

ICS 91.060.50

English version

**Industrial, commercial and garage doors and gates - Safety
devices for power operated doors and gates - Requirements and
test methods**

Portes et portails équipant les locaux industriels et
commerciaux et les garages - Dispositifs de sécurité pour
portes motorisées - Prescriptions et méthodes d'essai

Türen und Tore - Schutzeinrichtungen für kraftbetätigte
Türen und Tore - Anforderungen und Prüfverfahren

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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 document (prEN 12978:2002) has been prepared by Technical Committee CEN/TC 33 "Doors, windows, shutters, building hardware and curtain walling", the secretariat of which is held by AFNOR.

This document is currently submitted to the Formal Vote.

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 EC Directive(s).

For relationship with EC Directive(s), see informative annex ZA, which is an integral part of this document.

This standard is part of a series of European Standards for industrial, commercial and garage doors and gates that are identified in prEN 13241-1 and prEN 13241-2.

Annex A is normative.

Introduction

This European product related Standard has been prepared to meet the needs of manufacturers, users and safety enforcement authorities, with the primary purpose of providing design and performance requirements for various types of sensitive protective equipment employing different methods of sensing, for installation on power operated doors used by vehicular and pedestrian traffic.

This standard is a C-standard as specified in EN 1070.

Sensitive protective equipment (safety devices) for manufacturing machinery are specified in EN 1760-1, EN 1760 – 2, EN 61496-1 and IEC 61496-2, which are "Type B2" standards as specified in EN 292-1.

Sensitive protective equipment (safety devices) for power operated doors are not used in the same circumstances as safety devices for manufacturing machinery such as:

- a) be suitable for use by and to give protection to untrained persons, and in particular applications may be used to protect elderly persons, disabled persons and children ;
- b) be suitable for use outdoors, possibly in severe climatic and environmental conditions ;
- c) be capable if required, to form an integrated part of the door construction and/or perform additional functions, e.g. providing a means of sealing the door ;
- d) incorporate appropriate features for power operated door applications. Some safety devices for manufacturing machinery have e.g. a re-start interlock feature which, if used on power operated doors, could cause the door to operate incorrectly and could lead to heat losses, without increasing the level of safety.

Some provisions of this standard are different from the provisions specified in EN 1760-1, EN 1760-2, EN 61496-1 and IEC 61496-2. Where sensitive protective equipment (safety devices) are designed and built for use on power operated doors, the provisions of this standard take precedence.

This standard can not ensure that all possible hazardous situations will be eliminated. A particular attention should be given to the risk analysis when small children and /or elderly persons have to be detected.

With the aim of clarifying the intention of the standard and avoiding doubt when reading it, following assumptions were made when producing it :

- components are kept in good repair or working order ;
- negotiation occurred between the manufacturer and the user concerning the specificity of the use and place of use of the safety device.

1 Scope

1.1 General

This standard applies for design, construction and testing of sensitive protective devices where the device is used to detect pedestrians including in particular applications, slow moving elderly persons, slow moving disabled persons and children who may be exposed to injury by power operated doors, gates and barriers, electrically powered from a public supply and intended for installation in areas in the reach of persons, and for which the main intended uses are giving safe access for goods and vehicles accompanied or driven by persons in industrial, commercial, public or residential premises.

This standard also covers safety devices for commercial doors such as rolling shutters and rolling grilles when used as doors on retail premises which are mainly provided for the access of persons rather than vehicles or goods.

This standard deals with all significant hazards listed in Annex A and specifies requirements to eliminate or minimise them.

This standard covers the requirements for electrical powered safety devices using mains supply provided for installation on or used in conjunction with powered doors in order to avoid hazardous situations which can be encountered when a door is used normally.

The sensitive protective device is designed to give a change in the output signal switching device which may be used to provide protection for the person being at risk. It applies to ready to use sensitive protective device and integrated sensitive protective device (mounted on or connected to a power operated door in normal use).

This standard only applies to door safety devices manufactured after the date of publication.

1.2 Exclusions

This standard does not apply to protective equipment for installation on doors which are intended for a different use than the one described above such as :

- lock gates and dock gates ;
- doors on lifts ;
- doors on vehicles ;
- doors mainly for the retention of animals ;
- theatre textile curtains ;
- railway barriers ;
- barriers used solely for vehicles.

This standard does not apply to devices used only for the normal control and stopping, including emergency stopping, of power operated doors.

This standard does not apply to safety equipment or safety devices for use on machinery other than doors.

This standard does not cover operation in environments where the electromagnetic disturbances are outside the range of those specified in EN 50082-2 or for domestic domestic garage doors those of EN 55014-2.

This standard does not cover products to be used in potential explosive atmosphere or on armoured doors.

This standard does not cover programmable devices (see IEC 61508 series).

This standard does not deal with shock resistance of component (example IK code).

The above exclusions are based on technology used at the publication time of this standard.

1.3 Door types and applications

Doors, and gates can be sliding, sidefolding, tilting, pivoting, rolling, vertical lifting, etc. with many variances for each type. If not specified otherwise, the word "door" refers to any of these types and variances of doors, and gates.

This standard does not specify configuration of the sensitive protective device in relation to the door to be protected.

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 hereafter. For dated references, subsequent amendments to or revisions of any 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 292-2:1991, *Safety of machinery – Basic concepts, general principles for design – Part 2: Technical principles and specifications.*

EN 954-1, *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 1760-1:1997, *Safety of machinery – Pressure sensitive protective devices – Part 1 : General principles for the design and testing of pressure sensitive mats and pressure sensitive floors.*

EN 1760-2:2001, *Safety of machinery – Pressure sensitive protective devices – Part 2 : General principles for the design and testing of pressure sensitive edges and pressure sensitive bars.*

EN 12433-1:1999, *Industrial, commercial and garage doors and gates – Terminology – Part 1 : Types of doors.*

EN 12433-2:1999, *Industrial, commercial and garage doors and gates – Terminology – Part 2 : Parts of doors.*

EN 12445:2000, *Industrial, commercial and garage doors and gates – Safety in use of power operated doors – Test methods.*

EN 12453:2000, *Industrial, commercial and garage doors and gates – Safety in use of power operated doors – Requirements.*

prEN 12650-1:1996, *Building hardware – Powered pedestrian doors – Part 1 : Product requirements and test methods.*

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

EN 50082-2, *Electromagnetic compatibility – Generic immunity standard – Part 2 : Industrial environment.*

EN 55014-1, *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 1 : Emission (CISPR 14-1:2000)*

EN 55014-2, *Electromagnetic compatibility – Requirements for household appliances, electric tools and similar apparatus – Part 2 : Immunity product family standard (CISPR 14-2:1997).*

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EN 60068-2-6, *Environmental testing – Part 2 : Tests, Test 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 60204-1:1997, *Safety of machinery – Electrical equipment of machines – Part 1 : General requirements (IEC 60204-1:1997).*

EN 60439-1:1994, *Low voltage switch gear and control gear assemblies – Part 1 : Type tested and partially type-tested assemblies. (IEC 60439-1:1992 + Corrigendum 1993)*

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

EN 60825-1:1994, *Safety of laser products – Part 1: Equipment classification, requirements and user's guide (IEC 60825-1:1993).*

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

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

IEC 61496-2:1997, *Safety of machinery - Electro-sensitive protective equipment – Part 2 : Particular requirements for equipment using active opto-electronic protective devices (AOPDs).*

3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply in addition to the terminology as defined in EN 12433-1:1999 and EN 12433-2:1999.

3.1

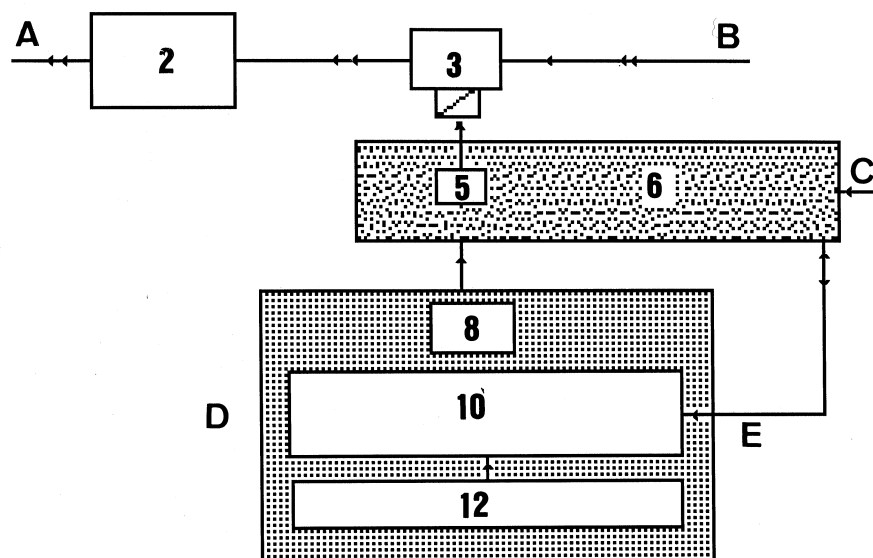
electro-sensitive protective equipment (ESPE)

non-mechanically actuated assembly of devices and/or components working together for protective tripping or presence-sensing purposes comprising as a minimum :

- a sensing function ;
- a control / monitoring function ;
- one or more output signal switching device(s).

NOTE 1 Examples are light beam, capacitive, active infra-red, ultra-sonic and image monitoring equipment.

NOTE 2 The safety related control system associated with the ESPE or the ESPE itself may further include a secondary switching device, muting functions, stopping performance monitor, start interlock, re-start interlock etc. In order to assist in the understanding of the inter-relationship of the various major elements of the ESPE and the associated safety-related control systems, a block schematic diagram is given (see Figure 1).

**Key**

A	door motion
B	main power
C	start signal
D	presence sensing device
E	control signals
2	door prime mover
3	MPCE
5	final switching device
6	door control system
8	OSSD
10	control/monitoring function
12	sensing function

Figure 1 — ESPE, block schematic diagram

3.2

pressure sensitive protective equipment (PSPE)

mechanically actuated assembly of devices and/or components working together for protective tripping or presence-sensing purposes comprising as a minimum :

- one or more sensing elements ;
- a control unit ;
- one or more output signal switching device(s).

NOTE 1 Examples are pressure sensitive edges, pressure sensitive floors, pressure sensitive mats and pressure sensitive bars.

NOTE 2 The safety related control system associated with the PSPE or the PSPE itself may further include a secondary switching device, start interlock, re-start interlock etc. In order to assist in the understanding of the inter-relationship of the various major elements of the PSPE and the associated safety-related control systems, a block schematic diagram is given (see Figure 2).

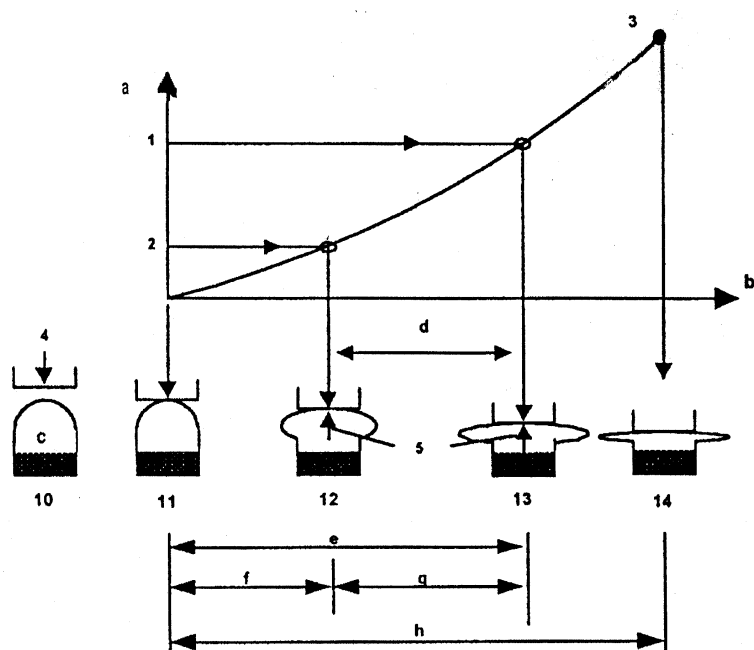


Figure 3 — Force / Travel relationship

Key

a	force in N
b	distance in mm
c	sensing element
d	established door stopping distance
e	working travel
f	pre-travel
g	over-travel
h	total travel
1	maximum working force
2	actuating force applied at "off" state signal at operating speed
3	no further deformation possible
4	approach speed
5	reaction force of device
10	before actuation
11	point of contact
12	switch to "off" state
13	maximum working force reached
14	maximum working force exceeded

3.9

control unit

part of the pressure-sensitive protective equipment (PSPE) that :

- receives and processes information from the sensing element(s) and provides signals to the OSSD(s) ;
- if intended, may monitor the sensing element(s) and the OSSD(s).

NOTE The control unit may be part of the drive control system.

3.10

specified signal range

signal range within which the safety related signal threshold values have been set, and are detected by the ESPE sensing function

3.11

detection capability

sensing function parameter limit that will cause the final output stage of the electro-sensitive protective equipment (ESPE) to change state

3.12

detection zone

zone within which a specified test piece is detected by the electro-sensitive protective equipment (ESPE)

3.13

failure

termination of the ability of an electrical component to perform a required function

NOTE 1 After failure the electrical component has a fault.

NOTE 2 "Failure" is an event, as distinguished from "fault" which is a state.

3.14

failure to danger

failure which prevents or delays all OSSD(s) going to and/or remaining in the OFF state in response to a condition which, in normal operation, would result in their so doing

3.15

fault

state of an electrical component characterised by inability to perform a required function, excluding the inability during preventive maintenance or other planned actions, or due to lack of external resources

NOTE A fault is often the result of a failure of the electrical component itself, but may exist without prior failure.

3.16

inactive area

part of the surface area of a PSPE sensing element outside the active area

3.17

mounting orientation

position in space of a device or component

3.18

off state of the output signal switching device(s) (OSSD)

state in which the output circuit(s) is broken and or changes the state

3.19

on state of the output signal switching device(s) (OSSD)

state in which the output circuit(s) is complete and permits the flow of current

3.20

output signal switching device (OSSD)

component of the ESPE or PSPE connected to the door control system which responds by going to the off-state when the sensing element or sensing function is actuated during normal operation

3.21

pressure-sensitive bar

type of PSPE which generates a signal when a force is applied to a specific area of its active surface, where :

- its length is greater than the width ;
- the cross section throughout the active area is constant ;
- the width of the cross section is > 8 mm and generally 80 mm ;
- the active area moves as a whole when the sensing element(s) is actuated.

NOTE 1 The surface of a pressure sensitive bar can also deform locally but the deformation does not actuate the sensing elements.

NOTE 2 For the purpose of this standard the specific area is as shown in clause 4.2.2 test piece 1.

3.22

pressure sensitive edge

type of PSPE which generates a signal when a force is applied to a specific area of its active surface, where :

- its length is greater than the width ;
- the cross section throughout the active area is constant ;
- the width of the cross section is generally > 8 mm and usually < 80 mm ;
- the active area is deformed locally at the point where the sensing element(s) is actuated.

NOTE For the purpose of this standard the specific area is as shown in clause 4.2.2 test piece 1.

3.23

pressure sensitive floor

type of PSPE which generates a signal when a force is applied to a specific area of its active surface, where the active area moves as a whole when the sensing element(s) is actuated

NOTE 1 The surface of a pressure sensitive floor can also deform locally but the deformation does not actuate the sensing elements.

NOTE 2 For the purpose of this standard the specific area is as shown in clause 4.2.2 test piece 1.

3.24

pressure sensitive mat

type of PSPE which generates a signal when force is applied to a specific area of its active surface, where the active area is deformed locally at the point where the sensing element(s) is actuated

NOTE For the purpose of this standard the specific area is as shown in clause 4.2.2 test piece 1.

3.25

response time

maximum time between the occurrence of the event leading to the actuation of the sensing element or sensing function and the OSSD(s) achieving the off-state

3.26

sensing element

part of the PSPE whose output changes in state, when the actuating force is applied to a specific area of its active surface

NOTE For the purpose of this standard the specific area is as shown in clause 4.2.2 test piece 1.

3.27

sensing function

function of the ESPE which uses electro-sensitive means to determine the event or state that the ESPE is intended to detect, e.g. in a photo-electric device the sensing function would detect an opaque object entering the detection zone

3.28

domestic garage door

door used on a domestic garage which is provided for one single household only and where the door does not protrude into a public area

4 Requirements

4.1 General

Pressure sensitive protective equipment (PSPE) and electrosensitive protective equipment (ESPE), shall be designed so that :

- a) in intended working conditions, they respond by giving an output signal :
 - when testing a pressure sensitive edge and bar according to 4.2.2.1, on a test specimen positioned at any angle between 90° and 45° to the direction of the motion of the test piece ;
 - or when testing an ESPE according to 7.7.1.1.3 and 7.7.1.1.4 ;
 - or when testing pressure sensitive mats or floors according to 7.7.1.1.2 ;

and

- b) if a single fault occurs according to Annex B of EN 61496-1:1997, in the sensing element, sensing function or the control system (i.e. interconnecting elements, monitoring function, OSSD), which leads to erroneous output signal(s), the PSPE and ESPE shall :
- either maintain their protective function (in accordance with at least category 3 of EN 954-1) or they shall meet category 2 of EN 954-1 and the function is checked only at one of the end positions of the door movement. If a fault is detected, the OSSD of the safety device shall go to the OFF state ;
 - for pressure sensitive bars, they shall meet category 1 of EN 954-1, monitoring the OFF position of the OSSD is not part of the safety device.

NOTE 1 These requirements, depending on the type of safety device, need to be considered together with the door control system (see clause 0, negotiation).

NOTE 2 monitoring the OFF position of the OSSD is not part of the safety device.

4.1.1 Environmental conditions

The safety device shall maintain its protective function and be suitable for operation in the environmental conditions expected from the intended use of the device.

The requirements for vibration (see 4.1.1.3) need not be fulfilled for ESPE(s) if the device is designed only for permanent fixing on the door surrounding structure only (see clause 6).

4.1.1.1 Climatic conditions

The safety device shall continue to operate as intended under the following climatic conditions :

- the basic temperature ranges shall be either +5 °C to + 40 °C if the device is intended for general indoor use only or – 10 °C to + 50 °C. Other intended temperature ranges requires tests for those temperature ranges ;
- after storage at a relative humidity of 93 %, at a temperature of + 40 °C, for four days, the device shall operate normally.

4.1.1.2 Electromagnetic compatibility

The safety device shall also have sufficient immunity to electromagnetic disturbances to enable it to operate as intended when exposed to the levels and types of disturbance as specified in EN 50082-2.

Safety devices designed exclusively for use on doors for domestic use need only fulfil the requirements in EN 55014-2.

The manufacturer of the safety device shall design, install and wire the equipment and sub-assemblies taking into account the recommendations of the supplier(s) of the sub-assemblies, to ensure that the effects of electromagnetic disturbances thereon shall not lead to unintended operation.

In particular, the following loss of performance or degradation of performance shall not occur :

- reduction in fault detection capability ;
- inhibition of the OSSD(s) going to the OFF-state when the safety device is tested according to 7.4.4 and 7.7.

Information on measures to reduce generated disturbances and measures to reduce the effects of disturbances on the safety device is given in EN 60204-1:1997 clause 4.4.2. For those tests specified in EN 50082-2, any degradation of performances or loss of function allowed with regard to performance criteria "A" & "B" shall be declared by the manufacturer. Any temporary loss of function allowed with regard to performance criteria "C" shall be declared by the manufacturer.

The electromagnetic disturbances generated by the safety device shall not exceed the levels specified in generic emission standard EN 50081-1.

Safety devices designed exclusively for use on doors for domestic use need only fulfil the requirements in EN 55014-1.

4.1.1.3 Vibration

The safety device shall continue to operate as intended and the status of the OSSD shall not change under the following vibration conditions in accordance with EN 60068-2-6 :

- frequency range: 10 Hz to 55 Hz ;
- displacement: 0,15 mm ;
- cycles per axis: 10 ;
- sweep rate: 1 octave/min.

After this vibration test, the safety device shall continue to operate normally.

4.1.2 Power supply

4.1.2.1 Electrical power supply

The safety devices shall be designed to operate correctly under full load as well as no load with the conditions of the nominal supply as specified in 4.3.1 and 4.3.4 of EN 60204-1:1997.

4.1.2.2 Non-electrical inner power supply

The device shall continue to operate normally when subjected to supply pressure variations within the range specified by the manufacturer.

Devices shall be in accordance with the requirements of EN 982 and EN 983, as applicable.

Variations of supply pressure below the operating range shall not prevent the OSSD to change to the off state.

4.1.3 Electrical equipment

The electrical equipment shall be suitable for their intended use and be operated within their specified ratings.

Protection against electric shock shall be provided in accordance with 6.1, 6.2 and 6.3 of EN 60204-1:1997.

Overcurrent protection, where applicable, shall be provided in accordance with 7.2.1, 7.2.3, 7.2.7, 7.2.8, and 7.2.9 of EN 60204-1:1997.

The electrical equipment shall be suitable for pollution degree 3 in accordance with 6.1.2.3 of EN 60439-1:1994. For electrical enclosures with a degree of protection of IP 54 or higher (according to EN 60529), pollution degree 2 is permissible.

The electrical equipment shall be wired in accordance with 7.8.3 of EN 60439-1:1994 and with EN 60204-1. Where components of different configurations are interchangeable by means of plug and socket connections, incorrect placement or exchange of these components shall either be made impossible by design or shall not cause a failure to danger.

When the ambient temperature limits set in 60204-1 are exceeded, the appropriate means such as design, heating, cooling, specific testing, etc. shall be used.

If a sensing element is connected by a plug and socket, either :

- a) removal or disconnection of the sensing element at the plug and socket from the control unit shall cause the OSSD to go to an off-state ;

or

b) the removal/disconnection shall be detected at the latest at one of the final end positions of the door leaf travel.

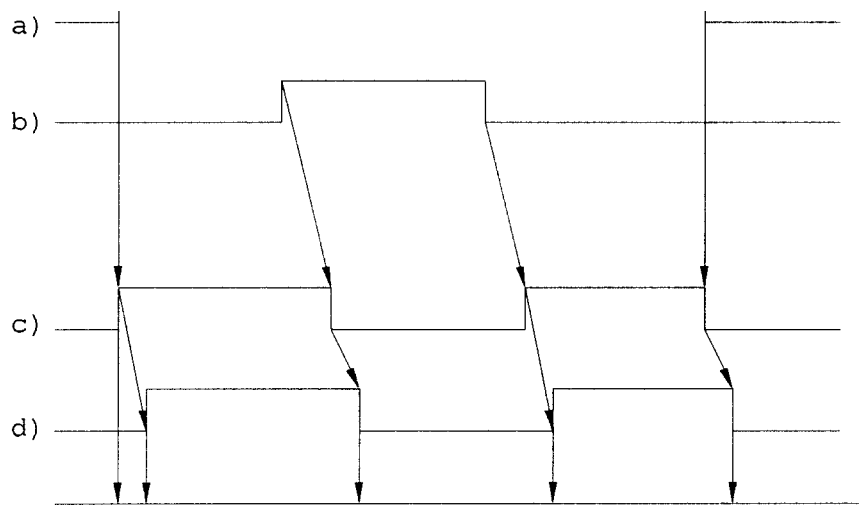
4.1.4 Enclosures for electrical equipment

Enclosures intended to be exposed to outdoor conditions shall be at least IPX4.

4.1.5 Functional requirements

4.1.5.1 Safety device response

The sensing function output shall change state when the device is actuated (see example in Figure 4 or examples in EN 1760-2).



Key

- a power to safety device
- b actuating force
- c sensing element output
- d output of OSSD(s)

Figure 4 — Example of relation between actuation and output

4.1.5.2 Detection capability

The detection capability stated by the manufacturer shall be maintained :

- for a supply which remains within the limits ;
- throughout the detection zone ;
- throughout the intended conditions of use.

4.1.6 Adjustments

Where adjustment is provided this shall only be possible by means of a key, tool or other means giving an equivalent level of security.

Adjustment shall require intentional human intervention.

4.1.7 Fixing of safety devices

The design of the safety device shall enable it to be fixed in the mounting orientation intended by the manufacturer.

The sensing element shall have sufficient mechanical strength to withstand the maximum forces stated by the manufacturer.

4.2 Additional requirements for pressure sensitive protective equipment

4.2.1 Additional coverings for sensing elements

Where the manufacturer specifies that additional coverings such as flexible extrusions can be used over the top of the sensing element, the requirements of this standard shall be fulfilled by the covered sensing element.

4.2.2 Actuating force

The actuating force shall be applied perpendicular to the sensing surface of the pressure sensitive protective equipment as shown on Figure 5.

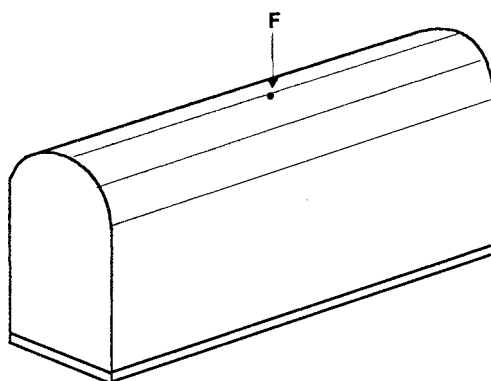


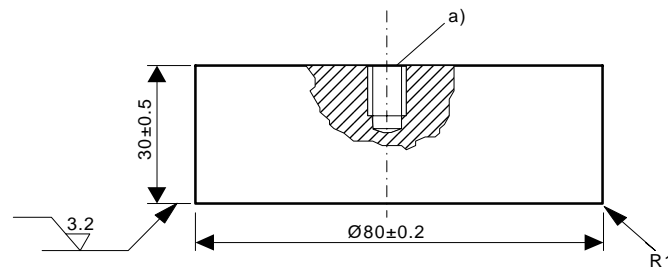
Figure 5 — Direction of actuating force F applied to a pressure sensitive equipment

The maximum working force (see Figure 3) shall be compatible with the requirements of EN12453:2000, Annex A.

4.2.2.1 Single sensing element

The OSSD of pressure sensitive edge(s) and pressure sensitive bar(s) shall switch to the off state :

- when tested in accordance with 4.2 of EN 1760-2:2001 using test piece 1 (see Figure 6) ;
- or when tested to the design actuating force when the test piece 1 (see Figure 6) is applied at the intended speed(s) and within the operating temperature range.



Key

“a)” is a mounting proposal only. Tolerance on radii is $\pm 0,2$ mm.

Figure 6 — Test piece n°1 for pressure sensitive edges and bars

Pressure sensitive mat(s) and pressure sensitive floor(s) shall meet the requirements in 4.2 of EN 1760-1:1997.

4.2.2.2 Combination of sensing elements

For pressure sensitive mat(s) or pressure sensitive floor(s) the combination of sensing elements shall also fulfil the requirements in 4.2.2 of EN 1760-1:1997.

For pressure sensitive edges or bars, the combination of sensing elements shall also fulfil the requirements in 4.8.2 of EN 1760-2:2001.

The tests carried out on a combination of sensing elements shall show no inactive area with the exception stated in 4.2.4.4.

4.2.3 Specific requirements for pressure sensitive edges and bars

4.2.3.1 Recovery after deformation

After being subject to the maximum actuating force using test piece n°1 for a period of 24 hours, the active area shall recover the same characteristics as before the loading within 30s under the worst temperature conditions within the temperature range, and the pressure sensitive edge or bar shall operate normally (i.e. the OSSD operates).

For pressure sensitive edge and bar only intended to be installed on doors where they are never loaded during normal operation of the door, including when the door is in the closed position, it may be accepted that the pressure sensitive edge or bar has a residual deformation after 30s of not more than 20% (as specified in EN 1760-2).

4.2.3.2 Protruding parts

Exposed parts of pressure sensitive edges and bars shall have no sharp edges and corners which can cause injury to persons coming into contact with the device(s). They shall be rounded to a 3mm radius.

4.2.4 Specific requirements for pressure sensitive mats and floors

4.2.4.1 Static force

4.2.4.1.1 Sensing element load capability

The pressure sensitive mat(s) or pressure sensitive floor(s) shall fulfil the requirements in 4.4.1 of EN 1760-1:1997

Pressure sensitive mats and floors intended to be used by wheeled traffic shall be so designed that they are able to resist the forces derived from the expected traffic.

4.2.4.1.2 Sensing element deformation capability

The pressure sensitive mat(s) or pressure sensitive floor(s) shall fulfil the requirements in 4.4.2 of EN 1760-1:1997.

4.2.4.2 Tripping

The pressure sensitive mats and floors shall be designed so that they can be recessed into a mat well and mounted flush with the surrounding floor.

Where mats or floors are intended to be used in combination, provision shall be made to minimise the tripping hazard at joints and junctions between the mats or floors.

NOTE This is normally realised e.g. by junctions, by limitations of the difference in level to maximum 6 mm.

4.2.4.3 Slipperiness and softness of the sensing element top surfaces

Provision shall be made on the top surface of pressure sensitive mats to minimise slipping hazard under the expected operating conditions, e.g. mats with non smooth surface, a checker plate.

Surfaces shall be resistant to water, oil, grease, and detergent where practicable.

4.2.4.4 Combinations of Pressure sensitive mats

Inactive areas at the edges of pressure sensitive mats shall have a maximum width of 38 mm.

Pressure sensitive mats intended to be fitted side by side, with the longest dimension perpendicular to a door opening, shall have a combined inactive area width of • 60 mm at the meeting line.

Pressure sensitive mats intended to be fitted side by side, with the longest dimension parallel to a door opening, shall have a combined inactive area width of • 90 mm at the meeting line.

4.2.4.5 Number of operations

The pressure sensitive mat or floor shall fulfil the requirements in 4.5.1, 4.5.2, 4.5.3 and 4.5.4 of EN 1760-1:1997.

When these requirements have been met, the pressure sensitive mat or pressure sensitive floor shall still meet the requirements in 4.2.3 of EN 1760-1:1997.

4.2.4.6 Fixing

Fastening of pressure sensitive mats and floors intended to be used by wheeled traffic shall be designed to resist the forces derived from the intended traffic.

4.3 Additional requirements for electro sensitive protective equipment

4.3.1 Detection capability

The sensing function shall be effective over the detection zone and the signal range specified by the manufacturer.

4.3.2 Lasers

The radiation intensity generated and emitted from the device shall be specified by the supplier and shall at no time exceed the maximum power or energy levels for a class 1 laser in accordance with 9.3 and 9.4 and table 1 of EN 60825-1:1994.

4.3.3 Additional requirements for active opto-electronic protective devices (AOPD's)

The AOPD shall fulfil the requirements for a type 2 ESPE in accordance with IEC 61496-2:1997 with the acceptable deviation that :

- the periodic test of the device can be done at the latest at one of the final end positions of the leaf in accordance with 5.1.1.6 f) of EN 12453:2000.

In the application of an AOPD as safeguarding device against drawing-in at the lintel can be accepted additionally, that :

- the initiation of the lock-out condition in accordance with 4.2.2.3 of EN 61496-1:1997 can be done outside of the AOPD, e.g. in the control unit of the door ;
- the duration of the periodic test of 150 ms maximum according to 4.2.2.3 of IEC 61496-2:1997 can be disregarded, if the testing of the device is done during the standstill of the door leaf and an other hazardous movement of the door leaf is only possible after a positive test result.

5 Marking

5.1 Electro sensitive protective equipment

Electro sensitive protective equipment (ESPE) shall be marked in accordance with clause 6 of EN 61496-1:1997 and, for AOPD(s), in accordance with clause 6 of IEC 61496-2:1997.

5.2 Pressure sensitive protective equipment

A label shall be located on the control unit or, when feasible, on the sensing unit, which shall contain the following information :

- name of manufacturer ;
- serial number or traceability code ;
- manufacturer's type reference ;
- rated supply level.

In addition a label shall be located on the control unit which shall contain information about the temperature range for which the sensing unit is intended.

All labels and markings shall be securely fixed and durable for the expected lifetime of the part to which it is attached. Plastic stickers satisfy this requirement.

Every part of the PSPE that can be replaced in accordance with the instruction manual shall be marked with a type reference or part number as listed in the manual and a traceability code.

6 Information for use

6.1 Instruction handbook -General

The instruction handbook shall be in accordance with clause 5.5 of EN 292-2:1991 and shall include information mentioned in sub-clause 1.7.4 of Annex A to EN 292-2:1991.

This information shall include the duties and conditions under which the equipment is intended to be used, in particular with regard to :

- category according to EN 954-1 ;
- electrical supply ;
- information on rating of fuses or setting of an over current protective device for the circuit(s) connected to the OSSD(s) output connection points ;
- intended type of door ;
- intended speed(s) ;
- intended over travel ;
- response time ;
- recovery of the sensing unit ;
- intended position on or towards the door ;
- range of intended environmental conditions (e.g. wind, temperature, relative humidity) ;
- restrictions of use.(see exclusions listed in the scope of this standard) ;
- a repeat of the information marked on the device ;
- address of manufacturer and maintenance provider.

This information shall also contain details as stated in the following clauses.

6.1.1 Electro sensitive protective equipment

- Documentation in accordance with clause 7 of EN 61496-1:1997 and, for AOPD(s) in accordance with clause 7 of IEC 61496-2:1997 as long as this is not in contradiction with clause 6.1.

6.1.2 Pressure sensitive protective equipment

- Guidance regarding use of the device in alternative mounting orientations, where applicable ;
- for non-electrical power supplies, the manufacturer shall specify the supply pressure and the allowable operating range within which normal operation will be maintained ;
- information about the possible need for an overpressure protective device in the power supply ;
- suitable information on pre-travel, over-travel, response time and ability to recover shall be provided to enable choice of an appropriate safety device to be chosen to ensures that the admissible values of operating forces are in accordance with Annex A of EN 12453:2000, or 4.6.3.2 of prEN 12650-1:1996 as appropriate.

6.2 Instructions for the installation of a safety device

When the equipment is supplied unassembled, the manufacturer shall provide with the equipment assembling specifications preferably with drawings showing :

- instructions for assembly, installation and fixing ;
- description of the intended interface (i.e. rating, characteristics and location of all input/output terminals, permissible lengths of interconnections and earthing, configurations of sensors which can be connected to a control unit) with the door equipment ;
- any special equipment for assembly, fixing and settings ;

- any fixing positions and fixing methods to ensure stability during assembly and operation ;
- electric, hydraulic and pneumatic connections and diagrams ;
- the assembly phases ;
- any special requirements for storage ;
- the methods for safe handling of the components.

The instruction handbook shall draw the attention of the installer on the fact that modification of the design or configuration of the equipment should not be made without consulting the manufacturer or his authorised representative.

6.3 Instructions for the use of the safety device

The installer of the safety device shall provide the end-user with the following :

the instruction handbook shall include, in addition to sub-clause 5.1.1 a), b), c) and d) of EN 292-2:1991 the following requirements :

- safety devices shall be made known to all appropriate persons. Areas giving access to them shall be kept clear of obstacles ;
- the cleaning requirements in order to avoid eventual dangerous accumulation of material ;
- possible details of a restarting procedure to be followed after an emergency or accidental stoppage caused by the control system.

The instruction handbook shall draw the attention of the user on the fact that modifying of the design or configuration of the equipment without consulting the manufacturer or his authorised representative may create dangerous situation.

6.4 Instructions for maintenance

The instruction handbook shall specify in particular (refer to subclause 5.5.1.e of EN 292-2:1991) :

- the technical knowledge and skills of the maintenance staff, specially for particular operations which need specific competence, and shall specify that all adjustments, whether mechanical or electrical, shall only be carried out by persons authorised to do so in accordance with a safe system of work and the manufacturer's instructions ;
- a list of wearing parts, as well as the approximate frequency and conditions for their replacement ;
- a list of parts to be checked periodically ;
- safety devices shall be kept in proper working condition and maintained in accordance with the manufacturer's instructions ;
- information about checking the presence and legibility of initial markings.

7 Verification and test methods

7.1 General

The following verification and testing shall be carried out to determine whether safety devices meet the requirements of this standard.

7.2 Test specimen

Insofar as it is practicable all parts of ESPE or PSPE shall be tested together. Where this is not practicable, parts of the ESPE or PSPE may be tested separately. In such cases any input signals necessary for the operation of the ESPE or PSPE shall be simulated. The tests shall be carried out on either a ready to use test specimen as specified below or on integrated ESPE's or PSPE's, (mounted on or linked to a door or barrier as in normal use).

In applications where the ESPE or PSPE is designed and manufactured as a part of a door or barrier it may be impossible or impractical to submit these devices to all tests set out in this clause. Where tests are omitted, the manufacturer shall provide information to explain and justify why the tests have been omitted and provide information to explain how the requirements are met.

Where a particular test is destructive and identical results are obtained by testing part of the ESPE or PSPE in isolation, a sample of that part may be used instead of the whole equipment sample for the purpose of obtaining the results of the test.

Where the ESPE or PSPE is designed for operation at a number of different supply voltages (e.g. for differing applications), more than one sample may be required.

When the ESPE or PSPE is designed to be supplied from an external dedicated power supply, it shall undergo testing with the specified dedicated power supply.

Some of the following factors which may affect the performance of the safeguarding device shall be considered :

- a) shape/size of the sensing element ;
- b) top or covering material of the active area or effective sensing zone ;
- c) combination of sensing elements ;
- d) length of the interconnecting cables or tubes ;
- e) sensing element mounting orientations.

7.2.1 Preferred test samples

7.2.1.1 Pressure sensitive protective equipment

7.2.1.1.1 Pressure sensitive edge(s) or bar(s)

The preferred sensing element sample(s) shall have a length of approximately 1 m. If the device is built up from a combination of sensing elements then, if relevant, the maximum stated number of sensors for connection with one control unit shall be provided.

If the sensor length influences the characteristics of the sensor output, a sensor of the least favourable length as specified by the manufacturer shall, where practicable, be used.

7.2.1.1.2 Pressure sensitive mat(s) or floor(s)

The preferred sensing element sample(s) shall have a sensing element top surface of at least 1 m x 0,5 m. If the device is built up from a combination of sensing elements then, if relevant, the maximum stated number of sensors for connection with one control unit shall be provided.

7.2.1.2 Electro-sensitive protective equipment (all types)

The preferred sensing element sample(s) shall consist of emitter(s) and receiver(s) or emitter(s)/receiver(s) and reflective parts for retro-reflective systems. If the device is built up from a combination of sensing elements this shall be considered when specifying the actual configuration.

In case of systems with separate emitter and receiver, those should be arranged at spatial distances not less than the maximum specified operating range.

In case of retro-reflective systems, those should be arranged at the spatial distance between emitter/receiver and reflecting object not less than the maximum specified operating range.

7.3 Test conditions

Unless otherwise specified in the test method, the tests shall be carried out with the test sample operating within the conditions specified.

For the purpose of electrical disturbance immunity tests the equipment shall be in as near its final operating configuration as is possible (i.e. with peripheral devices and covers attached, connected to the power supply and, where applicable, connected to the external protective conductor).

Testing shall, unless otherwise specified, be made at the least favourable positions on the active area taking account of the application.

When several mounting positions are specified, the least favourable mounting position shall be used.

7.3.1 Test environments

All tests shall, if practically possible and unless otherwise specified, be carried out, with the ESPE or PSPE operating under the following conditions :

- ambient temperature: 20 °C ± 5 °C except for pressure sensitive mats and floors which are to be tested at 23 °C ± 5 °C ;
- relative humidity: 25 % to 75 % ;
- barometric pressure: 86 kPa to 106 kPa ;
- rated voltage or a voltage within the rated voltage range ;
- rated frequency or a frequency within the specified frequency range.

7.4 Environmental tests

7.4.1 General

At the end of each of the following tests the sensing function of the PSPE or ESPE shall be verified by performing the tests, as relevant, according to 7.7.1.1. The requirement is fulfilled, if an off-state of the OSSD is produced.

7.4.2 Temperature range

The requirements of the specified temperature range shall be verified according to Table 1.

Table 1 — Temperature range

Test method	Remarks
EN 60068-2-14 Test Nb	Safety device is connected to the power supply.

The rate of change of temperature shall be $(0,8 \pm 0,3)$ °C/min over the whole temperature range for heating and cooling.

The functional test as described in 7.7.1.1 shall be repeated at least once at the upper and lower limit of the specified temperature range.

7.4.3 Humidity

The requirements for humidity shall be verified in accordance with Table 2 for a period of four days.

Table 2 — Humidity

Test method	Remarks
IEC 60068-2-3 Test Ca	Safety device is not connected to power supply. After this test a high voltage test according to Tables 1 and 5 of IEC 60664-1:1992 shall be performed between circuits and exposed conductive parts or accessible surfaces of the control unit/output signal switching device.

The functional test as specified in 7.7.1.1 shall be performed prior to and after the humidity test.

7.4.4 Electromagnetic compatibility

Compliance with the EMC immunity requirements of 4.1.1.2 above shall be checked in accordance with the standards mentioned. If testing of the completed safety device is not reasonably practicable due to the size of the machinery, the manufacturer shall verify that all appropriate equipment sub-assemblies comply with 4.1.1.2 above and are suitably installed and wired to minimise disturbances and/or their effects in accordance with any recommendation of the supplier(s) of the sub-assemblies.

Compliance with the EMC emission requirements of 4.1.1.2 above shall be checked in accordance with the standards mentioned. If testing of the completed safety device is not reasonably practicable due to the size of the machinery, the manufacturer shall verify that all appropriate equipment sub-assemblies comply with 4.1.1.2 above and are suitably installed and wired to minimise disturbances and/or their effects in accordance with any recommendation of the supplier(s) of the sub-assemblies.

7.4.5 Vibration

These requirements shall be verified in accordance with table 3. During this test, it shall be verified that the OSSD remains in the OFF state. After the vibration test has been completed, the function of the safety device shall be verified.

Table 3 — Vibration

Test method	Test conditions
EN 60068-2-6	Safety device is connected to the power supply

7.4.6 Power supply

7.4.6.1 Supply voltage variation

The safety device shall be subjected to the following sequence of tests using the relevant values according to 4.1.2.1.

The safety device shall be actuated at the lower limit of the power supply range.

The supply voltage shall be increased, within a period of 10 s to 20 s, to the upper limit of the power supply range.

The safety device shall be actuated at the upper limit of the power supply range.

The requirements for frequency variations and for harmonic distortions shall be verified either by testing or by using analytical methods.

7.4.6.2 Supply voltage interruptions

The ESPE or PSPE shall continue in normal operation when subjected to ten voltage interruptions each interruption having a duration of 3 ms and with a time of 1 s between successive interruptions.

7.4.6.3 Non-electric power supply

The function of the safety device shall be verified at the limits of power supply variations as specified by the manufacturer. Possible variations outside the operating range shall not cause the safety device to fail to danger.

7.5 Electrical equipment

The suitability and operation of each component within its specified ratings throughout the entire operating range of the ESPE or PSPE in accordance with the requirements of 4.1.3 shall be verified by design check and/or visual verification as applicable.

7.6 Enclosure(s) for electrical equipment

Degree of protection shall be verified by document and enclosure's marking analysis or tested according to EN 60529.

All other requirements shall, where applicable, be verified by visual verification.

7.7 Functional test

7.7.1 Sensing function and detection capability

Correct function of the ESPE or PSPE shall be tested according to the requirements in 4.1.1, 4.1.5.1 and 4.1.5.2 as specified below.

7.7.1.1 Sensing function

7.7.1.1.1 Pressure sensitive edge

The function of the pressure sensitive edge shall be verified using test piece n° 1 (see Figure 5) applying the actuating force to the active area in one random location, in the opposite direction to the door movement, at the highest and lowest specified speed. In the case of a pressure sensitive edge attached to a moving door leaf, the highest specified speed of actuation is the speed resulting from the specified maximum leaf speed (see also clause 7 of EN 12445:2000 or 5.4.2 of prEN 12650-1:1996) as appropriate depending on the type of door.

7.7.1.1.2 Pressure sensitive mat or floor

The function of the Pressure Sensitive Mat or Pressure Sensitive Floor shall be verified according to 7.4.1 and 7.4.2 of EN 1760-1:1997 using the relevant actuating force and test piece as given in table 1 of EN 1760-1:1997.

7.7.1.1.3 Opto-electronic safety device

The function shall be verified by a moving test piece according to clause 7 of EN 12445:2000 or 5.4.2 of prEN 12650-1:1996 as appropriate, depending on the type of door, at an angle of 45° and 90° through the detection zone at the following positions :

- midway between the emitter and receiver or, in case of retroreflective systems, at a distance of 1 m from the receiver/emitter ;
- close to the receiver ;
- close to the emitter.

7.7.1.1.4 Capacitive, active infra-red and ultra-sonic devices

The functional requirements of 4.1.6. shall be verified using a test piece according to clause 7 of EN 12445:2000 or 5.4.2 of prEN 12650-1:1996 as appropriate, depending on the type of door.

7.7.1.2 Integrity of the detection capability

It shall be verified that the integrity of the detection capability is maintained, or the ESPE or PSPE does not fail to danger in accordance with 4.1, by systematic analysis of the design employed, using tests where appropriate.

The results of the systematic analysis shall specify which measurement of the response time is required in addition to the tests.

7.7.1.3 Testing of safety devices installed on a power operated door

Where a safety device is installed on a power operated door, it shall be tested according to clause 7 of EN 12445:2000 or 5.4.2 of prEN 12650-1:1996 as appropriate, depending on the type of door.

7.7.2 Response time

The response time shall be verified by systematic analysis and test.

The response time may be determined by electrical simulation of an actuation, provided that it includes the maximum time between the event triggering the actuation of the sensing function and the actuation.

7.8 Adjustments

Compliance with the requirement in 4.1.6 shall be checked by visual verification.

7.9 Sensor fixing

Compliance with the requirement in 4.1.7 shall, where applicable, be verified by design check and visual verification.

7.10 PSPE operating characteristics

The requirements of 4.2.1, 4.2.2., 4.2.3 and 4.2.4. shall be verified by inspection and, where necessary, by testing and then at the least favourable temperature within the specified temperature range.

7.11 Single fault failure

The compliance with the requirements of 4.1.b shall be verified by design check.

7.12 Marking

Check by visual verification that the requirements of clause 5 are met.

7.13 Information for installation and use

Check by visual verification that the requirements of clause 6 are met.

To be checked at the application according to EN 12453:2000, Annex A

Annex A (normative)

List of significant hazards

This clause contains all the significant hazards, hazardous situations and events, as far as they are dealt with in this standard, identified by risk assessment as significant for this type of safety device and which require action to eliminate or reduce the risk.

Table A.1 — Significant hazard

N° from EN1050 annex A	Hazards	Relevant clause in this standard
Hazards, hazardous situations and hazardous events		
1	Mechanical hazards due to :	
	— - safety device parts or workpieces, e.g.:	
	a) shape ;	4.2.3.2
	b) inadequacy of mechanical strength.	4.1.7 /4.2.3.1/ 4.2.4.1.1/ 4.2.4.5/ 4.2.4.6
1.3	Cutting or severing hazard	4.2.3.2
2	Electrical hazards due to:	
2.1	Contact of persons with live parts (direct contact)	4.1.3
2.2	Contact of persons with parts which have become live under faulty conditions (indirect contact)	4.1.3
6	Hazards generated by radiation	
6.5	Lasers	4.3.2
8	Hazards generated by neglecting ergonomic principles in safety device design as, e.g. hazards from:	
8.1	Excessive effort or insufficient effort	4.2.2
8.6	Human behaviour	4.1.6
10	Unexpected start-up, unexpected overrun/over-speed (or any similar malfunction) from:	
10.1	Failure/disorder of the control system	4.1 /4.1.5/ 4.2.1/4.2.4.4/ 4.3.1/4.3.3
10.2	Restoration of energy supply after an interruption	4.1.3
10.3	External influences on electrical equipment	4.1.1/4.1.3/ 4.1.4/4.1.6
13	Failure of the power supply	4.1
14	Failure of the control circuit	4.1
15	Errors of fitting	4.1.3
19	Slip, trip and fall of persons (related to safety device)	4.2.4.2/ 4.2.4.3

Annex ZA (informative)

Relationship of this document with EC Directives

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 EC Directive(s) :

Machinery Directive 98/37/EC amended by Directive 98/79/EC.

Compliance with this standard provides one means of conforming with the specific essential requirements of the Directive concerned and associated EFTA regulations.

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