SLOVENSKI STANDARD
SIST EN 1760-2:2002

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Varnost strojev - Varovalne naprave, obļutljive na tlak - 2. del: Splošna naļela naļrtovanja in preskušanja robov in drogov, obļutljivih na dotik

Safety of machinery - Pressure sensitive protective devices - Part 2: General principles for the design and testing of pressure sensitive edges and pressure sensitive bars

Sicherheit von Maschinen - Druckempfindliche Schutzeinrichtungen - Teil 2: Allgemeine Leitsätze für die Gestaltung und Prüfung von Schaltleisten und Schaltstangen

Sécurité des machines - Dispositifs de protection sensibles a la pression - Partie 2 : Principes généraux de conception et d'essais des bords et barres sensibles a la pression

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Safety of machinery - Pressure sensitive protective devices - Part 2: General principles for the design and testing of pressure sensitive edges and pressure sensitive bars

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This European Standard was approved by CEN on 13 January 2001.

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 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 Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

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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 August 2001, and conflicting national standards shall be withdrawn at the latest by August 2001.

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.

This is the second 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 cover:

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

Part 3: Safety of machinery - Pressure sensitive protective devices - General principles for the design and testing of pressure sensitive bumpers and plates including pressure sensitive wires and barriers. (under preparation)

Normative annex A presents timing diagrams for devices with and without reset. Informative annex B explains the relationship between operating speed, the force exerted on the body and the distance travelled by the device following actuation. The notes in informative annex C provide guidance to users on the selection of a suitable device. It is recommended that the supplier and customer liase to examine carefully the constraints presented by the application before placing an order for the equipment.

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

The notes in informative annex D give guidance regarding the design of pressure sensitive edges and pressure sensitive bars. Informative annex E gives guidance on the application of pressure sensitive edges and pressure sensitive bars. Informative annex F gives guidance on installation, commissioning and testing. Informative annex G covers general considerations for meeting category 2 according to EN 954-1.

This European Standard does not specify the dimensions or the configuration of the effective sensing surface of pressure sensitive edges or pressure sensitive bars in relation to any particular application. However, there is a requirement for the manufacturer of any 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.

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.

Introduction

Pressure sensitive edges and pressure sensitive bars are safety devices of the "mechanically actuated trip device" type (see 3.23.5 of EN 292-1:1991). General requirements for these devices (as well as other safety devices) are given in 4.1 and 4.2 of EN 292-2:1991.

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

Pressure sensitive edges and pressure sensitive bars may be fitted to a moving part of a machine at the point where a trapping, crushing or collision hazard may occur. They may also be fitted to a fixed part of a machine or an obstacle to prevent trapping or crushing hazards with a moving part of a machine. Pressure sensitive edges and pressure sensitive bars are designed, selected, installed and/or interfaced with the control system of the machine so that the force/pressure applied to a person or parts of the body do not exceed certain limits.

This European standard is a type B standard as stated in EN 1070.

Pressure sensitive edges, bars, bumpers and barriers have many similarities. The following table summarises the differences which generally apply between the devices and gives guidance for their application.

Table 1 — Characteristic features of pressure sensitive devices excluding mats and floors

	Edge Part 2	Bar	Bumper Part 3
Cross section	regular	regular	regular / irregular
Length/Width ratio	>1	any ratio	any ratio
Effective sensing surface	deflects locally	moves as a whole	deflects locally and / or moves as a whole
Intended to detect	finger hand arm leg head torso	finger hand arm leg head torso	hand arm leg head torso

1 Scope

This standard contains requirements for pressure sensitive edges and pressure sensitive bars for use as safety devices and not as actuating devices for normal operational. The standard applies to pressure sensitive edges and pressure sensitive bars used to detect persons or parts of persons who may be exposed to danger such as hazardous moving parts.

The purpose of this standard relates primarily to safety and reliability rather than suitability. For the relationship between safety and reliability, see annex D of EN 954-1:1996.

This standard specifies requirements for pressure sensitive edges and pressure sensitive bars with and without an external reset facility.

This standard is restricted to the functioning of pressure sensitive edges and pressure sensitive bars and does not specify the requirements for their application. However, clause 6 contains requirements for information for use which has to be provided by the manufacturer. A selection procedure is given in annex C.

The design notes in annex D give additional guidance regarding the design of pressure sensitive edges and pressure sensitive bars which will give safe and reliable service. The notes in annex E provide general guidance regarding application, while annex G provides guidance on the application of sensors, especially for air-pulse systems.

This standard does not specify the dimensions of the pressure sensitive edges or bars in relation to a particular application.

The standard does not apply to stopping devices according to EN 60204-1 used only for normal operational, including emergency stopping, of machinery. Additional requirements may be necessary where pressure sensitive edges and pressure sensitive bars are used in locations accessible to elderly or disabled people or children.

Note It may not be possible to carry out all the tests in this standard for pressure sensitive edges and pressure sensitive bars when they have been designed and built into the machinery by its manufacturer.

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 (including amendments).

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*

EN 954-1:1996, *Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design*

EN 982, *Safety of machinery - Safety requirements for fluid power systems and their components – Hydraulics*

EN 983, *Safety of machinery - Safety requirements for fluid power systems and their components – Pneumatics*

EN 1070, *Safety of machinery – Terminology*

EN 50081-1, Electromagnetic compatibility - Generic emission standard - Part 1: Residential, commercial and light industry

EN 60068-2-6, Envi*ronmental testing - Part 2: Tests - Tests Fc: Vibration (sinusoidal) (IEC 60068-2-6:1995 + Corrigendum 1995)*

EN 60068-2-14, *Environmental testing - Part 2: Tests - Test N: Change of temperature (IEC 60068-2-14:1984 + A1:1986)*

EN 60068-2-29, *Basic environmental testing procedures; part 2: tests; test Eb and guidance: bump (IEC 60068-2-29:1987)*

EN 60204-1:1997, *Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 60204-1:1997)*

EN 60439-1:1999, *Low-voltage switchgear and controlgear assemblies; part 1: type-tested and partially type-tested assemblies (IEC 60439-1:1999)*

EN 60529, *Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)*

EN 60947-5-1:1997, *Low-voltage switchgear and controlgear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices (IEC 60947-5-1:1997)*

EN 61000-4-2, *Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 2: Electrostatic discharge immunity test - Basic EMC publication (IEC 61000-4-2:1995)*

EN 61000-4-3, *Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 3: Radiated, radio-frequency, electromagnetic field immunity test (IEC 61000-4-3:1995, 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 61000-4-4:1995)*

EN 61000-4-5, *Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 5: Surge immunity test (IEC 61000-4-5:1995)*

EN 61000-4-6, *Electromagnetic compatibility (EMC) - Part 4: Testing and measurement techniques - Section 6: Immunity to conducted disturbances, induced by radio-frequency fields (IEC 61000-4-6:1996)*

EN 61000-6-2, Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments (IEC 61000-6-2:1999)

EN 61496-1, *Safety of machinery - Electro-sensitive protective equipment - Part 1: General requirements and tests (IEC 61496-1:1997)*

prEN 61496-2:1997, *Safety of machinery – Electrosensitive protective equipment - Part 2: Particular requirements for equipment using active optoelectronic protective devices*

prEN 61496-3:2000, *Safety of machinery - Electro-sensitive protective equipment - Part 3: Particular requirements for Active Opto-electronic Protective Devices responsive to Diffuse Reflection (AOPDDR)*

IEC 60068-2-3, *Basic environmental testing procedures. Part 2: Tests. Test Ca: Damp heat, steady state*

IEC 60664-1, *Insulation co-ordination for equipment within low-voltage systems; Part 1: Principles, requirements and tests*

3 Terms and definitions

The terms and definitions given in EN 1070 apply to this standard in addition to the terms and definitions which follow.

3.1
pressure sensitive edge
safety device of the 'mechanically activated trip' type (see 3.23.5 of EN 292-1:1999) intended to detect the touch of a person or part of a person and comprising:

a) sensor(s) which generates a signal when pressure is applied to part of its surface, where:

- the length is greater than the width;
- the cross section throughout the pressure sensitive area is constant;
- the width of the cross section is greater than 8 mm;
- the effective sensing surface is deformed locally to actuate the sensor(s);

NOTE The width of the cross section is usually less than or equal to 80 mm.

b) a control unit, which responds to the signal from the sensor and generates an output signal(s) to the control system of a machine.

3.2
pressure sensitive bar
safety device (see 3.23 of EN 292-1:1991) comprising:

a) a sensor(s) which generates a signal when pressure is applied to part of its surface, where:

- the length is greater than the width;
- the cross section throughout the pressure sensitive area is constant;
- the width of the cross section is greater than 8 mm;
- the effective sensing surface moves as a whole to actuate the sensor(s).

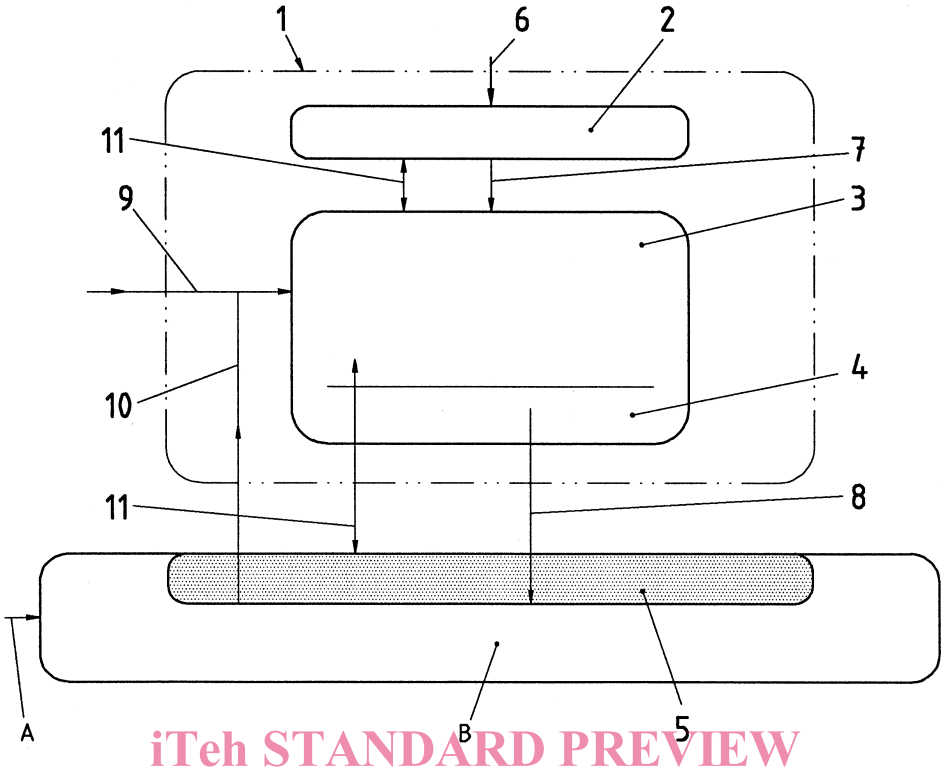
NOTE 1 The width of the cross section is usually less than or equal to 80 mm.

NOTE 2 The surface of a pressure sensitive bar can also deform locally but the deformation does not actuate the sensor(s).

b) a control unit, which responds to the signal from the sensor and generates an output signal(s) to the control system of a machine.

3.3
sensor
that part of the pressure sensitive edge or pressure sensitive bar which generates a signal in response to sufficient pressure applied to part of its surface.

3.4
control unit
that part of the pressure sensitive edge or pressure sensitive bar which responds to the condition of the sensor and generates output signals to the machine control system.



1) Pressure sensitive edge or bar

2) Sensor(s)

3) Control unit (may be located within the machine control system enclosure or be part of the machine control system)

4) Output signal switching device(s) (may be located within the machine control system enclosure or be part of the machine control system)

5) Part of the machine control system for pressure sensitive edge/pressure sensitive bar output signal processing

6) Actuating force

7) Sensor output signal

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).

B) Machine control system(s)

Figure 1 — Pressure sensitive edge or pressure sensitive bar applied to a machine