IEC 62046

Edition 2.0 2026-07

INTERNATIONAL STANDARD

Safety of machinery - Application of protective equipment to detect the presence of persons

ICS 13.110

ISBN 978-2-8327-1314-3

IEC 62046:2026-07(en)

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Safety of machinery - Application of protective equipment to detect the presence of persons

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IEC 62046 has been prepared by IEC technical committee 44: Safety of machinery – Electrotechnical aspects. It is an International Standard.

This second edition cancels and replaces the first edition published in 2018. This edition constitutes a technical revision.

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

a) restructuring of the document to aid the user;
b) additional information on vision and radar systems;
c) muting requirements have been updated;
d) information on whole body access has been added;
e) whole body access has also been covered in more detail;
f) alignment to changes in ISO 13855.

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

Draft	Report on voting
44/1080/FDIS	44/1088/RVD

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 International Standard 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.

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– withdrawn, or
– revised.

INTRODUCTION

This document provides requirements and information on the application of sensitive protective equipment (SPE), which employs sensing devices to detect persons, in order to reduce or minimize a risk from hazardous parts of machinery, without providing a physical barrier.

The objective of this document is to assist standards writing committees responsible for developing machine standards (type-C Standards), machine designers, manufacturers and refurbishers, machine safety certification organizations, workplace authorities and others on the proper application of sensitive protective equipment to machinery.

Figure 1 shows the general context and the intended use of this document.

Clause 1 to Clause 5, Clause 7 and Clause 8 of this document apply to all sensitive protective equipment included in the scope, Clause 6 contains guidance for the application of specific kinds of sensitive protective equipment.

The principles of this document can be useful in the application of devices using other detection technologies but this document does not give specific requirements for those devices.

This document considers devices standardized in the IEC 61496 series and the ISO 13856 series. Unless a product-specific safety-related standard for devices using other sensing technologies is published, their suitability as the sole means of protection from machine hazards is unknown. The selection and use of devices for which there is no product-specific safety-related standard because their behaviour, particularly under fault conditions, is not known to be sufficiently predictable should be selected only after adequate research.

A SIL (safety integrity level, as described in IEC 62061 or IEC 61508) or PL (performance level, as described in ISO 13849-1) is not sufficient as an indication of a device's suitability for use as a safeguard. Suitability depends on appropriate sensing means, environmental conditions especially those that can affect the detection capability, behaviour under fault conditions, etc.

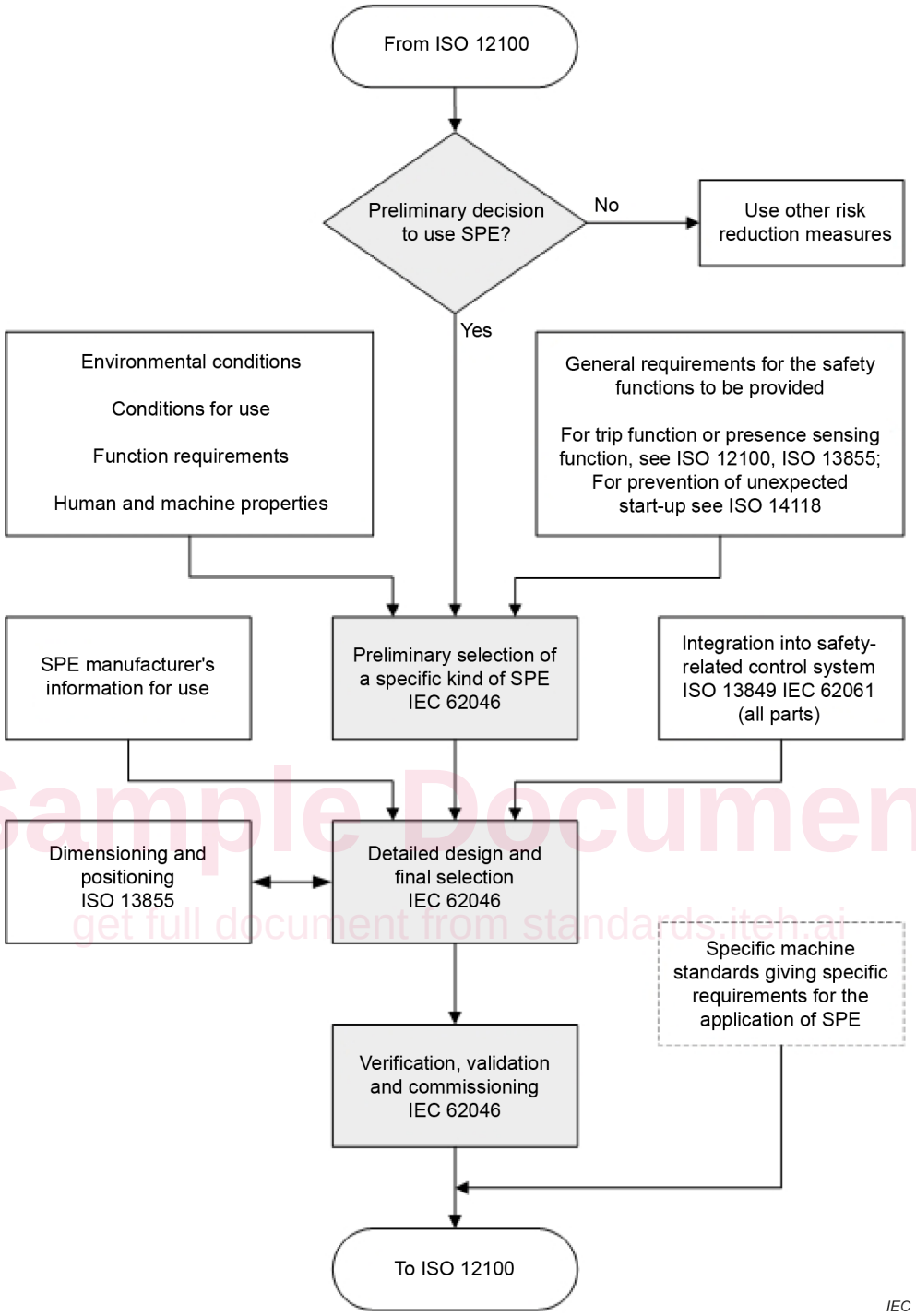

Figure 1 – Relationship of this document to other standards

1 Scope

This document specifies requirements for the selection, positioning, configuration and commissioning of sensitive protective equipment (SPE) to detect the momentary or continued presence of persons in order to protect those persons from dangerous part(s) of machinery in industrial applications. This document covers the application of electro-sensitive protective equipment (ESPE) specified in the IEC 61496 series and pressure-sensitive mats and floors specified in ISO 13856-1.

It takes into account the characteristics of the machinery, the sensitive protective equipment, the environment and human interaction by persons of 14 years and older.

This document includes informative annexes to provide guidance on the application of sensitive protective equipment to detect the presence of persons. These annexes contain examples to illustrate the principles of this document. These examples are not intended to be the only solutions to a given application and are not intended to restrict innovation or advancement of technology. The examples are provided only as representative solutions to illustrate some of the concepts of integration of sensitive protective equipment, and have been simplified for clarity, so they can be incomplete.

It is intended that this document is used in conjunction with ISO 13855.

2 Normative references

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.

IEC 62061:2021, *Safety of machinery - Functional safety of safety-related control systems*
IEC 62061:2021/AMD1:2024

IEC TS 61496-4-2:2022, *Safety of machinery - Electro-sensitive protective equipment - Part 4-2: Particular requirements for equipment using vision based protective devices (VBPD) - Additional requirements when using reference pattern techniques (VBPDPP)*

IEC TS 61496-4-3:2022, *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)*

ISO 13849-1:2023, *Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design*

ISO 13855:2024, *Safety of machinery - Positioning of safeguards with respect to the approach of the human body*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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

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

– IEC Electropedia: available at https://www.electropedia.org/

– ISO Online browsing platform: available at https://www.iso.org/obp

3.1.1
active opto-electronic protective device
AOPD
device whose sensing function is performed by opto-electronic emitting and receiving elements detecting the interruption of optical radiations generated, within the device, by an opaque object present in the specified detection zone (or for a light beam device, on the axis of the light beam)

[SOURCE: IEC 61496-2:2020, 3.201, modified – The note to entry has been removed.]

3.1.2
active opto-electronic protective device responsive to diffuse reflection
AOPDDR
assembly using active optical radiation to detect the diffuse reflection of an object present in a detection zone specified in two or three dimensions

[SOURCE: IEC 61496-3:2025, 3.301]

3.1.3
automatic selection of active detection zone
optional function that permits the selection/deselection of the active safety-related detection zone of sensitive protective equipment while still providing protection during the hazardous machine cycle

Note 1 to entry: Examples include selection of pre-defined blanking or reduced resolution configurations; see IEC 61496-2:2020, Clause A.12.

Note 2 to entry: The safety-related logic for the automatic selection of active detection zones may be within the sensitive protective equipment or may be applied externally from within the safety-related parts of the control system.

Note 3 to entry: The automatic selection of safety-related detection zones is not a muting function; see IEC 61496-3:2025, A.10.1, Note 2.

3.1.4
blanking
optional function that permits an object of a size greater than the detection capability of the ESPE to be located within the detection zone without causing an OFF-state of the OSSD(s)

Note 1 to entry: Blanked beams are monitored for continued interruption of light.

[SOURCE: IEC 61496-1:2020, 3.1, modified – Note 1 to entry has been modified, Note 2 to entry has been removed.]

3.1.5
detection capability
d
sensing function parameter limit specified by the supplier that will cause actuation of the sensitive protective equipment

[SOURCE: IEC 61496-1:2020, 3.3, modified – In the definition, "electro-" has been removed from the term "electro-sensitive".]

3.1.6
detection zone
zone within which a specified test piece is detected by the sensitive protective equipment

Note 1 to entry: The detection zone can also be a point, line, plane or volume.

Note 2 to entry: ISO 13856-1 uses the term "effective sensing area" when describing pressure-sensitive mats and pressure-sensitive floors. In this document the terms "detection zone" and "effective sensing area" are used synonymously.

[SOURCE: ISO 13855:2024, 3.1.7 , modified – "or volume" has been added to Note 1 to entry.]

3.1.7
effective detection capability
d_e
sensing function parameter limit set by the integrator of the device that will cause its actuation

Note 1 to entry: Some sensitive protective equipment provide a provision for the detection capability to be modified for the application.

[SOURCE: ISO 13855:2024, 3.1.4, modified – Note 1 to entry has been added.]

3.1.8
electro-sensitive protective equipment
ESPE
assembly of devices and/or components working together for protective tripping or presence-sensing purposes and comprising as a minimum

– a sensing device;
– controlling/monitoring devices;
– output signal switching devices and/or a safety-related data interface

[SOURCE: IEC 61496-1:2020, 3.5, modified – Notes 1 and 2 to entry have been removed.]

3.1.9
external device monitoring
EDM
means by which external devices are monitored for their correct operation

Note 1 to entry: EDM may be a function integrated into a SPE or control logic unit.

3.1.10
failure
loss of ability of an item to perform as required

Note 1 to entry: A failure of an item is an event that results in a fault of that item: see "fault" (IEV 192-04-01).

Note 2 to entry: Qualifiers, such as catastrophic, critical, major, minor, marginal and insignificant, can be used to categorize failures according to the severity of consequences, the choice and definitions of severity criteria depending upon the field of application.

Note 3 to entry: Qualifiers, such as misuse, mishandling and weakness, can be used to categorize failures according to the cause of failure.

Note 4 to entry: In practice, the terms fault and failure are often used synonymously.

[SOURCE: IEC 60050-192:2015, 192-03-01, modified – Note 4 to entry was added.]

3.1.11
failure to danger
failure which prevents or delays all output signal switching devices going to, and/or remaining in the OFF-state in response to a condition which, in normal operation, would result in their so doing

[SOURCE: IEC 61496-1:2020, 3.8]

3.1.12
fault
inability to perform as required, due to an internal state

Note 1 to entry: A fault of an item results from a failure, either of the item itself, or from a deficiency in an earlier stage of the life cycle, such as specification, design, manufacture or maintenance. See latent fault (192-04-08).

Note 2 to entry: Qualifiers, such as specification, design, manufacture, maintenance or misuse, may be used to indicate the cause of a fault.

Note 3 to entry: The type of fault may be associated with the type of associated failure, e.g. wear-out fault and wear-out failure.

Note 4 to entry: The adjective “faulty” designates an item having one or more faults.

[SOURCE: IEC 60050-192:2015, 192-04-01]

3.1.13
final switching device
FSD
component of the machine’s safety-related control system that interrupts the circuit to the machine primary control element (MPCE) when the output signal switching device (OSSD) goes to the OFF-state

[SOURCE: IEC 61496-1:2020, 3.10]

3.1.14
hazard
potential source of harm

Note 1 to entry: The word "hazard" is generally used in conjunction with other words defining its origin or the nature of the expected injury or damage to health: electrical shock hazard, crushing hazard, shearing hazard, toxic hazard, etc.

[SOURCE: ISO 12100:2010, 3.6, modified – Note 1 to entry has been modified, Notes 2 and 3 to entry have been removed.]