

Safety rules for the construction and installation of lifts —

Part 1: Electric lifts

ICS 91.140.90

National foreword

This British Standard is the UK implementation of EN 81-1:1998+A3:2009, incorporating corrigendum September 1999. It supersedes BS EN 81-1:1998, which will be withdrawn on 12 May 2011, and BS 5655-1:1986, which has been declared obsolescent.

The start and finish of text introduced or altered by amendment is indicated in the text by tags. Tags indicating changes to CEN text carry the number of the CEN amendment. For example, text altered by CEN amendment A1 is indicated by **A1** **A1**.

The start and finish of text introduced or altered by corrigendum is indicated in the text by tags. Text altered by CEN corrigendum September 1999 is indicated in the text by **AC1** **AC1**.

The UK participation in its preparation was entrusted by Technical Committee, MHE/4, Lifts, hoists and escalators.

A list of organizations represented on this committee can be obtained on request to its Secretary.

EN 81-1:1998+A3:2009 is a “harmonized” European Standard and fully takes into account the requirements of the Lift Directive (95/16/EC). EN 81-1:1998+A3:2009 and EN 81-1:1998 will have a transition period of eighteen months in which they will co-exist. It is intended that this period will allow manufacturers time to develop new products to meet the requirements contained in the A3 amendment. Based on this transition period, BS EN 81-1:1998 will be withdrawn in May, 2011.

Following the implementation of the Lift Directive on 1 July 1999, BS 5655-1:1986, together with BS 5655-11:1989, will apply only for modernization of existing lift installations. For all new installations this Standard will apply.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Amendments/corrigenda issued since publication

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English Version

Safety rules for the construction and installation of lifts - Part 1: Electric lifts

Règles de sécurité pour la construction et l'installation des
ascenseurs - Partie 1: Ascenseurs électriques

Sicherheitsregeln für die Konstruktion und den Einbau von
Aufzügen - Teil 1: Elektrisch betriebene Personen- und
Lastenaufzüge

This European Standard was approved by CEN on 21 February 1998 and includes Corrigendum 1 issued by CEN on 22 September 1999, Amendment 1 approved by CEN on 13 May 2005, Amendment 2 approved by CEN on 22 April 2004 and Amendment 3 approved by CEN on 13 August 2009.

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Foreword

This document (EN 81-1:1998+A3:2009) 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 June 2010, and conflicting national standards shall be withdrawn at the latest by June 2011.

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 European Standard was approved by CEN on 21 February 1998 and includes Corrigendum 1 issued by CEN on 22 September 1999, Amendment 1 approved by CEN on 13 May 2005, Amendment 2 approved by CEN on 22 April 2004 and Amendment 3 approved by CEN on 13 August 2009.

This document will supersede A3 EN 81-1:1998. A3

The start and finish of text introduced or altered by amendment is indicated in the text by tags A1 A1, A2 A2 and A3 A3.

The modifications of the related CEN Corrigendum have been implemented at the appropriate places in the text and are indicated by the tags AC1 AC1.

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

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

This is the third edition of the standard. It is an amendment of the 1985 edition and shall be given the status of a harmonised standard. The amendment is mainly based on the following points:

- elimination of national deviations;
- incorporation of essential health and safety requirements from the relevant EU Directives;
- elimination of obvious errors;
- incorporation of proposals resulting from interpretation requests dealing with the improvement relative to the progress in technology;
- improvement of the references to other standards according to the progress in that field.

After the CEN Enquiry on prEN81-1:1994 the EU Directive on Lifts (95/16/EC) was adopted. The requirements resulting from the essential health and safety requirements of this Directive being not taken into consideration in the draft have been summarised in the Addendum prA1:1996 to prEN81-1:1994 and submitted to the members of CEN/TC 10 for approval. Having received the approval this Addendum has been incorporated into this standard taking into account the comments received from TC members.

This standard does not correspond in all points to the present internal rules of CEN regarding the format of safety standards. However, the format of this standard has been accepted by the interested parties and is therefore regarded as the better way of implementation of the essential health and safety requirements than a formalistic re-draft. This is mainly because of the coming into force of the EU Directive 95/16/EC on 97-07-01.

With the next revision of the standard, being already intended, these shortcomings will be removed.

 Amendment 3 is needed on one hand because of the revision of the machinery directive, amendment of the lifts directive, and on the other hand because of improvements in the state of the art.

New ESR's in the revised machinery directive give new requirements for the fixation of protective guards. The amendment is addressing these new requirements.

Furthermore the borderline between the scope of the machinery directive and the lifts directive has changed. As a result of this the scope of EN 81-1 (and EN 81-2) is revised by means of this amendment.

Additionally this amendment is giving more severe requirements for (1) measures against the risk of stumbling during loading and unloading, and for (2) measures against the risks due to uncontrolled movements. These requirements are not linked to the revision of the machinery directive, but are a result of improved state of the art. By means of this amendment, an improved conformity to the relevant ESR's in the Lifts Directive and Machinery Directive is achieved. 

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, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

0.1 General

0.1.1 The object of this standard is to define safety rules related to passenger- and goods/passenger-lifts with a view to safeguarding persons and objects against the risk of accidents associated with the user-, maintenance- and emergency operation of lifts¹⁾

0.1.2 A study has been made of the various aspects of incidents possible with lifts in the following areas:

0.1.2.1 Risks possible due to:

- a) shearing;
- b) crushing;
- c) falling;
- d) impact;
- e) trapping;
- f) fire;
- g) electric shock;
- h) failure of material due to:
 - 1) mechanical damage;
 - 2) wear;
 - 3) corrosion.

0.1.2.2 Persons to be safeguarded:

- a) users;
- b) maintenance and inspection personnel;
- c) persons outside the lift well, the machine room and pulley room (if any).

0.1.2.3 Objects to be safeguarded:

- a) loads in car;

1) Within CEN/TC 10 an interpretation committee has been established to answer questions about the spirit in which the experts have drafted the various clauses of this standard. The issued interpretations are available from National Standards Bodies.

- b) components of the lift installation;
- c) building in which the lift is installed.

0.2 Principles

In drawing up this standard the following have been used.

0.2.1 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.

0.2.2 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.

0.2.3 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.

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

0.2.5 Negotiations have been made between the customer and the supplier about:

- a) the intended use of the lift;
- b) environmental conditions;
- c) civil engineering problems;
- d) other aspects related to the place of installation.



0.2.6 Risk analysis, terminology and technical solutions have been considered taking into account the methods of the EN 61508 series of standards. This led to a necessary classification of safety functions applied to PESSRAL.

0.3 Assumptions

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

Rules have been drawn up accordingly.

0.3.1 Components are:

- a) designed in accordance with usual engineering practice and calculation codes, taking into account all failure modes;
- b) of sound mechanical and electrical construction;
- c) made of materials with adequate strength and of suitable quality;
- d) be free of defects.

Harmful materials such as asbestos are not used.

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

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

0.3.4 By design of the load bearing elements, a safe operation of the lift is assured for loads ranging from 0 % to 100 % of the rated load.



0.3.5 The requirements of this European Standard regarding electrical safety devices are such that the possibility of a failure of an electric safety device (see 14.1.2.1.1 b)) complying with all the requirements of this European Standard need not to be taken into consideration.

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

0.3.7 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.

0.3.8 If in the course of maintenance work a safety device, normally not accessible to the users, is deliberately neutralised, safe operation of the lift is no longer assured, 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.

0.3.9 For horizontal forces, the following have been used:

- a) static force: 300 N;
- b) force resulting from impact: 1000 N;

reflecting the values that one person can exert.

0.3.10 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:

- a) breakage of the suspension;
- b) uncontrolled slipping of the ropes on the traction sheave;

- c) breakage and slackening of all linkage by auxiliary ropes, chains and belts;
- d) 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;
- e) failure of a component associated with the main drive elements and the traction sheave.

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

0.3.12 When the speed of the car 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.

0.3.13 The organisation within the building, where the lift is installed, is such that it can respond effectively to emergency calls without undue delay (see **0.2.5**).

0.3.14 Means of access are provided for the hoisting of heavy equipment (see **0.2.5**).

0.3.15  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 machinery space(s) is assumed to be maintained between + 5 °C and + 40 °C. 



0.3.16 Access ways to the working areas are adequately lit (see 0.2.5).

0.3.17 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 0.2.5).

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



0.3.19 The fixing system of guards, used specifically to provide protection against mechanical, electrical or any other hazards by means of a physical barrier, which have to be removed during regular maintenance and inspection, remains attached to the guard or to the equipment when the guard is removed. 

1 Scope

1.1 This standard specifies the safety rules for the construction and installation of permanently installed new electric lifts, with traction or positive drive, serving defined landing levels, having a car designed for the transportation of persons or persons and goods, suspended by ropes or chains and moving between guide rails inclined not more than 15° to the vertical.

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

1.3 This standard does not cover:

- a) lifts with drives other than those stated in 1.1;
- b) installation of electric lifts in existing buildings²⁾ 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) installations where the inclination of the guide rails to the vertical exceeds 15°;
- f) safety during transport, installation, repairs, and dismantling of lifts;



- g) lifts with rated speed ≤ 0.15 m/s.

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

Noise and vibrations are not dealt with in this standard because these are not relevant to the safe use of the lift.

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

2 Normative references

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

CEN/CENELEC standards

EN 294:1992, Safety of machinery - Safety distances to prevent danger zones being reached by the upper limbs.

EN 1050, Safety of machinery - Principles for risk assessment.

EN 10025, Hot rolled products of non alloy structural steels -Technical delivery conditions.

EN 50214, Flexible cables for lifts.

EN 60068-2-6, Environmental testing - Part 2: Tests - Test Fc: Vibration (sinusoidal).

EN 60068-2-27, Basic environmental testing procedures - Part 2: Tests - Test Ea and guidance: Shock.

EN 60068-2-29, Basic environmental testing procedures - Part 2: Tests - Test Eb and guidance: Bump.

2) Existing building is a building which is used or was already used before the order for the lift was placed. A building whose internal structure is completely renewed is considered as a new building.

EN 60249-2-2, Base materials for printed circuits - Part 2: Specifications - Specification N° 2: Phenolic cellulose paper copper-clad laminated sheet, economic quality.

EN 60249-2-3, Base materials for printed circuits - Part 2: Specifications - Specification N° 3: Epoxyde cellulose paper copper-clad laminated sheet of defined flammability (vertical burning test).

EN 60742, Isolating transformers and safety isolating transformers – Requirements.

EN 60947-4-1, Low-voltage switchgear and controlgear - Part 4: Contactors and motor-starters - Section 1: Electromechanical contactors and motor-starters.

EN 60947-5-1, Low-voltage switchgear and controlgear - Part 5: Control circuit devices and switching elements - Section 1: Electromechanical control circuit devices.

EN 60950, Safety of information technology equipment, including electrical business equipment.

EN 62326-1, Printed boards – Part 1: Generic specification.

EN 12015 1998, Electromagnetic compatibility - Product family standard for lifts, escalators and passenger conveyors – Emission.

EN 12016 1998, Electromagnetic compatibility - Product family standard for lifts, escalators and passenger conveyors – Immunity.

prEN 81-8 1997, Fire resistance tests of lift landing doors - Method of test and evaluation.

[A1] EN 61508-1:2001, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 1: General requirements (IEC 61508-1:1998 + Corrigendum 1999).*

EN 61508-2:2001, *Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems (IEC 61508-2:2000).*

EN 61508-3:2001, *Functional safety of electrical/electronic/programmable electronic safety related systems - Part 3: Software requirements (IEC 61508-3:1998 + Corrigendum 1999).*

EN 61508-4:2001, *Functional safety of electrical/electronic/programmable electronic safety related systems - Part 4: Definitions and abbreviations (IEC 61508-4:1998 + Corrigendum 1999).*

EN 61508-5:2001, *Functional safety of electrical/electronic/programmable electronic safety related systems - Part 5: Examples of methods for the determination of safety integrity levels (IEC 61508-5:1998 + Corrigendum 1999).*

EN 61508-7:2001, *Functional safety of electrical/electronic/programmable electronic safety related systems – Part 7: Overview of techniques and measures (IEC 61508-7:2000).* **[A1]**

IEC standards

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

IEC 60747-5, Semiconductor devices – Discrete devices and integrated circuits – Part 5: Optoelectronic devices.

CENELEC Harmonization Documents

HD 21.1 S3, Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V - Part 1: General requirements.

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.

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.

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

HD 22.4 S3, Rubber insulated cables of rated voltages up to and including 450/750 V - 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.

HD 323.2.14 S2, Basic environmental testing procedures - Part 2: Tests - Test N: Change of temperature.

HD 360 S2, Circular rubber insulated lift cables for normal use.

HD 384.4.41 S2, Electrical installations of buildings - Part 4: Protection for safety - Chapter 41: Protection against electric shock.

HD 384.5.54 S1, Electrical installations of buildings - Part 5: Selection and erection of electrical equipment - Chapter 54: Earthing arrangements and protective conductors.

HD 384.6.61 S1, Electrical installations of buildings - Part 6: Verification - Chapter 61: Initial verification.

ISO Standards

ISO 7465:1997, Passenger lifts and service lifts – Guide rails for lifts and counterweights – T type applies.

3 Terms and definitions

For the purposes of this standard, the following definitions apply:

apron (garde-pieds) (Schürze)

smooth vertical part extending downwards from the sill of the landing or car entrance

available car area (surface utile de la cabine) (Nutzfläche des Fahrkorbes)

area of the car measured at a height of 1 m above floor level, disregarding handrails, which is available for passengers or goods during operation of the lift

balancing weight (masse d'équilibrage) (Ausgleichgewicht)

mass which saves energy by balancing all or part of the mass of the car

buffer (amortisseur) (Puffer)

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

car (cabine) (Fahrkorb)

a part of the lift which carries the passengers and/or other loads

counterweight (contrepoids) (Gegengewicht)

mass which ensures traction

Ⓐ drive control system (système de commande de l'entraînement) (Antriebssteuerung)

system controlling and monitoring the running of the lift machine Ⓐ

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

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

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

headroom (partie supérieure de la gaine) (Schachtkopf)
part of the well between the highest landing served by the car and the ceiling of the well

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

instantaneous safety gear with buffered effect (parachute à prise instantanée avec effet amorti) (Sperrfangvorrichtung mit Dämpfung)
a safety gear in which the full gripping action on the guide rails is almost immediate, but the reaction on the car, counterweight or balancing weight is limited by presence of an intermediate buffering system

laminated glass (verre feuilleté) (Verbundsicherheitsglas VSG)
an assembly of 2 or more glass layers, each of which is bonded together using a plastic film

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

A3 levelling accuracy (précision du maintien au niveau) (Nachregulierungsgenauigkeit)
vertical distance between car sill and landing sill during loading or unloading of the car ^{A3}

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

A2 machinery (machinerie) (Triebwerk und Steuerung)
equipment traditionally placed in the machine room: control cabinet(s) and drive system, lift machine, main switch(es), and means for emergency operations ^{A2}

A2 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 ^{A2}

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

minimum breaking load of a rope (charge de rupture minimale d'un câble) (Mindestbruchkraft eines Seiles)
the 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

overspeed governor (limiteur de vitesse) (Geschwindigkeitsbegrenzer)
a 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) 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.

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

pit (cuvette) (Schachtgrube)
the part of the well situated below the lowest landing served by the car

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

A1) 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. **A1**

progressive safety gear (parachute à prise amortie) (Bremsfangvorrichtung)
a 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 car, counterweight or balancing weight to a permissible value

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

A2) pulley space (emplacement de poulies) (Aufstellungsort von Seilrollen)
space(s) inside or outside of the well where pulleys are placed **A2**

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

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

re-levelling (isonivelage) (Nachstellen)
an 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)

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

A1) safety integrity level (SIL) (niveau d'intégrité de sécurité) (Sicherheits-Integritätslevel)
discrete level for specifying the safety integrity requirements of the safety functions to be allocated to the PESSRAL

NOTE In this European Standard SIL 1 is representing the lowest level and SIL 3 the highest. **A1**

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

sling (étrier) (Rahmen)

the metal framework carrying the car, counterweight or balancing weight, connected to the means of suspension. This sling can be integral with the car enclosure

A3 stopping accuracy (précision d'arrêt) (Anhaltegenauigkeit)

vertical distance between car sill and landing sill at the moment when a car is stopped by the control system at its destination floor and the doors reach their fully open position **A3**

A1 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. **A1**

traction drive lift (ascenseur à adhérence) (Treibscheiben-Aufzug)

a lift whose lifting ropes are driven by friction in the grooves of the driving sheave of the machine

travelling cable (câble pendentif) (Hängekabel)

flexible cable between the car and a fixed point

A3 unintended car movement (mouvement incontrôlé de la cabine) (unbeabsichtigte Bewegung des Fahrkorbs)

non-commanded movement of the car with doors open within the door zone away from the landing, excluding movements resulting from loading/unloading operation **A3**

unlocking zone (zone de déverrouillage) (Entriegelungszone)

a zone, extending above and below the stopping level, in which the car floor must be to enable the corresponding landing door to be unlocked

user (usager) (Benutzer)

person making use of the services of a lift installation

well (gaine) (Schacht)

the space in which the car, the counterweight or the balancing weight travels. This space is usually bounded by the bottom of the pit, the walls and the ceiling of the well

4 Units and symbols

4.1 Units

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

4.2 Symbols

Symbols are explained relevant to the formulae used.

5 Lift well

5.1 General provisions

5.1.1 The requirements of this clause relate to wells containing one or more lift cars.

5.1.2 The counterweight or the balancing weight of a lift shall be in the same well as the car.

5.2 Well enclosure

5.2.1 A lift shall be separated from the surroundings by:

- a) walls, floor and ceiling, or
- b) sufficient space.

5.2.1.1 Totally enclosed well

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 **5.6**.

5.2.1.2 Partially enclosed well

Where the well is not required to contribute against the spread of fire, e.g. observation lifts in connection with galleries or atriums, tower buildings, etc., the well does not need to be totally enclosed, provided:

- a) the height of the enclosure at places normally accessible to persons shall be sufficient to prevent such persons:
 - being endangered by moving parts of the lift, and
 - interfering with the safe operation of the lift by reaching lift equipment within the well either directly or with hand-held objects.

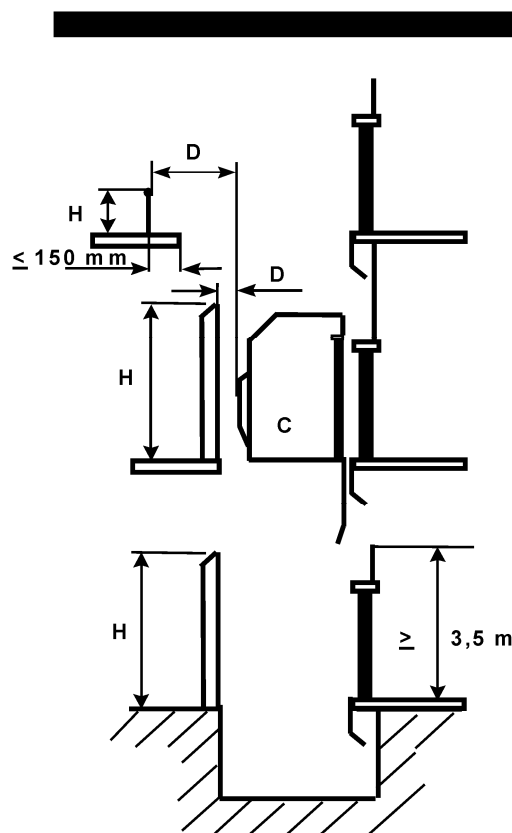
The height is assumed to be sufficient if it is in conformity with figure 1 and 2, that means:

- 1) minimum 3,50 m at a landing door side;
- 2) 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 2,0 m;

- b) the enclosure shall be imperforate;
- c) the enclosure shall be located within 0,15 m maximum of the edges of floors, stairs or platforms (see **figure 1**);
- d) provisions shall be taken to prevent the interference with the operation of the lift by other equipment (see **5.8 b**) and **AC1** 16.3.1 c) **AC1**);
- e) special precautions shall be taken for lifts exposed to weather (see **0.3.3**), e.g. wall climbing lifts installed against the exterior walls of a building.

NOTE Installation of lifts with partially enclosed well should only occur after full consideration of the environmental-/ location conditions.



- C car
- H height of the enclosure
- D distance to moving parts of the lift (see figure 2)

Figure 1 — Partially enclosed well

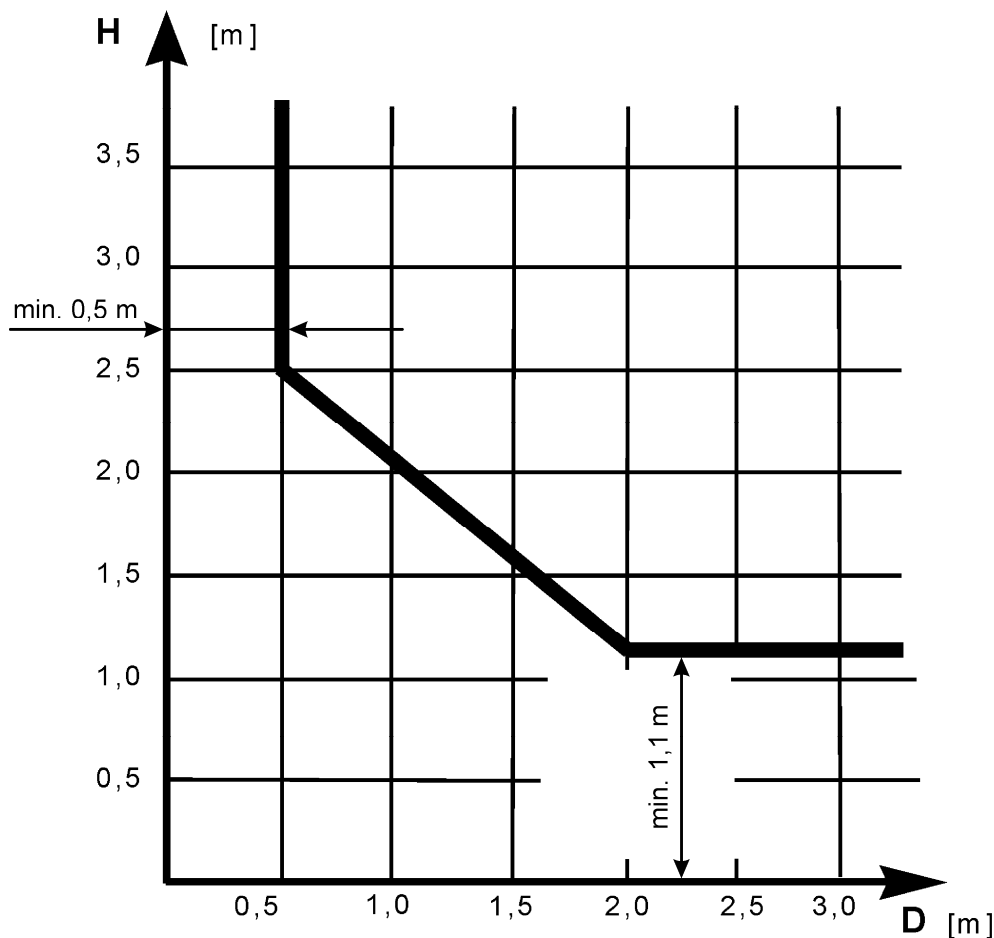


Figure 2 — Partially enclosed well – Distances

5.2.2 Inspection and emergency doors - Inspection traps

5.2.2.1 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.

5.2.2.1.1 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.

5.2.2.1.2 When the distance between consecutive landing doorsills exceeds 11 m, intermediate emergency doors shall be provided, such that the distance between sills is not more than 11 m. This requirement is not called for in the case of adjacent cars, each fitted with an emergency door provision for which is made in **8.12.3**.

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

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

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

5.2.2.2.2 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 **14.1.2** shall be employed.

An electric safety device is not required in case of access door(s) to the pit (**5.7.3.2**) provided the door(s) does not give access to a hazardous zone. This is regarded to be the case if the free vertical distance between the lowest parts of car, counterweight or balancing weight including guide shoes, apron, etc. during normal operation and the bottom of the pit is at least 2 m.

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

5.2.2.3 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.

5.2.3 Ventilation of the well

The well shall be suitably ventilated. It shall not be used to provide ventilation of rooms other than those belonging to the lift.

NOTE 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.

5.3 Walls, floor and ceiling of the well

The structure of the well shall conform to National Building Regulations and be able to support at least the loads which may be applied by the machine, by the guide rails at the moment of safety gear operation, in the case of eccentric load in the car, by the action of the buffers, by those which may be applied by the anti-rebound device, by loading and unloading the car, etc..

5.3.1 Strength of the walls

5.3.1.1 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 cm² 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.

AC1 See also 5.4. **AC1**

5.3.1.2 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 **5.2.1.2**.

5.3.2 Strength of the pit floor

5.3.2.1 The floor of the pit shall be able to support beneath each guide rail except hanging guide rails:

force in newtons, due to the mass in kilograms of the guide rails plus the reaction in newtons at the moment of operation of the safety gear (see **G.2.3** and **G.2.4**).

5.3.2.2 The floor of the pit shall be able to support beneath the car buffer supports 4 times the static load being imposed by the mass of the fully loaded car:

$$4 \cdot g_n \cdot (P + Q)$$

where:

P = masses of the empty car and components supported by the car, i.e. part of the travelling cable, compensating ropes/chains (if any), etc. in kilograms;

Q = rated load (mass) in kilograms;

g_n = standard acceleration of free fall, [9,81 (m/s²)];

5.3.2.3 The floor of the pit shall be able to support beneath the counterweight buffer supports, or the balancing weight travelling area, 4 times the static load being imposed by the mass of the counterweight or the balancing weight:

$$4 \cdot g_n \cdot (P + q \cdot Q) \quad \text{for counterweight}$$

$$4 \cdot g_n \cdot q \cdot P \quad \text{for balancing weight}$$

where:

P = masses of the empty car and components supported by the car, i.e. part of the travelling cable, compensating ropes/chains (if any), etc. in kilograms;

Q = rated load (mass) in kilograms;

g_n = standard acceleration of free fall, [9,81 (m/s²)];

q = balance factor (see **G.2.4**).

5.3.3 Strength of the ceiling

[A₂] Notwithstanding the requirements of 6.3.2 and/or 6.7.1.1, in the case of hanging guide rails the suspension points shall be able to take at least the loads and forces according to G.5.1. **[A₂]**

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

5.4.1 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.

For clearances between car and wall of the lift well facing the car entrance, see **11**.

5.4.2 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.

5.4.3 Below each landing door sill the wall of the lift well shall comply with the following requirements:

- a) it shall form a vertical surface which is directly connected to the landing door sill, whose height is at least half the unlocking zone plus 50 mm and whose width is at least the clear opening of the car access plus 25 mm on both sides;
- b) this surface shall be continuous and be 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 cm² in round or square section, it shall resist:
 - 1) without permanent deformation;
 - 2) without elastic deformation greater than 10 mm;
- c) any projections shall not exceed 5 mm. Projections exceeding 2 mm shall be chamfered at least 75° to the horizontal;
- d) furthermore, it shall be either:
 - 1) connected to the lintel of the next door, or
 - 2) extended downwards using a hard smooth chamfer whose angle to the horizontal plane shall be at least 60°. The projection to this chamfer on the horizontal plane shall not be less than 20 mm.

5.5 Protection of any spaces located below the car, the counterweight or the balancing weight

If accessible spaces do exist below the car, the counterweight or the balancing weight, the base of the pit shall be designed for an imposed load of at least 5 000 N/m², and:

- a) either there shall be installed below the counterweight buffer or under the travelling area of the balancing weight, a solid pier extending down to solid ground, or
- b) the counterweight or the balancing weight shall be equipped with safety gear.

NOTE Lift wells should preferably not be situated above a space accessible to persons.

5.6 Protection in the well

5.6.1 The travelling area of the counterweight or the balancing weight shall be guarded by means of a rigid screen extending from a position of not more than 0,30 m above the lift pit floor to a position at least 2,50 m.

The width shall be at least equal to that of the counterweight $\boxed{AC_1}$ or balancing weight $\boxed{AC_1}$ plus 0,10 m on each side.

If this partition is perforate, EN 294, subclause 4.5.1 has to be respected.

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

If this partition is perforate, EN 294, subclause 4.5.1 has to be respected.

5.6.2.1 This partition shall extend at least from the lowest point of travel of the car, 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 **5.2.2.2.2** are met.

5.6.2.2 The partition shall extend through the full height of the well if the horizontal distance between the edge of the car roof and a moving part (car, counterweight or balancing weight) of an adjacent lift is less than 0,50 m.

The width of the partition shall be at least equal to that of the moving part, or part of this, which is to be guarded, plus 0,10 m on each side.

5.7 Headroom and pit

5.7.1 Top clearances for traction drive lifts

The top clearances for traction drive lifts, as required in the following, are illustrated in **annex K**.

5.7.1.1 When the counterweight rests on its fully compressed buffer(s), the following four conditions shall be satisfied at the same time:

- a) the car guide rail lengths shall be such as would accommodate a further guided travel, expressed in metres, of at least $0,1 + 0,035 v^2$ ⁴⁾
- b) the free vertical distance between the level of the highest area on the car roof whose dimensions comply with **8.13.2** (areas on parts according to **5.7.1.1 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 $1,0 + 0,035 v^2$;
- 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 $0,3 + 0,035 v^2$;
 - 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 $0,1 + 0,035 v^2$;
- 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.

5.7.1.2 When the car rests on its fully compressed buffers, the counterweight guide rail lengths shall be such as would accommodate a further guided travel expressed in metres, of at least $0,1 + 0,035 v^2$.

5.7.1.3 When the slowdown of the machine is monitored, in accordance with **12.8**, the value of $0,035 v^2$ in **5.7.1.1** and **5.7.1.2** for calculation of clearances may be reduced:

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

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

- a) to one half for lifts whose rated speed does not exceed 4 m/s; however, this value shall not be less than 0,25 m;
- b) to one third for lifts whose rated speed exceeds 4 m/s; however, this value shall not be less than 0,28 m.

5.7.1.4 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.

5.7.2 Top clearances for positive drive lifts

5.7.2.1 The guided travel of the car upwards from the top floor until it strikes the upper buffers shall be at least 0,50 m. The car shall be guided to the limit of its buffer stroke.

5.7.2.2 When the upper buffers are fully compressed by the car, 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 **8.13.2** (areas on parts according to **5.7.2.2 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 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.

5.7.2.3 When the car 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.

5.7.3 Pit

5.7.3.1 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.

5.7.3.2 If there is an access door to the pit, other than the landing door, it shall comply with the requirements of **5.2.2**.

Such a door shall be provided if the pit depth exceeds 2,50 m and if the layout of the building so permits.

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.

5.7.3.3 When the car 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 vertical distance between the bottom of the pit and the lowest parts of the car, 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:
 - 1) apron or parts of the vertically sliding car door(s) and the adjacent wall(s);
 - 2) the lowest parts of the car and the guide rails;
- c) the free vertical distance between the highest parts fixed in the pit, for instance a tensioning device for compensation ropes being in its highest position and the lowest parts of the car, except for items detailed in b) 1) and b) 2) above, shall be at least 0,30 m.

5.7.3.4 There shall be in the pit:

- a) stopping device(s) accessible on opening the door(s) to the pit, and from the pit floor, in conformity with the requirements of **14.2.2** and **15.7**;
- b) a socket outlet (**13.6.2**);
- c) means to switch the lift well lighting (**5.9**), accessible on opening the door(s) to the pit.

5.8 Exclusive use of the lift 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 **5.2.1.2**, 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 **5.2.1.2**).

5.9 Lighting of the well

The well shall be provided with permanently installed electric lighting, giving an intensity of illumination of at least 50 lux, 1 m above the car roof and the pit floor, even when all doors are closed.

This lighting shall comprise one lamp at most 0,50 m from the highest and lowest points in the well with intermediate **AC1** lamp(s) **AC1**.

If use is made of the exception provided for in **5.2.1.2**, this lighting may not be necessary if the electric lighting existing in the neighbourhood of the well is sufficient.

5.10 Emergency release

If there is a risk for persons working in the well being trapped and no means are provided to escape, either through the car, or through the well, alarm devices shall be installed at places where this risk exists.

The alarm devices shall fulfil the requirements of **14.2.3.2** and **14.2.3.3**.



6 Machinery and pulley spaces

6.1 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 authorised 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 0.2.2, 0.2.5 and 0.3.3.

a) See Annex O.

6.2 Access

6.2.1 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.

6.2.2 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 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 1500 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.

6.3 Machinery in machine room

6.3.1 General provisions

6.3.1.1 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.

6.3.1.2 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.

6.3.2 Mechanical strength, floor surface

6.3.2.1 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.

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

6.3.3 Dimensions

6.3.3.1 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 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 x 0,60 m for maintenance and inspection of moving parts at points where this is necessary and, if need be, manual emergency operation (12.5.1).

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

The access ways to the clear spaces mentioned in 6.3.3.1 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.

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

6.3.3.4 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.

6.3.3.5 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.

6.3.4 Doors and trap doors

6.3.4.1 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.

6.3.4.2 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 1000 N on an area of 0,20 m x 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).

6.3.4.3 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.

6.3.5 Other openings

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

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.

6.3.6 Ventilation

The machine rooms shall be suitably ventilated. Should the well be ventilated through the machine room, this has to 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.

6.3.7 Lighting and socket outlets

The machine room shall be provided with permanently installed electric lighting with an intensity of at least 200 lux at floor level. The supply for this lighting shall be in conformity with 13.6.1.

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 (13.6.2) shall be provided.

6.3.8 Handling of equipment

One or more metal supports or hooks with the indication of the safe working load (15.4.5), as appropriate, are provided in the machine room ceiling or on the beams, conveniently positioned to permit the hoisting of heavy equipment (see 0.2.5 and 0.3.14).

6.4 Machinery inside the well

6.4.1 General provisions

6.4.1.1 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.

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

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

6.4.2 Dimensions of working areas inside the well

6.4.2.1 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 m at working areas, and:

- a) a clear horizontal working area of at least 0,50 m x 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.

6.4.2.2 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 9.7.1 a).

See also 5.7.1.1 or 5.7.2.2.

6.4.3 Working areas in the car or on the car roof

6.4.3.1 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 car movement resulting from maintenance/inspection can be dangerous to persons, the following applies:

- a) any dangerous movement of the car shall be prevented by a mechanical device;
- b) all movement of the car shall be prevented by means of an electric safety device in conformity with **14.1.2** 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.

6.4.3.2 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 car overspeed protection means) shall be arranged so that they can be carried out from outside of the well in accordance with 6.6.

6.4.3.3 If inspection door 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 14.1.2, checking the locked position;
- f) be imperforate and satisfy the same requirements for mechanical strength as the walls of the car.

6.4.3.4 Where it is necessary to move the car from the inside with open inspection door/trap the following applies:

- a) an inspection control station according to 14.2.1.3 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 6.4.3.3 e);
- c) the inspection control station in the car shall be accessible only to authorised persons and so arranged that it is not possible to use it to drive the car 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.

6.4.4 Working areas in the pit

6.4.4.1 Where machinery is to be maintained or inspected from the pit and if this work requires movement of the car, or is likely to result in uncontrolled or unexpected car movement, the following applies:

- a) a permanently installed device shall be provided to mechanically stop the car with any load up to rated load and from any speed up to rated speed to create a free distance of at least 2 m between the floor of the working area and the lowest parts of the car, excluding those mentioned in 5.7.3.3 b) 1) and 2). The retardation of mechanical devices other than safety gears shall not exceed that produced by the buffers (10.4);
- b) mechanical device shall be able to maintain the car stopped;
- c) mechanical device can be operated manually or automatically;
- d) where it is necessary to move the car from the pit, an inspection control station according to 14.2.1.3 shall be available for use in the pit;
- e) opening by the use of a key of any door providing access to the pit shall be checked by an electric safety device according to 14.1.2 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 car shall be prevented by means of an electric safety device in conformity with 14.1.2 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 14.1.2, electrically driven movement of the car 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 authorised persons only, e. g. inside a locked cabinet.

6.4.4.2 When the car is in the position according to 6.4.4.1 a), it shall be possible to leave the working area safely.

6.4.4.3 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 car overspeed protection means) shall be arranged so that they can be carried out from outside of the well in accordance with 6.6.

6.4.5 Working areas on a platform

6.4.5.1 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 car or counterweight/balancing weight.

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

- a) the car shall be stationary by using a mechanical device in conformity with 6.4.3.1 a) and b), or
- b) where the car needs to be moved, the travel path of the car shall be limited by movable stops in such a way that the car is stopped
 - at least 2 m above the platform if the car runs down towards the platform;
 - below the platform in compliance with 5.7.1.1 b), c) and d) if the car runs up towards the platform.

6.4.5.3 The platform shall be:

- a) able to support at any position the mass of two persons, each counting for 1000 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 6.4.10);
- b) provided with a balustrade in conformity with 8.13.3;
- 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.

6.4.5.4 In addition to 6.4.5.3 any retractable platform shall be:

- a) provided with an electric safety device in conformity with 14.1.2, 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 authorised 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.

6.4.5.5 In the case of 6.4.5.2 b) movable stops shall be automatically operated when the platform is lowered. They shall be provided with:

- a) buffers in conformity with 10.3 and 10.4;
- b) an electric safety device in conformity with 14.1.2, which only allows car movement if the stops are in their fully retracted position;

c) an electrical safety device in conformity with 14.1.2, which only allows car movement with a lowered platform if the stops are in their fully extended position.

6.4.5.6 Where it is necessary to move the car from the platform, an inspection control station according to **14.2.1.3** shall be available for use on the platform.

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

6.4.5.7 The necessary devices for emergency operation and dynamic tests (such as brake tests, traction tests, safety gear tests, buffer tests or tests of ascending car overspeed protection means) shall be arranged so that they can be carried out from outside of the well in conformity with 6.6.

6.4.6 Working areas outside of the well

When the machinery is in the well and is intended to be maintained/inspected from outside of the well, deviating from **6.1**, the working areas in accordance with 6.3.3.1 and 6.3.3.2 can be provided outside of the well. Access to this equipment shall only be possible by a door/trap in conformity with 6.4.7.2.

6.4.7 Doors and traps

6.4.7.1 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:

- 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 14.1.2, 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.

6.4.7.2 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 14.1.2, 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.

6.4.8 Ventilation

The machinery spaces shall be suitably ventilated. The electric equipment of the machinery shall be protected as far as it is reasonably practicable from dust, harmful fumes and humidity.

6.4.9 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 lux at floor level. The supply for this lighting shall be in conformity with 13.6.1.

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

A switch accessible only to authorised 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 (**13.6.2**) shall be provided at an appropriate place for each working area.

6.4.10 Handling of equipment

One or more metal supports or hooks with the indication of the safe working load (15.4.5), as appropriate, are provided in the machinery spaces, conveniently positioned to permit the hoisting of heavy equipment (see 0.2.5 and 0.3.14).

6.5 Machinery outside of the well

6.5.1 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.

6.5.2 Machinery cabinet

6.5.2.1 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.

6.5.2.2 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-authorised persons shall comply with the following requirements:

- 1) protection according to EN 294:1992, Table 5 against contact with danger zones, and
- 2) degree of protection of at least IP 2XD against contact with electrical equipment.

6.5.2.3 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.

6.5.3 Working area

The working area in front of a machinery cabinet shall comply with the requirements according to 6.4.2.

6.5.4 Ventilation

The machinery cabinet shall be suitably ventilated. It shall be such that the machinery is protected as far as it is reasonably practicable from dust, harmful fumes and humidity.

6.5.5 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 lux at floor level. The supply for this lighting shall be in conformity with 13.6.1.

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

At least one socket outlet (13.6.2) shall be provided.

6.6 Devices for emergency and test operations

6.6.1 In the case of 6.4.3, 6.4.4 and 6.4.5 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 authorised persons only. This applies also to means for maintenance where maintenance procedure(s) require(s) moving the car and the work cannot be carried out safely from the intended work areas provided inside the well.

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.

6.6.2 The panel(s) shall provide the following:

- a) emergency operation devices according to 12.5, together with an intercom system in conformity with 14.2.3.4;
- b) control equipment which enables dynamic tests to be carried out (6.4.3.2, 6.4.4.3, 6.4.5.7);
- c) direct observation of the lift machine or display device(s), which give indication of :
 - direction of movements of the car;
 - reaching of an unlocking zone, and
 - speed of the lift car.

6.6.3 The devices on the panel(s) shall be lit by a permanently installed electric lighting with an intensity of at least 50 lux 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 13.6.1.

6.6.4 The panel(s) for emergency and test operations shall be installed only where a working area in accordance with 6.3.3.1 is available.

6.7 Construction and equipment of pulley spaces

6.7.1 Pulley rooms

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

6.7.1.1 Mechanical strength, floor surface

6.7.1.1.1 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.

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

6.7.1.2 Dimensions

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

The requirements of 6.3.3.1 b) and 6.3.3.2, sentence two and three, are applicable.

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

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

6.7.1.2.4 If there are control panels and cabinets in the pulley room the provisions of 6.3.3.1 and 6.3.3.2 apply to this room.

6.7.1.3 Doors and trap doors

6.7.1.3.1 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.

6.7.1.3.2 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 1000 N on an area of 0,20 m x 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).

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

6.7.1.4 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.

6.7.1.5 Stopping device

A stopping device, in conformity with 14.2.2 and 15.4.4, shall be installed in the pulley room, close to the point(s) of access.

6.7.1.6 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.

6.7.1.7 Lighting and socket outlets

The pulley room shall be provided with permanently installed electric lighting with an intensity of at least 100 lux at the pulley(s). The supply for this lighting shall be in conformity with 13.6.1.

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 13.6.2 shall be provided. See also 6.7.1.2.4.

If there are control panels and cabinets in the pulley room, the provisions of 6.3.7 apply.

6.7.2 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 roof and that examinations and tests and maintenance operations can be carried out in complete safety from the car roof, from inside the car (6.4.3), from a platform (6.4.5) 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 (6.4.5). ^{A2}

7 Landing doors

7.1 General provisions

The openings in the well giving access to the lift car 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.

7.2 Strength of doors and their frames

7.2.1 Doors and their frames shall be constructed in such a way that they will not become deformed in the course of time. To this effect, it is recommended that they are made of metal.

7.2.2 Behaviour under fire conditions

Landing doors shall comply with the regulations relevant to the fire protection for the building concerned. PrEN 81-8 describes a method of the fire test.

7.2.3 Mechanical strength.

7.2.3.1 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 cm² in round or square section, is applied at right angles to the panel at any point on either face they shall:

- a) resist without permanent deformation;
- b) resist without elastic deformation greater than 15 mm;
- c) during and after such a test the safety function of the door shall not be affected.

7.2.3.2 Under the application of a manual force (without a tool) of 150 N in the direction of the opening of the leading door panel(s) of horizontally sliding doors and folding doors, at the most unfavourable point, the clearances defined in **7.1** 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.

7.2.3.3 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 **7.6.2**, 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.

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

7.2.3.5 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).

7.2.3.6 To avoid dragging of children hands, automatic power operated horizontally sliding doors made of glass of dimensions greater than stated in **7.6.2** shall be provided with means to minimise 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.

7.3 Height and width of entrances

7.3.1 Height

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

7.3.2 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.

7.4 Sills, guides, door suspension

7.4.1 Sills

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

NOTE 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.

7.4.2 Guides

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

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.

7.4.2.2 Horizontally sliding landing doors shall be guided top and bottom.

7.4.2.3 Vertically sliding landing doors shall be guided at both sides.

7.4.3 Suspension of vertically sliding doors

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

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

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

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

7.5 Protection in relation to door operation

7.5.1 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**.

7.5.2 Power operated doors

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:

7.5.2.1 Horizontally sliding doors

7.5.2.1.1 Automatic power operated doors

7.5.2.1.1.1 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.

7.5.2.1.1.2 The kinetic energy of the landing door and the mechanical elements which are rigidly connected to it, calculated or measured ⁵⁾ 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:

- a) 25 mm at each end of the travel in the case of centrally closing doors;
- b) 50 mm at each end of the travel in the case of side closing doors.

7.5.2.1.1.3 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 **8.7.2.1.1.3**).

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 **7.5.2.1.1.2** shall not exceed 4 J during movement of the door with the protective device inoperative.

7.5.2.1.1.4 In the case of coupled car and landing doors operated simultaneously, the requirements of **7.5.2.1.1.1** and **7.5.2.1.1.2** are valid for the joined door mechanism.

7.5.2.1.1.5 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) 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.

7.5.2.1.2 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 0,3 m/s, when the kinetic energy, calculated or measured as stated in 7.5.2.1.1.2, exceeds 10 J.

7.5.2.2 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 0,3 m/s;
- c) the car door is of construction as provided for in 8.6.1;
- d) the car door is at least two-thirds closed before the landing door begins to close.

7.5.2.3 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.

7.6 Local lighting and “car here” signal lights

7.6.1 Local lighting

The natural or artificial lighting of the landings in the vicinity of landing doors shall be at least 50 lux at floor level, such that a user can see ahead when he is opening the landing door to enter the lift, even if the car light has failed (see 0.2.5).

7.6.2 “Car here” indication

In the case of landing doors with manual opening, the user needs to know, before opening the door, whether the car is there or not.

To this effect, there shall be installed, either:

- a) one or more transparent vision panels conforming to the following four conditions at the same time:
 - 1) mechanical strength as specified in 7.2.3.1, with the exception of the pendulum shock tests;
 - 2) minimum thickness of 6 mm;
 - 3) minimum glazed area per landing door of 0,015 m² with a minimum of 0,01 m² per vision panel;
 - 4) width of at least 60 mm, and at most 150 mm. The lower edge of vision panels which are wider than 80 mm shall be at least 1 m above floor level, or
- b) an illuminated “car here” signal which can only light up when the car is about to stop or has stopped at the particular landing. The signal shall remain illuminated whilst the car remains there.

7.7 Locking and closed landing door check

7.7.1 Protection against the risk of falling

It shall not be possible in normal operation to open a landing door (or any of the panels in the case of a multi-panel door) unless the car has stopped, or is on the point of stopping, in the unlocking zone of that door.

The unlocking zone shall not extend more than 0,20 m above and below the landing level.

In the case, however, of mechanically operated car and landing doors operating simultaneously, the unlocking zone may extend to a maximum of 0,35 m above and below the landing level.

7.7.2 Protection against shearing

7.7.2.1 With the exception of **7.7.2.2**, it shall not be possible in normal operation to start the lift nor keep it in motion if a landing door, or any of the panels in the case of a multi-panel door is open. However, preliminary operations for the movement of the car may take place.

7.7.2.2 Operation with doors open is permitted in the following zones:

- a) in the unlocking zone to permit levelling or relevening at the corresponding floor level, provided the requirements of **14.2.1.2** are met;
- b) in a zone extending to a maximum height of 1,65 m above the landing level to permit the loading or unloading of the car, provided the requirements of **8.4.3**, **8.14** and **14.2.1.5** are met, and:
 - 1) the clear height between the landing door header and the floor of the car, in any position, shall not be less than 2 m, and
 - 2) whatever the position of the car inside this zone, it must be possible, without special operation, to effect the complete closure of the landing door.

7.7.3 Locking and emergency unlocking

Each landing door shall be provided with a locking device satisfying the conditions of **7.7.1**.

This device shall be protected against deliberate misuse.

7.7.3.1 Locking

The effective locking of the landing door in the closed position shall precede the movement of the car. However, preliminary operations for the movement of the car may take place. The locking must be proved by an electric safety device in conformity with **14.1.2**.

7.7.3.1.1 The car shall not be able to start until the locking elements are engaged by at least 7 mm; see **figure 3**.

AC1

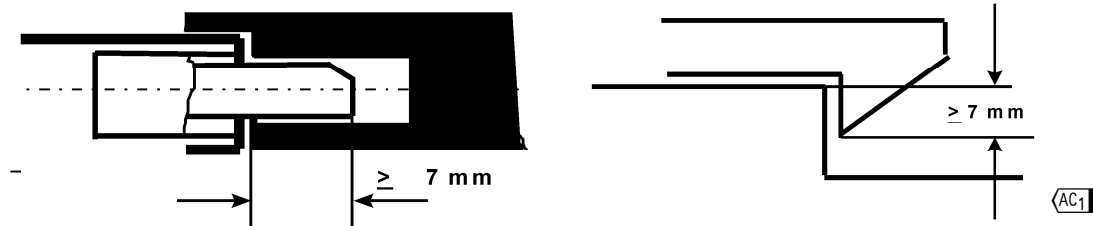


Figure 1 — Examples of locking elements

7.7.3.1.2 The element of the electric safety device proving the locked condition of the door panel(s) shall be positively operated without any intermediate mechanism by the locking element. It shall be foolproof but adjustable if necessary.

Specific case: In the case of locking devices used in installations requiring special protection against risks of humidity or explosion the connection may be only positive, provided the link between the mechanical lock and the element of the electric safety device proving the locked condition, can only be interrupted by destroying deliberately the locking device.

7.7.3.1.3 For hinged doors, locking shall be effected as near as possible to the vertical closing edge(s) of the doors, and maintained even in the case of panels sagging.

7.7.3.1.4 The locking elements and their fixings shall be resistant to shock, and be made or reinforced with metal.

7.7.3.1.5 The engagement of the locking elements shall be achieved in such a way that a force of 300 N in the opening direction of the door does not diminish the effectiveness of locking.

7.7.3.1.6 The lock shall resist, without permanent deformation during the test laid down in F.1, a minimum force at the level of the lock and in the direction of opening of the door of:

- a) 1000 N in the case of sliding doors;
- b) 3000 N on the locking pin, in the case of hinged doors.

7.7.3.1.7 The locking action shall be effected and maintained by the action of gravity, permanent magnets, or springs. The springs shall act by compression, be guided and of such dimensions that, at the moment of unlocking, the coils are not compressed solid.

In the event of the permanent magnet (or spring) no longer fulfilling its function, gravity shall not cause unlocking.

If the locking element is maintained in position by the action of a permanent magnet, it shall not be possible to neutralize its effect by simple means (e.g. heat or shock).

7.7.3.1.8 The locking device shall be protected against the risk of an accumulation of dust, which could hinder its proper functioning.

7.7.3.1.9 Inspection of the working parts shall be easy, as, for example, by use of a vision panel.

7.7.3.1.10 In the case where the lock contacts are in a box, the fixing screws for the cover shall be of the captive type, so that they remain in the holes in the cover or box when opening the cover.

7.7.3.2 Emergency unlocking

Each of the landing doors shall be capable of being unlocked from the outside with the aid of a key, which will fit the unlocking triangle as defined in **annex B**.

Keys of this type shall be given only to a responsible person. They shall be accompanied by a written instruction detailing the essential precautions to be taken in order to avoid accidents which could result from an unlocking which was not followed by effective relocking.

After an emergency unlocking, the locking device shall not be able to remain in the unlocked position with the landing door closed.

In the case of landing doors driven by the car door, a device (either weight or springs) shall ensure the automatic closing of the landing door if this door becomes open, for whatever reason, when the car is outside the unlocking zone.

7.7.3.3 The locking device is regarded as a safety component and shall be verified according to the requirements in F.1.

7.7.4 Electrical device for proving the landing door closed

7.7.4.1 Each landing door shall be provided with an electric safety device in conformity with **14.1.2** for proving the closed position, so that the conditions imposed by **7.7.2** are satisfied.

7.7.4.2 In the case of horizontally sliding landing doors, coupled with car doors, this device may be in common with the device for proving the locked condition, provided that it is dependent upon the effective closing of the landing door.

7.7.4.3 In the case of hinged landing doors, this device shall be placed adjacent to the closing edge of the door or on the mechanical device proving the closed condition of the door.

7.7.5 Requirements common to devices for proving the locked condition and the closed condition of the door

7.7.5.1 It shall not be possible, from positions normally accessible to persons, to operate the lift with a landing door open or unlocked, after one single action not forming part of the normal operating sequence.

7.7.5.2 The means used to prove the position of a locking element shall have positive operation.

7.7.6 Sliding doors with multiple, mechanically linked panels

7.7.6.1 If a sliding door comprises several directly mechanically linked panels, it is permitted:

- a) to place the device required in **7.7.4.1** or **7.7.4.2**, on a single panel, and
- b) to lock only one panel, provided that this single locking prevents the opening of the other panel(s) by hooking the panels in the closed position in case of telescopic doors.

7.7.6.2 If a sliding door comprises several indirectly, mechanically linked panels (e.g. by rope, belt or chain), it is permitted to lock only one panel provided that this single locking will prevent the opening of other panels, and that these are not fitted with a handle.

The closed position of the other panel(s), not locked by the locking device, shall be proved by an electric safety device in conformity with **14.1.2**.

7.8 Closing of automatically operated doors

In normal operation, automatically operated landing doors shall be closed after the necessary period of time, which may be defined according to the traffic using the lift, in the absence of a command for the movement of the car.

8 Car, counterweight and balancing weight

8.1 Height of car

8.1.1 The interior clear height of the car shall be at least 2 m.

8.1.2 The clear height of the car entrance(s) for the normal access of users shall be at least 2 m.

8.2 Available car area, rated load, number of passengers

8.2.1 General case

To prevent an overloading of the car by persons, the available area of the car shall be limited. To this effect the relationship between rated load and maximum available area is given in **table 1.1**.

Recesses and extensions, even of height less than 1 m, whether protected or not by separating doors, are only permitted if their area is taken into account in the calculation of maximum available car area.

Any available area in the entrance, when the doors are closed, shall also be taken into account.

Furthermore, overloading of the car shall be monitored by means of a device according to **14.2.5**.

Table 1.1

Rated load, mass kg	Maximum available car area m ²	Rated load, mass kg	Maximum available car area m ²
100 ¹⁾	0,37	900	2,20
180 ²⁾	0,58	975	2,35
225	0,70	1000	2,40
300	0,90	1050	2,50
375	1,10	1125	2,65
400	1,17	1200	2,80
450	1,30	1250	2,90
525	1,45	1275	2,95
600	1,60	1350	3,10
630	1,66	1425	3,25
675	1,75	1500	3,40
750	1,90	1600	3,56
800	2,00	2000	4,20
825	2,05	2500 ³⁾	5,00
1) Minimum for 1 person lift. 2) Minimum for 2 persons lift. 3) Beyond 2500 kg add 0,16 m² for each extra 100 kg. For intermediate loads the area is determined by linear interpolation.			

8.2.2 Goods passenger lifts

The requirements of 8.2.1 shall be applied and, in addition, design calculations shall take into account not only the rated load but also the weight of handling devices, which may enter the car.

8.2.3 Number of passengers

The number of passengers shall be obtained from:

- either, the formula, $\frac{\text{rated load}}{75}$, and the result rounded down to the nearest whole number, or
- table 1.2 which gives the smaller value.

Table 1.2

Number of passengers	Minimum available car area m ²	Number of passengers	Minimum available car area m ²
1	0,28	11	1,87
2	0,49	12	2,01
3	0,60	13	2,15
4	0,79	14	2,29
5	0,98	15	2,43
6	1,17	16	2,57
7	1,31	17	2,71
8	1,45	18	2,85
9	1,59	19	2,99
10	1,73	20	3,13
Beyond 20 passengers add 0,115 m ² for each extra passenger.			

8.3 Walls, floor and roof of the car

8.3.1 The car shall be completely enclosed by walls, floor and roof, the only permissible openings being as follows:

- a) entrances for the normal access of users;
- b) emergency trap doors and doors;
- c) ventilation apertures.

8.3.2 The walls, floor and roof shall have sufficient mechanical strength. The assembly comprising the sling, guide shoes, walls, floor and roof of the car shall have sufficient mechanical strength to resist the forces which will be applied in normal lift operation, in safety gear operation or impact of the car on its buffers.

8.3.2.1 Each wall of the car shall have a mechanical strength such that when a force of 300 N, being evenly distributed over an area of 5 cm² in round or square section, is applied at right angles to the wall at any point from the inside of the car towards the outside, it shall:

- a) resist without any permanent deformation;
- b) resist without elastic deformation greater than 15 mm.

8.3.2.2 Walls with glass shall use laminated glass and, additionally withstand the pendulum shock tests, described in **annex J**.

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

Car walls with glass placed lower than 1,10 m from the floor shall have a handrail at a height between 0,90 m and 1,10 m. This handrail shall be fastened independently from the glass.

8.3.2.3 The fixing of the glass in the wall shall ensure that the glass cannot slip out of the fixings, even when sinking.

8.3.2.4 The glass panels shall have markings giving the following information:

- a) name of the supplier and trademark;
- b) type of glass;
- c) thickness (e.g. 8/8/0,76 mm).

8.3.2.5 The car roof shall satisfy the requirements of **8.13**.

8.3.3 The walls, floor and roof shall not be made of materials likely to become dangerous through too great a flammability or through the nature and quantity of gas and fumes they may generate.

8.4 Apron

8.4.1 Each car sill shall be fitted with an apron, which extends to the full width of the clear landing entrance, which it faces. This vertical section shall be extended downwards by a chamfer whose angle with the horizontal plane shall be greater than 60°. The projection of this chamfer of the horizontal plane shall be not less than 20 mm.

8.4.2 The height of the vertical portion shall be at least 0,75 m.

8.4.3 In the case of a lift with a docking operation (**14.2.1.5**), the height of the vertical portion shall be such that, with the car in the highest loading or unloading position, it extends at least 0,10 m below the landing sill.

8.5 Car entrance

Car entrances shall be provided with doors.

8.6 Car doors

8.6.1 The car doors shall be imperforate, except for goods passenger lifts, which may use vertically sliding car doors, opening upwards, and these may be in mesh or perforated panel form. The dimensions of the mesh or perforations shall not exceed 10 mm horizontally and 60 mm vertically.

8.6.2 The car doors when closed shall, apart from the necessary clearances, completely close the car entrances.

8.6.3 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. Exception is made for vertically sliding doors, according to 8.6.1.

8.6.4 In the case of hinged doors, they shall strike stops to prevent them swinging outside the car.

8.6.5 The car door shall be fitted with a vision panel(s) if the landing door has a vision panel(s) (**7.6.2 a**)) unless the car door is automatic and remains in the open position when the car is stationary at the level of a landing.