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EUROPEAN STANDARD
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English Version

**Safety of machinery - Pressure-sensitive protective devices -
Part 3: General principles for design and testing of pressure-
sensitive bumpers, plates, wires and similar devices (ISO
13856-3:2013)**

Sécurité des machines - Dispositifs de protection sensibles
à la pression - Partie 3: Principes généraux de conception
et d'essai des pare-chocs, plaques, câbles et dispositifs
analogues sensibles à la pression (ISO 13856-3:2013)

Sicherheit von Maschinen - Druckempfindliche
Schutzeinrichtungen - Teil 3: Allgemeine Leitsätze für die
Gestaltung und Prüfung von Schaltuffern, Schaltflächen,
Schaltleinen und ähnlichen Einrichtungen (ISO 13856-
3:2013)

This European Standard was approved by CEN on 5 July 2013.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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Foreword

This document (EN ISO 13856-3:2013) has been prepared by Technical Committee ISO/TC 199 "Safety of machinery" in collaboration with Technical Committee CEN/TC 114 "Safety of machinery" the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2014, and conflicting national standards shall be withdrawn at the latest by January 2014.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 1760-3:2004+A1:2009.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive.

For relationship with EU Directive, see informative Annex ZA, which is an integral part of this document.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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Endorsement notice

The text of ISO 13856-3:2013 has been approved by CEN as EN ISO 13856-3:2013 without any modification.

Annex ZA (informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive Machinery 2006/42/EC.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard given in Table ZA.1 confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

Table ZA.1 — Correspondence between this European Standard and Directive 2006/42/EC

Clause(s)/sub-clause(s) of this Standard	Essential Requirements (ERs) of Directive 2006/42/EC	Qualifying remarks/Notes
Clause 4	Annex I, 1.2	Control systems
	Annex I, 1.3	Protection against mechanical hazards
	Annex I, 1.4	Required characteristics of (guards and) protection devices
	Annex I, 1.5	Risks due to other hazards
	Annex I, 1.6	Maintenance
Clauses 5 and 6	Annex I, 1.7	Information

WARNING — Other requirements and other EC Directives may be applicable to the product(s) falling within the scope of this standard.

INTERNATIONAL
STANDARD

ISO
13856-3

Second edition
2013-07-15

Safety of machinery — Pressure-sensitive protective devices —

Part 3:

General principles for design and testing of pressure-sensitive bumpers, plates, wires and similar devices

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Sécurité des machines — Dispositifs de protection sensibles à la pression —

Partie 3: Principes généraux de conception et d'essai des pare-chocs, plaques, câbles et dispositifs analogues sensibles à la pression
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ISO 13856-3:2013(E)

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 13856-3 was prepared by Technical Committee ISO/TC 199, *Safety of machinery* and by Technical Committee CEN/TC 114, *Safety of machinery* in collaboration.

This second edition cancels and replaces the first edition (ISO 13856-3:2006), which has been technically revised.

ISO 13856 consists of the following parts, under the general title *Safety of machinery — Pressure-sensitive protective devices*:

- Part 1: *General principles for design and testing of pressure-sensitive mats and pressure-sensitive floors*
- Part 2: *General principles for design and testing of pressure-sensitive edges and pressure-sensitive bars*
- Part 3: *General principles for design and testing of pressure-sensitive bumpers, plates, wires and similar devices*

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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-B2 standard as stated in ISO 12100.

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 standard, the requirements of that type-C standard take precedence.

The safeguarding of machinery (see ISO 12100:2010, 3.21) can be achieved by many different means. These means include guards which prevent access to the hazard zone by means of a physical barrier (for example, interlocking guards according to ISO 14119 or fixed guards according to ISO 14120) and protective devices (for example, electro-sensitive protective equipment according to IEC 61496-1 or pressure-sensitive protective devices according to this part of ISO 13856).

Type-C standards makers and designers of machinery/installations should consider the best way to achieve the required level of safety taking into account the intended application and the results of the risk assessment (see ISO 12100).

The required solution can also be to combine several of these different means. The machinery/installation supplier and the user examine together carefully the existing hazards and constraints before making their decision on the choice of safeguarding.

Pressure-sensitive protective devices are used in a wide range of applications with different conditions of use relating, for example, to extremes of loading or electrical, physical and chemical environments. They are interfaced with machine controls to ensure that the machine reverts to a safe condition if the sensitive protective equipment is actuated.

This part of ISO 13856 is restricted to the design of pressure-sensitive protective devices so that they can be used when the risk assessment carried out by the machine manufacturer and/or relevant type-C standard, when available, shows this to be appropriate.

This part of ISO 13856 does not specify the dimensions and the configuration of the effective sensing surface of the pressure-sensitive protective devices in relation to any particular application. However, there is a requirement for the manufacturer of any safeguard to provide sufficient information to enable the user (i.e. the machinery manufacturer and/or user of the machinery) to specify an adequate arrangement.

The forces for the activation of the pressure-sensitive protection devices specified in this part of ISO 13856 are based on the information available at the time of publication. These forces will be kept under review so that the results of further research into forces that can be applied to the human body without causing significant injury can be taken into account. While these forces provide a practical means for the design and testing of the pressure-sensitive device, they cannot prevent injury in all applications. When specifying the actuating force for a specific device or application many factors should be taken into account. These include the contact area, the contact speed, the material used and the part of the body affected.

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Safety of machinery — Pressure-sensitive protective devices —

Part 3: General principles for design and testing of pressure-sensitive bumpers, plates, wires and similar devices

1 Scope

This part of ISO 13856 establishes general principles and specifies requirements for the design and testing of those pressure-sensitive protective devices, with or without an external reset facility, that are not specified in either ISO 13856-1 or ISO 13856-2, and the majority of which are produced for specific applications and are not available as “off-the-shelf” items.

This part of ISO 13856 also gives specific requirements for the following pressure-sensitive protective devices:

- a) pressure-sensitive bumpers;
- b) pressure-sensitive plates;
- c) pressure-sensitive wires (trip wires).

It deals with the design of a pressure-sensitive device with regard to safety and reliability rather than its suitability for particular applications.

NOTE 1 For the relationship between safety and reliability, see ISO 13849-1:2006, 4.2.

NOTE 2 The machinery manufacturer and/or user is responsible for installing appropriate types of protective device based on a risk assessment.

It is not applicable to

- specifying the dimensions of pressure-sensitive protective devices in relation to any particular application, or
- stopping devices according to IEC 60204-1 used for the normal operation, including emergency stopping of machinery.

NOTE 3 Specific requirements for particular applications are intended to be set forth in relevant type-C standards (see ISO 12100 and Introduction).

Additional requirements can be necessary where pressure-sensitive protective devices are used in locations accessible to elderly or disabled people or children.

NOTE 4 While requirements are given for the immunity of the device to electromagnetic disturbances, these are not intended to cover all aspects of electromagnetic compatibility (EMC).

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies

ISO 4413, *Hydraulic fluid power — General rules and safety requirements for systems and their components*

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ISO 4414, *Pneumatic fluid power — General rules and safety requirements for systems and their components*

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

ISO 13849-1:2006, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

ISO 13849-2, *Safety of machinery — Safety-related parts of control systems — Part 2: Validation*

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

IEC 60068-2-6, *Environmental testing — Part 2-6: Tests — Test Fc: Vibration (sinusoidal)*

IEC 60068-2-14, *Environmental testing — Part 2-14: Tests — Test N: Change of temperature*

IEC 60068-2-27, *Environmental testing — Part 2-27: Tests — Test Ea and guidance: Shock*

IEC 60068-2-78, *Environmental testing — Part 2-78: Tests — Test Cab: Damp heat, steady state*

IEC 60204-1:2005, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

IEC 60529, *Degrees of protection provided by enclosures (IP code)*

IEC 60664-1:2007, *Insulation coordination for equipment within low-voltage systems — Part 1: Principles, requirements and tests*

IEC 60947-5-1, *Low-voltage switchgear and controlgear — Part 5-1: Control circuit devices and switching elements — Electromechanical control circuit devices*

IEC 60947-5-5:1997, *Low-voltage switchgear and controlgear — Part 5-5: Control circuit devices and switching elements — Electrical emergency stop device with mechanical latching function*

IEC 61000-4-2, *Electromagnetic compatibility (EMC) — Part 4-2: Testing and measuring techniques — Electrostatic discharge immunity test*

IEC 61000-4-3, *Electromagnetic compatibility (EMC) — Part 4-3: Testing and measurement techniques — Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4, *Electromagnetic compatibility (EMC) — Part 4-4: Testing and measurement techniques — Electrical fast transient/burst immunity test*

IEC 61000-4-5, *Electromagnetic compatibility (EMC) — Part 4-5: Testing and measurement techniques — Surge immunity test*

IEC 61000-4-6, *Electromagnetic compatibility (EMC) — Part 4-6: Testing and measurement techniques — Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-6-2, *Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity for industrial environments*

IEC 61439-1:2009, *Low-voltage switchgear and controlgear assemblies — Part 1: General rules*

3 Terms and definitions

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

3.1**pressure-sensitive protective device**

sensitive protective equipment of the “mechanically activated trip” type intended to detect the touch of a person or body part of a person and which can also act as impeding device

Note 1 to entry: A pressure-sensitive protective device consists of a sensor or sensors, which generates a signal when pressure is applied to part of its outer surface, and a control unit, which responds to the signal from the sensor and generates an output signal(s) to the control system of a machine.

Note 2 to entry: Pressure-sensitive protective devices can be used as tripping devices as well as presence-sensing devices, as mentioned in ISO 12100:2010, Note to 3.28.5. For presence-sensing devices, see also [4.2.6.2](#).

Note 3 to entry: For the definitions of sensitive protective equipment and impeding device, see ISO 12100:2010, 3.28.5 and 3.29, respectively.

3.1.1**pressure-sensitive bumper**

pressure-sensitive protective device (3.1) with a *sensor* (3.3) or sensors whose characteristics are a cross-section throughout the pressure-sensitive area that can be regular or irregular, a cross-section width usually greater than 80 mm, and an *effective sensing surface* (3.10) that is deformed locally or that can move as a whole

3.1.2**pressure-sensitive plate**

pressure-sensitive protective device (3.1) with a *sensor* (3.3) or sensors whose characteristics are an *effective sensing surface* (3.10) that is normally — but not necessarily — flat, an effective sensing surface width usually greater than 80 mm, and an effective sensing surface that moves as a whole

Note 1 to entry: See [Figure C.5](#).

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3.1.3**pressure-sensitive wire**

pressure-sensitive protective device (3.1) with a *sensor* (3.3) or sensors whose characteristics are a wire, cord, rope or cable held in tension, and where a change in the tension is detected to give an output signal

3.2**presence-sensing device****PSD**

sensitive protective equipment that creates a sensing field, area or plane for detecting the presence of a body part or the whole of a person

Note 1 to entry: Pressure-sensitive protective devices can be used as tripping devices as well as presence-sensing devices, as mentioned in ISO 12100:2010, Note to 3.28.5.

Note 2 to entry: See also [4.2.6.2](#).

3.3**sensor**

part of the *pressure-sensitive protective device* (3.1) which generates a signal in response to sufficient pressure applied to part of its surface

Note 1 to entry: This definition together with that of *control unit* (3.4) covers the functional components of a pressure-sensitive protective device. These functions can be integrated into a single assembly or contained in any number of separate assemblies. See [Figure 1](#).