PD IEC TS 61496-5:2023

BSI Standards Publication

Safety of machinery — Electro-sensitive protective equipment

Part 5: Particular requirements for radar-based protective devices

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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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Published by BSI Standards Limited 2023

ISBN 978 0 539 06247 2

ICS 13.110; 29.260.99

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This Published Document was published under the authority of the Standards Policy and Strategy Committee on 30 September 2023.

Amendments/corrigenda issued since publication

Date	Text affected

IEC TS 61496-5

Edition 1.0 2023-08

TECHNICAL SPECIFICATION

colour inside

Safety of machinery – Electro-sensitive protective equipment – Part 5: Particular requirements for radar-based protective devices

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 13.110; 29.260.99

ISBN 978-2-8322-7299-2

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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SAFETY OF MACHINERY – ELECTRO-SENSITIVE PROTECTIVE EQUIPMENT –

Part 5: Particular requirements for radar-based protective devices

FOREWORD

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IEC TS 61496-5 has been prepared by IEC technical committee 44: Safety of machinery – Electrotechnical aspects. It is a Technical Specification.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
44/986/DTS	44/1007/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 Technical Specification 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 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 radar protective devices (RPDs) responsive to diffuse reflection 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 3.501. Additional annexes are lettered from AA onwards and additional tables are numbered with prefix 5.

A list of all the 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

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.

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 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 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.

Differences between worldwide frequency allocation can affect some tests due to national regulations.

SAFETY OF MACHINERY – ELECTRO-SENSITIVE PROTECTIVE EQUIPMENT –

Part 5: Particular requirements for radar-based protective devices

1 Scope

Replacement:

This part of IEC 61496 provides particular requirements for the design, construction and testing of non-contact electro-sensitive protective equipment (ESPE) designed specifically to provide whole-body detection of a person or persons as part of a safety-related system, employing radar protective devices (RPDs) responsive to diffuse reflection of radar signals for the sensing function using frequency-modulated continuous-wave (FMCW) technique. 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 Annex A of this document.

The requirements given in this document are related to the detection of adult persons being present in an industrial manufacturing environment.

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.

This document does not consider the aspects of a moving RPD application. Additional consideration can be necessary, if the RPD supplier specifies the RPD for use on moving application.

Additional requirements and tests can apply if setup of the RPD differs from Figure 2 and Figure 4.

NOTE The Radar cross-section stated in this document is based on measurements using horizontal arrangements.

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

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

Excluded from this document are RPDs that employ electromagnetic radiation outside the range 9 GHz to 81 GHz (identified as subset of band 10 and band 11 in accordance with ITU Radio Regulations). For sensing devices that employ electromagnetic radiation outside this range, this document can be used as a guide. National regulations can limit the available frequencies.

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

This document does not deal with requirements for ESPE functions not related to the protection of persons (e.g. using sensing unit data for navigation).

While a data interface can be used to control optional safety-related ESPE functions (Annex A), this document does not provide specific requirements. Requirements for these safety-related functions can be determined by consulting other standards (for example, IEC 61508, IEC 62046, IEC 62061, and ISO 13849-1).

This document does not deal with EMC emission requirements.

2 Normative references

Clause 2 of IEC 61496-1:2020 applies, except as follows.

Addition:

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

3 Terms and definitions

Clause 3 of IEC 61496-1:2020 applies, except as follows.

Replacement of 3.3 and 3.4:

3.3
detection capability
sensing function parameter limit(s) specified by the supplier that will cause actuation of the RPD

Note 1 to entry: Detection capability of RPD is often described by the minimum detectable object radar cross section, which refers to its size, the angle and the object properties (e.g. reflectivity, geometry, distance, velocity, approaching angle).

Note 2 to entry: A list of influences which can affect the RPD detection capability is given in 4.2.12.1.

3.4
detection zone
zone within the specified test target(s) is detected by the RPD with a minimum required probability of detection

Addition:

3.501
radar protective device
RPD
device whose sensing function is performed by radio wave emitting and receiving elements that detect the diffuse reflection of an object present in a detection zone

3.502
radar cross section
RCS
equivalent echoing area which is 4π times the ratio of the power per unit solid angle scattered in a specified direction to the power per unit area in a plane wave incident on the scatterer from a specified direction

Note 1 to entry: See Bibliography [1] chapter 2.

[SOURCE: ISO 8729-2:2009, 3.3, modified – Note 1 to entry has been replaced.]