



SLOVENSKI STANDARD

SIST EN 1760-1:2000

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Safety of machinery - Pressure sensitive protective devices - Part 1: General principles for the design and testing of pressure sensitive mats and pressure sensitive floors

Sicherheit von Maschinen - Druckempfindliche Schutzeinrichtungen - Teil 1: Allgemeine Leitsätze für die Gestaltung und Prüfung von Schalmatten und Schaltplatten

Sécurité des machines - Dispositifs de protection sensibles a la pression - Partie 1: Principes généraux de conception et d'essai des tapis et planchers sensibles a la pression

Ta slovenski standard je istoveten z: EN 1760-1:1997

ICS:

29.120.50 Xæ[çæ\ ^ŋ Ái~ * æ Fuses and other overcurrent protection devices
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EUROPEAN STANDARD

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Descriptors: safety of machines, accident prevention, safety devices, sensitivity, pressure, carpets, floors, definitions, specifications, design, marking, utilization, tests

English version

**Safety of machinery - Pressure sensitive
protective devices - Part 1: General principles for
the design and testing of pressure sensitive mats
and pressure sensitive floors**

Sécurité des machines - Dispositifs de
protection sensibles à la pression - Partie 1:
Principes généraux de conception et d'essai des
tapis et planchers sensibles à la pression

Sicherheit von Maschinen - Druckempfindliche
Schutzeinrichtungen - Teil 1: Allgemeine
Leitsätze für die Gestaltung und Prüfung von
Schaltmatten und Schaltplatten

This European Standard was approved by CEN on 1997-03-26. 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 Central Secretariat or to any CEN member.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

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Foreword

This European Standard has been prepared by 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 February 1998, and conflicting national standards shall be withdrawn at the latest by February 1998.

This is the first part of a multi-part type B standard which will cover safety devices that detect the presence of a person through the application of a pressure or force by a part of the person's body. After actuation the safety devices give a stop command which is used by the control system of the machine to provide protection for the person who caused the device to be actuated.

The other parts of the standard will cover:

Part 2: General principles for the design and testing of pressure sensitive edges and pressure sensitive bars (in preparation)

Part 3: General principles for the design and testing of pressure sensitive bumpers (in preparation)

The informative annex A presents timing diagrams for devices with and without reset. The notes in informative annex B provide guidance regarding application. It is recommended that the supplier and customer liaise to examine carefully the constraints presented by the application before placing an order for the equipment.

The safeguarding of machinery (see clause 3.19 of EN 292-1:1991) can be achieved by many different means. These means include guards which prevent access to the danger zone by means of a physical barrier (e.g. fixed guards to prEN 953 and interlocking guards to EN 1088); and protective devices, (e.g. electro-sensitive protective equipment to prEN 61496 ¹⁾ and pressure-sensitive protective devices to this standard).

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 EN 1050).

The best solution may combine several of these different means. It is recommended that the machinery / installation supplier and the user examine together carefully the existing constraints before making their decision on the choice of safeguarding means.

¹⁾ under preparation

The notes in informative annex C give guidance regarding the design of pressure sensitive mats and pressure sensitive floors. Informative annex D gives guidance for installation, commissioning and testing. Informative annex E contains bibliography.

This European Standard does not specify the dimensions or the configuration of the effective sensing area of pressure sensitive mat(s) or floor(s) in relation to any particular application. However, there is a requirement for the manufacturer of the safety device to provide sufficient information to enable the user (i.e. the machinery manufacturer and / or the user of the machinery) to specify an adequate arrangement.

This European Standard 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(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this standard.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

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0 Introduction

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

Each type of application presents particular hazards. It is not the intention of this standard to identify those hazards nor to recommend specific methods of application to particular machines. This is normally the function of machine specific standards.

1 Scope

This Standard specifies requirements for pressure sensitive mats and floors normally actuated by the feet for use as safety devices to protect persons from dangerous machinery. The minimum safety requirements for the performance, marking and documentation are given.

The Standard covers pressure sensitive mats and floors, regardless of type of energy used, e.g. electrical, hydraulic, pneumatic or mechanical.

This standard covers mats and floors designed to detect:

- a) persons weighing more than 35 kg;
- b) and persons (e.g. children) weighing more than 20 kg.

The detection of persons weighing less than 20 kg is not covered by this standard.

This European Standard does not specify the dimensions or the configuration of the effective sensing area of pressure sensitive mat(s) or floor(s) in relation to any particular application.

2 Normative references

This European standard incorporates by dated or undated reference provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed below. For dated references, subsequent amendments or revisions of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 292-1:1991	Safety of machinery; basic concepts, general principles for design; part 1: basic terminology, methodology
EN 292-2:1991	Safety of machinery; basic concepts, general principles for design; part 2: technical principles and specifications
prEN 953:1996	Safety of machinery - General requirements for the design and construction of guards (fixed, movable)
EN 954-1:1996	Safety of machinery - Safety related parts of control systems - Part 1: General principles for design
EN 982:1996	Safety of machinery - Safety requirements for fluid power systems and their components - Hydraulics
EN 983:1996	Safety of machinery - Safety requirements for fluid power systems and their components - Pneumatics
prEN 999	Safety of machinery - The positioning of protective equipment in respect of approach speeds of parts of the human body
EN 1050	Safety of machinery - Risk assessment

ENV 1070	Safety of machinery - Terminology
EN 1088:1995	Safety of machinery - Interlocking devices associated with guards - Principles for design and selection
prEN 12437-2	Safety of machinery - Permanent means of access to machines and industrial plants - Part 2: Working platforms and gangways
EN 50081	Electromagnetic compatibility - Generic emission standard
EN 50082	Electromagnetic compatibility - Generic immunity standard
EN 60204-1:1992	Safety of machinery; electrical equipment of machines; part 1: general requirements (IEC 204-1:1992, modified)
EN 60439-1:1994	Low-voltage switchgear and controlgear assemblies; part 1: type-tested and partially type-tested assemblies (IEC 439-1:1992 + corrigendum 1993)
EN 60529	Degrees of protection provided by enclosures (IP code) (IEC 529:1989)
EN 61000-4-2	Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 2: Electrostatic discharge immunity test - Basic EMC publication (IEC 1000-4-2:1995)
EN 61000-4-3	Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 3: Radiated, radio-frequency, electromagnetic field immunity test (IEC 1000-4-3:1995, modified)
EN 61000-4-4	Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 4: Electrical fast transient/burst immunity test - Basic EMV publication (IEC 1000-4-4:1995)
EN 61000-4-5	Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 5: Surge immunity test (IEC 1000-4-5:1995)
EN 61310-2	Safety of machinery - Indication, marking and actuation - Part 2: Requirements for marking (IEC 1310-2:1995)
IEC 68-2-3:1969	Basic environmental testing procedures - Part 2: Tests. Test Ca: Damp heat, steady state
IEC 68-2-6:1995	Environmental testing - Part 2: Tests - Test Fc: Vibration (sinusoidal)
IEC 68-2-14:1984	Basic environmental testing procedures - Part 2: Tests. Test N: Change of temperature
ISO 6431:1992	Pneumatic fluid power; single-rod cylinders, 1000 kPa (10 bar) series, with detachable mountings, bores from 32 mm to 320 mm; mounting dimensions

3 Definitions

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For the purposes of this standard the definitions of ENV 1070 apply; in addition the following definitions apply:

3.1 pressure sensitive mat: A safety device (see 3.23.5 of EN 292-1:1991) which detects a person standing on it or who steps onto it. It comprises a sensor(s) which responds to the application of pressure and a control unit, and one or more output signal switching device(s) (see figure 1).

In a pressure sensitive mat the effective sensing area is deformed locally when the sensor(s) is actuated.

3.2 pressure sensitive floor: A safety device (see 3.23.5 of EN 292-1:1991) which detects a person standing on it or who steps onto it. It comprises a sensor(s) which responds to the application of pressure and a control unit, and one or more output signal switching device(s)

In a pressure sensitive floor the effective sensing area is moved as a whole when the sensor(s) is actuated.

3.3 sensor: That part of the pressure sensitive mat or pressure sensitive floor which contains an effective sensing area on which the application of an actuating force causes the signal from the sensor to the control unit to change state.

3.4 effective sensing area: That part of the top surface area of the sensor or a combination of sensors of the pressure sensitive mat or pressure sensitive floor within which a response to an actuating force (see 4.2) will take place.

3.5 control unit: The device that responds to the condition of the sensor(s) and controls the state of the output signal switching device. It may also monitor the integrity of the pressure sensitive mat or pressure sensitive floor (see reference to categories EN 954-1) and it may contain facilities to process a reset signal. The control unit may be integrated with the machine control system.

3.6 output signal switching device: That part of the pressure sensitive mat or pressure sensitive floor which when the sensor or monitoring function means is actuated responds by producing an OFF state. The output signal switching device may be integrated with the machine control system.

3.7 actuating force: Any force which produces a pressure on the effective sensing area to create an OFF state in the output signal switching device.

3.8 reset: The function which permits an ON state in the output signal switching devices, providing that certain conditions are met.

3.9 ON state of output signal switching device(s): A state where the output circuit(s) is complete and the flow of current or fluid is possible.

3.10 OFF state of output signal switching device(s): A state where the output circuit(s) is broken and the flow of current or fluid is interrupted.

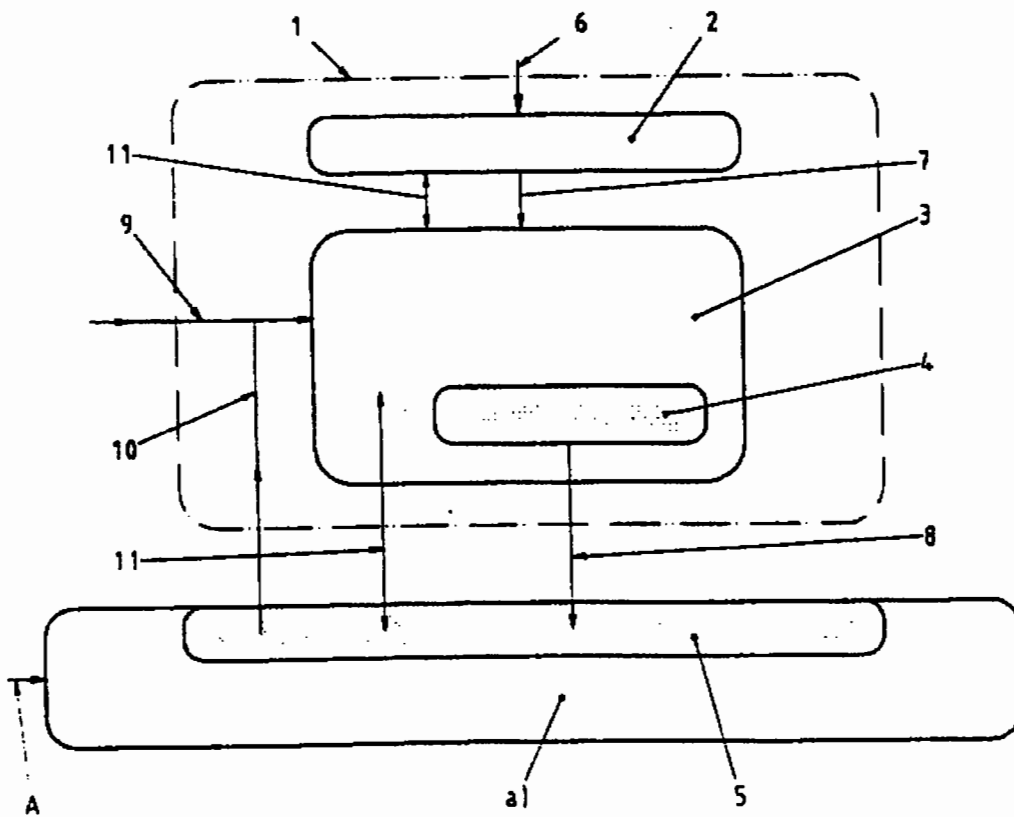
3.11 response time: The time between the start of the application of a force to the effective sensing area and the start of the OFF state of the output signal switching device (see 4.3).

3.12 dead zone: That part of the top surface area of the sensor outside the effective sensing area.

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- 1 Pressure sensitive mat or floor output signal processing
- 6 Actuating force
- 7 Sensor output
- 8 ON state/OFF state signal
- 9 Manual reset signal (where appropriate alternative to A)
- 10 Reset signal from machine control system (where appropriate)
- 11 Monitoring signals (optional)
- A Manual reset signal to the machine control system (where appropriate alternative to 9)
- a Machine control system(s)

Figure 1: Pressure sensitive mat or pressure sensitive floor interfaced with a machine

4 Requirements

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4.1 General

Pressure sensitive mats and pressure sensitive floors shall be able to detect a person who is standing on, or who steps onto the effective sensing area. <https://standards.iteh.ai/catalog/standards/sist/dc9856e1-75d0-4a59-9844-9941a087a2d2/sist-en-1760-1-2000>

4.2 Actuating force

4.2.1 Single sensor (see 7.4.1 and 7.4.2 for test method)

The pressure sensitive mat or pressure sensitive floor shall respond to the actuating forces stated in table 1 when the test piece (see figure 2) is applied over the effective sensing area at a maximum speed of 2 mm/s within the operating temperature range.

Test pieces 1, 2 and 3 apply to pressure sensitive mats and pressure sensitive floors designed to detect persons weighing more than 35 kg. Test piece 4 shall additionally be applied to pressure sensitive mats and pressure sensitive floors designed to detect persons (e.g. children) weighing more than 20 kg.

Table 1: Actuating force

Application	Test piece		Actuating force N
	Number	d mm	
For pressure sensitive mats and pressure sensitive floors designed to detect persons weighing more than 35 kg	1	11	300
	2	80	300
	3	200	600
Additional test for pressure sensitive mats and pressure sensitive floors designed to detect persons (e.g. children) weighing more than 20 kg	4	40	150

4.2.2 Combinations of sensors (see 7.4.3 and 7.4.4 for test methods)

Where an effective sensing area is built up of more than one sensor, joints and junctions shall fulfil the requirements of 4.2.1 except that only test piece 2 in table 1 applies to pressure sensitive mats and pressure sensitive floors designed to detect persons weighing more than 35 kg.

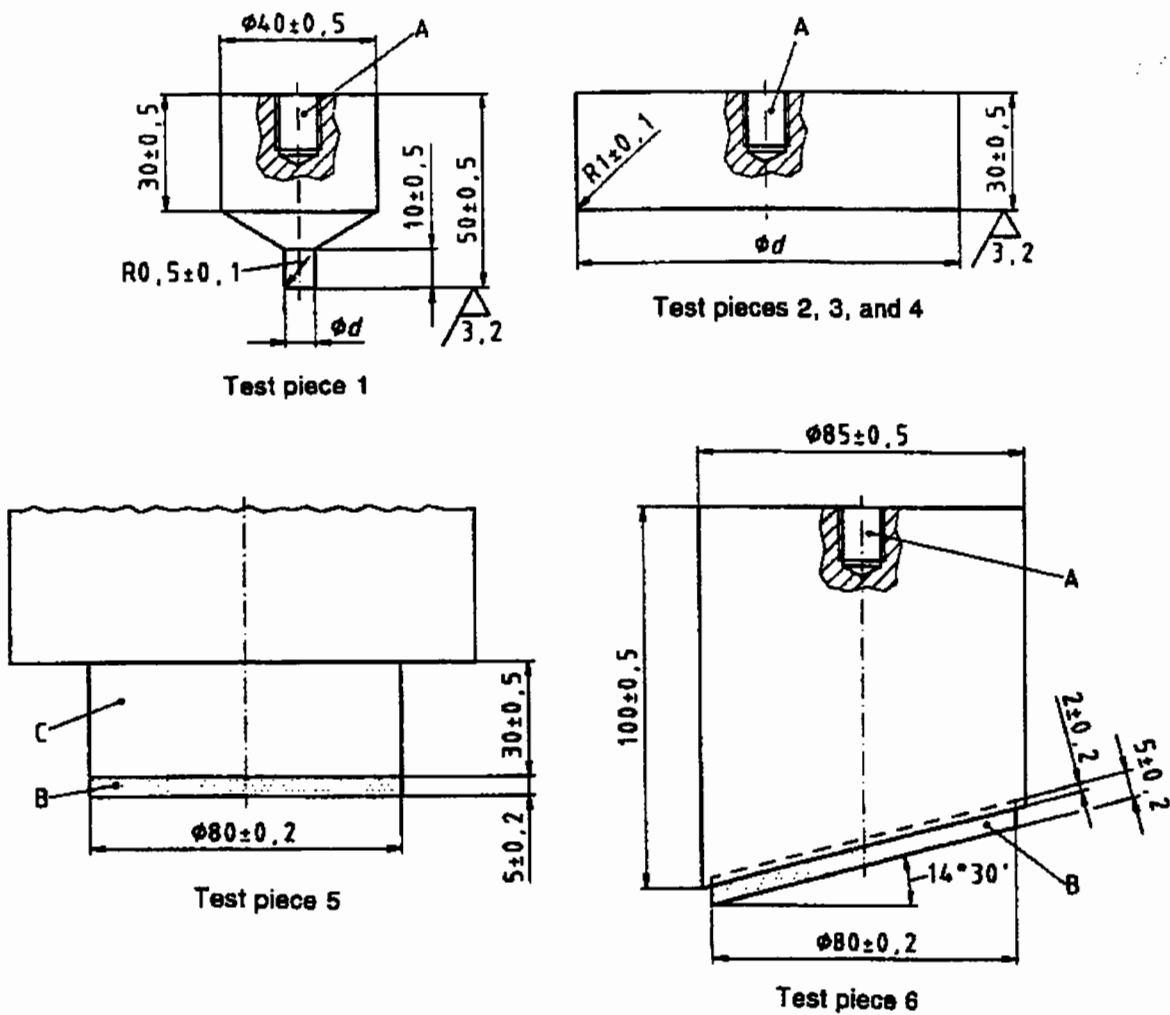
Where pressure sensitive mats and pressure sensitive floors are designed to detect persons (e.g. children) weighing 20 kg or more only test pieces 2 and 4 shall apply.

For other parts of the effective sensing area, 4.2.1 shall apply (see table 1).

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- A Mounting proposal only
 B Rubber "shoe", 60 Shore A \pm 5 Shore A, fixed with adhesive.
 C Steel
 For d see table 1

Figure 2: Test pieces
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4.3 Response time (see 7.5 for test method)

The response time shall be stated by the manufacturer and shall not exceed 200 ms over the operating temperature range. The response time is the time between (a) and (b) where:

- is when a test piece touches vertically the effective sensing area at a velocity of 0,25 m/s; and
- is the start of the OFF state of the output signal switching device (see figures A.1, A.2 and A.3).

NOTE: The 200 ms limit is specified to prevent the safety device from being defeated by the application of short stepping impulses.

4.4 Static loading (see 7.6 for test method)

4.4.1 After the application of a static force of 2000 N \pm 50 N within the effective sensing area through test piece 2 (see figure 2), for a period of 8 h, the output signal switching device shall change state within 2 min after the removal of the force and the deformation shall not be more than 2 mm depth at the lowest part of the top surface after 1 h.