SLOVENSKI STANDARD
oSIST prEN ISO 13855:2022

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Varnost strojev - Postavitev varovalne opreme glede na hitrost približevanja človeškega telesa (ISO/DIS 13855:2022)

Safety of machinery - Positioning of safeguards with respect to the approach of the human body (ISO/DIS 13855:2022)

Sicherheit von Maschinen - Anordnung von Schutzeinrichtungen im Hinblick auf Annäherung des menschlichen Körpers (ISO/DIS 13855:2022)

Sécurité des machines - Positionnement des moyens de protection par rapport à l'approche du corps humain (ISO/DIS 13855:2022)

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Safety of machinery — Positioning of safeguards with respect to the approach of the human body

Sécurité des machines — Positionnement des moyens de protection par rapport aux parties du corps

ICS: 13.110

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 199, *Safety of machinery*.

This third edition cancels and replaces the second edition (ISO 13855:2010), which has been technically revised.

The main changes compared to the previous edition are as follows:

— xxx xxxxxxx xxx xxxx

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The structure of safety standards in the field of machinery is as follows:

a) type-A standards (basic safety standards) giving basic concepts, principles for design, and general aspects that can be applied to all machinery;

b) type-B standards (generic safety standards) dealing with one safety aspect or one type of safeguard that can be used across a wide range of machinery:

   — type-B1 standards on particular safety aspects (e.g. safety distances, surface temperature, noise);

   — type-B2 standards on safeguards (e.g. two-hand controls, interlocking devices, pressure-sensitive devices, guards);

c) type-C standards (machine safety standards) dealing with detailed safety requirements for a particular machine or group of machines.

This document is a type-B1 standard as stated in ISO 12100.

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

— machine manufacturers (small, medium and large enterprises);

— health and safety bodies (regulators, accident prevention organisations, market surveillance etc.);

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

— machine users/employers (small, medium and large enterprises);

— machine users/employees (e.g. trade unions, organizations for people with special needs);

— service providers, e. g. for maintenance (small, medium and large enterprises);

— consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

In addition, this document is intended for standardization bodies elaborating type-C standards.

The requirements of this document can be supplemented or modified by a type-C standard.

For machines which are covered by the scope of a type-C standard and which have been designed and built according to the requirements of that type-C standard, the following applies: if the requirements of that type-C standard deviate from the requirements in type-B standards, the requirements of that type-C standard take precedence over the provisions of other standards.

Correct positioning of safety devices are critical for them to be effective. In deciding on these positions, a number of aspects are taken into account, such as:

— the necessity of a risk assessment according to ISO 12100;

— the practical experience in the use of the machine;

— the overall system response time;

— the time taken to achieve the intended risk reduction following operation of the safeguard, for example to stop the machine;

— the bio-mechanical and anthropometric data;

— any intrusion by a part of the body towards the hazard zone until the protective device is actuated;

— the path taken by the body part when moving from the detection zone towards the hazard zone;

— the possible presence of a person between the safeguard and the hazard zone;

— the possibility of undetected access to the hazard zone.

Safety of machinery — Positioning of safeguards with respect to the approach of the human body

1 Scope

This document specifies requirements for the positioning of safeguards with respect to the approach of the human body or its parts from the detection zone, plane, line, point or interlocking guard to:

— the nearest hazard within the span-of-control of the safeguard, and

— any safety-related manual control device.

Approaches such as running, jumping or falling, are not considered in this document.

NOTE 1 The values for approach speeds (walking speed and upper limb movement) in this document are time tested and proven in practical experience.

NOTE 2 Other types of approach can result in approach speeds that are higher or lower than those defined in this document.

This document applies for safeguards used on machinery for the protection of persons 14 years and older.

Safeguards considered in this document include:

a) electro-sensitive protective equipment (ESPE) such as:

— active opto-electronic protective devices (AOPDs) as described in IEC 61496-2;

— active opto-electronic protective devices responsive to diffuse reflection that have one or more detection zone(s) specified in two dimensions (AOPDDRs-2D) as described in IEC 61496-3;

— active opto-electronic protective devices responsive to diffuse reflection that has one or more detection zone(s) specified in three dimensions (AOPDDRs-3D) as described in IEC 61496-3;

— vision based protective devices (VBPDPP) as described in IEC/TS 61496-4-2

— vision based protective devices (VBPDST) as described in IEC/TS 61496-4-3

b) pressure-sensitive mats and floors as described in ISO 13856-1;

c) two-hand control devices as described in ISO 13851;

d) single control device;

e) interlocking guards as described in ISO 14119;

f) pressure-sensitive edges as described in ISO 13856-2 and bumpers as described in ISO 13856-3.

This document is not applicable to safeguards (e.g. pendant two-hand control devices) that can be manually moved, without using tools, nearer to the hazard zone than the separation distance.

Protection against the risks from hazards arising from emissions (e.g. the ejection of solid or fluid materials, radiation, electric arcs, heat, noise, fumes, gases) are not covered by this document.

Protection against the risks arising from failure of mechanical parts of the machine or gravity falls, are not covered in this document.

Where safeguards are used solely to prevent start or restart of hazardous machine functions or movements, the separation distances derived from this document are not applicable.

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.

ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 13854:2017, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

ISO 13857:2019, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs*

ISO 7250-3:2015, *Basic human body measurements for technological design — Part 3: Worldwide and regional design ranges for use in product standards*

3 Terms, definitions, symbols and abbreviated terms

For the purposes of this document, the terms and definitions given in ISO 12100 and the following apply.

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

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

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

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100 and the following apply.

3.1.1
overall system response time
T
time interval between the actuation of the sensing function and achieving the intended risk reduction.

Note 1 to entry: In the previous version referred to as *overall system stopping performance*.

Note 2 to entry: This time typically includes tolerance factors (e.g. due to uncertainty of measurements, consideration of environmental factor like friction).

[SOURCE: IEC 61496-1:2020, 3.20, modified]

3.1.2
response time
t_x
maximum time between the occurrence of the event leading to the actuation of the device and the output signal goes to the OFF-state

Note 1 to entry: This time typically includes tolerance factors (e.g. due to uncertainty of measurements, consideration of environmental factor like friction).

[SOURCE: IEC 61496-1:2020, 3.20, modified]

3.1.3
detection capability
d
ability to detect the specified test piece(s) in the specified detection zone

[SOURCE: IEC 61496-3:2018, 3.x, modified — notes and references have been removed]

3.1.4
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

Note 1 to entry: ESPE's refer only to non-contact sensing devices.

[SOURCE: IEC 61496-1:2012, 3.5, modified — Original Note 1 and 2 to entry removed]

3.1.5
indirect approach
approach where the shortest path to the hazard zone is obstructed by a mechanical obstacle

Note 1 to entry: The hazard zone can only be approached by going around the obstacle.

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 may also be a point, line or plane.

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

[SOURCE: IEC 61496-1:2012, 3.4, modified — "sensitive" has been removed before "protective equipment" and Note to entry added]

3.1.7
separation distance
S
Minimum distance required between the actuation position of the protective devices and the hazard zone to prevent the human body or its parts from reaching the hazard zone before the cessation of the hazardous machine function

Note 1 to entry: Previously referred to as *minimum distance*.

Note 2 to entry: Examples of protective devices are found in 3.28 of ISO 12100.

3.1.8
reaching distance associated with a protective device
D_{DS}
distance that a part of the body (usually a hand) can move past the safeguard towards the hazard zone or to the safety-related manual control device prior to actuation of the safeguard

Note 1 to entry: previously referred to as *intrusion distance*.

3.1.9
reference plane
level at which persons would normally stand during the use of the machine or access to the hazard zone or safety-related manual control device

Note 1 to entry: The reference plane is not necessarily the ground or the floor (for example a working platform could be the reference plane).

[SOURCE: ISO 13857:2019, 3.2 modified]

3.1.10
span of control
predetermined portion of the machinery under control of a specific device or safety function

Note 1 to entry: A protective device could initiate a stop function of a machine or a portion of a machine. For example, an emergency stop pushbutton could cause a local stop or a global stop (see ISO 13850).

[SOURCE: ISO/CD 11161:2021, 3.1.8]

3.1.11
safeguarded space
area or volume enclosing a hazard zone(s) where guards and/or protective devices are intended to protect persons

[SOURCE: ISO/CD 11161:2021, 3.1.7]

3.1.12
whole body access
situation where a person can be completely inside a safeguarded space

Note 1 to entry: The term whole body access is used in other documents to specify the opening size for safe access.

[SOURCE: ISO/CD 11161:2021, 3.1.17, modified – Note 1 to entry has been added]

3.1.13
safety-related manual control device
SRMCD
control device which requires deliberate human action and whose actuation can result in an immediate increase of the risk(s)

Note 1 to entry: Examples include actuating devices such as pushbuttons, selector switches, or foot pedals designed for functions like reset, start/restart, unconditional guard unlocking or hold-to-run control (e.g. jog, inching).

3.1.14
single control device
control device that requires operation by either a single the hand or foot to initiate and maintain hazardous machine functions, thus providing a protective measure only for the person operating the control device.

Note 1 to entry: Examples include actuating devices such as pushbuttons or foot pedals designed to control hazardous machine functions only during actuation.

3.1.15
industrial environment
workplace where the public is restricted from access or not reasonably expected to be present for the intended tasks and machine applications

3.1.16
dynamic hazard
Source of harm that changes its location either by the movement of parts of the machine or the machine itself

Note 1 to entry: The dimensions and shape of the dynamic hazard zone result from the range of the moving parts of the machine (operating space) or the moving range of the machine itself.

3.1.17
stopping distance
distance traveled by the hazard, hazardous point or part of the machine or the machine itself until the intended risk reduction is achieved

Note 1 to entry: Situations are possible in which the intended risk reduction is achieved even if the hazardous machine parts are still moving.

Note 2 to entry: Hazards can also travel even if machine parts do not. (e.g. a rotating laser beam).

3.1.18
speed and separation monitoring
SSM
maintaining the separation distance by changing the speed and or the trajectory of the machine or its parts relative to the detected position of parts of the human body

Note 1 to entry: The separation distance will depend on several parameters e.g. the speed and approach direction of the parts of the human body; the speed, direction, and orientation of moving hazard zones; the detection capability of the protective devices; the response time of the safety-related parts of the control system involved, etc.

3.1.19
safety-related part of a control system
SRP/CS
part of a control system that performs a safety function, starting from a safety-related input(s) togenerating a safety-related output(s)

[SOURCE: ISO/DIS 13849-1:2021, 3.x, modified]

3.2 Symbols and abbreviated terms

3.2.1 Symbols

See Annex E.

3.2.2 Abbreviated terms

AOPD	Active opto-electronic protective device
AOPDDR	Active opto-electronic protective device responsive to diffuse reflection (e.g. laser scanners)
VBPD	Vision-based protective device
ESPE	Electro-sensitive protective equipment
PFMD	Pressure and force measurement device
PSPD	Pressure-sensitive protective device
SPE	Sensitive protective equipment (see ISO 12100, 3.28.5)
SRMCD	Safety-related manual control device