AS 1735.8.1:2020

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# Lifts, escalators and moving walks

## Part 8.1: Safety rules for the construction and installation of lifts — Lifts for the transport of persons and goods — Electric lifts with inclined path (EN 81-22:2014, MOD)

*This national standard is the adoption of EN 81-22:2014 with national modifications as set out in the Appendix ZZ to take account of Australian conditions with the permission of the European Committee for Standardization — CEN, Rue de la Science 23, B — 1040 Brussels, Belgium.*

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Australasian Fire and Emergency Service Authorities Council
Australian Building Codes Board
Australian Chamber of Commerce and Industry
Australian Elevator Association
Australian Industry Group
Communications, Electrical and Plumbing Union — Electrical Division
Engineers Australia
Lift Engineering Society of Australia
Property Council of Australia

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## Part 8.1: Safety rules for the construction and installation of lifts — Lifts for the transport of persons and goods — Electric lifts with inclined path (EN 81-22:2014, MOD)

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# Preface

This Standard was prepared by the Standards Australia Committee ME-004, Lift Installations.

The objective of this document is to specify the safety rules for the construction and installation of permanently installed new electric lifts, with traction or positive drive, serving defined landings levels, having a vehicle designed to convey passengers or passengers and loads, suspended by ropes or chains and travelling in a vertical plan along guide rails that are inclined at an angle of between 15° and 75° in relation to the horizontal.

Vibrations are dealt with for electric parts only. Direct effects on human bodies are not considered as harmful.

This document does not cover—

(a) lifts with drives other than those stated in Clause 1.1;

(b) installation of electric lifts in existing buildings to the extent that space does not permit;

(c) important modifications (see Annex E) to a lift installed before this document is brought into application;

(d) lifting appliances, such as paternosters, mine lifts, theatrical lifts, appliances with automatic caging, skips, lifts and hoists for building and public works sites, ships' hoists, platforms for exploration or drilling at sea, construction and maintenance appliances;

(e) safety during transport, installation, repairs, and dismantling of lifts;

(f) lifts with rated speed ≤ 0,15 m/s; and

(g) noise in lifts.

This document does not specify the additional requirements necessary for the use of lifts in case of fire.

Considering the state of art, the scope of this document is limited as follows:

(i) inclination: a variation in inclination is permitted for the travel path;

(ii) travel path: confined within the vertical plane;

(iii) maximum capacity of the car: 7 500 kg (100 passengers); and

(iv) maximum rated speed ($v$): 4 m/s.

Both characteristics (capacity and speed) are linked by the relation given in Figure 1.

This document applies to all the constituent components of the lift including—

(A) running tracks;

(B) guides;

(C) safety gear operating device; and

(D) counter-rails.

This document excludes—

(1) supporting structures;

(2) civil engineering structures; and

(3) anchorages that are dealt with by other regulations.

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This document is not applicable for inclined lifts which are manufactured before 2014.

This document is an adoption with national modifications, and has been reproduced from, EN 81-22:2014, *Safety rules for the construction and installation of lifts — Lifts for the transport of persons and goods — Part 22: Electric lifts with inclined path*.

The modifications are additional requirements and are set out in Appendix ZZ, which has been added at the end of the source text.

Appendix ZZ lists the variations to EN 81-22:2014 for the application of this document in Australia.

As this document has been reproduced from an International Standard, the following applies:

(aa) In the source text "this European Standard" should read "this document".

(bb) A full point substitutes for a comma when referring to a decimal marker.

Australian or Australian/New Zealand Standards that are identical adoptions of international normative references may be used interchangeably. Refer to the online catalogue for information on specific Standards.

The terms "normative" and "informative" are used in Standards to define the application of the appendices or annexes to which they apply. A "normative" appendix or annex is an integral part of a Standard, whereas an "informative" appendix or annex is only for information and guidance.

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# Foreword

This document (EN 81-22:2014) has been prepared by Technical Committee CEN/TC 10 “Lifts, escalators and moving walks”, the secretariat of which is held by AFNOR.

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

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

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

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

This document is part of the EN 81 series of standards, *Safety rules for the construction and installation of lifts.*

This is the first edition of this European Standard.

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

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# 0 Introduction

## 0.1 General

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

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

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.

The purpose of this standard is to define safety requirements for inclined lifts in order to safeguard persons and objects against risks of accidents during installation, operation, maintenance, inspection work and emergency operations of lifts.

## 0.2 Considerations

Consideration has been taken into account of various categories of lifts with inclined travel path to ascertain the related hazards and risks owing to the configuration of structures (civil engineering works), inclination and outside influences such as the following:

a) the large opening to the exterior;

b) the possibility to walk around inside the lift well;

c) the arrangement of the doors;

d) the horizontal component of deceleration in the event of stopping of the vehicle.

The prescriptions relating to the protection of workers and to the evacuation from the car are different when it is possible to walk inside the well and when the car roof is used as working station for the maintenance.

An Interpretation Committee has been established to clarify, if necessary, the spirit in which the clauses of the standard have been drafted and to specify the requirements appropriate to particular cases. Interpretation Requests can be sent to the National Standard Bodies which will contact the responsible Technical Committee CEN/TC 10 (see CEN/TR 81-10 [1] for information).

## 0.3 Principles

In drawing up this standard the following have been used.

This standard does not repeat all the general technical rules applicable to every electrical, mechanical, or building construction including the protection of building elements against fire.

It has, however, seemed necessary to establish certain requirements of good construction, either because they are peculiar to lift manufacture or because in the case of lift utilization the requirements may be more stringent than elsewhere.

This standard does not only address the essential safety requirements of the Lift Directive, but additionally states minimum rules for the installation of lifts into buildings/constructions. There may be in some countries regulations for the construction of buildings, etc. which cannot be ignored.

Typical clauses affected by this are those defining minimum values for the height of the machine and pulley rooms and for their access doors dimensions.


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When the weight, size and/or shape of components prevent them from being moved by hand, they are:

a) either fitted with attachments for lifting gear, or

b) designed so that they can be fitted with such attachments (e.g. by means of threaded holes), or

c) shaped in such a way that standard lifting gear can easily be attached.

As far as possible the standard sets out only the requirements that materials and equipment will meet in the interests of safe operation of lifts.

## 0.4 Assumptions

The contents of this standard are based on the assumption that persons using inclined lifts are able to do so unaided.

It is assumed that negotiations have been made for each contract between the customer and the supplier/installer (see also Annex O) about:

a) intended use of the inclined lift;

b) environmental conditions;

c) civil engineering problems;

d) other aspects relating to the place of installation (e.g. high-voltage electric line, bridges, dangerous buildings, natural obstacle).

Possible risks have been considered of each component that may be incorporated in a complete lift installation. Rules have been drawn up accordingly.

Components are:

— designed in accordance with usual engineering practice and calculation codes, taking into account all failure modes;

— of sound mechanical and electrical construction;

— made of materials with adequate strength and of suitable quality;

— be free of defects.

Harmful materials, such as asbestos are not used.

Components are kept in good repair and working order, so that the required dimensions remain fulfilled despite wear.

Components will be selected and installed so that foreseeable environmental influences and special working conditions do not affect the safe operation of the lift.

Especially for the extreme temperatures which were agreed between the customer and the supplier, the choice of materials and components will be made with particular attention that they keep their characteristics for impact strength for the steel, rigidity and function for plastics, functional for the electronic components, viscosity for oils, etc.

By design of the load bearing elements, a safe operation of the lift is ensured for loads ranging up to 125 % (static) and up to 110 % (dynamic) of the rated load.

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The requirements of this European Standard regarding electrical safety devices are such that the possibility of a failure of an electric safety device (see 5.11.1.2) complying with all the requirements of this European Standard need not be taken into consideration."

Users should be safeguarded against their own negligence and unwitting carelessness when using the lift in the intended way.

A user may, in certain cases, make one imprudent act. The possibility of two simultaneous acts of imprudence and/or the abuse of instructions for use is not considered.

If in the course of maintenance work a safety device, normally not accessible to the users, is deliberately neutralized, safe operation of the lift is no longer ensured, but compensatory measures will be taken to ensure users safety in conformity with maintenance instructions.

It is assumed that maintenance personnel is instructed and works according to the instructions.

Horizontal forces and/or energies to consider are indicated in the applicable clauses of the standard. Typically:

— the static force that a person normally exerts is of the magnitude of 300 N;

— the energies resulting from impact depend on the lift component where the impact can occur; if not otherwise specified the resulting force is assumed to be 1 000 N.

With the exception of the items listed below, a mechanical device built according to good practice and the requirements of the standard will not deteriorate to a point of creating hazard without the possibility of detection.

The following mechanical failures are considered:

— breakage of the suspension;

— uncontrolled slipping of the ropes on the traction sheave;

— breakage and slackening of all linkage by auxiliary ropes, chains and belts;

— failure of one of the mechanical components of the electromechanical brake which take part in the application of the braking action on the drum or disk;

— failure of a component associated with the main drive elements and the traction sheave;

— ropes leaving the pulleys and, in case of change of inclination, leaving the rollers;

— blockage of the rope movement;

— blockage or derailment of the vehicle.

The possibility of the safety gear not setting, should the vehicle free fall from the lowest landing, before the vehicle strikes the buffer(s) is considered acceptable.

When the speed of the vehicle is linked to the electrical frequency of the mains up to the moment of application of the mechanical brake, the speed is assumed not to exceed 115 % of the rated speed or a corresponding fractional speed.

Means of access are provided for the hoisting of heavy equipment.


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To ensure the correct functioning of the equipment in the machinery space(s), i.e. taking into account the heat dissipated by the equipment, the ambient temperature in the machine room is assumed to be maintained between + 5 °C and + 40 °C.

Access ways to the working areas are adequately lit.

Minimum passageways required by building regulations are not obstructed by the open door/trap of the lift and/or any protection means for working areas outside of the well, where fitted according to the maintenance instructions (see above Principles).

Where more than one person is working at the same time on a lift, an adequate means of communication between these persons is ensured.

The fixing system of guards, which will be removed during maintenance and inspection, remains attached to the guard or to the equipment when the guard is removed.

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# 1 Scope

**1.1** This European Standard specifies the safety rules for the construction and installation of permanently installed new electric lifts, with traction or positive drive, serving defined landings levels, having a vehicle designed to convey passengers or passengers and loads, suspended by ropes or chains and travelling in a vertical plan along guide rails that are inclined at an angle of between 15° and 75° in relation to the horizontal.

**1.2** In addition to the requirements of this standard, supplementary requirements should be considered in special cases (potentially explosive atmosphere, extreme climate conditions, seismic conditions, transporting dangerous goods, etc.).

**1.3** This European Standard does not cover:

a) lifts with drives other than those stated in 1.1;

b) installation of electric lifts in existing buildings to the extent that space does not permit;

c) important modifications (see Annex E) to a lift installed before this standard is brought into application;

d) lifting appliances, such as paternosters, mine lifts, theatrical lifts, appliances with automatic caging, skips, lifts and hoists for building and public works sites, ships' hoists, platforms for exploration or drilling at sea, construction and maintenance appliances;

e) safety during transport, installation, repairs, and dismantling of lifts;

f) lifts with rated speed ≤ 0,15 m/s.

However, this standard may usefully be taken as a basis.

Noise is not dealt with in this standard because it is not relevant to the safe use of the lift.

Vibrations are dealt with for electric parts only. Direct effects on human bodies are not considered as harmful.

**1.4** This European Standard does not specify the additional requirements necessary for the use of lifts in case of fire.

**1.5** Taking into account the state of art, the scope of the present standard is limited as follows:

— inclination: a variation in inclination is permitted for the travel path;

— travel path: confined within the vertical plane;

— maximum capacity of the car: 7 500 kg (100 passengers);

— maximum rated speed ($v$): 4 m/s.

Both characteristics (capacity and speed) are linked by the relation given in the following Figure 1.


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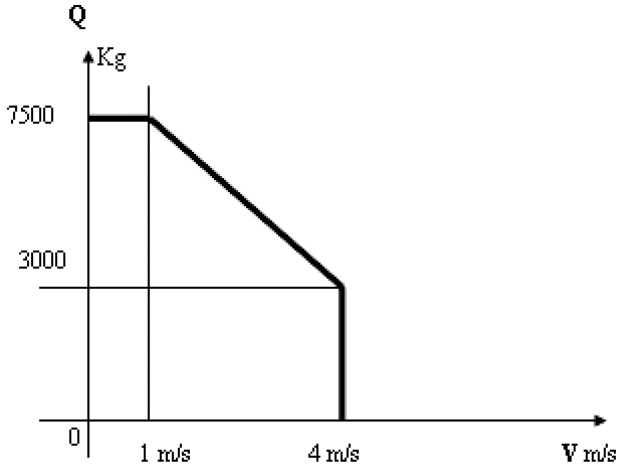


**Key**

$Q$ maximum capacity

$V$ rated speed

**Figure 1 — Speed and capacity**

The standard applies to all the constituent components of the lift including: running tracks, guides, safety gear operating device, counter-rails, but excludes the supporting structures, civil engineering structures and anchorages that are dealt with by other regulations.

**1.6** This standard is not applicable for inclined lifts which are manufactured before the date of its publication as EN.

## 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 81-1:1998+A3:2009, *Safety rules for the construction and installation of lifts — Part 1: Electric lifts*

EN 81-28:2003, *Safety rules for the construction and installation of lifts — Lifts for the transport of persons and goods — Part 28: Remote alarm on passenger and goods passenger lifts*

EN 81-58:2003, *Safety rules for the construction and installation of lifts — Examination and tests — Part 58: Landing doors fire resistance test*

EN 131-2:2010+A1:2012, *Ladders — Part 2: Requirements, testing, marking*

EN 10025-2:2004, *Hot rolled products of structural steels — Part 2: Technical delivery conditions for non-alloy structural steels*

EN 12015:2014, *Electromagnetic compatibility — Product family standard for lifts, escalators and moving walks — Emission*

EN 12016:2013, *Electromagnetic compatibility — Product family standard for lifts, escalators and moving walks — Immunity*

EN 13015:2001+A1:2008, *Maintenance for lifts and escalators — Rules for maintenance instructions*

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EN 13796-1:2005, *Safety requirements for cableway installations designed to carry persons — Carriers — Part 1: Grips, carrier trucks, on-board brakes, cabins, chairs, carriages, maintenance carriers, tow-hangers*

EN 50214:2006, *Flat polyvinyl chloride sheathed flexible cables*

EN 60068-2-6:2008, *Environmental testing — Part 2-6: Tests — Test Fc: Vibration (sinusoidal) (IEC 60068-2-6:2007)*

EN 60068-2-14:2009, *Environmental testing — Part 2-14: Tests — Test N: Change of temperature (IEC 60068-2-14:2009)*

EN 60068-2-27:2009, *Environmental testing — Part 2-27: Tests — Test Ea and guidance: Shock (IEC 60068-2-27:2008)*

EN 60204-1:2006, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:2005, modified)*

EN 60269-1:2007, *Low-voltage fuses — Part 1: General requirements (IEC 60269-1:2006)*

EN 60529:1991, *Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989)*[1)]

EN 60747-5-5:2011, *Semiconductor devices — Discrete devices — Part 5-5: Optoelectronic devices — Photocouplers (IEC 60747-5-5:2007)*

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

EN 60947-4-1:2010, *Low-voltage switchgear and controlgear — Part 4-1: Contactors and motor-starters — Electromechanical contactors and motor-starters (IEC 60947-4-1:2009)*

EN 60947-5-1:2004, *Low-voltage switchgear and controlgear — Part 5-1: Control circuit devices and switching elements — Electromechanical control circuit devices (IEC 60947-5-1:2003)*[2)]

EN 61249-2 (all parts), *Materials for printed boards and other interconnecting structures — Part 2: Reinforced base materials, clad and unclad (IEC 61249-2, all parts)*

EN 61439-1:2011, *Low-voltage switchgear and controlgear assemblies — Part 1: General rules (IEC 61439-1:2011)*

EN 61508-1:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 1: General requirements (IEC 61508-1:2010)*

EN 61508-2:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems (IEC 61508-2:2010)*

EN 61508-3:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 3: Software requirements (IEC 61508-3:2010)*

EN 61508-7:2010, *Functional safety of electrical/electronic/programmable electronic safety related systems — Part 7: Overview of techniques and measures (IEC 61508-7:2010)*

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1) This document is currently impacted by EN 60529:1991/A1:2000 and EN 60529:1991/A2:2013.

2) This document is currently impacted by EN 60947-5-1:2004/A1:2009.


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EN 61558-1:2005, *Safety of power transformers, power supplies, reactors and similar products — Part 1: General requirements and tests (IEC 61558-1:2005)*

EN 61800-5-2:2007, *Adjustable speed electrical power drive systems — Part 5-2: Safety requirements — Functional (IEC 61800-5-2:2007)*

EN 62326-1:2002, *Printed boards — Part 1: Generic specification (IEC 62326-1:2002)*

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

EN ISO 13857:2008, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2008)*

HD 21.3 S3, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V — Part 3: Non-sheathed cables for fixed wiring (IEC 60227-3)*

HD 21.4 S2, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V — Part 4: Sheathed cables for fixed wiring (IEC 60227-4)*

HD 21.5 S3, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V — Part 5: Flexible cables (cords) (IEC 60227-5)*

HD 22.4 S4, *Cables of rated voltages up to and including 450/750 V and having cross-linked insulation — Part 4: Cords and flexible cables*

HD 214 S2, *Method for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions (IEC 60112)*

HD 60364-4-41:2007, *Low-voltage electrical installations — Part 4-41: Protection for safety — Protection against electric shock (IEC 60364-4-41:2005, modified)*

HD 60364-6:2007, *Low-voltage electrical installations — Part 6: Verification (IEC 60364-6:2006, modified)*

ISO 7465:2007, *Passenger lifts and service lifts — Guide rails for lift cars and counterweights — T-type*

# 3 Terms and definitions, symbols and abbreviated terms

## 3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12100:2010, EN 81-1:1998+A3:2009 and the following apply.

NOTE The term “lift” in this documents means “lift with an inclined travel path”.

**3.1.1**
**building**
civil engineering works

**3.1.2**
**angle of inclination**
α
(angle d’inclinaison) (Neigungswinkel)
angle between the travel path as measured against the horizontal


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**3.1.3**
**apron**
(garde-pieds) (Schürze)
smooth vertical part extending downwards from the sill of the landing or car entrance

**3.1.4**
**balancing weight**
(masse d'équilibrage) (Ausgleichgewicht)
mass which saves energy by balancing all or part of the mass of the vehicle

**3.1.5**
**buffer**
(amortisseur) (Puffer)
resilient stop at the end of travel, and comprising a means of braking using fluids or springs (or other similar means)

**3.1.6**
**car**
(cabine) (Fahrkorb)
load carrier being part of the vehicle which carries the passengers and/or other loads and which can be supported by a sling or mounted on a carriage

Note 1 to entry: A car can consist of several sections separated by a wall or a handrail.

**3.1.7**
**carriage**
(chariot) (Fahrwerk)
structure hitched to traction devices on which the car and other elements are mounted

Note 1 to entry: Running/sliding elements, safety gear, shock absorbers can belong to the latter elements.

**3.1.8**
**compensating rope**
(cable de compensation) (Ausgleichsseil)
rope to be used for compensating one or all parts of the variations of weight of the traction ropes

**3.1.9**
**counterweight**
(contrepoids) (Gegengewicht)
mass which ensures traction

**3.1.10**
**counter-guide rail**
(contre-rail) (Schutzschiene)
rigid element that maintains the vehicle within the dynamic envelope

**3.1.11**
**dynamic envelope**
(gabarit dynamique) (Lichtraumprofil)
envelope surface of the final limits

Note 1 to entry: The dynamic envelope could be taken by all of the moving parts (e.g. car, carriage, sprocket, ropes, pulleys) taking into account wear and clearances, anticipated deformation and lateral motion caused by transverse forces to the trajectory. Breakages are not considered except for the running/sliding elements.


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**3.1.12**
**electric safety chain**
(chaîne électrique des sécurités) (elektrische Sicherheitskette)
total of the electric safety devices connected in series

**3.1.13**
**front-mounted door**
(porte frontale) (Fronttür)
door whose vertical plane is at 90 degrees to the travel path of the vehicle

**3.1.14**
**goods passenger lift**
(ascenseur de charge)[3)] (Lastenaufzug)
lift mainly intended for the transport of goods, which are generally accompanied by persons

**3.1.15**
**guide rails**
(guides) (Führungsschienen)
rigid components which provide guiding for the vehicle, the counterweight or the balancing weight

**3.1.16**
**headroom**
(partie supérieure de la gaine) (Schachtkopf)
part of the well at its top end

**3.1.17**
**instantaneous safety gear**
(parachute à prise instantanée) (Sperrfangvorrichtung)
safety gear in which the full gripping action on the guide rails is almost immediate

**3.1.18**
**instantaneous safety gear with buffered effect**
(parachute à prise instantanée avec effet amorti) (Sperrfangvorrichtung mit Dämpfung)
safety gear in which the full gripping action on the guide rails is almost immediate

Note 1 to entry: The reaction on the vehicle, counterweight or balancing weight is limited by presence of an intermediate buffering system.

**3.1.19**
**laminated glass**
(verre feuilleté) (Verbundsicherheitsglas VSG)
assembly of two or more glass layers, each of which is bonded together using a plastic film

**3.1.20**
**levelling**
(nivelage) (Einfahren)
operation which improves the accuracy of stopping at landings

**3.1.21**
**levelling accuracy**
(precision du maintien au niveau) (Nachregulierungsgenauigkeit)
vertical distance between car sill and landing sill during loading or unloading of the car

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3) The French expression “ascenseur de charge” has been introduced into the French language document with the aim of harmonizing the texts in the three languages of CEN and of simplifying the wording. It does not in any way define a particular or supplementary category of lift.

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**3.1.22**
**lift machine**
(machine) (Triebwerk)
unit including the motor which drives and stops the lift

**3.1.23**
**loop rope**
(câble en boucle) (umlaufendes Zugseil)
tensioned traction rope, both ends of which are attached to the carriage of the vehicle

**3.1.24**
**machine room**
(local de machines) (Triebwerksraum)
room in which a machine or machines and/or the associated equipment are placed

**3.1.25**
**machinery**
(machinerie) (Triebwerk und Steuerung)
equipment traditionally placed in the machine room: cabinet(s) for control and drive system

Note 1 to entry: This includes the lift machine, main switch(es) and means for emergency operations.

**3.1.26**
**machinery space**
(emplacement de machinerie) (Aufstellungsort von Triebwerk und Steuerung)
space(s) inside or outside of the well where the machinery as a whole or in parts is placed

**3.1.27**
**minimum breaking load of a rope**
(charge de rupture minimale d'un câble) (Mindestbruchkraft eines Seiles)
product of the square of the nominal diameter of the rope (in square millimetres) and the nominal tensile strength of the wires (in newtons per square millimetre) and a coefficient appropriate to the type of rope construction

**3.1.28**
**overspeed governor**
(limiteur de vitesse) (Geschwindigkeitsbegrenzer)
device which, when the lift attains a predetermined speed, causes the lift to stop, and if necessary causes the safety gear to be applied

**3.1.29**
**passenger**
(passager) (Fahrgast)
person transported by a lift in the car

**3.1.30**
**pit**
(cuvette) (Schachtgrube)
part of the well at its bottom end

**3.1.31**
**positive drive lift (includes drum drive)**
(ascenseur à treuil attelé) (Trommelaufzug, Kettenaufzug)
lift suspended by chains or ropes driven by means other than friction


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**3.1.32**
**programmable electronic system in safety related applications for lifts**
PESSRAL
(système électronique programmable dans les applications liées à la sécurité des ascenseurs (PESSRAL))
(programmierbares elektronisches System in sicherheitstechnisch relevanten Anwendungen für Aufzüge (Pessral))
system for control, protection or monitoring based on one or more programmable electronic devices, including all elements of the system such as power supplies, sensors and other input devices, data highways and other communication paths, and actuators and other output devices, used in safety related applications as listed in Tables A.1 and A.2

**3.1.33**
**progressive safety gear**
(parachute à prise amortie) (Bremsfangvorrichtung)
safety gear in which retardation is effected by a braking action on the guide rails and for which special provisions are made so as to limit the forces on the vehicle, counterweight or balancing weight to a permissible value

**3.1.34**
**pulley room**
(local de poulies) (Rollenraum)
room not containing the machine, in which pulleys are located, and in which the overspeed governor and the electrical equipment can also be housed

**3.1.35**
**pulley space**
(emplacement de poulies) (Aufstellungsort von Seilrollen)
space(s) inside or outside of the well where pulleys are placed

**3.1.36**
**rated load**
(charge nominale) (Nennlast)
load for which the equipment has been built

**3.1.37**
**rated speed**
(vitesse nominale) (Nenngeschwindigkeit)
speed v in metres per second of the vehicle for which the equipment has been built

**3.1.38**
**re-levelling**
(isonivelage) (Nachstellen)
operation, after the lift has stopped, to permit the stopping position to be corrected during loading or unloading, if necessary by successive movements (automatic or inching)

**3.1.39**
**running/sliding element**
(élément de roulement/glissement) (Lauf-/Gleitkörper)
element that ensures contact between the vehicle and the running tracks and between the vehicle and the guide rails

**3.1.40**
**running track**
(piste de roulement) (Laufbahn)
rigid element that the vehicle or counterweight runs along

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**3.1.41**
**safety integrity level**
SIL
(niveau d'intégrité de sécurité) (Sicherheits-Integritätslevel)
discrete level (one out of a possible three) for specifying the safety integrity requirements of the safety functions allocated to the programmable electronic safety-related system, in which Safety-Integrity Level 3 has the highest level of safety integrity and Safety-Integrity Level 1 has the lowest

**3.1.42**
**safety gear**
(parachute) (Fangvorrichtung)
mechanical device for stopping, and maintaining stationary on the guide rails, the vehicle, counterweight or balancing weight in case of overspeeding or breaking of the suspension

**3.1.43**
**safety gear gripping element**
(élément de prise de parachute) (Fangschiene)
structure that the safety gear grips onto

**3.1.44**
**safety rope**
(câble de sécurité) (Sicherheitsseil)
auxiliary rope attached to the vehicle, the counterweight or balancing weight for the purpose of tripping a safety gear in case of suspension failure

**3.1.45**
**sling**
(étrier) (Rahmen)
metal framework carrying the car, counterweight or balancing weight, connected to the means of suspension

Note 1 to entry: This sling can be integral with the car enclosure.

**3.1.46**
**side-mounted door**
(porte latérale) (Seitentür)
door whose plane is parallel to the travel path of the vehicle

**3.1.47**
**stopping accuracy**
(precision d'arrêt) (Anhaltegenauigkeit)
vertical distance between car sill and landing sill at the moment when the vehicle is stopped by the control system at its destination floor and the doors reach their fully open position

**3.1.48**
**system reaction time**
(temps de réaction système) (Systemreaktionszeit)
sum of the following two values:

a) time period between the occurrence of a fault in the PESSRAL and the initiation of the corresponding action on the lift;

b) time period for the lift to respond to the action, maintaining a safe state

**3.1.49**
**traction drive lift**
(ascenseur à adhérence) (Treibscheiben-Aufzug)
lift whose lifting ropes are driven by friction in the grooves of the driving sheave of the machine


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**3.1.50**
**travelling cable**
(câble pendentif) (Hängekabel)
flexible cable between the vehicle and a fixed point

**3.1.51**
**unintended vehicle movement**
(mouvement incontrôlé du véhicule) (unbeabsichtigte Bewegung des Fahrkorbs)
non-commanded movement of the vehicle with doors open within the unlocking zone away from the landing, excluding movements resulting from loading/unloading operation

**3.1.52**
**unlocking zone**
(zone de déverrouillage) (Entriegelungszone)
zone, extending above and below the stopping level, in which the car floor enables the corresponding landing door to be unlocked

**3.1.53**
**user**
(usager) (Benutzer)
person making use of the services of a lift installation

**3.1.54**
**vehicle**
(véhicule) (Laufwagen)
car, including the sling/carriage and the working station if required

**3.1.55**
**well**
(gaine) (Schacht)
space in which the vehicle, the counterweight or the balancing weight travels and which is usually bounded by the bottom of the pit, the walls and the ceiling of the well

**3.1.56**
**working station**
(poste de travail) (Arbeitsstation)
specific arranged area either on the car roof, on an inspection platform, or inside the car for maintenance operations

## 3.2 Symbols and abbreviated terms

### 3.2.1 Symbols

Symbols are explained relevant to the formulae used.

### 3.2.2 Abbreviated terms

The abbreviated terms used are chosen from the International System of units (SI).

# 4 List of significant hazards

## 4.1 General

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 machinery and which require action to eliminate or reduce the risk.

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The significant hazards are based upon EN ISO 12100:2010. Also shown are the subclause references to the safety requirements and/or protective measures in this standard.

Before using this standard it is important to carry out risk assessment of the lift with an inclined travel path to check that its hazards have been identified in this clause.

**Table 1 — List of significant hazards**

| No | **Hazards as listed in Annex B of** EN ISO 12100:2010 | **Relevant clauses in that standard** |
|---|---|---|
| 1 | **Mechanical hazards** due to: | |
| | Acceleration, deceleration (kinetic energy) | 5.6.3, 5.6.8.4, 5.6.10, 5.6.11, 5.7.2.1, 5.7.4, 5.9.4, 5.9.13, F.2, F.4, F.5.4.3 |
| | Approach of a moving element to a fixed part | 5.2, 5.3, 5.7.1.1 |
| | Falling objects, gravity | 5.2, 5.3.3.5, 5.3.7.1.5 |
| | Height from the ground | 5.3.2, 5.5.6, 5.5.13, 5.6 |
| | Moving elements | 5.2, 5.4, 5.5, 5.6 |
| | Rotating elements | 5.3.3.3.3, 5.3.4.2, 5.6.7, 5.6.9, 5.9.2.1, 5.9.11 |
| | Rough, slippery surface | 5.3.7.1, 5.5.3.4, 5.5.13, 7.4.1 a), Annex P |
| | Sharp edges | Introduction, 5.5.3.1, 5.10.5.3 |
| | Stability | See 0.4 |
| | Strength | See 0.4 |
| | - Machine parts or work pieces, e.g.:<br>- Accumulation of energy inside the machinery, e.g.: | |
| | Crushing hazard | 5.2, 5.4, 5.8.1, 5.8.2 |
| | Shearing hazard | 5.2, 5.4.5, 5.4.7.2, 5.5.7.1, 5.8 |
| | Entanglement hazard | 5.3, 5.6.7 |
| | Drawing-in or trapping hazard | 5.2.1, 5.2.10, 5.4.1, 5.4.7, 5.5.12, 5.5.17, 5.6.3, 5.6.7, 5.7.2.2, 5.11.2.3, 7.2.2.2, 7.2.8.2 |
| | Impact hazard | Introduction, 5.2, 5.3.3, 5.5.20, 5.5.21, 5.6, 5.7, 5.8.3 |
| | Slip, trip and fall of persons (related to machinery) | 5.2.11, 5.4, 5.5.3.2, 5.5.3.4, 5.5.13, 5.6.8.7, 7.2.5 |
| | - Uncontrolled amplitude of movements | 5.9, 5.11 |
| | - From insufficient mechanical strength of parts | See 0.4, 5.2.3, 5.2.7, 5.3.2, 5.4.5, 5.4.7.3.2, 5.7, Annex G, Annex J |
| | - From inadequate design of pulleys, drums | 5.6.2, 5.6.4, Annex C |
| | - Falling of person from the vehicle | 5.4, 5.5.4, 5.5.13, 5.5.14 |
| 2 | **Electrical hazards** | |
| | Arc, electrostatic phenomena | 5.10.2 |
| | Live parts | 5.10.1, 7.2.5.2 |
| | Overload | 5.10.3, 7.2.2.1 |
| | Parts which have become short-circuit | 5.10.1, 5.10.2, 5.10.5 |
| | Live under faulty conditions | 5.10 |
| 3 | **Thermal hazards** | |
| | Flame | 5.2.2.2.2, 5.4.2.2, 5.5.3.3 |
| | Objects or materials with a high or low temperature | 0.4, 5.3.3.1, 5.10.3 |


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| | | |
|---|---|---|
| **4** | **Hazards generated by vibration** | 5.10.5.1.4, F.5.4.2 |
| **5** | **Hazards generated by radiation** | |
| | Low frequency electromagnetic radiation | 5.10.1.1.3 |
| | Radio frequency electromagnetic radiation | 5.10.1.1.3, Annex O |
| **6** | **Hazards generated by materials and substances** | |
| | Combustible | 5.5.3.3, 5.9.4.2.7 |
| | Explosive | 1.2, Annex O |
| | Fluid | 5.7.4.3.5 |
| | Fume | 1.4, 5.2.2, 5.3, 5.4.2.2, 5.5.3.3, 5.5.16, N.3.2 |
| **7** | **Hazards generated by neglecting ergonomic principles in machinery design** as, e.g. hazards from: | |
| | Access | 0.4, 5.2.2.4, 5.2.7.4.2, 5.2.11, 5.3.3.3.2, 5.3.3.4, 5.3.4.3, 5.3.4.5, 5.3.4.6, 5.3.5, 5.4, 5.5.3.1, 5.6.9.6, 5.9.5, 5.10.4.4, 7.2, 7.4.1 |
| | Inadequate local lighting | 5.2.7.4, 5.2.9, 5.3.4.8, 5.3.6.3, 5.3.7.1.8, 5.4.6.1, 5.5.17, 5.10.5.5, 5.10.5.6 |
| | Unhealthy postures | 5.2.7, 5.3 |
| | Human error, human behaviour | 7.2.5.6, 7.2.6, 7.2.7, 5.11.2.1.4.3 |
| | From abnormal conditions of assembly / testing / use / maintenance | 6.1, 6.2, 7.1, 7.3.1, 7.3.2, Annex C, D.3 |
| | Design or location of indicators and visual displays units | 5.3, 5.4, 7.2.5.5, 7.2.5.6, 7.2.5.9, 7.2.8.1 |
| | Design, location or identification of control devices | 5.11.2, 5.5.15, 5.5.17, 7.2.5, 7.2.6, 7.2.7 |
| | Effort | 0.4, 5.2.1, 5.2.2.4, 5.3.4.9, 5.4.8, 5.5.7, 5.5.10, 5.5.13, 5.9.5 |
| | Visibility | 5.2, 5.11.2.4.3, 5.11.2.5.3 a), 7.2, Annex O |
| **8** | **Hazards associated with the environment in which the machine is used** | |
| | Failure of the power supply | 5.9.4.1, 5.11.1, 5.11.2 |
| | Failure of the control circuit | 5.6.11, 5.9.4.1, 5.9.7, 5.10.2, 5.11, Annex F |
| | Unexpected start-up, unexpected overrun / overspeed (or any similar malfunction) from restoration of energy supply after an interruption | 5.6.11, 5.11 |
| | Dust and fog | 5.3, N.3.2, Annex O |
| | Electromagnetic disturbance | 5.10.1, Annex O |
| | Moisture | 5.3.1, 5.4.7.3.2.3, G.2.1.1.1, Annex H, Annex N, Annex O |
| | Snow | 5.2.2.3, 5.2.3.1, 5.5.21, Annex G, Annex N, Annex O |
| | Temperature | Introduction, 5.3.7.1, 5.4.2.2, 5.4.2.2, 5.5.16, 5.10.3.3, F.2, Annex G, Annex H, Annex N |
| | Water | 5.2.7.4, 5.4.4.1, Annex O |
| | Wind | 5.2.2, 5.2.3.1, Annex G, Annex N, Annex O |

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# 5 Safety requirements and/or protective measures

## 5.1 General provisions

Inclined lifts shall comply with the safety requirements and/or protective measures of this clause. In addition, the machine shall be designed according to the principles of EN ISO 12100 for relevant but not significant hazards, which are not dealt with by this document.

## 5.2 Lift well

### 5.2.1 General provisions

**5.2.1.1** The requirements of this clause relate to wells containing one or more lift vehicles.

**5.2.1.2** The counterweight or the balancing weight of a lift shall be in the same well as the vehicle.

**5.2.1.3** The minimum dimensions of the well section are those of the dynamic envelope plus landing doors augmented on the sides and above the vehicle with a clearance required for safe operation.

### 5.2.2 Well enclosure

#### 5.2.2.1 General

A lift shall be separated from the surroundings by:

a) walls, floor and ceiling, or

b) sufficient space.

#### 5.2.2.2 Totally enclosed well

##### 5.2.2.2.1 Building installation

In sections of the building where the well is required to contribute against the spread of fire, the well shall be totally enclosed by imperforate walls, floor and ceiling.

The only permissible openings are:

a) openings for landing doors;

b) openings for inspection and emergency doors to the well and inspection traps;

c) vent openings for escape of gases and smoke in the event of fire;

d) ventilation openings;

e) necessary openings for the functioning of the lift between the well and the machine or pulley rooms;

f) openings in partition between lifts according to 5.2.6.

##### 5.2.2.2.2 Tunnel installation

Lifts with inclined travel path running in tunnels of length greater than 300 m or where the evacuation zones are more than 300 m apart should be designed, built, maintained and operated by taking into account the objectives defined by CEN/TR 14819-1:2004, 4.2 [2].


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#### 5.2.2.3 Partially enclosed well

##### 5.2.2.3.1 Introduction

In those parts of the building where the well is not required to contribute against the spread of fire, e.g. observation lifts in connection with galleries or atriums or garden lifts the well does not need to be totally enclosed, provided 5.2.2.3.2 to 5.2.2.3.4 are fulfilled as appropriate.

##### 5.2.2.3.2 General

The following requirements apply:

a) The height of the enclosure at places normally accessible to persons shall be sufficient to prevent such persons from:

   1) being endangered by moving parts of the lift with inclined travel path, and

   2) interfering with the safe operation of the lift by reaching a part of the lift located inside the well either directly or with hand-held objects.

b) Perforated enclosure walls are permitted as long as they comply with EN ISO 13857:2008, Table 5, regarding mesh size.

c) The enclosure shall be located within 0,15 m maximum of the edges of floors, stairs or platforms.

d) Measures are to be taken to prevent interference with the safe operation of the lift by other aspects relating to the location of the equipment (see Introduction, 0.4 d), 5.2.8 b) and 7.4.1 b)).

   A specific analysis of particular risks is necessary in order to define the safety devices needed (see Annex O).

e) Special precautions shall be taken for lifts exposed to bad weather conditions (see Introduction and Scope), especially snowfall and wind.

##### 5.2.2.3.3 Lifts with an inclination of more than 45°

The height of the enclosure is assumed to be sufficient if it is in conformity with Figure 2, that means:

a) minimum 3,50 m at a landing door side;

b) minimum 2,50 m at other sides and with a minimum horizontal distance of 0,50 m to moving parts of the lift.

   If the distance to moving parts exceeds 0,50 m, the value of 2,50 m can be reduced progressively to a minimum height of 1,10 m in a distance of 2,00 m.

##### 5.2.2.3.4 Lifts with an inclination not exceeding 45°

The height $H$ of the enclosure shall be:

a) at landings side at least the height of the travelling area of the vehicle;

b) for the other sides, the following formula is applied:

$$H + D \geq 2{,}50 \text{ m} \qquad \text{with} \qquad H \geq 1{,}80 \text{ m}$$

where


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$D$ is the horizontal distance between the wall and the moving parts of the lift (see Figure 2).

In the inclined portion of the well, $H$ is measured vertically.

The height $H$ may be lowered to 1,10 m in relation to the design and use conditions, taking account the environment (Safety rules relating to the sizes of safe-guards) (see Figure 2). Furthermore, this protection shall be ensured for all normally predictable situations (snow in particular).

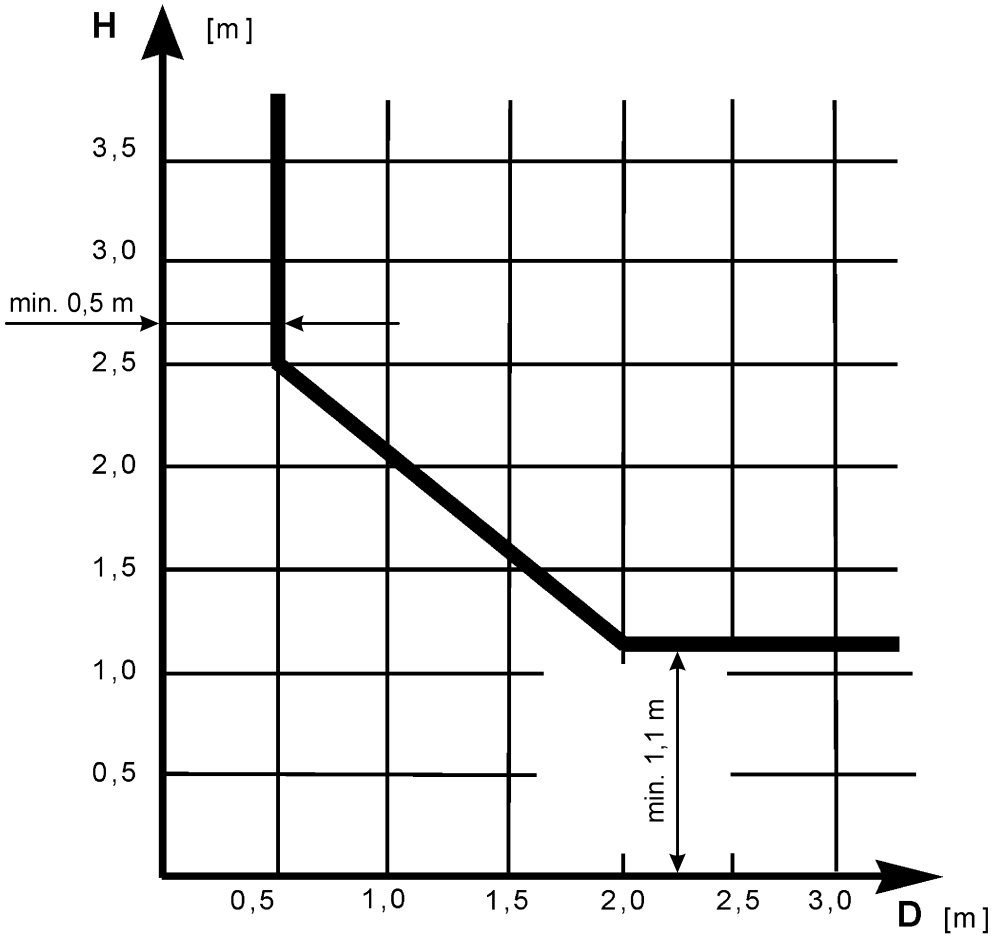


**Figure 2 — Lift in a partially enclosed well – Distances**

**5.2.2.4 Inspection and emergency doors - Inspection traps**

**5.2.2.4.1 General**

**5.2.2.4.1.1** Inspection and emergency doors, and inspection traps to the well, shall not be used except on grounds of safety to users or the requirements of maintenance.

**5.2.2.4.1.2** Inspection doors shall have a minimum height of 1,40 m and a minimum width of 0,60 m.

Emergency doors shall have a minimum height of 1,80 m and a minimum width of 0,35 m.

Inspection traps shall have a maximum height of 0,50 m and a maximum width of 0,50 m.

**5.2.2.4.2 Emergency and inspection accesses**

**5.2.2.4.2.1** For emergency access or inspection access to the well, one of the following requirements shall be applied as appropriate:


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a) emergency doors with a distance between landing doorsills in accordance with the means used; if a ladder is used the distance shall not exceed 11 m, measured according to the inclination;

b) a permanent walkway with a minimum width of 0,50 m and a minimum step width of 0,35 m or a permanent ladder according to EN 131-2:2010+A1:2012; these can be used safely under all circumstances from one end of the well to the other and shall comprise the following:

   1) for vertical distances between the door sill and the walkway exceeding 0,50 m, steps or a ladder affording access to the car from the inside of the well; if the steps or ladders are removable they shall be stored immediately nearby the lift and be available at all times;

   2) trap doors affording access to the well shall be compliant with 5.2.2.4.1.2; if well access is via landing doors, steps or ladders leading to the service walkway shall be provided;

c) adjacent vehicle equipped with an emergency exit compliant with the requirements of 5.5.12;

d) external means allowing direct access to the car without danger (e.g. by mobile elevating work platform);

e) a combination of some foregoing solutions.

**5.2.2.4.2.2** Inspection and emergency doors and inspection traps shall not open towards the interior of the well.

**5.2.2.4.2.3** The doors and traps shall be provided with a key-operated lock, capable of being reclosed and relocked without a key.

**5.2.2.4.2.4** Inspection and emergency doors shall be capable of being opened from inside the well without a key even when locked.

**5.2.2.4.2.5** Operation of the lift shall automatically depend on maintaining these doors and traps in the closed position. For this purpose electric safety devices in conformity with 5.11.1.2 shall be employed.

An electric safety device is not required in case of access door(s) to the pit (5.2.7.4.2) provided the door(s) does not give access to a hazardous zone.

The presence of travelling cables, compensating ropes and their equipment, tensioning pulleys for the overspeed governor and similar installations is not regarded as being hazardous.

**5.2.2.4.2.6** Inspection and emergency doors and inspection traps shall be imperforate, satisfy the same requirements for mechanical strength as the landing doors, and comply with the regulations relevant to the fire protection for the building concerned.

#### 5.2.2.5 Ventilation of the well

The well shall be suitably ventilated (see N.3.2 for information). It shall not be used to provide ventilation of rooms other than those belonging to the lift.

In the absence of relevant regulations or standards, it is recommended that ventilation openings at the top of the well, with a minimum area of 1 % of the horizontal section of the well, are provided.

### 5.2.3 Walls, floor, ceilings

#### 5.2.3.1 General

The structure of the well shall be able to support at least the loads that may be applied by the machine, by the guiding elements, by the supporting elements and the safety gear operation rail element at the moment of safety gear operation or in the case of eccentric load in the car, by the action of the buffers, by those which

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may be applied by the anti-rebound device, or by any other source of foreseeable strain caused by the immediate environment: such as the effect of wind or snowfall.

**5.2.3.2 Strength of the walls**

**5.2.3.2.1** For the safe operation of the lift the walls shall have a mechanical strength such that when a force of 300 N, being evenly distributed over an area of 5 $cm^2$ in round or square section, is applied at right angles to the wall at any point on either face they shall:

a) resist without permanent deformation ;

b) resist without elastic deformation greater than 15 mm.

See also 5.2.4.

**5.2.3.2.2** Glass panels, plane or formed, placed at points normally accessible to persons shall be made of laminated glass up to a height as required in 5.2.2.3.

**5.2.3.3 Strength of the pit floor**

**5.2.3.3.1** If the safety gear gripping element is not suspended, the pit floor shall be able to bear the relevant components of the force due to the mass of this element plus the reaction force at the moment of the operation of the safety gear.

**5.2.3.3.2** Engineering civil works shall be able to support in the direction of the travel, beneath the vehicle buffers supports, the maximum dynamic load due to the shock of the vehicle on the buffers with a safety factor of 2.

The maximum speed is 115 % of the rated speed as defined in 5.7.4.

**5.2.3.3.3** The floor of the pit shall be able to support beneath the counterweight buffer supports or the balancing weight travelling area, the dynamic load being due to the mass of the counterweight or the balancing weight with a safety factor of 2.

The maximum speed is 115 % of the rated speed as defined in 5.7.4.

**5.2.3.4 Strength of the ceiling**

Notwithstanding the requirements of 5.2.3.2 and/or 5.3.7.1.2 in the case of hanging guide rails or hanging safety gear gripping elements the suspension points shall be able to take at least the loads and forces according to G.3.

**5.2.3.5 Structure**

Structures carrying the running tracks, the guide rails and the element of the safety gear operation rail shall be designed according to the rules of construction, and taking into account the functionality of the lift as well as the specificity of the site.

All the predictable movements of supports shall be taken into account to ensure a safe operation of the lift.

Annex G provides all the information for building structure by calculation.

**5.2.4 Construction of the walls of lift wells and landing doors facing a car entrance**

**5.2.4.1** The following requirements relating to landing doors and walls, or parts of walls, facing a car entrance shall apply over the full height of the well.


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For clearances between car and wall of the lift well facing the car entrance, see 5.8.

**5.2.4.2** At each landing, the assembly comprising the landing doors and any wall or part of a wall facing the car entrance shall form an imperforate surface over the full entrance width of the car, excluding the operational clearances of doors.

Furthermore, the walls located around the entrance of the landing shall present a flat continuous surface parallel to the trajectory.

This surface shall be composed of smooth and hard elements according to 5.2.4.3.

The lift car position to be taken into account in reference to the theoretical stopping position includes all the unlocking zone plus for the following cases:

a) Side-mounted doors: 50 mm on both sides;

b) Front-mounted doors: 25 mm on both sides.

**5.2.4.3** Below each landing doorsill, the apron of the lift well shall comply with the following requirements:

a) it shall form a surface which is directly connected to the landing door sill, whose dimension covers the entire opening under the sill when moving in the unlocking zone plus 50 mm on each side and below,

b) this surface shall be continuous and composed of smooth and hard elements, such as metal sheets, and shall be capable of withstanding a force of 300 N applied at a right angle to the wall at any point, being evenly distributed over an area of 5 $cm^2$ in round or square section, it shall resist:

   1) without permanent deformation;

   2) without elastic deformation greater than 10 mm.

### 5.2.5 Protection of any spaces located in the vehicle trajectory, the counterweight or the balancing weight at the lowest level

If accessible spaces do exist in the vehicle trajectory, counterweight or the balancing weight, the base of the pit or the lower wall end shall be designed for an imposed load of at least 5 000 $N/m^2$, and:

a) either there shall be installed below the counterweight buffers, a solid pier extending down to solid ground and according to the lift inclination, or

b) the counterweight or the balancing weight shall be equipped with safety gear.

### 5.2.6 Protection in the well

#### 5.2.6.1 General provisions

**5.2.6.1.1** In the usual zones of maintenance (defined in the instruction manual), the travelling area of counterweight or the balancing weight shall be guarded by a rigid screen on all the accessible faces.

The width shall be at least equal to the area of risk. If this partition is perforate, EN ISO 13857:2008, Table 4, shall be respected.

However, this provision need not apply if, at the opening of the doors accessing to the well, the lift is automatically stopped by a safety device according to 5.2.2.4.2.5.

The restarting of the lift shall only happen after a voluntary resetting made by a competent person.

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**5.2.6.1.2** If it is intended to access the car roof for maintenance or inspection work, the free vertical distance of at least 2,00 m shall be reserved above the car roof along the normal travel path. This distance is measured at a right angle to the floor of the working station where the free distance is the lowest.

**5.2.6.2 Several lifts in the well**

**5.2.6.2.1** Where the well contains several lifts there shall be a partition between the moving parts of different lifts.

If this partition is perforate, EN ISO 13857:2008, Table 4, shall be respected.

**5.2.6.2.2** This partition shall extend at least from the lowest point of the travel of the vehicle, the counterweight or the balancing weight to a height of 2,50 m above the floor of the lowest landing.

The width shall be as to prevent access from one pit to another, except where the conditions of 5.2.2.4.2.5 are met.

**5.2.6.2.3** The partition shall extend through the full travel of the moving parts if the horizontal distance between the edge of the car roof and a moving part (car, counterweight or balancing weight) of an adjacent carrier is less than 0,50 m.

The dimensions of the partition shall at least cover all moving parts, or part of this, which is to be guarded, plus 0,10 m on each side.

**5.2.6.2.4** When it is possible to walk inside the well (5.2.2.4.2.1 b)) a separation shall be provided along the well between the adjacent lifts with a height $H$ such that:

$H + D \geq 2{,}50$ m with $H \geq 1{,}10$ m,

where

$D$ is the horizontal distance measured between the most exposed side of the walkway and the closest wall of the vehicle (or the counterweight) of the adjacent lift.

In the inclined portion of the well, $H$ is measured at a right angle to the inclination.

If this separation is perforated, openings shall be compliant with the requirements of EN ISO 13857:2008 relating to the protection of persons.

However, this provision need not apply if, at the opening of the doors accessing the well, all the lifts are automatically stopped by a safety device according to 5.2.2.4.2.5.

The re-starting of the lifts can only be carried out after a voluntary reset made by a competent person from outside the well.

**5.2.7 Headroom and pit**

**5.2.7.1 General**

If it is intended to carry out maintenance or inspection work in the headroom or in the pit, safety volumes shall be made available under the worst conditions as given in 5.2.7.2 and 5.2.7.3.

The available safety volume shall be provided for the over travel.


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#### 5.2.7.2 Access to the headroom through the car roof

##### 5.2.7.2.1 Top clearances for traction drive lifts

###### 5.2.7.2.1.1 Vehicle at its limit of travel

The limit of travel of the vehicle shall be provided by the compressed buffers of the counterweight or by compressed buffers specific for the vehicle.

When the vehicle reaches the limit of its travel, the following four conditions shall be satisfied at the same time:

a) the vehicle guide rail lengths shall be such as would accommodate a further guided travel, expressed in metres, of at least 0,1 + 0,035 $v^2/\sin\alpha$ [4)], or the vehicle shall be guided until the specific buffers are fully compressed;

b) the free vertical distance between the level of the highest area on the car roof whose dimensions comply with 5.5.13.2.2 (areas on parts according to 5.2.7.2.1.1.c) excluded) and the level of the lowest part of the ceiling of the well (including beams and components located under the ceiling) situated in the projection of the car, expressed in metres, shall be at least 1,0 + 0,035 $v^2/\sin\alpha$ ;

c) the free vertical distance, expressed in metres, between the lowest parts of the ceiling of the well and:

   1) the highest pieces of equipment fixed on the roof of the car enclosure, except for those covered in 2) below, shall be at least 0,3 + 0,035 $v^2/\sin\alpha$;

   2) the highest part of the guide shoes or rollers, of the rope attachments and of the header or parts of vertically sliding doors, if any, shall be at least 0,1 + 0,035 $v^2/\sin\alpha$;

d) there shall be above the car sufficient space to accommodate a rectangular block not less than 0,50 m x 0,60 m x 0,80 m resting on one of its faces. For lifts with direct roping, the suspension ropes and their attachments may be included in this space, provided that no rope centre-line shall be at a distance exceeding 0,15 m from at least one vertical surface of the block.

###### 5.2.7.2.1.2 Counterweight at its limit of travel

The limit of travel of the counterweight shall be provided by the compressed buffers of the vehicle or by compressed buffers specific for the counterweight.

When the counterweight reaches the limit of its travel, the counterweight guide rail lengths shall be such as would accommodate a further guided travel, expressed in metres, of at least 0,1 + 0,035 $v^2/\sin\alpha$, or the counterweight shall be guided until the specific buffers are fully compressed.

###### 5.2.7.2.1.3 Reduced clearances

When the slowdown of the machine is monitored, in accordance with 5.9.8, the value of 0,035 $v^2/\sin\alpha$ in 5.2.7.2.1.1 and 5.2.7.2.1.2 for calculation of clearances may be reduced to one half; however, this value shall not be less than 0,25 m.

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4) 0,035 $v^2/\sin\alpha$ represents half the gravity stopping distance corresponding to 115 % of the rated speed:

$$1/2 \cdot \frac{(1{,}15v)^2}{2 \cdot g_n} 0{,}0337\,v^2 \text{ rounded to } 0{,}035\,v^2$$



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For lifts which are fitted with compensating ropes having a tensioning pulley equipped with an anti-rebound device (braking or lock-down device), the value of 0,035 $v^2$ may be replaced in the calculation of the clearances by a figure related to the possible travel of that pulley (depending on the roping used) plus 1/500 of the travel of the car, with a minimum of 0,20 m to take account of the elasticity of the ropes.

**5.2.7.2.2 Top clearances for positive drive lifts**

**5.2.7.2.2.1** The guided travel of the vehicle upwards from the top floor until it strikes the upper buffers shall be at least 0,50 m along the inclined travel path. The vehicle shall be guided to the limit of its buffer stroke.

**5.2.7.2.2.2** When the upper buffers are fully compressed by the vehicle, the following three conditions shall be satisfied at the same time:

a) the free vertical distance between the level of the highest area on the car roof whose dimensions comply with 5.5.13.2.2 (areas on parts according to 5.2.7.2.2.2 b) excluded) and the level of the lowest part of the ceiling of the well (including beams and components located under the ceiling) situated in the projection of the car, shall be at least 1 m;

b) the free vertical distance between the lowest part of the ceiling of the well and:

   1) the highest pieces of equipment fixed on the car roof, except for those covered by 2) below, shall be at least 0,30 m;

   2) the highest part of the guide shoes or rollers, of the rope attachments, or of the header, or the parts of vertically sliding doors, if any, shall be at least 0,10 m;

c) there shall be above the car roof sufficient space to accommodate a rectangular block not less than 0,50 m x 0,60 m x 0,80 m resting on one of its faces. For lifts with direct roping, the suspension ropes or chains and their attachments may be included in this space, provided that no rope, or chain, centre-line shall be at a distance exceeding 0,15 m from at least one vertical surface of the block.

**5.2.7.2.2.3** When the vehicle rests on its fully compressed buffers, the guide rail lengths of the balancing weight, if there is one, shall be such as would accommodate a further guided travel of at least 0,30 m.

**5.2.7.3 Access to the headroom through the well**

If, because of the inclination access to the top of well may be made other than by the roof of the vehicle, the horizontal measured distance between the most advanced part of the vehicle and the extremity of the well shall be at least 0,50 m by taking into consideration e.g. the inclination, friction and the gravity distance of the vehicle. In this case the height of the safety volume shall be at least 2,00 m.

**5.2.7.4 Pit**

**5.2.7.4.1** The lower part of the well shall consist of a pit, the bottom of which shall be smooth and approximately level, except for any buffer and guide rail bases and water drainage devices.

After the building-in of guide rail fixings, buffers, any grids, etc., the pit shall be impervious to infiltration of water.

When a lift is installed outdoors means shall be provided to ensure the removal of any water from the pit in all cases.

**5.2.7.4.2** If there is an access door to the pit, other than the landing door, it shall comply with the requirements of 5.2.2.4. Such a door shall be provided if the pit depth exceeds 2,50 m and if the layout of the building so permits.


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If there is no other access a permanent means shall be provided inside the well, easily accessible from the landing door, to permit competent persons to descend safely to the floor of the pit. This shall not project into the clear running space of the lift equipment.

**5.2.7.4.3** When the vehicle rests on its fully compressed buffers, the following three conditions shall be satisfied at the same time:

a) there shall be in the pit sufficient space to accommodate a rectangular block not less than 0,50 m x 0,60 m x 1,0 m resting on one of its faces;

b) the free distance measured between the rear well of the pit and the most rear part of the vehicle, shall be at least 0,50 m. This distance may be reduced to a minimum of 0,10 m within a horizontal distance of 0,15 m between the most rear parts of the car and the guide rails;

c) the free distance measured in the direction of travel between the most rear part of the vehicle and the first fixed possible collision point shall be at least 0,30 m

**5.2.7.4.4** There shall be in the pit:

a) a stopping device(s) accessible on opening the door(s) to the pit, and from the pit floor, in conformity with the requirements of 5.11.2.2;

b) a socket outlet (5.10.5.5.2) ;

c) means to switch the lift well lighting (5.2.9), accessible on opening the door(s) to the pit.

**5.2.7.5 Lifts with front mounted doors**

5.2.7.2.1.1 and 5.2.7.4.3 do not apply.

The safety area for works at the upper and the lower end of the travel path shall be obtained by a safety stopping of the vehicle in accordance with 5.3.4.4.

For positive drive lifts or lifts with a loop rope without counterweight, only the protection against a downwards movement is needed.

**5.2.8 Exclusive use of the well**

The well shall be exclusively used for the lift. It shall not contain cables or devices, etc., other than for the lift. The well may, however, contain heating equipment for the lift well excluding steam heating and high pressure water heating. However, any control and adjustment devices of the heating apparatus shall be located outside the well.

In the case of lifts according to 5.2.2.3, it is regarded as “well” in the case where enclosures:

a) are present: the area inside the enclosure;

b) are missing: the area being inside a horizontal distance of 1,50 m from movable components of the lift (see 5.2.2.3.2 d)).

**5.2.9 Lighting of the well**

If a compartment of the vehicle (for example the roof) is accessible for the maintenance operations, the well shall be provided with permanently installed electric lighting, giving an intensity of illumination of at least 50 lx, 1,00 m above the compartment and the pit floor, even when all doors are closed.

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This lighting shall comprise intermediate lamps and one lamp at lower than 0,50 m from the top and the bottom of the well.

If the well is not totally closed as detailed in 5.2.2.3, this lighting is not necessary if the electric lighting existing in the neighbourhood of the well is sufficient in order to satisfy the requirement above.

When a walkway is provided in the well according to 5.2.2.4.2.1 b):

a) the well shall be provided with permanently installed electric lighting, giving an intensity of illumination of at least 50 lx, at the walkway;

b) there shall be emergency lightings along the walkway so that the walkway and the access doors have a beacon lighting in case of absence of the main energy;

c) in case of blackout this lighting shall be sufficient for the complete evacuation of the site (maintenance and/or inspection personnel, trapped passengers).

For maintenance purposes the lift well lighting shall be a minimum of 50 lx.

#### 5.2.10 Emergency release

If no means to escape are provided for person trapped in the well, additional alarm initiation devices to the alarm system according to EN 81-28:2003 shall be installed at places where the risk of trapping exists.

#### 5.2.11 Access to the well through a landing door

If the access into the lift well is at least a landing door, the following devices shall be accessible from the landing when the door is open:

a) a switch for the lighting of the well (see 5.10.5.6.2);

b) a stopping device according to 5.11.2.2.1.

#### 5.2.12 Protection of the areas under the running track

If persons can gain access under the running tracks of the lift, a protection screen shall be provided in order to receive and to retain any piece or component ejected from the lift.

## 5.3 Machine, working areas and pulley spaces

### 5.3.1 General provisions

Machinery and pulleys shall be located in machinery and pulley spaces. These spaces and the associated working areas shall be accessible. Provisions shall be made to allow access to the spaces only to authorized persons (maintenance, inspection and rescue). The spaces and the associated working areas shall be suitably protected against environmental influences to be taken into consideration and provisions made for suitable areas for maintenance/inspection work and emergency operation (see Introduction - Principles).

### 5.3.2 Access

**5.3.2.1** The access way adjacent to any door/trap giving access to machinery and pulley spaces shall be:

a) capable of being properly lit by a permanent electric light fixture(s);

b) easy to use in complete safety in all circumstances without necessitating entry into private premises.


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**5.3.2.2** A safe access for persons to machinery and pulley spaces shall be provided. For preference this should be effected entirely by way of stairs. If it is not possible to install stairs, ladders satisfying the following requirements shall be used:

a) the access to the machinery and pulley spaces shall not be situated more than 4,00 m above the level accessible by stairs;

b) ladders shall be fastened to the access in such a way that they cannot be removed;

c) ladders exceeding 1,50 m in height shall, when in position for access, form an angle between 65° and 75° to the horizontal and shall not be liable to slip or turn over;

d) the clear width of the ladder shall be at least 0,35 m, the depth of the steps shall not be less than 25 mm and in the case of vertical ladders the distance between the steps and the wall behind the ladder shall not be less than 0,15 m. The steps shall be designed for a load of 1 500 N;

e) adjacent to the top end of the ladder there shall be at least one hand hold within easy reach;

f) around a ladder, within a horizontal distance of 1,50 m, the risk of falling by more than the height of the ladder shall be prevented.

### 5.3.3 Machinery in machine room

#### 5.3.3.1 General provisions

**5.3.3.1.1** When lift machines and their associated equipment are located in a machine room, it shall comprise solid walls, ceiling, floor and door and/or trap.

Machine rooms shall not be used for purposes other than lifts. They shall not contain ducts, cables or devices other than for the lift.

These rooms may, however, contain:

a) machines for service lifts or escalators;

b) equipment for air-conditioning or heating of these rooms, excluding steam heating and high pressure water heating;

c) fire detectors or extinguishers, with a high operating temperature, appropriate for the electrical equipment, stable over a period of time, and suitably protected against accidental impact.

**5.3.3.1.2** The traction sheave may be installed in the well, provided that:

a) examinations and the tests and the maintenance operations may be carried out from the machine room;

b) openings between the machine room and the well are as small as possible.

#### 5.3.3.2 Mechanical strength, floor surface

**5.3.3.2.1** Machine rooms shall be so constructed to withstand the loads and forces to which they are intended to be subjected.

They shall be in durable material not favouring the creation of dust.

**5.3.3.2.2** Room floors shall be of non-slip material, e.g. trowelled concrete or chequer plate.

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**5.3.3.3 Dimensions**

**5.3.3.3.1** The dimensions of machine rooms shall be sufficient to permit easy and safe working on equipment, especially the electrical equipment.

In particular there shall be provided at least a clear height of 2,00 m at working areas, and:

a) a clear horizontal area in front of the control panels and cabinets. This area is defined as follows:

   1) depth, measured from the external surface of the enclosures, at least 0,70 m;

   2) width, the greater of the following values: 0,50 m or the full width of the cabinet or panel;

b) a clear horizontal area of at least 0,50 m × 0,60 m for maintenance and inspection of moving parts at points where this is necessary and, if need be, manual emergency operation (5.9.5).

**5.3.3.3.2** The clear height for movement shall not be less than 1,80 m.

The access ways to the clear spaces mentioned in 5.3.3.3.1 shall have a width of at least 0,50 m. This value may be reduced to 0,40 m where there are no moving parts.

This clear height for movement is taken to the underside of the structural roof beams and measured from the floor of the access area.

**5.3.3.3.3** There shall be a clear vertical distance of at least 0,30 m above the rotating parts of the machine.

**5.3.3.3.4** When the machine room floor comprises a number of levels differing by more than 0,50 m, stairways or steps and guardrails shall be provided.

**5.3.3.3.5** When the floor of the machine rooms has any recesses greater than 0,50 m deep and less than 0,50 m wide, or any ducts, they shall be covered.

**5.3.3.4 Doors and trap doors**

**5.3.3.4.1** Access doors shall have a minimum width of 0,60 m and a minimum height of 1,80 m. They shall not open towards the inside of the room.

**5.3.3.4.2** Access trap doors for persons shall give a clear passage of at least 0,80 m x 0,80 m, and shall be counterbalanced.

All trap doors, when they are closed, shall be able to support two persons, each counting for 1 000 N on an area of 0,20 m × 0,20 m at any position, without permanent deformation.

Trap doors shall not open downwards, unless they are linked to retractable ladders. Hinges, if any, shall be of a type which cannot be unhooked.

When a trap door is in the open position, precautions shall be taken to prevent the fall of persons (e.g. a guardrail).

**5.3.3.4.3** Doors or trap doors shall be provided with a key operated lock, capable of being opened without a key from inside the room.

Trap doors used only for access of material may be locked from the inside only.

**5.3.3.5 Other openings**

The dimension of holes in the slab and room floor shall be reduced to a minimum for their purpose.


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With the aim of removing the danger of objects falling through openings situated above the well, including those for electric cables, ferrules shall be used, which project at least 50 mm above the slab or finished floor.

#### 5.3.3.6 Ventilation

The machine rooms shall be suitably ventilated (see N.3.3 for information). Should the well be ventilated through the machine room, this shall be taken into account. Stale air from other parts of the building shall not be extracted directly into the machine room. It shall be such that the motors, and equipment, as well as electric cables, etc., are protected as far as it is reasonably practicable from dust, harmful fumes and humidity.

#### 5.3.3.7 Lighting and socket outlets

The machine room shall be provided with permanently installed electric lighting with an intensity of at least 200 lx at floor level. The supply for this lighting shall be in conformity with 5.10.5.5.1.

A switch placed inside close to the access point(s), at an appropriate height, shall control lighting of the room.

At least one socket outlet (5.10.5.5.2) shall be provided.

#### 5.3.3.8 Handling of equipment

One or more metal supports or hooks with the indication of the safe working load (see 7.2.5.7), as appropriate, are provided in the machine room ceiling or on the beams, conveniently positioned to permit the hoisting of heavy equipment (see Introduction, 0.3, Principles).

### 5.3.4 Working areas and machinery inside the well

#### 5.3.4.1 General provisions

**5.3.4.1.1** Machinery supports and working areas inside the well shall be so constructed to withstand the loads and forces to which they are intended to be subjected.

**5.3.4.1.2** In the case of wells partially enclosed at the exterior of buildings the machinery shall be suitably protected against the environmental influences.

**5.3.4.1.3** The clear height for moving inside the well from one working area to another one shall not be less than 1,80 m.

#### 5.3.4.2 Dimensions of working areas inside the well

**5.3.4.2.1** The dimensions of working areas at the machinery inside the well shall be sufficient to permit easy and safe working on equipment.

In particular there shall be provided at least a clear height of 2,00 m at working areas, and:

a) a clear horizontal working area of at least 0,50 m × 0,60 m for maintenance and inspection of parts at points where this is necessary;

b) a clear horizontal space in front of the control panels and cabinets, defined as follows:

   1) depth, measured from the external surface of the enclosures, at least 0,70 m;

   2) width, the greater of the following values: 0,50 m or the full width of the cabinet or panel.

**5.3.4.2.2** There shall be a clear vertical distance of at least 0,30 m above unprotected rotating parts of the machine. If the distance is less than 0,30 m guarding shall be provided according to 5.6.7.1 a).

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NOTE See also 5.2.7.2.

**5.3.4.3 Working stations in the car or on the car roof**

**5.3.4.3.1** Where maintenance/inspection work on the machinery is to be carried out from inside the car or from the car roof and if any kind of uncontrolled or unexpected vehicle movement resulting from maintenance/inspection can be dangerous to persons, the following applies:

a) any dangerous movement of the vehicle shall be prevented by a mechanical device;

b) all movement of the vehicle shall be prevented by means of an electric safety device in conformity with 5.11.1.2 unless the mechanical device is in its inactive position;

c) when this device is in its active position, it shall be possible to carry out maintenance work and to leave the working area safely.

**5.3.4.3.2** The necessary devices for emergency operation and for dynamic tests (such as brake tests, traction tests, safety gear tests, buffer tests or tests of ascending vehicle overspeed protection means) shall be arranged so that they can be carried out from outside of the well in accordance with 5.3.6.

**5.3.4.3.3** If inspection doors and/or traps are located in the walls of the car, they shall:

a) have sufficient dimensions to carry out the required work through the door/trap;

b) be as small as possible to avoid falling into the well;

c) not open towards the outside of the car;

d) be provided with a key-operated lock, capable of being reclosed and relocked without a key;

e) be provided with an electrical safety device in conformity with 5.11.1.2, checking the locked position;

f) be imperforate and satisfy the same requirements for mechanical strength as the walls of the car.

**5.3.4.3.4** Where it is necessary to move the vehicle from the inside with open inspection door/trap the following applies:

a) an inspection control station according to 5.11.2.1.4 shall be available near the inspection door/trap;

b) the inspection control station in the car shall render inoperative the electric safety device according to 5.3.4.3.3 e);

c) the inspection control station in the car shall be accessible only to authorized persons and so arranged that it is not possible to use it to drive the vehicle when standing on the car roof, e.g. by placing it behind the inspection door/trap;

d) if the smaller dimension of the opening exceeds 0,20 m the clear horizontal distance between the outside edge of the opening in the car wall and equipment installed in the well in front of that opening shall be at least 0,30 m.

**5.3.4.3.5** If the car roof is not used for maintenance operation or rescue operation for the passengers transported, the access to the car roof shall not be permitted. This shall be clearly indicated by a suitable warning sign (see 7.2.6) and also in the instructions manual in conformity with 7.4.1 c).


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#### 5.3.4.4 Working areas in the pit and in the headroom of the well

**5.3.4.4.1** Where machinery and components are to be maintained or inspected from the pit or from the headroom and if this work requires movement of the vehicle, or is likely to result in uncontrolled or unexpected vehicle movement, the following applies:

a) a permanently installed device shall be provided to mechanically stop the vehicle with any load up to rated load and from any speed up to rated speed to create a free distance of at least 2,00 m between the floor of the working area and the most advanced parts of the vehicle, excluding those mentioned in 5.2.7.4.3.; the retardation of mechanical devices other than safety gears shall not exceed that produced by the buffers (5.7.4);

b) mechanical device shall be able to maintain the vehicle stopped;

c) mechanical device may be operated manually or automatically;

d) where it is necessary to move the vehicle from the pit or from the headroom, an inspection control station according to (5.11.2.1.4) shall be available for use in the pit and in the headroom respectively;

e) opening by the use of a key of any door providing access to the well shall be checked by an electric safety device according to 5.11.1.2 which prevents all further movement of the lift. Movement shall only be possible under the requirements given in g) below;

f) all movement of the vehicle shall be prevented by means of an electric safety device in conformity with 5.11.1.2 unless the mechanical device is in its inactive position;

g) when the mechanical device is in its active position as checked by means of an electric safety device in conformity with 5.11.1.2, electrically driven movement of the vehicle shall only be possible from the inspection control station(s);

h) return of the lift to normal service shall only be made by operation of an electrical reset device placed outside of the well and accessible to authorized persons only, e. g. inside a locked cabinet.

**5.3.4.4.2** When the vehicle is in the position according to 5.3.4.4.1 a), it shall be possible to leave the working area safely.

**5.3.4.4.3** The necessary devices for emergency operation and for dynamic tests (such as brake tests, traction tests, safety gear tests, buffer tests or tests of ascending vehicle overspeed protection means) shall be arranged so that they can be carried out from outside of the well in accordance with 5.3.6.

#### 5.3.4.5 Working areas on a platform in the well

**5.3.4.5.1** Where machinery is to be maintained or inspected from a platform, it shall be:

a) permanently installed, and

b) retractable if it is in the travel path of the vehicle or counterweight/balancing weight.

**5.3.4.5.2** Where machinery is to be maintained or inspected from a platform positioned into the travel path of the vehicle, the counterweight or the balancing weight:

a) the vehicle shall be stationary by using a mechanical device in conformity with 5.3.4.3.1, or

b) where the vehicle needs to be moved, the travel path of the vehicle shall be limited by movable stops in such a way that the vehicle is stopped:

   1) at least 2 m above the platform if the vehicle runs down towards the platform;

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2) below the platform in compliance with 5.2.7.2 if the vehicle runs up towards the platform.

**5.3.4.5.3** The platform shall be:

a) able to support at any position the mass of two persons, each counting for 1 000 N over an area of 0,20 m × 0,20 m without permanent deformation; if the platform is intended to be used for handling heavy equipment the dimensions shall be considered accordingly and the platform shall have a mechanical strength to withstand the loads and forces to which it is intended to be subjected (see 5.3.4.9);

b) provided with a balustrade in conformity with 5.5.13.3;

c) equipped with means ensuring that:

1) the step rise between the floor of the platform and the level of the access does not exceed 0,50 m;

2) it shall not be possible to pass a ball with a diameter of 0,15 m through any gap between the platform and the sill of the access door;

3) any gap measured horizontally between the fully open landing door panel and the platform edge does not exceed 0,15 m, unless additional provisions have been taken to prevent falling into the well.

**5.3.4.5.4** In addition to 5.3.4.5.3 any retractable platform shall be:

a) provided with an electric safety device in conformity with 5.11.1.2, checking the fully retracted position;

b) provided with means for putting it into or removing it from the working position. This operation shall be possible from the pit or by means located outside of the well and accessible only to authorized persons.

If the access to the platform is not through a landing door, the opening of the access door shall be impossible when the platform is not in the working position, or alternatively, means shall be provided to prevent persons from falling into the well.

**5.3.4.5.5** In the case of 5.3.4.5.2 b) movable stops shall be automatically operated when the platform is lowered. They shall be provided with:

a) buffers in conformity with 5.7.3 and 5.7.4;

b) an electric safety device in conformity with 5.11.1.2, which only allows vehicle movement if the stops are in their fully retracted position;

c) an electrical safety device in conformity with 5.11.1.2, which only allows vehicle movement with a lowered platform if the stops are in their fully extended position.

**5.3.4.5.6** Where it is necessary to move the vehicle from the platform, an inspection control station according to 5.11.2.1.4 shall be available for use on the platform.

When the movable stop(s) is(are) in its active position, electrically driven movement of the vehicle shall only be possible from the inspection control station(s).

**5.3.4.5.7** The necessary devices for emergency operation and dynamic tests (such as brake tests, traction tests, safety gear tests, buffer tests or tests of ascending vehicle overspeed protection means) shall be arranged so that they can be carried out from outside of the well in conformity with 5.3.6.

**5.3.4.6 Doors and traps**

**5.3.4.6.1** Working areas inside the well shall be accessible through doors in the well enclosure. Doors shall be either the landing doors or doors satisfying the following requirements. They shall:


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a) have a minimum width of 0,60 m and a minimum height of 1,80 m;

b) not open towards the inside of the well;

c) be provided with a key-operated lock, capable of being reclosed and relocked without a key;

d) be capable of being opened from inside the well without a key, even when locked;

e) be provided with an electrical safety device in conformity with 5.11.1.2, checking the closed position;

f) be imperforate, satisfy the same requirements for mechanical strength as the landing doors, and comply with the regulations relevant to the fire protection for the building concerned.

**5.3.4.6.2** Access to machinery inside of the well from a working area outside of the well shall:

a) have sufficient dimensions to carry out the required work through the door/trap;

b) be as small as possible to avoid falling into the well;

c) not open towards the inside of the well;

d) be provided with a key-operated lock, capable of being reclosed and relocked without a key;

e) be provided with an electrical safety device in conformity with 5.11.1.2, checking the closed position;

f) be imperforate, satisfy the same requirements for mechanical strength as the landing doors, and comply with the regulations relevant to the fire protection for the building concerned.

#### 5.3.4.7 Ventilation

The machinery spaces shall be suitably ventilated (see N.3.3 for information). The electric equipment of the machinery shall be protected as far as it is reasonably practicable from dust, harmful fumes and humidity.

#### 5.3.4.8 Lighting and socket outlets

The working areas and machinery spaces shall be provided with permanently installed electric lighting with an intensity of at least 200 lx at floor level. The supply for this lighting shall be in conformity with 5.10.5.5.1.

This lighting may be part of the lighting of the well.

A switch accessible only to authorized persons and placed close to the access point(s) to working area(s), at an appropriate height, shall control the lighting of the areas and spaces.

At least one socket outlet (5.10.5.5.2) shall be provided at an appropriate place for each working area.

#### 5.3.4.9 Handling of equipment

One or more metal supports or hooks with the indication of the safe working load (see 7.2.5.7), as appropriate, are provided in the machinery spaces, conveniently positioned to permit the hoisting of heavy equipment (see Introduction, 0.3 Principles).

### 5.3.5 Working areas and machinery outside of the well

#### 5.3.5.1 General provisions

Machinery spaces outside of the well and not located in a separate machine room shall be so constructed to withstand the loads and forces to which they are intended to be subjected.

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#### 5.3.5.2 Machinery cabinet

**5.3.5.2.1** The machinery of a lift shall be located inside a cabinet which shall not be used for purposes other than the lift. It shall not contain ducts, cables or devices other than for the lift.

**5.3.5.2.2** The machinery cabinet shall consist of imperforate walls, floor, roof and door(s). The only permissible openings are:

a) ventilation openings;

b) necessary openings for the functioning of the lift between the well and the machinery cabinet;

c) vent openings for escape of gases and smoke in the event of fire.

These openings when accessible to non-authorized persons shall comply with the following requirements:

— protection according to EN ISO 13857:2008, Table 5, against contact with danger zones, and

— degree of protection of at least IP2XD against contact with electrical equipment.

**5.3.5.2.3** The door(s) shall:

a) have sufficient dimensions to carry out the required work through the door;

b) not open towards the inside of the cabinet;

c) be provided with a key-operated lock, capable of being reclosed and relocked without a key.

#### 5.3.5.3 Working area

When the machinery is in the well and is intended to be maintained/inspected from outside of the well, deviating from 5.3.1, the working areas in accordance with 5.3.3.3.1 and 5.3.3.3.2 can be provided outside of the well. Access to this equipment shall only be possible by a door/trap in conformity with 5.3.4.6.2.

The working area in front of a machinery cabinet shall comply with the requirements according to 5.3.4.2.

#### 5.3.5.4 Ventilation

The machinery cabinet shall be suitably ventilated (see N.3.3 for information). It shall be such that the machinery is protected as far as it is reasonably practicable from dust, harmful fumes and humidity.

#### 5.3.5.5 Lighting and socket outlets

The inside of the machinery cabinet shall be provided with permanently installed electric lighting with an intensity of at least 200 lx at floor level. The supply for this lighting shall be in conformity with 5.10.5.5.1.

A switch placed inside close to the door(s), at an appropriate height, shall control lighting of the cabinet.

At least one socket outlet (5.10.5.5.2) shall be provided.

### 5.3.6 Devices for emergency and test operations

**5.3.6.1** In the case of 5.3.4.3, 5.3.4.4 and 5.3.4.5 the necessary devices for emergency and test operations shall be provided on a panel(s) suitable for carrying out from outside of the well all emergency operations and any necessary dynamic tests of the lift. The panel(s) shall be accessible to authorized persons only. This applies also to means for maintenance where maintenance procedure(s) require(s) moving the vehicle and the work cannot be carried out safely from the intended work areas provided inside the well.


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If the emergency and test devices are not protected inside a machinery cabinet, they shall be enclosed with a suitable cover, which:

a) does not open towards the inside of the well;

b) is provided with a key-operated lock, capable of being reclosed and relocked without a key.

**5.3.6.2** The panel(s) shall provide the following:

a) emergency operation devices according to 5.9.5, together with an intercom system in conformity with 5.11.2.3.2;

b) control equipment which enables dynamic tests to be carried out (5.3.4.3.2, 5.3.4.4.3, 5.3.4.5.7);

c) direct observation of the lift machine or display device(s), which give indication of:

   1) direction of movements of the vehicle;

   2) reaching of an unlocking zone, and

   3) speed of the vehicle.

**5.3.6.3** The devices on the panel(s) shall be lit by a permanently installed electric lighting with an intensity of at least 50 lx measured at the device.

A switch placed on or close to the panel shall control lighting of the panel(s).

The electrical supply for this lighting shall be in conformity with 5.10.5.5.1.

**5.3.6.4** The panel(s) for emergency and test operations shall be installed only where a working area in accordance with 5.3.3 is available.

### 5.3.7 Construction and equipment of pulley spaces

#### 5.3.7.1 Pulley rooms

##### 5.3.7.1.1 General

Pulleys outside of the well shall be located in a pulley room.

##### 5.3.7.1.2 Mechanical strength, floor surface

**5.3.7.1.2.1** The pulley rooms shall be so constructed to withstand the loads and forces to which they will normally be subjected.

They shall be in durable material, not favouring the creation of dust.

**5.3.7.1.2.2** The floors of the pulley rooms shall be of non-slip material, e.g. troweled concrete or chequer plate.

##### 5.3.7.1.3 Dimensions

**5.3.7.1.3.1** Pulley room dimensions shall be sufficient to provide easy and safe access for maintenance personnel to all the equipment.

The requirements of 5.3.3.3.1 b) and 5.3.3.3.2, sentence two and three, are applicable.

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**5.3.7.1.3.2** The height under the ceiling shall be at least 1,50 m.

**5.3.7.1.3.3** There shall be a clear space of at least 0,30 m high above the pulleys.

**5.3.7.1.3.4** If there are control panels and cabinets in the pulley room the provisions of 5.3.3.3.1 and 5.3.3.3.2 apply to this room.

**5.3.7.1.4 Doors and trap doors**

**5.3.7.1.4.1** Access doors shall have a minimum width of 0,60 m and minimum height of 1,40 m. They shall not open towards the inside of the room.

**5.3.7.1.4.2** Access trap doors for persons shall give a clear passage of at least 0,80 m × 0,80 m and shall be counterbalanced.

All trap doors, when they are closed, shall be able to support two persons, each counting for 1 000 N on an area of 0,20 m × 0,20 m at any position, without permanent deformation.

Trap doors shall not open downwards, unless they are linked to retractable ladders. Hinges, if any, shall be of a type which cannot be unhooked.

When a trap door is in the open position, precautions shall be taken to prevent the fall of persons (e.g. a guardrail).

**5.3.7.1.4.3** Doors or trap doors shall be provided with a key operated lock, capable of being opened without a key from inside the room.

**5.3.7.1.5 Other openings**

The dimensions of holes in the slab and pulley room floor shall be reduced to a minimum for their purpose.

With the aim of removing the danger of objects falling through openings situated over the well, including those for electric cables, ferrules shall be used which project at least 50 mm above the slab or finished floor.

**5.3.7.1.6 Stopping device**

A stopping device, in conformity with 5.11.2.2 and 7.2.5.6 shall be installed in the pulley room, close to the point(s) of access.

**5.3.7.1.7 Temperature**

If there is a risk of frost or condensation in the pulley rooms, precautions shall be taken to protect the equipment.

If the pulley rooms also contain electrical equipment, the ambient temperature shall be similar to that of the machine room.

**5.3.7.1.8 Lighting and socket outlets**

The pulley room shall be provided with permanently installed electric lighting with an intensity of at least 100 lx at the pulley(s). The supply for this lighting shall be in conformity with 5.10.5.5.1.

A switch, placed inside, close to the access point, at an appropriate height, shall control the lighting of the room.

At least one socket outlet in conformity with 5.10.5.5.2 shall be provided.


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If there are control panels and cabinets in the pulley room, the provisions of 5.3.3.7 apply.

#### 5.3.7.2 Pulleys in the well

Diverter pulleys may be installed in the headroom of the well provided that they are located outside the projection of the car or vehicle and that examinations and tests and maintenance operations can be carried out in complete safety from the car roof, from inside the car (5.3.4.3), from a platform (5.3.4.5) or from outside of the well.

However, a diverter pulley, with single or double wrap, may be installed above the car roof for diverting towards the counterweight, provided that its shaft can be reached in complete safety from the car roof or from a platform (5.3.4.5).

## 5.4 Landing doors

### 5.4.1 General provisions

The openings in the well giving access to the well shall be provided with imperforate landing doors.

When closed, the clearance between panels, or between panels and uprights, lintels or sills, shall be as small as possible.

This condition is considered to be fulfilled when the operational clearances do not exceed 6 mm. This value, due to wear, may reach 10 mm. These clearances are measured at the back of recesses, if present.

### 5.4.2 Strength of doors and their frames

#### 5.4.2.1 General provisions

Landing doors and their frames shall be constructed in such a way that they will not become deformed over the course of time.

#### 5.4.2.2 Behaviour under fire conditions

Landing doors shall comply with the regulations relevant to the fire protection for the building concerned. EN 81-58:2003 shall be applied for the testing and certification of such doors.

#### 5.4.2.3 Mechanical strength

**5.4.2.3.1** Complete landing doors, with their locks, shall have a mechanical strength such that in the locked position and when a force of 300 N, being evenly distributed over an area of 5 $cm^2$ in round or square section, is applied at right angles to the panel/frame at any point on either face they shall resist without:

a) permanent deformation (e.g. less than 1 mm);

b) elastic deformation greater than 15 mm.

During and after such a test the safety function of the door shall not be affected.

**5.4.2.3.2** Under the application of a manual force (without a tool) of 150 N in the direction of the opening of the leading landing door panel(s) of horizontally sliding doors and folding doors, at the most unfavourable point, the clearances defined in 5.4.1 may exceed 6 mm, but they shall not exceed:

a) 30 mm for side opening doors;

b) 45 mm in total for centre opening doors.

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**5.4.2.3.3** Door panels made of glass shall be fixed in such a way that forces demanded by this standard which may be applied are transferred without damaging the fixing of the glass.

Doors, with glass of dimensions greater than stated in 5.4.6.2, shall use laminated glass and, additionally withstand the pendulum shock tests, described in Annex J.

After the tests the safety function of the door shall not be affected.

**5.4.2.3.4** The fixing of the glass in doors shall ensure that the glass cannot slip out of the fixings, even when sinking.

**5.4.2.3.5** The glass panels shall have markings giving the following information:

a) name of the supplier and trade mark;

b) type of glass;

c) thickness (e.g. 8/8/0,76 mm).

**5.4.2.3.6** To avoid dragging of children hands, automatic power operated horizontally sliding doors made of glass of dimensions greater than stated in 5.4.6.2 shall be provided with means to minimize the risk, such as:

a) reducing the coefficient of friction between hands and glass;

b) making the glass opaque up to a height of 1,10 m;

c) sensing the presence of fingers, or

d) other equivalent methods.

### 5.4.3 Height and width of entrances

#### 5.4.3.1 Height

Landing doors shall be such that a minimum clear height of the entrance is 2,00 m.

#### 5.4.3.2 Width

The clear entrance of the landing doors shall not extend more than 50 mm in width beyond the clear car entrance on both sides.

### 5.4.4 Sills, guides, door suspension

#### 5.4.4.1 Sills

Every landing entrance shall incorporate a sill of sufficient strength to withstand the passage of loads being introduced into the car.

It is recommended that a slight counter slope be provided in front of each landing sill to avoid water from washing, sprinkling, etc., draining into the well.

#### 5.4.4.2 Guides

**5.4.4.2.1** Landing doors shall be designed to prevent, during normal operation, derailment, mechanical jamming, or displacement at the extremities of their travel.


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Where the guides may become ineffective due to wear, corrosion or fire, emergency guidance shall be provided to maintain the landing doors in their position.

**5.4.4.2.2** Horizontally sliding landing doors shall be guided top and bottom.

**5.4.4.2.3** Vertically sliding landing doors shall be guided at both sides.

**5.4.4.3 Suspension of vertically sliding doors**

**5.4.4.3.1** Panels of vertically sliding landing doors shall be fixed to two independent suspension elements.

**5.4.4.3.2** Suspension ropes, chains, belts shall be designed with a safety factor of at least 8.

**5.4.4.3.3** The pitch diameter of suspension rope pulleys shall be at least 25 times the rope diameter.

**5.4.4.3.4** Suspension ropes and chains shall be guarded against leaving the pulley grooves or sprockets.

**5.4.5 Protection in relation to door operation**

**5.4.5.1 General**

The doors and their surrounds shall be designed in such a way as to minimize risk of damage or injury due to jamming of a part of the person, clothing or other object.

To avoid the risk of shearing during operation, the exterior face of automatic power operated sliding doors shall not have recesses or projections exceeding 3 mm. Edges of these shall be chamfered in the opening direction of movement.

Exception to these requirements is made for the access to the unlocking triangle defined in Annex B.

The side of the landing doors facing to the car shall have a smooth, continuous surface which has no recesses or projections exceeding 3 mm, for all parts likely to be exposed when the car doors open and for all the possible stopping positions of the car in the unlocking zone.

**5.4.5.2 Power operated doors**

**5.4.5.2.1 General provision**

Power operated doors shall be designed to reduce to a minimum the harmful consequences of a person being struck by a door panel.

To this effect, the following requirements shall be met:

**5.4.5.2.2 Horizontally sliding doors**

**5.4.5.2.2.1 Automatic power operated doors**

a) The effort needed to prevent the door closing shall not exceed 150 N. This measurement shall not be made in the first third of the travel of the door.

b) The kinetic energy of the landing door and the mechanical elements which are rigidly connected to it, calculated or measured at the average closing speed shall not exceed 10 J.

   The average closing speed of a sliding door is calculated over its whole travel, less:

   1) 25 mm at each end of the travel in the case of centrally closing doors;

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2) 50 mm at each end of the travel in the case of side closing doors.

NOTE Measured using, for example, a device consisting of a graduated piston acting on a spring with a spring constant of 25 N/mm, and fitted with an easy sliding ring allowing the extreme point of movement at the moment of impact to be measured. An easy calculation allows the graduation corresponding to the limits fixed to be determined.

c) A protective device shall automatically initiate re-opening of the door in the event of a person being struck, or about to be struck, by the door in crossing the entrance during the closing movement.

This protective device may be that for the car door (see 5.5.7.2.2.1 c)).

The effect of the device may be neutralized during the last 50 mm of travel of each leading door panel.

In the case of a system, which makes the protective device inoperative after a predetermined time, to counteract persistent obstructions when closing the door, the kinetic energy defined in 5.4.5.2.2.1 b) shall not exceed 4 J during movement of the door with the protective device inoperative.

d) In the case of coupled car and landing doors operated simultaneously, the requirements of 5.4.5.2.2.1 a) and b) are valid for the joined door mechanism.

e) The effort needed to prevent a folding door from opening shall not exceed 150 N. This measurement shall be made with the door collapsed such that the adjacent outer edges of the folded panels or equivalent, e.g. door frame, are at a distance of 100 mm.

#### 5.4.5.2.2.2 Non-automatic power operated doors

When the closing of the door is carried out under the continuous control and supervision of the user, by continuous pressure on a button or similar (hold-to-run control), the average closing speed of the fastest panel shall be limited to 0,30 m/s, when the kinetic energy, calculated or measured as stated in 5.4.5.2.2.1 b), exceeds 10 J.

#### 5.4.5.2.3 Vertically sliding doors

This type of sliding door shall only be used for goods passenger lifts.

Power closing shall only be used if the following four conditions are fulfilled at the same time:

a) the closing is carried out under the continuous control and supervision of the users;

b) the average closing speed of the panels is limited to 0,30 m/s;

c) the car door is of construction as provided for in 5.5.6.1.1;

d) the car door is at least two-thirds closed before the landing door begins to close.

#### 5.4.5.2.4 Other types of doors

When using other types of doors, e.g. swing doors, with power operation, where there is a risk when opening or closing, of striking persons, precautions similar to those laid down for power operated sliding doors shall be taken.


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