

DIN EN 16005



ICS 91.060.50

**Power operated pedestrian doorsets –
Safety in use –
Requirements and test methods;
English version EN 16005:2012,
English translation of DIN EN 16005:2013-01**

Kraftbetätigte Türen –
Nutzungssicherheit –
Anforderungen und Prüfverfahren;
Englische Fassung EN 16005:2012,
Englische Übersetzung von DIN EN 16005:2013-01

Blocs-portes motorisés pour piétons –
Sécurité d'utilisation –
Exigences et méthodes d'essai;
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English Version

Power operated pedestrian doorsets - Safety in use - Requirements and test methods

Blocs-portes motorisés pour piétons - Sécurité d'utilisation -
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Kraftbetätigte Türen - Nutzungssicherheit - Anforderungen
und Prüfverfahren

This European Standard was approved by CEN on 11 August 2012.

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Introduction

This standard is a type C standard as stated in EN ISO 12100.

The machinery concerned and the extent to which hazards, hazardous situations and hazardous events are covered are indicated in the scope of this document.

When provisions of this type C standard are different from those which are stated in type A or B standards, the provisions of this type C standard take precedence over the provisions of the other standards, for machines that have been designed and built according to the provisions of this type C standard.

1 Scope

1.1 General

This European Standard specifies requirements regarding design and test methods for external and internal power operated pedestrian doorsets. Such doorset constructions may be operated electro-mechanically, electro-hydraulically or pneumatically.

This European Standard covers safety in use of power operated pedestrian doorsets used for normal access as well as in escape routes and as fire resistance and/or smoke control doorsets.

The type of doorsets covered include power operated pedestrian sliding, swing and revolving doorsets, including balanced doorsets and folding doorsets with a horizontally moving leaf.

Power operated pass doorsets incorporated in other doorsets for which the main intended use is giving safe access for persons are covered by the scope of this European Standard.

This European Standard deals with all significant hazards, hazardous situations and events relevant to power operated doorsets when they are used as intended and under conditions of misuse which are reasonably foreseeable by the manufacturer (see Annex J).

1.2 Exclusions

This European Standard does not apply to:

- vertically moving doors;
- doors on lifts;
- doors on vehicles;
- power operated doors or gates mainly intended for vehicular traffic or access for goods;
- doors used in industrial processes;
- partition walls;
- doors outside the reach of people (such as crane gantry fences);
- traffic barriers;
- turnstiles;
- platform doors.

This European Standard does not cover special functions of doorsets, such as security in banks, airports, etc. or fire compartments, where conformity of the specific function with requirements of the application shall have the preference.

This European Standard does not cover operation in environments where the electromagnetic disturbances are outside the range of those specified in EN 61000-6-3.

This European Standard does not cover the radio part of operating devices of doorsets. If a radio-operating device is used, the relevant ETSI standards should be applied in addition.

This European Standard does not contain any specific requirement regarding noise emitted by a power operated doorset in relation to the Machinery Directive as it is not considered to be a significant hazard.

This European Standard is not applicable to power operated pedestrian doorsets in use before the date of publication of this document by CEN.

This European Standard does not cover operation in environments where there is a risk of explosion.

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.

EN 349 *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

EN 1760-1, *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, *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 12150-1, *Glass in building — Thermally toughened soda lime silicate safety glass — Part 1: Definition and description*

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 12519:2004, *Windows and pedestrian doors — Terminology*

EN 12978, *Industrial, commercial and garage doors and gates — Safety devices for power operated doors and gates — Requirements and test methods*

EN 14351-1:2006+A1:2010, *Windows and doors — Product standard, performance characteristics — Part 1: Windows and external pedestrian doorsets without resistance to fire and/or smoke leakage characteristics*

EN 60335-2-103, *Household and similar electrical appliances — Safety — Part 2-103: Particular requirements for drives for gates, doors and windows*

EN 60529, *Degrees of protection provided by enclosures (IP Code)*

EN ISO 4413:2010, *Hydraulic fluid power — General rules and safety requirements for systems and their components (ISO 4413:2010)*

EN ISO 4414:2010, *Pneumatic fluid power — General rules and safety requirements for systems and their components (ISO 4414:2010)*

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

EN ISO 12543-1, *Glass in building — Laminated glass and laminated safety glass — Part 1: Definitions and description of component parts (ISO 12543-1)*

EN ISO 12543-2, *Glass in building — Laminated glass and laminated safety glass — Part 2: Laminated safety glass (ISO 12543-2)*

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

EN ISO 13850, *Safety of machinery — Emergency stop — Principles for design (ISO 13850)*

EN ISO 17025, *General requirements for the competence of testing and calibration laboratories (ISO/IEC 17025)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12100:2010, EN 12433-1:1999 (definitions from 2.1 to 3.11), EN 12433-2:1999, EN 12519:2004 and EN 14351-1:2006+A1:2010 and the following apply.

3.1 power operated pedestrian doorset

doorset for pedestrian passage only with one or more leaves that is moved, at least in one direction, by an external energy supply (e.g. electrically) instead of manual or stored mechanical energy

Note 1 to entry: It includes drive, leaves, protective devices and any components needed for its safe operation.

3.2 revolving doorset

power operated pedestrian doorset with one or more leaves connected to a common vertical axis of rotation within an enclosure

Note 1 to entry: There is a wide range of design variations in this product group. See Figure 1 for examples.

Note 2 to entry: Figure 1 refers to any rotation. The shown anticlockwise rotation is only the more common one.

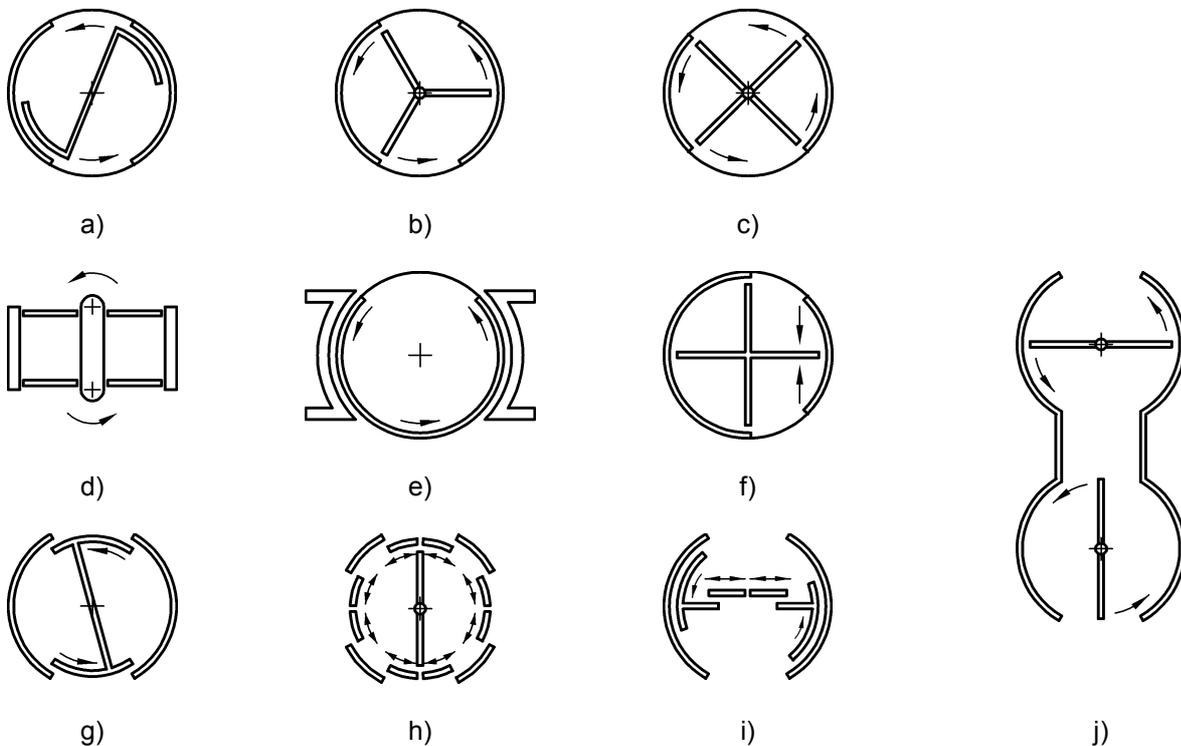


Figure 1 — Revolving doorsets

3.3

balanced doorset

power operated pedestrian doorset with a pivot point allowing the leaf/leaves to slide sideways whilst simultaneously rotating

3.4

swing doorset

power operated pedestrian doorset with a leaf which is hinged or pivoted at one side

3.5

folding doorset

doorset with two or more leaves hinged together with one side of the leaf hinged or pivoted at the doorset jamb

3.6

sliding doorset

power operated pedestrian doorset with one or more leaves, moving horizontally in its guides parallel to the adjacent structure

3.7

low energy power operated doorset

power operated pedestrian doorset with a limited kinetic energy

3.8

break-out

system whereby doorset leaves and side screens can be pushed open manually in the direction of escape

3.9

monitoring system

system that checks and verifies the correct functioning of another system and in the event of any malfunctioning of that system switches the power operated doorset to a selected safe mode of operation

3.10

activator

means by which the power operation of the doorset is started

3.11

cycle

movement consisting of an opening and closing movement

Note 1 to entry: For sliding and swing doorsets, a cycle consists of a complete opening and closing movement. For revolving doorsets, a cycle means one passage.

3.12

lintel

horizontal structural member spanning an opening at its head to carry a load above the opening

3.13

side screen

side wall fixed or with a break out function that can be part of a power operated pedestrian doorset

3.14

track

component or assembly designed to guide or support a doorset leaf when it moves

3.15

leading mullion

doorset mullion at the first point at which a leaf of a power operated revolving doorset passes the curved screens

4.2 Information for use

4.2.1 General

The manufacturer shall provide with the machine an instruction handbook in accordance with EN ISO 12100:2010, 6.4. In particular, the following shall be included.

The manufacturer shall provide information on operation, maintenance and inspection. Documents with instructions on how to correctly install and dismantle the power operated pedestrian doorset shall be provided where appropriate.

Particular importance is attached to the description of danger points, the appropriate protective devices and residual risks.

All documentation relevant to the doorset, the installation, the maintenance requirements and any incorporated diagrams, shall be legible and written in a language acceptable in the country in which the product is to be installed.

Installation instructions to be used solely by the professional installer and which are not intended to be handed over to the owner, may be written in any official language used in Europe and agreed upon between manufacturer and purchaser.

The documentation shall include all the necessary warning, advisory or cautionary notices.

All symbols and diagrams incorporated into the documentation shall be in accordance with relevant European Standards.

The installation instructions shall detail all operations to be carried out to safely install or dismantle the doorset and shall clearly state when the specified procedure can be adequately completed by non-professionals. The installation instruction shall specify all verifications needed after installation of the doorset.

Proper operating instructions including routine maintenance instructions shall be provided to the final user after installation/upgrading of the doorset.

User instructions shall at least include the following, as far as applicable:

- a) correct methods for operating the doorset;
- b) operating conditions: e.g. operating hours per day, automatic/manual operation, indication of the operating mode(s);
- c) explanation of the warning signs of the doorset;
- d) information about the safe use of manual emergency and/or manual release;
- e) range of intended environmental conditions (e.g. temperature, relative humidity, electromagnetic fields, and when applicable, warning against use in windy conditions);
- f) restrictions of use.

Details of safety functions, list and location of protective devices shall also be provided.

The documentation shall also contain information on prohibited use such as dashing through a closing doorset.

Routine maintenance instructions shall highlight that to ensure safe operation, long term reliability and working efficiency, a power operated pedestrian doorset (including protective devices and safety systems) shall be regularly maintained according to the manufacturer's specification. They shall also detail frequency of maintenance to be carried out (recommended frequency for checking the correct operation of safety function and devices is, at least, once a year) and give simple general instructions for those that can be

undertaken by the owner without any specific competence, highlighting all other maintenance is to be carried out by professionals. The maintenance instructions shall inform the owner about the importance of recording any maintenance operation. Annex I describes the log book to be used.

4.2.2 Marking

The following information shall be included, as a minimum, in the rating plate of the machine:

- a) business name and full address of the manufacturer and, where applicable, his authorised representative;
- b) designation of the machinery;
- c) mandatory marking¹⁾;
- d) designation of series or type;
- e) serial number, if any;
- f) the year of construction, that is the year in which the manufacturing process was completed.

Marking shall be visible, legible and indelible.

4.3 Drive

4.3.1 General

The drive shall be constructed in such a way that it will move and stop the leaf (leaves) in a safe manner under intended conditions of use and reasonably foreseeable misuse. It shall provide connection facilities for all relevant start, stop and protective devices.

Electrical drives shall fulfil the requirements of EN 60335-2-103 for electrical safety.

4.3.2 Switching off the drive

When mains power of the drive is deactivated, either by the user or by a leaf travel-limiting device or by the interruption of the power supply, the leaf movement shall stop or reach a pre-determined safe position after one or more cycles and stop without endangering persons. A low-energy power operation mode complying with 4.6.4 is considered safe for persons. The pre-determined safety position can be reached using any kind of stored energy, e.g. batteries, mechanical, hydraulic, etc. The leaf shall remain stationary until the cause of deactivation has been eliminated or the power supply is restored.

In case of failure or interruption of the power supply during movement of the doorset, restart shall not lead to a hazardous situation.

NOTE This might not apply to fire doorsets and doorsets in emergency and escape routes as national regulations for these doorset types might differ.

4.3.3 Electrical equipment

Doorsets with electrical drives shall be equipped with a main switch or plug-in system with which all mains poles can be switched off. A main switch is not necessary if the electrical drive unit is connected via a plug-in system. The means of disconnection shall be designed so that it can be safeguarded against unintentional

1) For machines and their related products intended to be put on the market in the EEA, the mandatory marking is the CE marking as defined in the applicable European Directive(s), e.g. Machinery, Low voltage, Explosive Atmosphere, Gas appliances.

and unauthorised reactivation. If this is not possible, the means of disconnection shall be visible from the doorset.

4.3.4 Hydraulic drives

Hydraulic drives shall meet the requirements of EN ISO 4413.

4.3.5 Pneumatic drives

Pneumatic drives shall meet the requirements of EN ISO 4414.

4.4 Doorset

4.4.1 General

Safety related parts of the control system shall comply with EN ISO 13849-1 Performance Level "c". Safety related parts of the control system used for escape route functionality shall comply with EN ISO 13849-1 Performance Level "d".

4.4.2 Materials

There shall be no sharp edges and glazing shall not form sharp splinters if broken.

Toughened glass in accordance with EN 12150-1 and laminated glass in accordance with EN ISO 12543-1 and EN ISO 12543-2 are examples of suitable glazing materials. Plain float glass (silica-based glass) and wired glass are not suitable for this application due to the risk of serious injury upon breaking.

Transparent leaves or leaf surfaces shall be clearly recognisable, e.g. by permanent marking, suitable labels or by using coloured materials.

Measures shall be taken to prevent unintentional disengagement of components or parts during use. The deflection of doorset leaves or other parts due to forces or pressure occurring either during normal use or during foreseeable misuse shall not cause permanent deformations or create any risk of derailment.

4.4.3 Shape of leaves

Sharp edges that may cause injuries due to cutting or grazing shall be avoided. Parts projecting from or devices such as a letter box incorporated into the leaf shall not create potential hazards (e.g. drawing-in, shearing).

If power operated glass doorset leaves are not totally framed, (e.g. glazing is only supported at the top and bottom), there shall be no glass to hard materials contact during the operation of the doorset.

4.4.4 Leaf travel limiting device

The doorset leaf shall be stopped automatically at its terminal travel position by means of limiting devices or other means e.g. mechanical, electronic or electrical devices.

4.4.5 Manual operation

If the doorset can be operated manually the elements for manual operation, e.g. handles, grips, and grip plates, shall not constitute pinch, shear and drawing-in hazards in conjunction with fixed or movable elements in the immediate vicinity. It shall be possible to open or close the doorset leaf or leaves by means of a force as described in 4.7.1.6. The influence of wind or other environmental factors shall not be taken into account.

4.5 Activation

4.5.1 Automatic activation

4.5.1.1 General

The function of automatic activators is to ensure that activation is achieved by a person approaching a doorset at normal walking pace.

In some situation, i.e. doorset opening on a public path, to avoid the doorset staying permanently open due to continuous passage of people, the person will have to get close to the doorset to activate the sensor and will have to wait for the doorset to open. The distance from the doorset to the position where activation is initiated to ensure the doorset is open in time will be influenced by the doorset width and its opening speed.

The selection and location of activation devices shall also take into account the expected line of approach to the doorset by the user. If the line of approach could be from several directions, additional activation devices - possibly a combination of devices - may be required to ensure satisfactory operation.

NOTE Activation can, for example, be radar, infra-red sensors, mat activation, vision detection sensors, etc.

4.5.1.2 Mat activation

The minimum width of the exposed area of a mat activator shall be the doorway opening width, less a maximum of 75 mm on each side.

The minimum depth of the exposed area of a mat activator may vary, depending on the width of the doorset.

To ensure that the doorset opens in time, the minimum depth should be 1 000 mm from the plane of the doorset, or, in case of a doorset opening against the direction of travel, from the leading edge of the doorset (or doorsets) in the open position.

The minimum depth shall be not less than 1 500 mm for power operated sliding doorsets on escape routes without break-out function.

Where two or more mat activators are fitted side by side the inactive distance between the adjacent edges shall not exceed 60 mm.

Where two mat activators are fitted next to each other at a threshold the inactive distance between them shall not exceed 75 mm.

Mat activators shall be securely fastened to the floor without tripping hazards.

4.5.1.3 Sensor activation

Motion sensing devices or presence sensing devices may be used as automatic activation devices to initiate doorset movement since they are capable of detecting motion or presence within a given detection zone. Attention shall be paid to the provision and positioning of sufficient automatic activation devices for different types of doorset.

NOTE 1 The edge of the detection zone where activation is preferably minimum 1 000 mm in front of the plane of the doorset.

NOTE 2 Motion sensing devices or presence sensing devices are devices designed to detect the movement of objects or persons and to give a signal to the control system.

In the case of power operated doorsets on escape routes without break-out function, the detection zone in the escape direction shall be not less than 1 500 mm measured from the centre of the opening width of the doorset. The detection zone shall cover at least the entire opening width of the doorset.

When a swing doorset opens towards the user, the edge of the detection zone where activation is initiated shall be minimum 1 000 mm from the leading edge of the doorset leaf in its fully open position.

4.5.2 Manual activation

Manual activation enables the user to open a power operated doorset by deliberately operating a manual activation device. The manual command may, however, also be given by pushing the doorset. Manually activated doorsets are also usually designed to close automatically after a predetermined delay.

The possibility of manual activation may be provided on power operated doorsets used by the public, for instance to help elderly and infirm persons open the doorset. Additional signs will be necessary.

NOTE See example of pictogram in Annex D.

The type of manual activation device and its positioning shall meet the needs of the user. In particular, the device shall be positioned where the user has a clear view of the doorset to ensure that they will not be impeded or struck by the doorset during its opening cycle. Manual activation devices shall be designed and installed so as to minimise the risk of inadvertent activation. They shall be positioned within reach of the user and shall be clearly identified and visible.

4.5.3 Remote activation

Remote activation enables a doorset to be activated by a remote command that may be initiated some distance from the doorset. The remote command may be given by a fire alarm, a centralised control station following mains power failure or by other sources.

The remote activation of a doorset on escape or emergency route shall only initiate the opening of the doorset or hold the doorset in an open position.

4.6 Avoidance of danger points and protection at danger points

4.6.1 General

Power operated pedestrian doorsets shall be designed so that hazards due to crushing, shearing, impact and drawing-in during the opening and closing cycles are avoided or so that safeguards against such hazards are provided.

Danger points shall be safeguarded up to a height of 2,5 m above the floor with the following exception:

- a) the guide slot in the drive cover, or drive arm or closing action at the top of the doorset below the lintel is not regarded as a danger point and a protective device need not be provided at this point as any contact with it requires an intentional action;
- b) danger points between the leaf and frame presenting a fingertrap hazard can be protected up to only 2 m.

The following may be used:

- guards (see 4.6.9);
- barriers (see 4.6.10 and 4.6.11);
- limitation of leaf forces (does not apply to shearing and drawing-in hazards) (see 4.6.7);
- electro-sensitive protective equipment (ESPE) and/or pressure sensitive protective equipment (PSPE) (see 4.6.8);
- safety distances (see 4.6.11);

— low energy movement (see 4.6.4).

4.6.2 Power operated sliding doorsets

4.6.2.1 Opening of the doorset

Safeguards concerning the danger of crushing and impact shall be deemed to have been provided at the danger points during the opening cycle if one of the following requirements is met, considering that when a large proportion of the users are elderly, infirm, disabled persons and young children any contact of the doorset with the user is unacceptable:

- a) there is a safety distance ($Y \geq 200$ mm) between the secondary closing edge and adjacent parts of the surroundings with regard to the endangered parts of the human body and the leaves move along a plain part and the distance (X) between the front surface of the leave and the fixed side screen is not more than 100 mm (see Figure 2 a)). In this case, the impact hazard and the hazard concerning crushing of the body are considered to be not relevant. For telescopic doorsets, the reference leaf for the measurement is considered to be the one nearest to the adjacent part of the surroundings; or
- b) the force of the leaves is limited to the permitted forces specified in 4.6.7.2 and the leaves move along a plain part and the distance (X) between the front surface of the leave and the fixed side screen is more than 100 mm and less or equal to 150 mm (see Figure 2c)), or
- c) protective devices in accordance with 4.6.8 are provided between the secondary closing edge and adjacent parts of the surroundings, or
- d) the area of the secondary closing edge is covered by guards in accordance with 4.6.9, positioned at a distance of ≤ 8 mm or ≥ 25 mm in front of the doorset leaf, or
- e) the area of the secondary closing edge is covered by barriers in accordance with 4.6.10, positioned in a distance of ≤ 8 mm or ≥ 25 mm in front of the moving part of the doorset, or;
- f) the movement fulfils the low energy requirements of 4.6.4.

Safeguards concerning shearing and drawing-in hazards shall be deemed to have been provided at the danger points during the opening cycle if safety distances shown in Figure 2b) and 2d) are met.

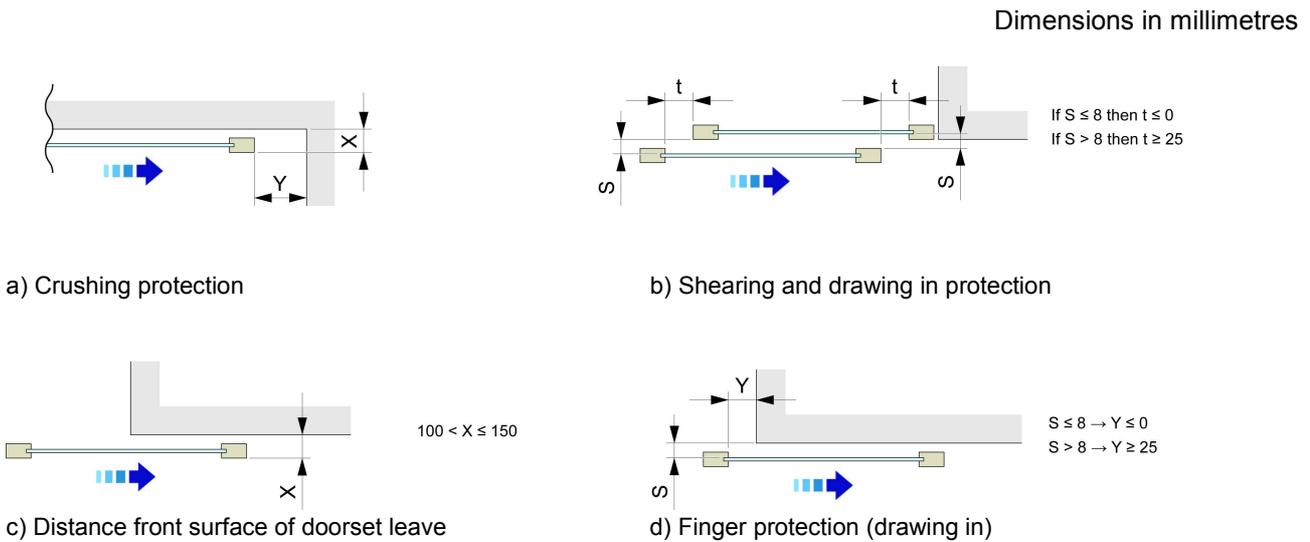


Figure 2 — Examples of safety distances for sliding doorsets

4.6.2.2 Closing of the doorset

Safeguards shall be deemed to have been provided at the danger points during the closing cycle if one of the following requirements is met, considering that when a large proportion of the users are elderly, infirm, disabled persons and young children, any contact of the doorset with the user is to be considered unacceptable:

- a) protective devices in accordance with 4.6.8 are provided at the main closing edge so that in protection area (see Annex C) the reference body CA is detected in all positions of the travel area of the doorset leaves, or
- b) the movement fulfils the low energy requirements of 4.6.4.

4.6.3 Power operated swing doorsets

4.6.3.1 General

If power operated and swing doorsets are moved by stored mechanical energy during part of an opening or closing cycle this part of the movement shall be adjusted to low energy settings as required in 4.6.4 or shall meet the requirements in 4.6.3.2 or 4.6.3.3.

For doorsets opening directly on to areas with through traffic or when any contact with the user is unacceptable because a large proportion of the users are elderly, infirm, disabled persons and young children additional protective devices in accordance with 4.6.8 shall be provided.

4.6.3.2 Opening of the doorset

Crushing, and impact danger points between the doorset leaf and the adjacent parts of the surroundings of the doorset can be considered safeguarded during the opening cycle if:

- a) the doorset is adjusted according to the low energy requirements defined in 4.6.4 during opening; or
- b) the doorset is adjusted according to the settings defined in Annex G and a sufficient safety distance is provided (see Figure 3 a)); or
- c) protective devices in accordance with 4.6.8 monitor the travel area of the doorset leaf; or
- d) the travel area of the leaf is safeguarded by mats complying with EN 1760-1.

4.6.3.3 Closing of the doorset

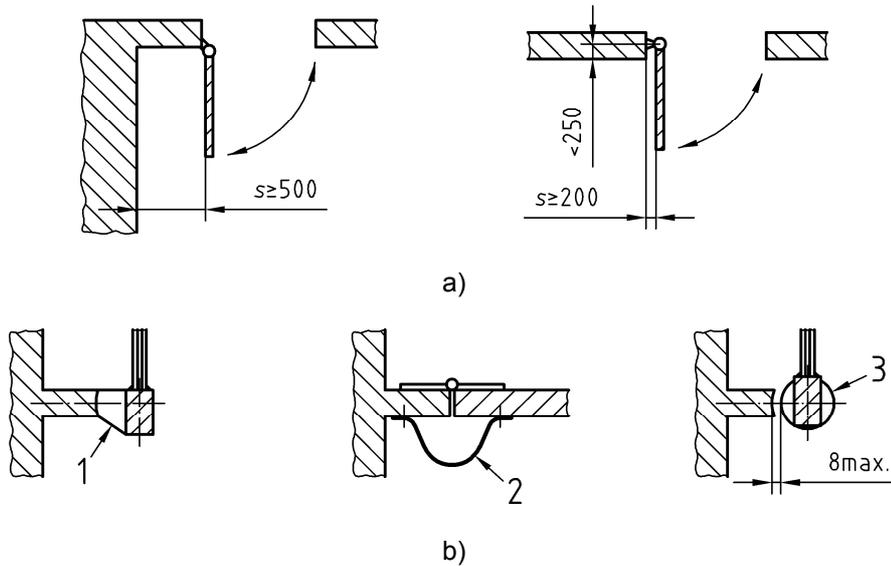
Crushing, shearing and impact danger points between the doorset leaf and the adjacent parts of the surroundings of the doorset can be considered safeguarded during the closing cycle if:

- a) the doorset is adjusted according to the low energy requirements defined in 4.6.4 during closing; or
- b) the doorset is adjusted according to the settings defined in Annex G; or
- c) protective devices in accordance with 4.6.8 monitor the travel area of the doorset leaf; or
- d) the travel area of the leaf is safeguarded by mats complying with EN 1760-1.

4.6.3.4 Danger points at secondary closing edges between leaf and frame

Danger points between the leaf and frame presenting a fingertrap hazard shall be avoided structurally or by an appropriate protective device or safeguards provided by means of protective measures (see Figure 3 b)).

Dimensions in millimetres



Key

- 1 rubber cover
- 2 rubber or textile cover
- 3 profile

Figure 3 — Examples of safety distances and safety measures for swing doorsets

4.6.4 Low energy movement

4.6.4.1 General

The force required to prevent a stopped doorset from opening or closing any further - measured at the main closing edge in the direction of travel - shall not exceed 67 N at any point in the opening or closing cycle.

The kinetic energy of a doorset in motion shall not exceed 1,69 J. Annex F states the speed settings for various widths and masses of doorsets required to obtain results conforming to this requirement.

In the event of any interruption of mains power or failure of the drive, it shall be possible to open the doorset with a manual force not exceeding 67 N to release a latch and 90 N to open the doorset, when the force is applied to the main closing edge in the direction of travel.

Low energy movement of the doorset is generally not protected with additional protective devices because the kinetic energy levels are not considered to be hazardous. However use of low energy doorset movement should only be considered when the risk assessment has taken account of elderly, frail and disabled users and indicates that the risk to these users is low.

A static closing force up to 150 N is allowed

- a) when the gap between the main closing edge and the counterclosing edge is ≤ 8 mm for swing doorsets, or
- b) during the last 50 mm for any type of sliding and folding doorsets.

4.6.4.2 Additional requirements for low-energy movement of swing doorsets

4.6.4.2.1 Opening time

Doorsets shall open from closed to back check, or 80° whichever occurs first, in 3 s or longer as required in Table F1. Back check shall not occur before 60° opening. If the doorset opens more than 90° , it shall continue at the same rate as back check speed.

NOTE Back check: the checking or slowing down of the speed of doorset opening before being fully opened (also called open check).

4.6.4.2.2 Closing time

It shall be possible to adjust the doorset on site to close from 90° to 10° in not less than 3 s and from 10° to fully closed in not less than 1,5 s as required in Table F1.

4.6.5 Power operated balanced doorsets

Subclauses 4.3, 4.4 and 4.5 apply to balanced doorsets.

Moreover, as the safeguarding of a balanced doorset depends on various factors (e.g. structural conditions, driving phase and operator principle), the safeguarding of such a doorset has to be realised considering the prevailing conditions of the installation.

Possible technical solutions for it are, for e.g:

- a) safety distances according to 4.6.11 and barriers according to 4.6.10 for crushing and shearing hazards;
- b) limitation of leaf forces according to 4.6.7 for crushing and impact hazards;
- c) protective devices in accordance with 4.6.8 for crushing, shearing and impact hazards;
- d) or a combination thereof.

4.6.6 Power operated folding doorsets

4.6.6.1 Opening of the doorset

Danger points in the area of the hinges, where fingers might get crushed, shall be avoided by constructive means such as profiles or protected by separating equipment (see Figure 3b) or protective devices.

The crushing edge between the secondary closing edge of the doorset leaf that opens and the opposing closing edge (e. g. adjacent wall) and the gap between the two folding leaves is regarded as protected if:

- a) there is a sufficient safety distance between the secondary closing edge and adjacent parts of the surroundings with regard to the endangered parts of the human body (see Figure 3 a), or
- b) the impact force of the leaves is limited to the permitted forces specified in 4.6.7, or
- c) protective devices in accordance with 4.6.8 monitor the travel area of the doorset leaf.

The danger of hitting and crushing within the movement range of the doorset leaves is regarded as safeguarded if the impact force of the leaves is limited to the permitted forces specified in 4.6.7.

4.6.6.2 Closing of the doorset

Danger points in the area of the hinges, where fingers might get crushed, shall be avoided by constructive means or protected by protective devices or profiles (see Figure 3b).

Crushing edges at the main closing edge are regarded as protected if protective devices according to 4.6.8 are installed at the outer doorset side in combination with a force limitation device according to 4.6.7.

NOTE 1 Only the main closing edges of the doorset leaves can hit people or objects, therefore it is essential that suitable safeguarding be provided in this area against crushing.

NOTE 2 The crushing and shearing edge between the folding leaves and the operator cover below the lintel is not regarded as a danger point. It occurs only during opening and moves away from the person..

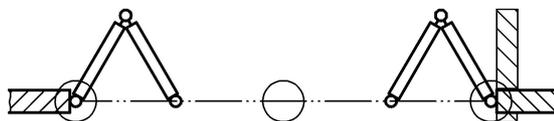


Figure 4 — Possible dangers of crushing of power operated folding doorsets

4.6.7 Limitation of impact forces

4.6.7.1 General

When limitation of forces is achieved through protective devices, such equipment shall be designed to meet the requirements specified in 4.6.8.

4.6.7.2 Permissible dynamic forces

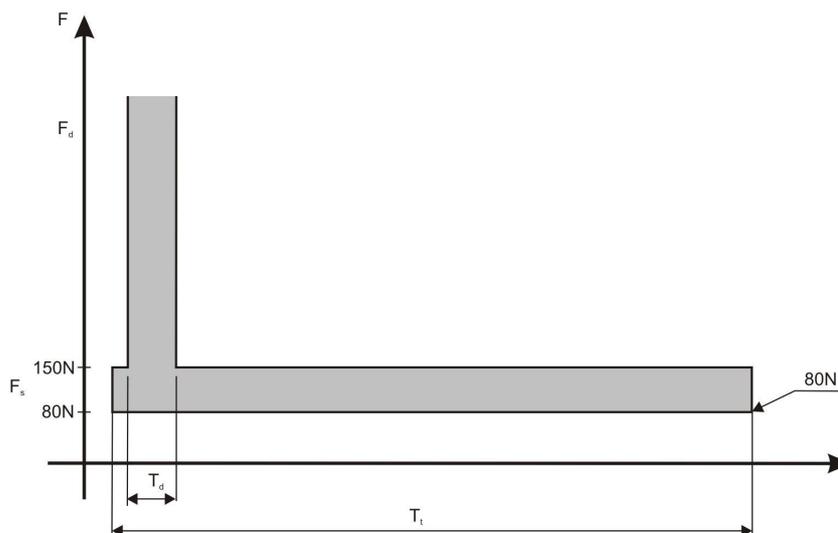
The values of dynamic force generated by the doorset leaf when impacting a person or an obstacle shall be considered to be safe if the limits specified in Table 1 are not exceeded, when measured according to Annex B with an instrument complying with 5.2.2 or 5.2.3.

Table 1 — Permissible dynamic forces

Doorset type	Permissible dynamic forces			Measuring points
	Between closing edges and opposing closing edges in gaps of ^a			
	< 200 mm	200 mm to 500 mm	> 500 mm	
Sliding doorset and sliding/swing (balanced) doorset	400 N	700 N	1400 N	Figures B.1 and B.2
Folding doorset	400 N	700 N	1400 N	Figure B.3
Revolving doorset	400 N	700 N	1400 N	Figures B.4 to B.6

^a The opposing closing edge may also be a second main closing edge or flat areas around the opening doorset.
Flat areas are areas other than closing edges > 0,1 m² and with no side < 100 mm.
The above values shall be the maximum allowed within a maximum period of time of 0,75 s ($T_d < 0,75$ s).

The leaf force measurements shall not exceed the profile shown in Figure 5.



Key

- F_d maximum force measured during the dynamic period T_d (dynamic force) – see Table 1 for permitted values
- T_d period of time of maximum 0,75 s starting from the first measured force exceeding 150 N
- F_s maximum force measured outside the dynamic period T_d (static force)
- T_t period of 5 s starting from the first measured force exceeding 80 N and including T_d

Figure 5 — Force versus time

4.6.7.3 Permissible static forces

After T_d has elapsed, no static force > 150 N is allowed. This static force shall come down to < 80 N after a total time T_t of maximum 5 s.

However, after T_d , peaks exceeding 150 N but lower than the admissible dynamic forces shown in Table 1 are accepted if:

- a) they are decreasing from one to the other;
- b) the period of oscillation is ≤ 1 s;
- c) the average force calculated over the period of $T_t - T_d$ is ≤ 150 N.

4.6.8 Protective devices

Protective devices can be:

- Pressure-sensitive protective equipment (PSPE), where the sensing function is actuated when mechanical pressure is applied to the surface, e.g. pressure sensitive edges, trip bars, mats, etc. Such protective devices shall be installed so as to provide full protection at the danger point.
- Electro-sensitive protective equipment (ESPE), where the sensing function is actuated by interruption or reflection of beams/waves, e.g. photo cells, light grids, light detectors, acoustic devices, vision detector sensors, etc.

Protective devices shall be designed so that:

- a) a command preventing hazardous leaf movements shall be given while a protective device is actuated;
- b) after resetting them a functional check is carried out and normal operation of the doorset is started only if safety functions are in place;

- c) permissible operating forces shall not be exceeded after a protective device has been actuated;
- d) ESPE that continuously adapt to environmental changes shall be field adjusted to adapt to any environmental change lasting at least 30 s;
- e) sensor control units and output signal switching devices which can be exposed to outdoor conditions shall be protected to a level of at least IP44 or higher (see EN 60529) in installation;
- f) the protective device complies with the requirements of EN 12978.

4.6.9 Guards

Protective measures such as enclosures, covers, enclosing guards or fixed protection leaves shall be designed so that:

- a) persons cannot reach any danger point up to a height of 2,5 m above floor level;
- b) they can only be removed or opened with the aid of a tool;
- c) they do not cause additional hazards (e.g. shearing or drawing in).

NOTE A protection leaf is a mechanical protective device used to protect danger points. It may, but not necessarily, be an enclosure, cover or enclosing guard.

4.6.10 Barriers

Barriers are intended to direct pedestrian traffic or to avoid pedestrians from entering non-safe zones.

They shall be:

- a) designed so that children cannot easily climb over or crawl under them,
- b) suitably secured,
- c) able to withstand forces occurring in normal service,
- d) a minimum of 900 mm high.

Barriers, when used, shall not create new hazards.

4.6.11 Safety distances

Sufficiently dimensioned safety distances to prevent crushing or drawing in are:

- ≤ 8 mm or ≥ 25 mm for fingers,
- ≥ 200 mm for the head,
- ≥ 500 mm for the body.

Further safety distances are specified in EN 349.

4.7 Additional requirements

4.7.1 Additional requirements for revolving doorsets

4.7.1.1 Peripheral speed

The maximum peripheral speed of revolving doorsets with a diameter up to 3 000 mm shall not exceed 1 000 mm/s. The maximum peripheral speed of revolving doorsets with a diameter over 3 000 mm shall not exceed 750 mm/s.

4.7.1.2 Safety distances and safeguards

For all types of revolving doorset, the distance between the outer edge of the doorset leaf and any part of the drum wall shall be not less than 25 mm to provide protection against entrapment of fingers.

Any off-set in the drum wall of a revolving doorset shall not exceed 10 mm in size, unless protected.

The floor covering (i.e. barrier matting, threshold matting, kawneer matting) used in a revolving doorset shall be even, with a maximum unevenness of 4 mm, in the area swept by the doorset leaves. Any gaps in the floor covering shall not exceed 4 mm in width.

The gap between the lower edge of the doorset leaves of revolving doorsets and the floor shall not exceed 8 mm; otherwise the gap shall be protected by means of a protective device complying with 4.6.8.

Danger points between main and opposing closing edges shall be protected with devices complying with 4.6.8. The dynamic force after actuation of the protective device shall not exceed 150 N at danger points between main and opposing closing edge of revolving doorsets used by persons in need of special protection.

PSPE installed at danger points shall also meet the requirements of EN 1760-2 with regard to protection against potential finger traps.

4.7.1.3 Protection when doorset leaves are swivelled beyond 15°

The pivoted doorset leaves of revolving doorsets shall incorporate a switching device which detects any swivelling of the leaf beyond an angle of 15° in either direction. The device, when activated, shall send a stop signal to the control system.

After return of the leaf to the operational position, a functional check is carried out by the monitoring system and automatic restart of the doorset is allowed only if all safety functions are working properly.

4.7.1.4 Emergency stop function

Revolving doorsets shall be equipped with an emergency stop command device in accordance with EN ISO 13850, stop category 1. Low energy power operated revolving doorsets shall be equipped with an emergency stop command device in accordance with EN ISO 13850, stop category "0".

Emergency stop devices shall be positioned at the access point in the inner side of the building.

After reset of an emergency stop device, a functional check is carried out by the monitoring system and automatic restart of the doorset is allowed only if all safety functions are working properly.

4.7.1.5 Lighting

Suitable integral lighting to illuminate the swept areas of power operated revolving doorsets shall be provided if normal ambient lighting is insufficient to ensure the safety of users.

Swept areas of power operated revolving doorsets shall be illuminated with minimum 50 lx. This level can be provided by normal ambient lighting or integral lighting.

The level shall be measured at one meter from the floor level in the centre of the compartment.

4.7.1.6 Danger of entrapment

It shall be ensured that persons cannot be entrapped in the passage area of the doorset during normal service or if the power supply fails. It shall be possible to open or close the doorset leaf or leaves by means of a force not exceeding 220 N.

4.7.2 Additional requirements for doorsets in escape routes and emergency exits

4.7.2.1 Operating mode selection

When an operating mode selector is used, the mode of operation shall be clearly identified and marked on the operating mode selector.

If a "locked" mode of operation is available, the mode of operation shall be protected, e.g. by an access code or a key, so that changes can only be made by authorised personnel.

4.7.2.2 Power operated doorsets with break-out function

Maximum width of floor guide slots shall be ≤ 20 mm.

Thresholds that are essential to the functioning or securing of a doorset shall not exceed 12 mm in height and their edges shall be sloped in order to minimise the danger of tripping.

The break-out function may be security-locked (to prevent unauthorised entry) if the requirements of 4.7.2.1 are fulfilled.

Doorset leaves or doorset leaves and side screens shall be capable of being broken out in any position in the direction of escape. The total force required to release the break out function shall not exceed 220 N. The force shall be measured in a static way at the leading edge at right angles to the doorset leaf or side screen at a height of $(1\ 000 \pm 10)$ mm.

If the swing leaf is fitted with a mechanical doorset closing device, the force required to further open the doorset shall not exceed 150 N when measured in a static way at the leading edge at right angles to the doorset leaf or side screen at a height of $(1\ 000 \pm 10)$ mm.

When the doorset leaf or side screen is broken out, the automatic doorset movement shall stop or reach a pre-determined safe position and stop. The doorset shall remain stationary until the broken out leaves have fully recovered the normal operation position.

An emergency break-out pictogram shall be fitted on doorsets with an emergency break-out function. An example of a suitable pictogram is shown in Annex E.

4.7.2.3 Power operated sliding and folding doorsets without a break-out function

Power operated sliding or folding doorsets with a clear opening width of up to 2 000 mm shall open by at least 80 % within 3 s after activation by the activator(s) in the escape direction or at the latest after 5 s when the power supply goes off. Opening time for larger doorset widths shall be calculated proportionally.

Power operated sliding or folding doorsets shall withstand a durability test of not less than 1 000 000 cycles.

The opening of the doorset shall be guaranteed by a fail-safe system according to Performance Level "d" of EN ISO 13849-1 and any electrical faults preventing normal operation of the doorset shall either be automatically or after activation of the doorset detected within 15 s and cause the doorset to automatically open and remain open.

The fail-safe system shall be automatically tested, at least once every 24 h.

Systems using stored electrical energy for fail-safe systems shall have a monitoring system checking that the energy level stored is enough for at least one cycle of operation. This check shall be carried out immediately after connection to the power supply and subsequently at least once every 24 h. If the check failed or was not performed, the doorset shall automatically open and remain open. If the operating mode selector is in the security-locked position, the doorset does not need to open if the requirements of 4.7.2.1 are satisfied.

When the mains power goes off, doorsets shall automatically open at the latest after 5 s and remain in the open position (except when in the security-locked position).

4.7.2.4 Power operated swing doorsets without a break-out function

Power operated swing doorsets without a break-out function shall be capable of manual operation in the direction of escape and need not open automatically in case mains power goes off or in an emergency situation.

The force required to manually open a doorset without a break-out function shall not exceed 150 N. The force shall be measured in a static way at the leading edge at right angles to the doorset leaf and at a height of $(1\ 000 \pm 10)$ mm.

4.7.2.5 Power operated revolving doors

4.7.2.5.1 General

In escape routes and emergency exits, only doorsets with a break out function are allowed. The break out function shall be available in any position of the doorset.

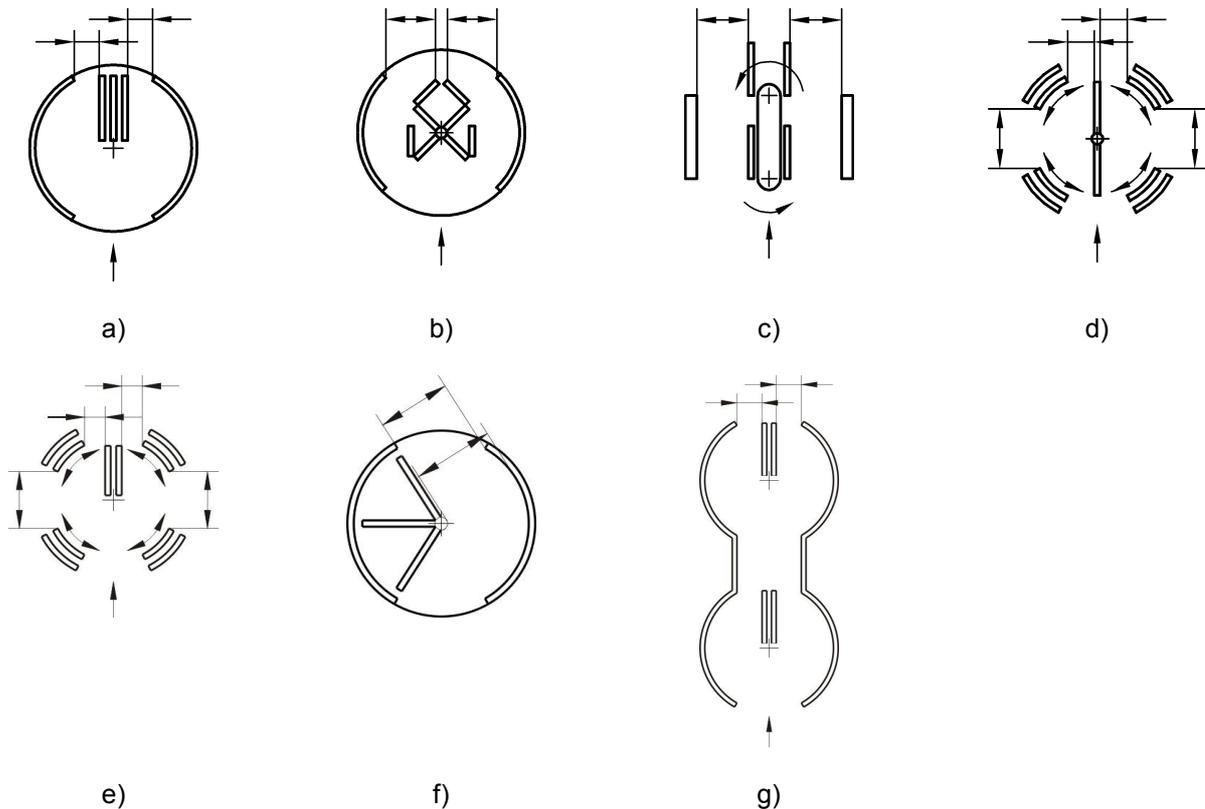


Figure 6 — Typical emergency escape position of power operated revolving pedestrian doorsets

4.7.2.5.2 Break-out doorset leaves

Break-out leaves may have additional devices that unlock the break-out function when the appropriate command is given or when the mains power goes off. The control device for unlocking the break-out mechanism shall comply with the requirements specified in 4.7.2.5.3.

4.7.2.5.3 Device to release the electric locking mechanism of the break-out function

The release of the break-out function shall be triggered in one of the ways described below. The method of triggering shall be selected in the following order of precedence:

- a) triggering by an external signal e.g. fire alarm system, building services control system, etc.;
- b) release device positioned in a 24 h a day manned area (e.g. reception) with direct view of the doorset;
- c) emergency stop equipment complying with EN ISO 13850 with release of the break-out mechanism when the doorset stops.

5 Tests

5.1 General

Unless test conditions are specified, tests shall be carried out in the worst conditions and configuration.

Tests are normally carried out using the same test specimen.

As far as applicable, tests are performed in normal and abnormal operation. This is not applicable when the component has already been checked for the relevant fault condition(s).

Testing may also be carried out on a separate test specimen or component if a test is destructive and equivalent results can be achieved by testing individual parts of the equipment.

5.2 Test conditions

5.2.1 General

With the exception of temperature tests and on site measurements, testing shall be performed at an ambient temperature between 15 °C and 30 °C and a relative humidity between 30 % and 70 %.

The following measuring accuracy applies:

- temperature measurements: ± 3 °C;
- force measurements: ± 10 %;
- electrical quantities: ± 3 %;
- time measurements: ± 5 %;
- length measurements: ± 5 %.

5.2.2 Impact force measuring equipment

The test equipment for measuring forces shall consist of the following parts:

- a) two contact areas with a diameter of 80 mm. The contact areas shall be made of a hard material with sufficient strength, e.g. steel;
- b) spring that gives the contact area a spring ratio of (500 ± 50) N/mm;

- c) load cell;
- d) time measuring device;
- e) measuring value display/measuring value output device.

The measuring equipment shall comply with the following specification:

- rising/falling time of the load cell amplifier < 5 ms;
- the equipment shall be able to give measured values with an accuracy of at least $\pm 5\%$ or ± 10 N, whichever is the maximum deviation;
- measurements to be given in graphical form or by displaying the values.

5.2.3 Field impact force measuring equipment

Field measuring equipment need not display the values and accuracy shall at least be $\pm 10\%$ or ± 20 N of measured values, whichever is the maximum deviation. Calibration shall be performed at least once per year.

5.2.4 On site measurement

Site measurements are performed if:

- required in the installation instructions, or
- power operating an existing manual doorset and limitation of forces is one of the chosen safeguarding.

5.3 Product information for installation, operation and maintenance

Installation, operation and maintenance manuals are checked to verify all required information are included.

5.4 Drive

Doorset is operated normally and mains power supply of the drive is deactivated. Requirements of 4.3.2 shall be fulfilled by the doorset.

If not part of the doorset, installation instructions shall clearly state the need to install a main switch disconnecting all mains supply phases. This can be disregarded if the electrical drive is connected via a plug-in system.

5.5 Doorset

5.5.1 Materials

Compliance with requirements of 4.4.2 shall be checked by visual inspection.

5.5.2 Shape of leaves

It shall be checked by inspection that there are no sharp edges and that parts projecting or incorporated into the leaf, if any, are not creating potential hazards.

It shall also be checked that glass doorset leaves not totally framed do not come into contact under any possible circumstance during operation of the doorset.

5.5.3 Leaf travel limiting device

It shall be checked by inspection and/or by test that the doorset, both in normal and single fault condition, is automatically and safely stopped at its terminal travel position(s).

5.6 Manual operation

The force shall be measured in a static way either at the elements for manual operation or, in case they are not fitted in the doorset, at the leading edge at right angles to the doorset leaf at a height of $(1\ 000 \pm 10)$ mm.

5.7 Activation

The activation of the doorset shall be checked by inspection, appropriate measurements and tests to confirm that requirements described in 4.5 relevant to the used activation mode are fulfilled.

5.8 Durability test

5.8.1 General

If declared, the durability of the power operated doorset shall be checked as described below.

This test does not apply to a power operated doorset produced by upgrading a manually operated doorset by the subsequent addition of a drive.

The durability test defined by the relevant product standard applies to manually operated doorsets.

The power operated doorset shall be installed in accordance with the manufacturer's installation instructions. Lubrication and adjustments to any part may be undertaken during the test in accordance with the manufacturer's maintenance instructions.

Number of test cycles performed shall be in accordance to what declared by the manufacturer as expected lifetime of the doorset in the operating instructions.

Durability test shall be carried out with the following minimum number of cycles/day:

- 0 to 200 000 cycles: 600 cycles/day,
- 200 001 to 500 000 cycles: 2 400 cycles/day,
- above 500 000 cycles: 4 000 cycles/day.

The test specimen shall be connected to the supply voltage at all times during the test unless disconnected for safety reasons during installation or for maintenance purposes.

5.8.2 Testing under normal conditions

After a conditioning period of $6\text{ h} \pm 10\%$, the power operated doorset shall be subjected to a durability test at ambient temperature. During the durability test, the doorset shall be operated in reverse for at least 30 % of the cycles if this type of operation is intended.

In the case of revolving doorsets, the response to a signal from protective devices used to protect danger points of the doorset shall be tested during 30 % of the cycles.

In the case of sliding doorsets without a break-out facility to be installed in escape routes and emergency exits, the doorset opening speed during the durability test shall be set in accordance with 4.7.2.3.

5.8.3 Testing at extreme temperature

If the doorset is declared for use in a range of temperature outside normal environmental conditions ($5\text{ °C} - 40\text{ °C}$), the drive unit and mechanical transmission components shall be subjected to a durability test of 1 000 cycles both at the maximum and minimum declared temperatures.

5.8.4 Additional test for doorsets in escape routes and emergency exits with a break-out facility

After 10 000 cycles at ambient temperature, the leaves of power operated doorsets with a break-out facility intended for use in escape routes and emergency exits shall be opened to at least 90° for (100 ± 10) cycles..

Upon completion of the durability test, they shall be subjected to a further 100 cycles. The force required to break out the doorset shall comply with 4.7.2.2.

5.8.5 Additional test for doorsets in escape routes and emergency exits without a break-out facility

The fail-safe mechanism of power operated doorsets without a break-out facility intended for use in escape routes and emergency exits shall be tested by carrying out 20 cycles at ambient temperature after the first 10 000 cycles and a further 20 cycles upon completion of the durability test. At the manufacturer's request, the product may be subjected to three opening cycles after 10 000 cycles and three opening cycles after each of the following 100 000 cycles. The product shall be subjected to a further three test cycles upon completion of the test.

5.9 Special tests for hazards of revolving doorsets

5.9.1 General

This subclause does not apply to low energy power operated revolving doorsets in accordance with 4.6.4.

5.9.2 Main closing edge/opposing closing edge

A touchless protection of this hazard by means of an electro-sensitive equipment installed to avoid this hazard shall be tested using a CA reference body (see Annex C). The CA reference body shall be located next to the opposing closing edge and shall not be touched by the doorset leaf (see test 2 in Figures C.7 a), C.8 a), C.9 a).

If the hazard is protected by a device or combination of devices allowing contact with the doorset, it shall be tested by a force measurement in accordance with 4.6.7 at an opening width of less than 200 mm as specified in Figures B.4, B.5 or B.6. If an ESPE is used for speed reduction, the test shall be carried out at the speed after activation of the ESPE.

5.9.3 Secondary closing edge/floor

Protective equipment installed to avoid this hazard shall be tested using the CB reference body.

The CB reference body is positioned on the floor so that it cannot be pushed away. The doorset shall come to a stop without completely passing over the reference body or the reference body being touched by the doorset leaf in the slanted areas. Contact with the flexible parts of the protective equipment is acceptable (see test 3 in Figures C.7 b), C.8 b) and C.9 b)). If an ESPE is used for speed reduction, the test shall be carried out with the combination of test bodies CB and CA. See test 4 in Figures C.7 c), C.8 c) and C.9 c).

The test need not be performed if this hazard is safeguarded by safety distances.

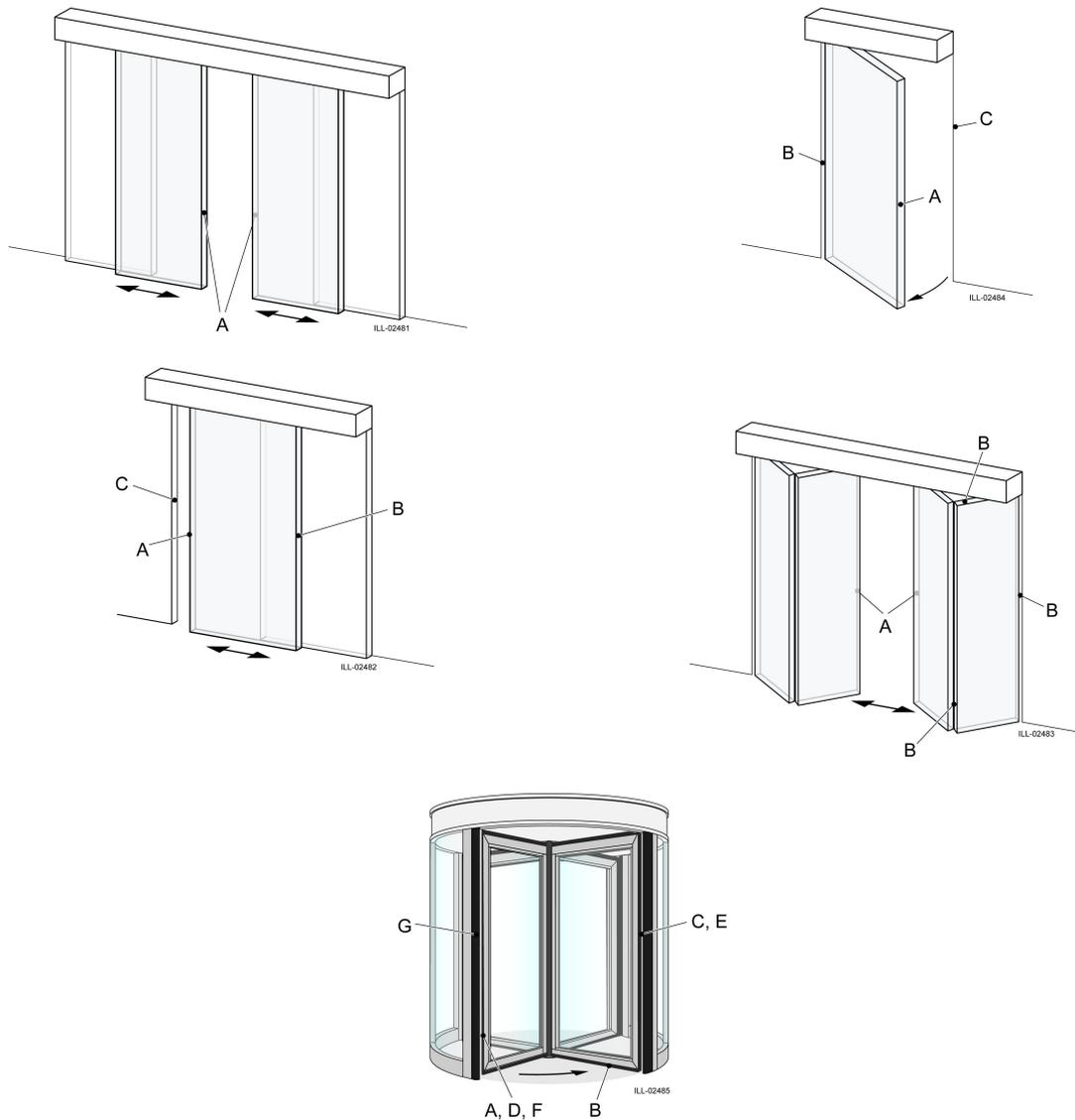
5.9.4 Main closing edge/inside wall

Safeguarding of this danger point shall be tested by means of the CB reference body.

The reference body is positioned at a height of 1200 mm above the floor on the drum wall as shown in Figures C.7 d), C.8 d) and C.9 d). During the test the reference body shall not come into contact with the doorset leaf (see test 5 in Figures C.7 d), C.8 d) and C.9 d)). Contact with the flexible parts of the protective equipment is acceptable.

Annex A (informative)

Illustration of some essential terms for various types of doorsets



Key

- A main closing edge
- B secondary closing edge
- C opposing closing edge
- D leading edge
- E leading mullion
- F outer stile
- G trailing mullion

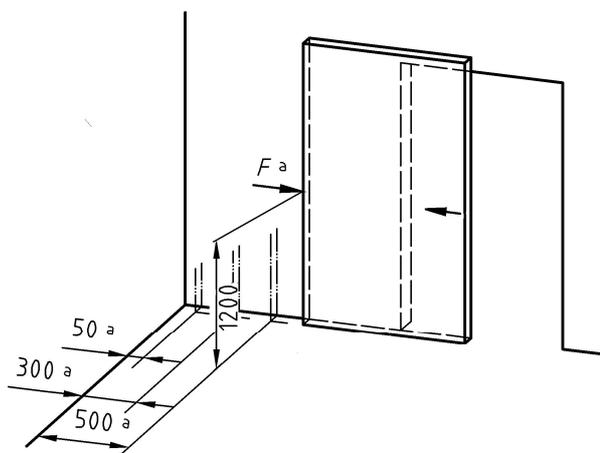
Figure A.1 — Illustration of some essential terms

Annex B (normative)

Measuring points

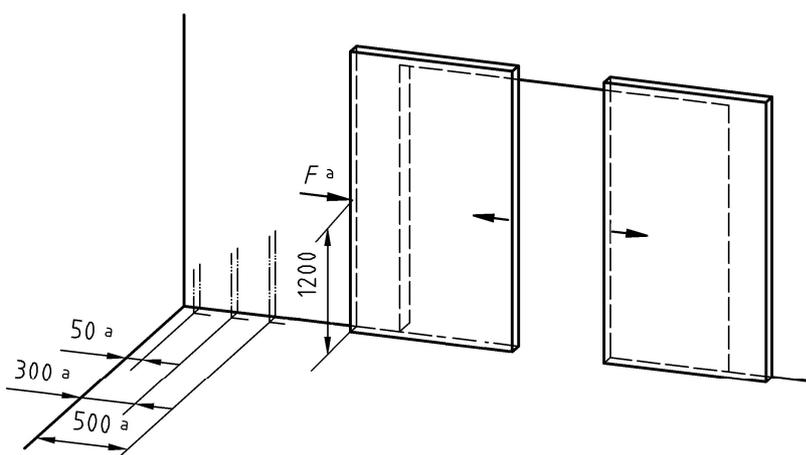
All dimensions are in millimetres.

Forces (see Table 1) shall be measured at the measuring points shown in Figures B.1 to B.6 with the instrument of 5.2.2 or 5.2.3.



a) See 4.6.1 if applicable.

Figure B.1 — Single-leaf sliding doorset



a) See 4.6.1 if applicable.

Figure B.2 — Double-leaf sliding doorset

Annex C (normative)

Tests for protective devices

This annex is applicable to ESPE based on AOPDDRs (Active Optoelectronic Protective Devices responsive to Diffuse Reflection) using a radiation wavelength in the range 820 nm to 946 nm. For sensing devices using other technologies, this annex may be used as a guide. ESPE shall always be tested on a complete power operated doorset assembly.

The CA reference body is a box with the dimensions 0,7 m x 0,3 m x 0,2 m. Both the top side and two sides that meet are made of a material with a diffuse reflectance value in the range of 2 % to 5 % of the wavelength of the ESPE transmitter (e.g. IC antistatic foam; see also Figure 2 of IEC 61496-3:2008 for further materials). The other two sides are made of a material with a diffuse reflectance value in the range of 80 % to 90 % of the wavelength of the ESPE transmitter (e.g. white paper). The base of the reference body is not defined as it does not serve any purpose in the test.

The CB reference body is made of a matt-black elastomer with a Shore-A hardness of (70 ± 5) and a diffuse reflectance value in the range of 10 % to 90 % of the wavelength of the ESPE transmitter.

The reference body shall be detected and the doorset shall then either stop before it touches the reference body, or reverse or switch over to low-speed motion as described in the product documentation.

ESPEs which do not move with the doorset leave(s) shall be tested using all relevant sides of the CA reference body.

All dimensions are in millimetres.



a) CA reference body

b) CB reference body

Key

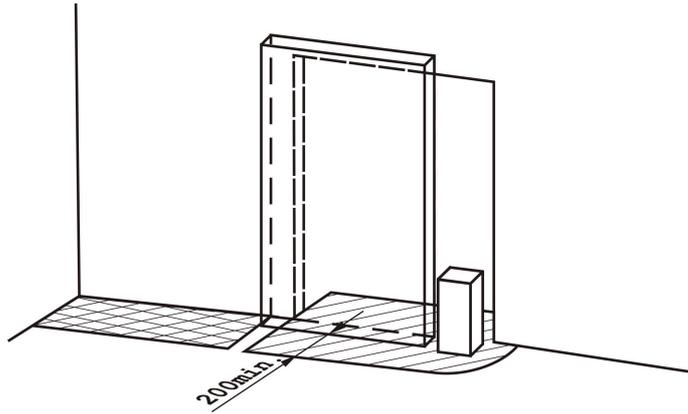
-  Diffuse reflectance value in the range of 2 % to 5 % at the wavelength of the transmitter of the ESPE
-  Diffuse reflectance value in the range of 80 % to 90 % at the wavelength of the transmitter of the ESPE

-  Diffuse reflectance value in the range of 10 % to 90 % at the wavelength of the transmitter of the ESPE

Figure C.1 — Reference bodies

The tests for presence detection are shown in Figures C.2 to C.9 below.

Tests for ESPE using the background as a reference shall be performed with a background with a diffuse reflectance value of (20 ± 5) % of the ESPE wavelength (e.g. carpet).



Key

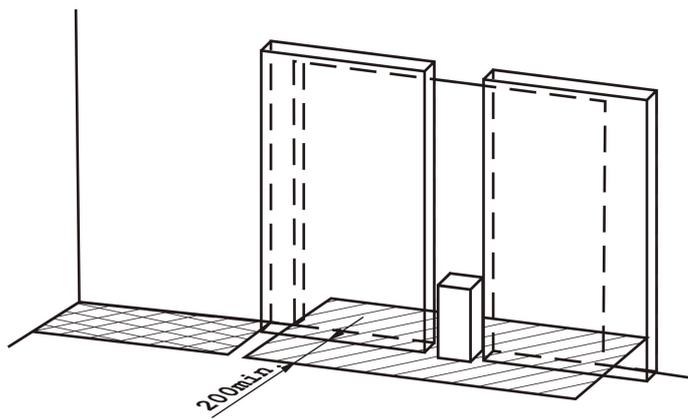


protection area



see 4.6.1 if applicable

Figure C.2 — Single-leaf sliding doorset



Key

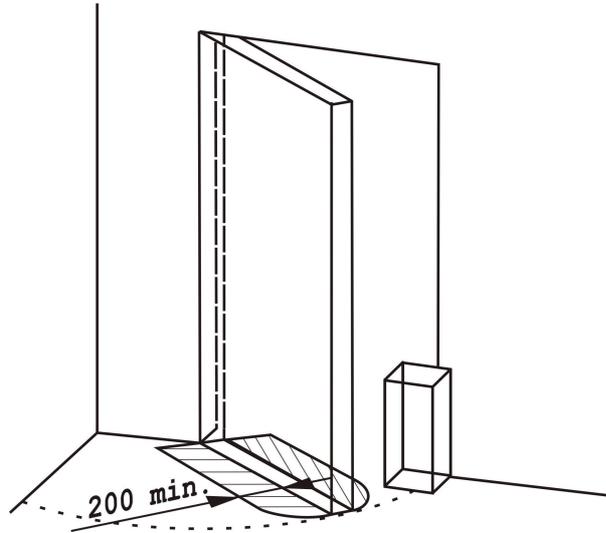


protection area



see 4.6.1 if applicable

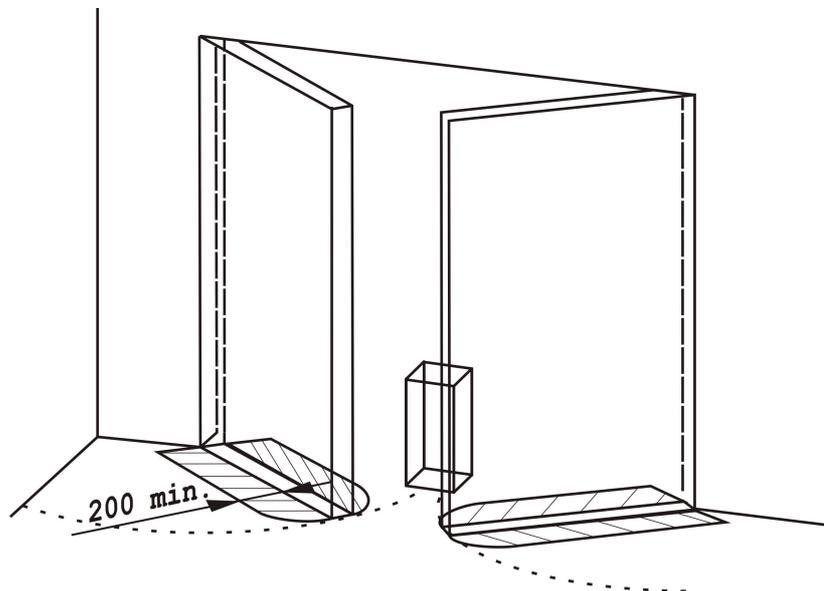
Figure C.3 — Double-leaf sliding doorset



Key

 protection area

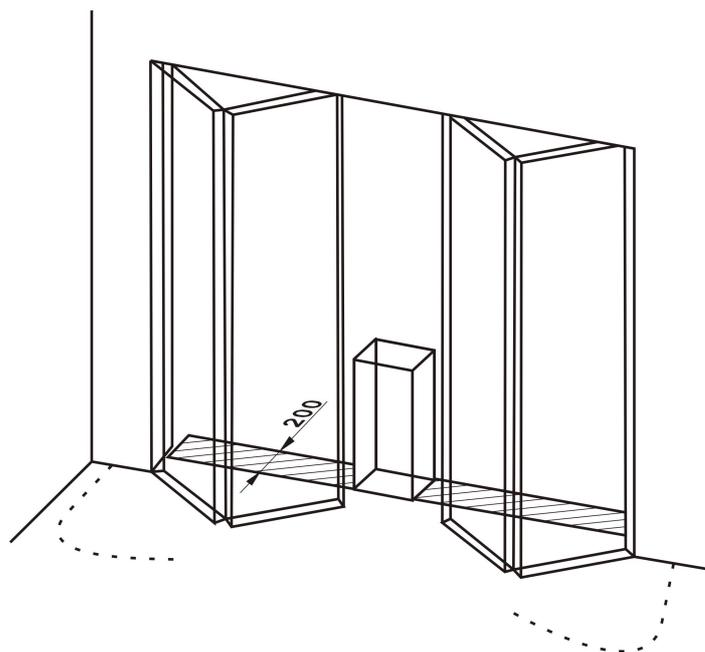
Figure C.4 — Single-leaf swing doorset



Key

 protection area

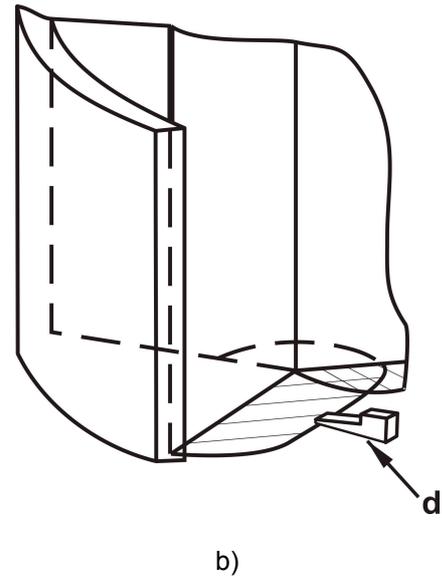
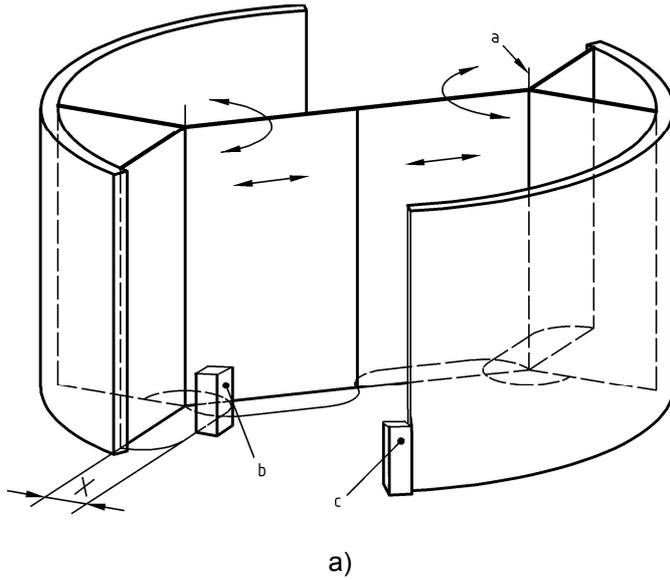
Figure C.5 — Double-leaf swing doorset



Key

 protection area

Figure C.6 — Folding doorset

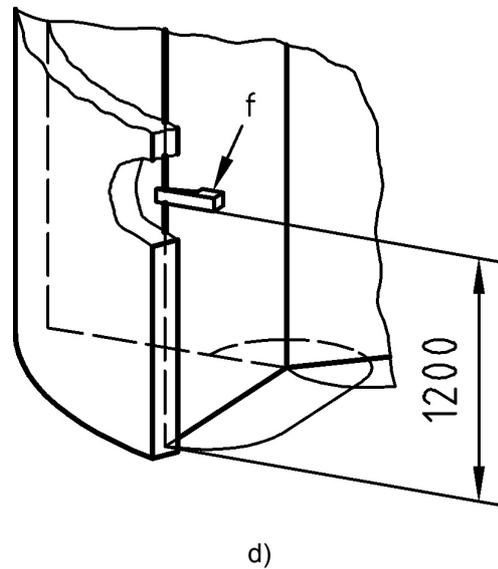
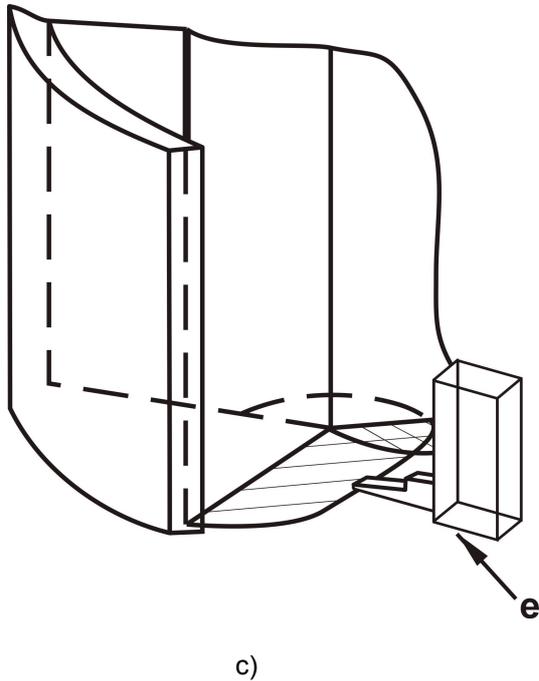


Key

- a pivot point
- b test 1 (with CA) for doorset diameters greater than 3 000 mm, see also 5.9.2
- c test 2 (with CA) for all doorset diameters, see also 5.9.2
- X protection area

Key

- d test 3 (with CB) in centre of doorset leaf



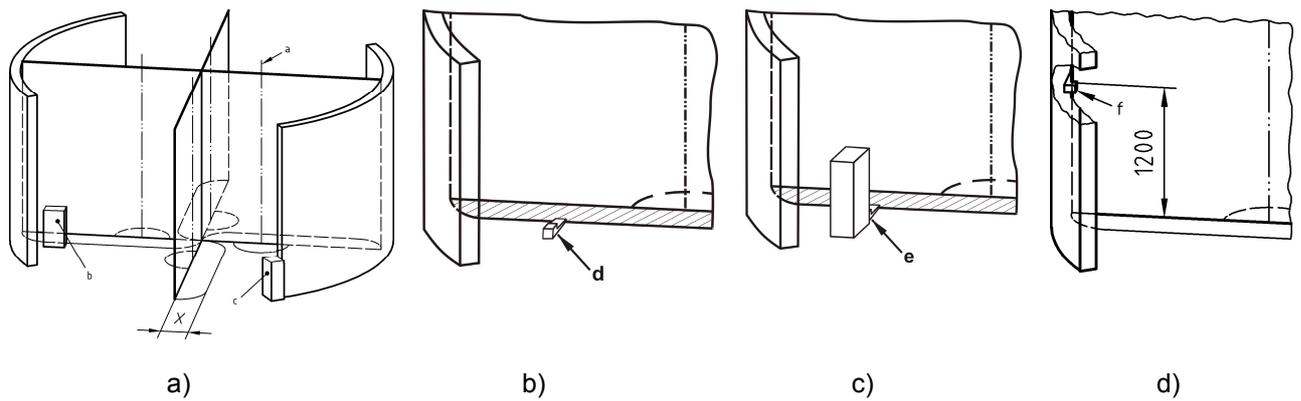
Key

- e test 4 (with the combination of CB and CA) for all doorset diameters, in centre of doorset leaf

Key

- f test 5 (with CB) for all doorset diameters

Figure C.7 — Revolving doorset, two leaves



Key

- a pivot point for doorsets with a break-out system
- b test 1 (with CA) for doorset diameters greater than 3 000 mm, see also 5.9.2
- c test 2 (with CA) for all doorset diameters, see also 5.9.2
- X protection area

Key

- d test 3 (with CB) in centre of doorset leaf

Key

- e test 4 (with the combination of CB and CA) for all doorset diameters, in centre of doorset leaf

Key

- f test 5 (with CB) for all doorset diameters

Figure C.9 — Revolving doorset, four leaves

Annex D
(informative)

Disabled person sign



0100

Figure D.1 — Disabled person sign

Annex E
(informative)

Emergency break-out sign



E001

Figure E.1 — Emergency break-out sign

Annex F (normative)

Low energy doorsets

F.1 Speed settings for low energy power operated swing doorsets

Table F.1 shows the minimum opening time (in seconds) to back-check or to 80° open or minimum closing time (in seconds) from 90° to 10° open for most common doorset widths and masses.

Table F.1 — Speed settings

Width of doorset leaf (m)	Mass of doorset leaf (kg)				
	50	60	70	80	90
	Time (s)				
0,75	3,0	3,0	3,0	3,0	3,5
0,85	3,0	3,0	3,5	3,5	4,0
1,00	3,5	3,5	4,0	4,0	4,5
1,20	4,0	4,5	4,5	5,0	5,5
NOTE Values for time are rounded up to the nearest half second.					

The minimum opening time for doorsets of other widths and/or masses shall be calculated using the following formula:

$$t = \frac{D\sqrt{m}}{2,26\sqrt{J}}$$

where

- t is the time, in s;
- D is the doorset width, in m;
- m is the mass of the doorset leaf, in kg;
- 2,26 is the conversion factor.

F.2 Speed settings for low energy sliding doorsets

Table F.2 shows the minimum travelling time per doorset leaf referred to the doorset mass and the travelling distance per doorset leaf.

Table F.2 — Minimum travelling time per doorset leaf vs. mass of doorset leaf

90% travelling distance per leaf D [m]	Mass of doorset leaf m [kg]														
	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10
	Maximum travelling speed v [m/s]														
	0,15	0,16	0,16	0,17	0,18	0,18	0,19	0,21	0,22	0,24	0,26	0,29	0,34	0,41	0,58
Minimum travelling time t [s]															
0,7	4,7	4,6	4,4	4,2	4,0	3,9	3,7	3,5	3,2	3,0	2,7	2,5	2,1	1,8	1,3
0,8	5,4	5,2	5,0	4,8	4,6	4,4	4,2	3,9	3,7	3,4	3,1	2,8	2,4	2,0	1,4
0,9	6,0	5,8	5,6	5,4	5,2	4,9	4,7	4,4	4,1	3,8	3,5	3,1	2,7	2,2	1,6
1,0	6,7	6,5	6,3	6,0	5,8	5,5	5,2	4,9	4,6	4,3	3,9	3,5	3,0	2,5	1,8
1,1	7,4	7,1	6,9	6,6	6,3	6,0	5,7	5,4	5,1	4,7	4,3	3,8	3,3	2,7	1,9
1,2	8,0	7,8	7,5	7,2	6,9	6,6	6,2	5,9	5,5	5,1	4,7	4,2	3,6	3,0	2,1
1,3	8,7	8,4	8,1	7,8	7,5	7,1	6,8	6,4	6,0	5,5	5,0	4,5	3,9	3,2	2,3
1,4	9,4	9,1	8,7	8,4	8,0	7,7	7,3	6,9	6,4	5,9	5,4	4,9	4,2	3,5	2,5
1,5	10,0	9,7	9,4	9,0	8,6	8,2	7,8	7,3	6,9	6,4	5,8	5,2	4,5	3,7	2,6

NOTE For telescopic sliding doorsets, the travelling distance applies to the fast moving leaf.

The maximum speed for doorsets of other masses shall be calculated using the kinetic energy formula, considering that the maximum admitted energy is 1,69 J:

$$E_c = \frac{1}{2} m v^2 = 1,69 \text{ (J)}$$

By knowing the leaf weight, it is possible to calculate the maximum allowed speed as follows:

$$v = \sqrt{\frac{2E_c}{m}} \text{ (m/s)}$$

where

- v is the speed, in m/s;
- E_c is the kinetic energy, in J – always 1,69 J;
- m is the mass of the doorset leaf, in kg.

Time settings for other travelling distances per leaf and masses shall be calculated using the following formula:

$$t = \frac{D}{v}$$

where

- t is the travelling time for opening or closing, in s;
- D is 90 % of the travelling distance of the leaf, in m;
- V is the doorset speed, in m/s.

Table G.1 — Minimum width of doorset leaf to be protected vs. radius of doorset and doorset travelling time

r_{doorset} [m]	Time [s]										
	1	1,5	2	2,5	3	3,5	4	4,5	5	5,5	6
	r_{slow area} [m]										
	0,16	0,24	0,32	0,4	0,48	0,56	0,64	0,72	0,8	0,88	0,95
d_{protected} [m]											
0,7	0,54	0,46	0,38	0,30	0,22	0,14	0,06	-	-	-	-
0,8	0,64	0,56	0,48	0,40	0,32	0,24	0,16	0,08	-	-	-
0,9	0,74	0,66	0,58	0,50	0,42	0,34	0,26	0,18	0,10	0,02	-
1,0	0,84	0,76	0,68	0,60	0,52	0,44	0,36	0,28	0,20	0,12	0,05
1,1	0,94	0,86	0,78	0,70	0,62	0,54	0,46	0,38	0,30	0,22	0,15
1,2	1,04	0,96	0,88	0,80	0,72	0,64	0,56	0,48	0,40	0,32	0,25
1,3	1,14	1,06	0,98	0,90	0,82	0,74	0,66	0,58	0,50	0,42	0,35
1,4	1,24	1,16	1,08	1,00	0,92	0,84	0,76	0,68	0,60	0,52	0,45
1,5	1,34	1,26	1,18	1,10	1,02	0,94	0,86	0,78	0,70	0,62	0,55
1,6	1,44	1,36	1,28	1,20	1,12	1,04	0,96	0,88	0,80	0,72	0,65
1,7	1,54	1,46	1,38	1,30	1,22	1,14	1,06	0,98	0,90	0,82	0,75
1,8	1,64	1,56	1,48	1,40	1,32	1,24	1,16	1,08	1,00	0,92	0,85

The opening time is measured from 0° to 80° and the closing time from 90° to 10°.

r_{slow area} and the width of the doorset which needs to be protected (d_{protected}) by protective devices for doorsets with other opening and closing times shall be calculated using the following formulae:

$$r_{\text{slow area}} = \frac{2}{\pi} \cdot v \cdot t = 0,16 \frac{m}{s} \cdot t$$

$$d_{\text{protected}} = r_{\text{doorset}} - r_{\text{slow area}}$$

where

t is the time, in s;

r_{slow area} is the radius of the slow area, in m;

v is the maximum allowed collision speed of 0,25 m/s;

0,16 is the conversion factor, in m/s;

d_{protected} is the width of the doorset which needs to be protected.

Annex H (informative)

Danger points at revolving doorsets

Table H.1 — Mechanical hazards at two-leaf revolving doorsets

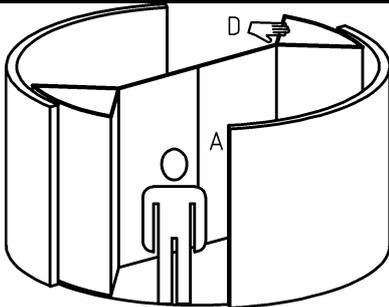
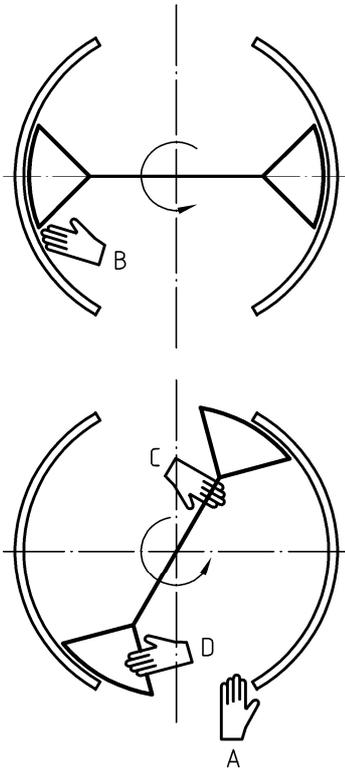
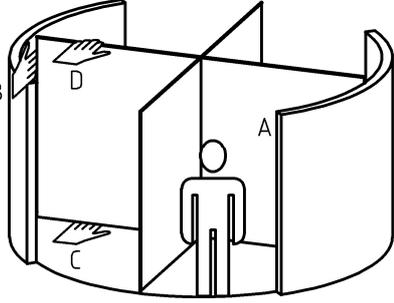
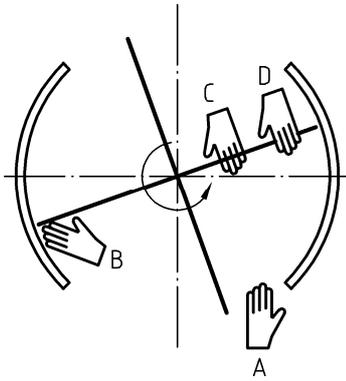
Danger points	Hazards as specified in EN ISO 12100	Illustration
A : Main closing edge/opposing closing edge	Drawing in of hands, arms, feet, legs, small children bodies	
	Crushing of head, trunk, hands, arms, feet, legs	
	Shearing of hands, arms, feet, legs	
B: Main closing edge/inside wall	Crushing of hands, feet	
	Shearing ^a of hands, feet	
C: Secondary closing edge/floor	Crushing of hands, feet	
	Shearing ^b of hands	
	Impact of doorset leaf on body	
D: Secondary closing edge/ceiling	Crushing of hands	
	Shearing ^c of hands	
<p>NOTE Other mechanical hazards may also arise depending on the design of the doorset, e.g. at pivoted doorset leaves.</p>		
<p>^a By projecting profiles.</p> <p>^b Depending on type of floor.</p> <p>^c Depending on type of ceiling.</p>		

Table H.2 — Mechanical hazards at three-leaf revolving doorsets

Danger points	Hazards as specified in EN ISO 12100	Illustration
A : Main closing edge/opposing closing edge	Crushing of head, trunk, hands, arms, feet, legs Shearing of hands, arms, feet, legs	
B: Main closing edge/inside wall	Crushing of hands, feet Shearing ^a of hands, feet	
C: Secondary closing edge/floor	Crushing of hands, feet Shearing ^b of hands Impact of doorset leaf on body	
D: Secondary closing edge/ceiling	Crushing of hands Shearing ^c of hands	
<p>NOTE Other mechanical hazards may also arise depending on the design of the doorset, e.g. at pivoted doorset leaves.</p>		
<p>^a By projecting profiles. ^b Depending on type of floor. ^c Depending on type of ceiling.</p>		

Table H.3 — Mechanical hazards at four-leaf revolving doorsets

Danger points	Hazards as specified in EN ISO 12100	Illustration
A : Main closing edge/opposing closing edge	Crushing of head, trunk, hands, arms, feet, legs Shearing of hands, arms, feet, legs	
B: Main closing edge/inside wall	Crushing of hands, feet Shearing ^a of hands, feet	
C: Secondary closing edge/floor	Crushing of hands, feet Shearing ^b of hands Impact of doorset leaf on body	
D: Secondary closing edge/ceiling	Crushing of hands Shearing ^c of hands	
<p>NOTE Other mechanical hazards may also arise depending on the design of the doorset, e.g. at pivoted doorset leaves.</p>		
<p>^a By projecting profiles. ^b Depending on type of floor. ^c Depending on type of ceiling.</p>		

Annex I (normative)

Log book

At least the following general data shall be included in a log book prior to hand over of the document:

- a) name and contact details of the manufacturer;
- b) unique identification number which appears on the doorset labelling (only for new complete doorsets);
- c) doorset location reference (when necessary);
- d) name and contact details of the installation organisation, where appropriate;
- e) date of completion of the installation;
- f) identification of any power operated drive unit;
- g) identification of any protective devices.

The result of the final verification and operational tests shall be recorded in the log book, dated and signed by the manufacturer or the installer for doorsets supplied in kits.

The log book shall refer to applicable instruction for use.

The log book shall have space available to allow the record of:

- 1) all maintenance and repairs carried out, including recommendations (e.g. improvements, replacements);
- 2) all significant changes or upgrading carried out;
- 3) any work done;
- 4) name, date and signature of the responsible person.

Annex J (informative)

List of hazards, hazardous situations and hazardous events covered by this standard

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

The following list is based on EN ISO 12100:2010.

In the last column, reference to the sub-clauses of this standard dealing with the listed hazards, hazardous situations and hazardous events can be found.

Table J.1 — List of hazards covered by this European Standard

Type or group	Hazards		Sub-clause of this European Standard
	Origin ^a	Potential consequences ^b	
Mechanical hazards	<ul style="list-style-type: none"> - acceleration, deceleration - angular parts - approach of a moving element to a fixed part - cutting parts - elastic elements - falling objects - high pressure - instability - kinetic energy - moving elements - sharp edges - stored energy 	<ul style="list-style-type: none"> - crushing - cutting or severing - drawing-in or trapping - entanglement - impact - shearing - tripping and falling - suffocation 	<ul style="list-style-type: none"> 4.4.1 4.4.2 4.4.3 4.4.4 4.6 4.7
Electrical hazards	<ul style="list-style-type: none"> - arc - electromagnetic phenomena - electrostatic phenomena - live parts - not enough distance to live parts under high voltage - overload - parts which have become live under fault conditions - short-circuit - thermal radiation 	<ul style="list-style-type: none"> - bum - chemical effects - effects on medical implants - electrocution - falling, being thrown - fire - projection of molten particles - shock 	<ul style="list-style-type: none"> 1.2 4.3.1 4.3.2 4.3.3
Thermal hazards	<ul style="list-style-type: none"> - explosion - flame - objects or materials with a high temperature 	<ul style="list-style-type: none"> - bum - discomfort - scald 	<ul style="list-style-type: none"> 4.3

Type or group	Hazards		Sub-clause of this European Standard
	Origin ^a	Potential consequences ^b	
Noise hazards	<ul style="list-style-type: none"> - cavitation problems - moving parts - unbalanced rotating parts - worn parts 	<ul style="list-style-type: none"> - discomfort - loss of awareness - loss of balance - permanent hearing loss - stress - tinnitus - tiredness - any other (for example mechanical, electrical) as a consequence of an interference with speech communication or with acoustic signals 	Not dealt with as not significant
Vibration hazards	<ul style="list-style-type: none"> - cavitation phenomena - misalignments of moving parts - unbalanced rotating parts - worn parts 	<ul style="list-style-type: none"> - discomfort 	Not dealt with as not significant
Radiation hazards	<ul style="list-style-type: none"> - low frequency electromagnetic radiations - optical radiation (infrared, visible and ultraviolet), including lasers - radio frequency electromagnetic radiations 	<ul style="list-style-type: none"> - burn - damage of eyes and skin - effects on reproductive capability - mutation - headache, insomnia, etc. 	1.2 4.3 4.6.8
Material/substance hazards	<ul style="list-style-type: none"> - aerosol - dust - explosive - fibre - flammable - fluid - gas 	<ul style="list-style-type: none"> - breathing difficulties, suffocation - cancer - effects on reproductive capability - explosion - fire 	4.4.2
Ergonomic hazards	<ul style="list-style-type: none"> - access - design or location of indicators and visual display units - design, location or identification of control devices - effort - local lighting - visibility 	<ul style="list-style-type: none"> - discomfort - fatigue - musculoskeletal disorder - stress - any other (for example, mechanical, electrical) as a consequence of a human error 	4.4.5 4.5.2 4.7.1.5

Type or group	Hazards		Sub-clause of this European Standard
	Origin ^a	Potential consequences ^b	
Hazards associated with the environment in which the power operated doorset is used	<ul style="list-style-type: none"> - electromagnetic disturbance - lightning - pollution - snow - temperature - wind 	<ul style="list-style-type: none"> - slipping, falling - any other as a consequence of the effect caused by the sources of the hazards on the machine or parts of the machine 	1.2 4.3.1 4.3.2 4.3.3 4.7.2.2
Combination of hazards	- for example, repetitive activity + effort + high environmental temperature	- for example, dehydration, loss of awareness, heat stroke	Not considered as not significant

^a A single origin of a hazard can have several potential consequences.
^b For each type of hazard or group of hazards, some potential consequences can be related to several origins of hazards.

Table J. 2 — List of hazardous situations, described in terms of tasks, covered by this European Standard

Phases of the power operated doorset life cycle	Tasks	Sub-clause of this European Standard
Transport	<ul style="list-style-type: none"> - Lifting - Loading - Packing - Transportation - Unloading - Unpacking 	Not considered as not significant
Assembly and installation Commissioning	<ul style="list-style-type: none"> - Adjustments of the power operated doorset and its components - Assembly of the power operated doorset - Connecting to power supply (for example, electric power supply, compressed air, ...) - Fencing (guards) - Fixing, anchoring - Testing 	4.1 4.2 4.3 4.6.9 4.6.10 4.6.11 5.3 5.4
Setting Teaching/programming and/or process changeover	<ul style="list-style-type: none"> - Adjustment and setting of protective devices and other component - Adjustment and settings or verification of functional parameters of the power operated doorset (for example speed, pressure, force, travelling limits) - Functional tests - Programming verification - Verification of the final product 	4.1 4.2 4.4.4 4.4.5 4.5 4.6.4 4.6.7 4.6.8 5

Phases of the power operated doorset life cycle	Tasks	Sub-clause of this European Standard
Operation	<ul style="list-style-type: none"> - Minor adjustments and setting of functional parameters of the power operated doorset (for example, speed, pressure, force, travel limits) - Operating manual controls - Restarting the power operated doorset after stopping/interruption 	4.1 4.2 4.3.2 4.5.2
Cleaning Maintenance	<ul style="list-style-type: none"> - Adjustments - Cleaning - Dismantling/removal of parts, components, devices of the power operated doorset - Isolation and energy dissipation - Lubrication - Replacement of worn parts - Verification of parts, components devices of the power operated doorset 	4.1 4.2
Fault finding Troubleshooting	<ul style="list-style-type: none"> - Fault finding - Repairing - Replacement of parts, components, devices of the power operated doorset 	4.1 4.2
Dismantling Disabling	<ul style="list-style-type: none"> - Disconnection and energy dissipation - Dismantling 	4.1 4.2

Table J.3 — List of hazardous events covered by this European Standard

Origin related to	Hazardous event	Sub-clause of this European Standard
Shape and/or superficial finishing of accessible parts of the power operated doorset	<ul style="list-style-type: none"> - Contact with rough surfaces - Contact with sharp edges and corners, protruding parts 	4.4.2 4.4.3
Moving parts of the power operated doorset	<ul style="list-style-type: none"> - Contact with moving parts - Contact with rotating open ends 	4.6 4.7.1
Kinetic energy of the power operated doorset, parts of the power operated doorset	<ul style="list-style-type: none"> - Falling of objects - Contact with moving parts 	4.1 4.2 4.6.4
Stability of the power operated doorset and/or parts of the power operated doorset	<ul style="list-style-type: none"> - Loss of stability - Impact forces with the human body 	4.1 4.2 4.6.4 4.6.7

Origin related to	Hazardous event	Sub-clause of this European Standard
Mechanical strength of parts of the power operated doorset	- Break-up during operation	4.4.2 5.8
Pneumatic, hydraulic equipment	- Displacement of moving elements - Projection of high pressure fluids - Uncontrolled movements	4.3.4 4.3.5
Electrical equipment	- Direct contact - Disruptive discharge - Electric arc - Fire - Indirect contact - Short-circuit	4.3.1 4.3.2 4.3.3
Control system	- Failure to stop moving parts - Power operated doorset action resulting from defeating/failure of protective devices - Uncontrolled movements - Unintended/unexpected start-up	4.3.2 4.4.1 4.4.4 4.5 4.6.8
Materials and substances or physical factors (temperature, noise, vibration, radiation and environment)	- Contacts with parts with high temperature - Harsh environmental conditions	4.2 4.3.1 5.8.3
Manual operation of a power operated doorset	- Excessive effort - Human errors/misuse - Visibility	4.4.2 4.4.5

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 confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive 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.

Bibliography

- [1] EN 14600, *Doorsets and openable windows with fire resisting and/or smoke control characteristics — Requirements and classification*
- [2] EN 61000-6-3, *Electromagnetic compatibility (EMC) — Part 6-3: Generic standards — Emission standard for residential, commercial and light-industrial environments*
- [3] IEC 61496-3:2008, *Safety of machinery — Electro-sensitive protective equipment — Part 3: Particular requirements for Active Opto-electronic Protective Devices responsive to Diffuse Reflection (AOPDDR)*