSTs employing radiation at wavelengths within the range 400 nm to 1 500 nm.
– This document does not address those aspects required for complex classification or differentiation of the object detected.
– This document does not consider the aspects of a moving ESPE installation.

Additional requirements and tests can apply in the following cases:

– Use of multi-spectral (colour) techniques;
– Setups other than as shown in Figure 2 and Figure 3 (e.g. changing backgrounds, horizontal orientation of the optical axis with respect to the floor);

– Intended for outdoor applications.

This document is relevant for VBPDSTs having a stated detection capability up to 200 mm.

This document can be relevant to applications other than those for the protection of persons or parts of persons like arm or fingers (in the range 14 mm to 200 mm), 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 EMC emission requirements.

2 Normative references

Addition:

IEC 60825-1:2014, *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*

IEC 62471:2006, *Photobiological safety of lamps and lamp systems*

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

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

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

This clause of IEC 61496-1:2020 is applicable except as follows:

Replacement:

3.3
detection capability
ability to detect the specified test pieces (see 4.2.13) in the specified detection zone

Note 1 to entry: Detection capability is measured by the size of an object that can be detected. An increase in detection capability means that a smaller object can be detected.

[SOURCE: IEC 61496-1:2020, 3.3, modified – The text has been changed to make it more relevant to vision based sensors and Note 1 has been added.]