BRITISH STANDARD

BS EN 81-31:2010

# Safety rules for the construction and installation of lifts — Lifts for the transport of goods only

## Part 31: Accessible goods only lifts

ICS 91.140.90



BSI
British Standards

# National foreword

This British Standard is the UK implementation of EN 81-31:2010.

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

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

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.**

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EUROPEAN STANDARD

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English Version

# Safety rules for the construction and installation of lifts - Lifts for the transport of goods only - Part 31: Accessible goods only lifts

Règles de sécurité pour la construction et l'installation des élévateurs - Elévateurs pour le transport d'objets seulement - Partie 31: Monte charge accessibles

Sicherheitsregeln für die Konstruktion und den Einbau von Aufzügen - Aufzüge für den Gütertransport - Teil 31: Betretbare Güteraufzüge

This European Standard was approved by CEN on 13 February 2010.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
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## Foreword

This document (EN 81-31:2010) 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of an identical text or by endorsement, at the latest by October 2010, and conflicting national standards shall be withdrawn at the latest by October 2010.

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

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

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

This standard is a part of the EN 81 series of standards, which covers safety rules for the construction and installation of lifts. See CEN/TR 81-10.

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




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# 0 Introduction

## 0.1 General

**0.1.1** The object of this European Standard is to give safety rules related to the construction and installation of accessible goods only lifts, with a view to safeguarding persons and objects against the risk of accidents associated with the use, maintenance and emergency operation of accessible goods only lifts.

This document is a type C standard as specified in EN ISO 12100-1.

The accessible goods only lift installation concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the scope of this document.

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

**0.1.2** The following are to be safeguarded:

a) persons such as:

   1) operators and users;

   2) maintenance personnel;

   3) persons in the near vicinity, outside the accessible goods only lift well, the machine room/spaces and pulley room/spaces (if any);

b) objects such as components of the accessible goods only lift installation and load inside the load carrying unit;

c) building parts (see 0.2.5) such as those parts of the building which are directly associated with the accessible goods only lift.

## 0.2 Principles

**0.2.1** In drawing up this European Standard the following have been used:

**0.2.2** This European 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.

**0.2.3** This European Standard addresses the essential safety requirements of the Machinery Directive including those related to the well and machinery spaces, excluding any other requirement for the building.

There can 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.

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

a) 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.

**0.2.5** Negotiations have been made between the parties involved and decisions have been taken, particularly about:

a) the intended use of the accessible goods only lift and its limits;

b) environmental conditions, including surrounding lighting;

c) compliance of the civil engineering with the requirements of this European Standard for those parts of the installation, which belong to the building and are not provided by the manufacturer.

## 0.3 Assumptions

**0.3.1** Risks have been considered for each component that may be incorporated in a complete accessible goods only lift installation.

Rules have been drawn up accordingly to mitigate such risks.

**0.3.2** 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. Harmful materials, such as asbestos, are not used.

**0.3.3** The machine is kept in good repair and working order, so that the initial safety level is maintained.

**0.3.4** The IP code of electrical components is selected in relation with the intended use where not specified in this European Standard in accordance with EN 60529.

**0.3.5** By design of the load bearing elements, a safe operation of the accessible goods only lift is assured for loads ranging from 0 % to 100 % of the rated load, including provisions for taking into account possible overloading.

**0.3.6** The requirements of this European Standard regarding electric safety devices are such that the possibility of a failure of an electric safety device complying with all the requirements of the standard needs not to be taken into consideration.

**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 user, is deliberately neutralised, safe operation of the accessible goods only lift is no longer assured, but compensatory measures will be taken to ensure safety of all persons in conformity with maintenance instructions according to EN 13015.

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

**0.3.9** For horizontal forces, the following have been used:

a) static force: minimum 300 N;

b) force resulting from impact: minimum 1 000 N,

reflecting the values that one person can exert.




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Higher values need to be taken into account where powered or hand powered means for loading and unloading are intended to be used (see 0.2.5).

**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 as long as regular and periodical examinations, tests and maintenance are carried out according to the instruction manual delivered with the installation.

The following mechanical failures, where applicable, are considered in the requirements:

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 takes 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;

f) rupture in the hydraulic system (jack excluded).

**0.3.11** When the speed of the load carrying unit 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.

**0.3.12** When the device according to 5.2.14 is provided, the organisation within the building, where the accessible goods only lift is installed, is such that it can respond effectively to emergency calls without undue delay (see 0.2.5).

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

**0.3.14** To ensure the correct functioning of the equipment in the machinery spaces, the ambient temperature in these spaces is assumed to be maintained between + 5 °C and + 40 °C (see EN 60204-1). When the temperature exceeds these limits, appropriate means are used to compensate the difference, such as heating or cooling (see 0.2.5).

**0.3.15** Accessible goods only lifts are used only by authorised and instructed users. This can be achieved by the way of key operated control buttons, key card operated control or similar devices or the accessible goods only lifts are installed in an area where only trained persons have access (see 0.2.5).

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

**0.3.17** The location of the accessible goods only lift to be such that users using the accessible goods only lift have means conveniently available to them, to access the different landing levels served, either a staircase or a means for the transportation of persons, within a reasonable distance.




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# 1 Scope

**1.1** This European Standard applies to new electric accessible goods only lifts with traction or positive drive and new hydraulic accessible goods only lifts, permanently installed in restricted areas and/or only used by authorised and instructed persons (users), serving fixed and permanent landing levels, having a load carrying unit made of a single load carrying area, designed for the transportation of goods only, moving along a fixed path (e.g. scissor lifts, lifts with guide rails) and inclined not more than 15° to the vertical, with rated speed not exceeding 1 m/s.

This European Standard covers accessible goods only lifts with rated load exceeding 300 kg and not intended to move persons.

This standard deals with all significant hazards, hazardous situations and events with the exception of those listed in 1.3 below, relevant to accessible goods only lifts, when they are used as intended and under the conditions foreseen by the manufacturer (see Clause 4).

**1.2** For the purpose of this European Standard, a goods only lift is regarded as accessible where one of the following conditions is satisfied:

a) floor area of the load carrying unit is greater than 1,0 $m^2$;

b) depth of the load carrying unit is greater than 1,0 m;

c) height of the load carrying unit is greater than 1,20 m.

In case of a platform, it is considered accessible when the height of the landing doors is more than 1,20 m.

**1.3** Two types of accessible goods only lifts are addressed:

a) Type A, where the intended use is bound to the following two simultaneous conditions:

   1) maximum rated speed: 0,30 m/s;

   2) maximum travelling height: 12 m;

b) Type B, where one of the conditions mentioned above is not fulfilled.

**1.4** This European Standard does not give the requirements to be met in special cases (potentially explosive atmosphere, extreme climate conditions, seismic conditions, transporting dangerous goods, etc.).

**1.5** This standard is not applicable to:

a) accessible goods only lifts:

   1) with more than one machine;

   2) where loading and unloading is automated or the load carrying unit floor is fitted with mobile devices (e.g. rollers) for loading and unloading purposes;

   3) intended to carry bulk loads (such as loose sand, gravel, etc.);

b) lifting appliances, such as appliances with more than one load carrying unit, skips, goods only lifts for construction sites, for underground applications, mine winding gear, goods only lifts on seagoing vessels and mobile offshore units, machinery intended to move performers during artistic performances, goods only lifts specially designed and constructed for research purposes for temporary use in laboratories, goods only lifts specially designed and constructed for military or police purposes;

c) installations where the inclination of the fixed course of movement to the vertical exceeds 15°;

d) safety during transport, installation, repairs and dismantling of accessible goods only lifts;

e) the use of translucent material for the walls of the well and machinery spaces, for the load carrying unit and for the landing doors with the exception of their vision panels;

f) the use of programmable electronic systems in safety related applications for lifts (PESSRAL).

However, this European Standard may usefully be taken as guidance where relevant.

**1.6** This European Standard is not applicable to accessible goods only lifts which were manufactured before the date of its publication as EN.

**1.7** The significant hazards, hazardous situations and events dealt with by this standard are those listed in EN ISO 14121-1:2007, Annex A (see Clause 4) with the exception of:

— noise;

— vibration;

— fire;

— any form of radiation except EMC.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 81-1:1998, *Safety rules for the construction and installation of lifts — Part 1: Electric lifts*

EN 81-2:1998, *Safety rules for the construction and installation of lifts — Part 2: Hydraulic lifts*

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

EN 1005-3, *Safety of machinery — Human physical performance — Part 3: Recommended force limits for machinery operation*

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

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

EN 12385-4, *Steel wire ropes — Safety — Part 4: Stranded ropes for general lifting applications*

EN 12385-5, *Steel wire ropes — Safety — Part 5: Stranded ropes for lifts*

EN 13015, *Maintenance for lifts and escalators — Rules for maintenance instructions*

EN 50214, *Flat polyvinyl chloride sheathed flexible cables*

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

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




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

EN 60068-2-29:1993, *Basic environmental testing procedures — Part 2: Tests — Test Eb and guidance: Bump (IEC 60068-2-29:1987)*

EN 60112, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials (IEC 60112:2003)*

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

EN 60204-32, *Safety of machinery — Electrical equipment of machines — Part 32: Requirements for hoisting machines (IEC 60204-32:2008)*

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

EN 60747-5-1:1997, *Discrete semiconductor devices and integrated circuits — Part 5-1: Optoelectronic devices — General (IEC 60747-5-1:1997)*

EN 60747-5-2, *Discrete semiconductor devices and integrated circuits — Part 5-2: Optoelectronic devices — Essential ratings and characteristics (IEC 60747-5-2:1997)*

EN 60947-4-1:2001, *Low-voltage switchgear and controlgear — Part 4-1: Contactors and motor-starters; Electromechanical contactors and motor-starters (IEC 60947-4-1:2000)* (including EN 60947-4-1:2001/A1:2002)

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

EN 60950 (all parts), *Information technology equipment — Safety*

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

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

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

EN ISO 12100-1:2003, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology (ISO 12100-1:2003)*

EN ISO 12100-2:2003, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles (ISO 12100-2:2003)*

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

EN ISO 14121-1:2007, *Safety of machinery — Risk assessment — Part 1: Principles (ISO 14121-1:2007)*

EN ISO 14122-3, *Safety of machinery — Permanent means of access to machinery — Part 3: Stairs, stepladders and guard-rails (ISO 14122-3:2001)*

ISO 1219-1, *Fluid power systems and components — Graphic symbols and circuit diagrams — Part 1: Graphic symbols for conventional use and data-processing applications*

ISO 6403:1988, *Hydraulic fluid power — Valves controlling flow and pressure — Test methods*




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HD 21.3 S3, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V — Part 3: Non-sheathed cables for fixed wiring (IEC 60227-3:1993, modified)*

HD 21.4 S2:1990, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V — Part 4: Sheathed cables for fixed wiring*

HD 21.5 S3:1994, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V — Part 5: Flexible cables (cords) (IEC 60227-5:1979, modified)*

HD 22.4 S4:2004, *Cables of rated voltages up to and including 450/750 V and having crosslinked insulation — Part 4: Cords and flexible cables*

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

HD 60364-5-54:2007, *Low-voltage electrical installations — Part 5-54: Selection and erection of electrical equipment — Earthing arrangement and protective bonding conductors (IEC 60364-5-54:2002, modified)*

# 3 Terms, definitions, units and symbols

## 3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12100-1:2003 and the following apply.

**3.1.1**
**accessible goods only lift**
**fr** monte charge accessible
de betretbarer Güteraufzug
permanently installed lifting equipment intended for the transport of goods only, serving fixed and permanent landing levels, comprising a load carrying unit accessible for loading and unloading, running along a fixed course, inclined not more than 15° to the vertical, for use only by authorised and instructed persons (users)

**3.1.2**
**apron**
**fr** garde-pieds
**de** Schürze
smooth vertical part extending downwards from the sill of the landing or load carrying unit entrance

**3.1.3**
**available load carrying unit area**
**fr** surface utile de la cabine
**de** Nutzfläche des Fahrkorbes
area of the load carrying unit measured at a height of 1 m above floor level, which is available for goods during operation of the lift

**3.1.4**
**balancing weight**
**fr** masse d'équilibrage
**de** Ausgleichgewicht
mass which saves energy by balancing all or part of the mass of the load carrying unit and of other suspended equipment

**3.1.5**
**buffer**
**fr** amortisseur
**de** Puffer
resilient stop at the end of travel, which may comprise a means of braking using fluids or springs (or other similar means)




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**3.1.6**
**clamping device**
**fr** dispositif de blocage
**de** Klemmvorrichtung
mechanical device which when activated stops the load carrying unit in downward motion and maintains it stationary at any point of the travel to limit the extent of creep, by gripping the ram

**3.1.7**
**counterweight**
**fr** contrepoids
**de** Gegengewicht
mass which ensures traction

**3.1.8**
**direct acting accessible goods only lift**
**fr** monte charge accessible à action directe
**de** direkt angetriebener Aufzug
hydraulic accessible goods only lift where the means of driving is directly attached to the load carrying unit or its sling

**3.1.9**
**dissipation type buffer**
**fr** amortisseur à dissipation d'énergie
**de** Energie verzehrende Puffer
buffer that disperses the energy of a moving mass within defined levels of deceleration

**3.1.10**
**down direction valve**
**fr** soupape descente
**de** Abwärtsventil
electrically controlled valve in a hydraulic circuit for controlling the descent of the load carrying unit

**3.1.11**
**electric safety chain**
**fr** chaîne électrique des sécurités
**de** elektrische Sicherheitskette
total of the electric safety devices connected in series

**3.1.12**
**full load pressure**
**fr** pression à pleine charge
**de** Druck bei Volllast
static pressure exerted on the piping directly connected to the jack, the load carrying unit with the rated load being at rest at the highest landing level

**3.1.13**
**guide rails**
**fr** guides
**de** Führungsschienen
rigid components which provide guiding for the load carrying unit or the counterweight or the balancing weight, if there is one

**3.1.14**
**headroom**
**fr** partie supérieure de la gaine
**de** Schachtkopf
part of the well between the highest landing served by the load carrying unit and the ceiling of the well




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**3.1.15**
**hydraulic accessible goods only lift**
**fr** monte charge accessible hydraulique
**de** hydraulisch betriebener betretbarer Güteraufzug
accessible goods only lift in which the lifting power is derived from an electrically driven pump transmitting hydraulic fluid to a jack, acting directly or indirectly on the load carrying unit (multiple motors, pumps and/or jacks may be used)

**3.1.16**
**hydraulic buffer**
**fr** amortisseur hydraulique
**de** hydraulischer Puffer
buffer that uses hydraulic fluid as a means to dissipate energy

**3.1.17**
**indirect acting accessible goods only lift**
**fr** monte charge accessible à action indirecte
**de** indirekt angetriebener betretbarer Güteraufzug
hydraulic accessible goods only lift where the means of driving is connected to the load carrying unit or its sling by suspension means (e.g. ropes, chains, belts)

**3.1.18**
**instantaneous safety gear**
**fr** parachute à prise instantanée
**de** Sperrfangvorrichtung
safety gear in which the full gripping action on the guide rails is almost immediate

**3.1.19**
**jack**
**fr** vérin
**de** Heber
combination of a cylinder and a ram forming a hydraulic actuating unit

**3.1.20**
**levelling**
**fr** nivelage
**de** Einfahren
operation which improves the accuracy of stopping at landings

**3.1.21**
**lift machine**
**fr** machine
**de** Triebwerk
unit which drives and stops the load carrying unit

**3.1.22**
**load carrying unit**
**fr** unité de transport
**de** Lastträger
part of the accessible goods only lift which carries the loads

**3.1.23**
**machine room**
**fr** local de machines
**de** Triebwerksraum
room in which machine or machines and/or the associated equipment are placed




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**3.1.24**
**machinery**
**fr** machinerie
**de** Triebwerk und Steuerung
equipment traditionally placed in the machine room

NOTE Those equipment are usually cabinet(s) for control and drive system, lift machine, main switch(es) and means for emergency operations.

**3.1.25**
**machinery space**
**fr** emplacement de machinerie
**de** Aufstellungsort für Triebwerk und Steuerung
space(s) where the machinery (as a whole or in parts) is placed

**3.1.26**
**minimum breaking load of a rope**
**fr** charge de rupture minimale d'un câble
**de** Mindestbruchkraft eines Seiles
product of the square of the nominal diameter of the rope (in square millimetres) and the nominal tensile strength of the wires (in newtons per square millimetre) and a coefficient appropriate to the type of rope construction

**3.1.27**
**non return valve**
**fr** clapet de non retour
**de** Rückschlagventil
valve which allows flow in one direction only

**3.1.28**
**one-way restrictor**
**fr** clapet freineur
**de** Drossel-Rückschlagventil
valve which allows free flow in one direction and restricted flow in the other direction

**3.1.29**
**overspeed governor**
**fr** limiteur de vitesse
**de** Geschwindigkeitsbegrenzer
device which, when the accessible goods only lift attains a predetermined speed, initiates a stoppage of the accessible goods only lift load carrying unit and if necessary causes the safety gear, where provided, to be applied

**3.1.30**
**pawl device**
**fr** dispositif à taquet
**de** Aufsetzvorrichtung
mechanical device for stopping involuntary movement of the load carrying unit, and maintaining it stationary on fixed supports placed in the well

**3.1.31**
**pit**
**fr** cuvette
**de** Schachtgrube
part of the well situated below the lowest landing served by the load carrying unit

**3.1.32**
**platform**
**fr** plate-forme
**de** Platform
load carrying unit including the floor, and which may have wall(s) and entrance(s)




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**3.1.33**
**positive drive accessible goods only lift**
**fr** monte charge accessible à treuil attelé
**de** formschlüssig angetriebener betretbarer Güteraufzug
accessible goods only lift where chain or rope suspension is directly driven by means other than friction

NOTE This includes drum drive.

**3.1.34**
**pressure relief valve**
**fr** limiteur de pression
**de** Druckbegrenzungsventil
valve which limits the pressure to a pre-determined value by exhausting fluid

**3.1.35**
**pulley space**
**fr** emplacement de poulies
**de** Aufstellungsort von Seilrollen
space not containing the machine, in which pulleys are located, and in which the overspeed governor and the electrical equipment can also be housed

**3.1.36**
**rated load**
**fr** charge nominale
**de** Nennlast
load for which the equipment has been built

**3.1.37**
**rated speed**
**fr** vitesse nominale
**de** Nenngeschwindigkeit
speed v in metres per second (m/s) of the load carrying unit for which the equipment has been built

NOTE Three rated speed need to be addressed:

— $v_m$ = rated speed upwards in metres per second (m/s);

— $v_d$ = rated speed downwards in metres per second (m/s);

— $v_s$ = the higher value of both rated speeds $v_m$ and $v_d$ in metres per second (m/s).

**3.1.38**
**restricted area**
**fr** zone réservée
**de** beschränkter Bereich
area in which only trained and/or authorized persons may have access

NOTE Such areas can be found in factories, warehouses, military establishments, theatres, etc.

**3.1.39**
**restrictor**
**fr** réducteur de débit
**de** Drossel
valve in which the inlet and outlet are connected through a restricted passage way

**3.1.40**
**rupture valve**
**fr** soupape de rupture
**de** Leitungsbruchventil
valve designed to close automatically when the pressure drop across the valve, caused by the increased flow in a pre-determined flow direction, exceeds a pre-set amount




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**3.1.41**
**safety gear**
**fr** parachute
**de** Fangvorrichtung
mechanical device for stopping, and maintaining stationary on fixed means, the accessible goods only lift load carrying unit or counterweight/balancing weight by gripping the guide rails

**3.1.42**
**safety rope**
**fr** câble de sécurité
**de** Sicherheitsseil
auxiliary rope attached to the load carrying unit and the balancing weight for the purpose of tripping a safety gear in case of suspension failure

**3.1.43**
**"shut-off" valve**
**fr** robinet d'isolement
**de** Absperrventil
manually operated two-way valve which can permit or prevent flow in either direction

**3.1.44**
**sling**
**fr** étrier
**de** Rahmen
metal framework carrying the load carrying unit or counterweight/balancing weight, connected to the means of suspension

NOTE The sling can be integral with the load carrying unit enclosure.

**3.45**
**stopping gear**
**fr** dispositif d'arrêt
**de** Haltevorrichtung gegen unkontrollierte Bewegung
mechanical device for stopping, and maintaining stationary the load carrying unit in the case of unintended movement of the load carrying unit above and/or below a predetermined position in the well to protect person(s) on the load carrying unit roof and/or in the pit

**3.1.46**
**traction drive accessible goods only lift**
**fr** monte charge accessible à adhérence
**de** Treibscheiben-Aufzug
accessible goods only lift whose lifting ropes are driven by friction in the grooves of the driving sheave of the machine

**3.1.47**
**travelling cable**
**fr** câble pendentif
**de** Hängekabel
flexible cable between the load carrying unit and a fixed point

**3.1.48**
**uncontrolled movement**
**fr** mouvement incontrôlé
**de** unkontrollierte Bewegung
movement of the load carrying unit not controlled by the control system




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**3.1.49**
**unlocking zone**
**fr** zone de déverrouillage
**de** Entriegelungszone
zone, extending above and below the stopping level, in which the load carrying unit floor needs to be to enable the corresponding landing door to be unlocked

**3.1.50**
**user**
**fr** utilisateur
**de** Benutzer
person making use of the services of an accessible goods only lift installation, except for maintenance purposes

**3.1.51**
**vendor**
**fr** vendeur
**de** Verkäufer/Errichter
person or organisation that makes the accessible goods only lift available for the first use[1)]

**3.1.52**
**well**
**fr** gaine
**de** Schacht
space in which the load carrying unit and the counterweight/balancing weight, if there is one, travel

NOTE This space is usually bounded by the bottom of the pit, the walls and the ceiling of the well.

## 3.2 Units and symbols

### 3.2.1 Units

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

### 3.2.2 Symbols

Symbols are explained relevant to the equations used.

# 4 List of significant hazards

This clause contains all the significant hazards, hazardous situations and events, as far as they are dealt with in this European Standard, identified by risk assessment as significant for this type of machinery and which require action to eliminate or reduce the risk (see Table 1).

1) For the application of Machinery Directive in the European Union (EU) countries, the vendor acts as manufacturer.




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**Table 1 — List of significant hazards**

| No. | Hazards as listed in Annex A of EN ISO 14121-1:2007 | Relevant clauses in this European Standard |
|---|---|---|
| **Hazards, hazardous situations and hazardous events** | | |
| 1 | **Mechanical hazards** due to:<br>- machine parts or work pieces, e.g.:<br>- accumulation of energy inside the machinery, e.g.: | |
| | Crushing hazard | 5.2.2.2, 5.2.2.3, 5.2.3.2.2, 5.2.9, 5.2.10, 5.2.11, 5.3, 5.4.3.2, 5.4.3.4.2, 5.4.6, 5.6.2, 5.7, Annex L |
| | Shearing hazard | 5.2.3.2.2, 5.2.10, 5.3, 5.4, 5.5.1.7, 5.5.2.2, 5.6.2, 5.6.3 |
| | Cutting or severing hazard | 5.3, 5.5.1.3, 5.6.2 |
| | Entanglement hazard | 5.3, 5.4, 5.5.1.3, 5.5.1.7, 5.5.2.2, 5.6.2, 5.6.3 |
| | Drawing-in or trapping hazard | 5.2.3.2.1, 5.2.8, 5.2.14, 5.3, 5.4.3.2, 5.4.3.4.2, 5.4.6, 5.5.2.2, 5.6.2, 5.6.3 |
| | Impact hazard | 5.2.3.2, 5.2.10, 5.4, 5.5.1.2.4, 5.5.1.3, 5.5.1.4, 5.5.1.5, 5.6.2, 5.7 |
| | Stabbing or puncture hazard | Not relevant |
| | Friction or abrasion hazard | 5.3 |
| | High pressure fluid injection or ejection hazard | Not relevant |
| | Loss of stability / overturning of machinery | 5.2.5, Annex D, G.2 |
| | Slip, trip and fall of persons (related to machinery) | 5.2.8, 5.3, 5.4, 5.5.1.2 |
| | From load falls, collisions, machine tipping caused by: | 5.4.2.4 |
| | — lack of stability | 5.5.2.1, G.1, G.2, Annex I |
| | — uncontrolled loading – overloading – overturning moments exceeded | 5.5.1.1 |
| | — uncontrolled amplitude of movements | 5.5.1.8, 5.6.2, 5.7 |
| | — unexpected/unintended movement of loads | 5.5.1.2.3, 5.5.1.3, 5.5.2.1 |

*(to be continued)*

**Table 1 — List of significant hazards** *(continued)*

| No. | Hazards as listed in Annex A of EN ISO 14121-1:2007 | Relevant clauses in this European Standard |
|---|---|---|
| | From access of persons to load support | 5.4.2.2, 5.4.2.3 |
| | From derailment | 5.4.2.4, 5.7 |
| | From insufficient mechanical strength of parts | 5.4.2.3, 5.4.3.2, 5.4.4, 5.4.5, 5.5.1.1, 5.5.1.3, 5.6.1, 5.6.2, 5.7, 5.8, Annex F: F.2, F.3, F.4, F.5, F.6, G.1, G.2, Annex I |
| | From inadequate design of pulleys, drums | 5.5.1.7, 5.5.2.2, 5.6.1, 5.6.2, 5.6.3, G.1 |
| | From inadequate selection of chains, ropes, lifting and accessories and their inadequate integration into the machine | 5.3.3.3, 5.4.3.2, 5.4.3.3, 5.6.1, 5.6.2, 5.8, G.1, G.2 |
| | Falling or ejected objects or fluids | 5.2.8, 5.4.5, G.2, Annex I |
| | Falling of person from person carrier | 5.5.1.5, 5.5.1.6 |
| | Falling or overturning of person carrier | 5.6.2 |
| **2** | **Electrical hazards** due to: | |
| | Contact of persons with live parts (direct contact) | 5.2.11.2.4, 5.3, 5.9, 5.10, 7.1, F.2, F.4, F.5 |
| | Contact of persons with parts which have become live under faulty conditions (indirect contact) | 5.3, 5.3.3.2, 5.5.1.8, 5.9, 5.10, 7.1, F.5 |
| **3** | **Thermal hazards**, resulting in: | |
| | Burns, scalds and other injuries by a possible contact of persons with objects or materials with an extreme high or low temperature, by flames or explosions and also by the radiation of heat sources | 5.2.12, 5.3, 7.1, G.2 |
| | Damage to health by hot or cold working environment | 5.2.12, 5.3, G.2 |
| **4** | **Hazards generated by noise**, resulting in: | |
| | Hearing loss (deafness), other physiological disorders (e.g. loss of balance, loss of awareness) | 7.2 |
| | Interference with speech communication, acoustic signals, etc. | 7.2 |
| **5** | **Hazards generated by vibration** | Not relevant |
| **6** | **Hazards generated by radiation** | Not relevant |
| **7** | **Hazards generated by materials and substances** (and their constituent elements) processed or used by the machinery | Not relevant |
| | Hazards from contact with or inhalation of harmful fluids, gases, mists, fumes and dusts | Not relevant |
| **8** | **Hazards generated by neglecting ergonomic principles in machinery design** as, e.g. hazards from: | |
| | Unhealthy postures or excessive effort | 5.2.11.2.3.1, 5.3.2.2, 5.3.3.2, 5.3.3.3, 5.4, 5.5.1.3, 5.5.1.6, 7.2, G.1 |

*(to be continued)*

**Table 1 — List of significant hazards** *(continued)*

| No. | Hazards as listed in Annex A of EN ISO 14121-1:2007 | Relevant clauses in this European Standard |
|---|---|---|
| | Inadequate local lighting | 5.2.13, 5.4.2.5, 5.5.1.8, 5.5.1.9, 5.9, 7.2 |
| | Human error, human behaviour | 5.2.12, 5.3, 5.4.5, 5.6.2, 5.10, 7.1, 7.2, Annex C, Annex D, F.2, F.4, F.5, F.6, G.1, G.2, Annex K |
| | Errors made by the operator (due to mismatch of machinery with human characteristics and abilities, see 8.6) | Annex K |
| | Errors of fitting | 5.9, Annex D, Annex K |
| | Inadequate design, location or identification of manual controls | 5.4.3.4.2, 7.2 |
| | Inadequate holding devices/accessories | 5.5.1.3, 5.5.2.1 |
| | From abnormal conditions of assembly/testing/use/maintenance | 5.6.2, 7.2, F.2, F.3, F.4, F.6, G.1 |
| | Insufficient visibility from the driving position | 5.4.2.5, 5.4.3.4.2, 5.5.1.3, 5.5.1.9, 7.2 |
| **9** | **Hazards associated with the environment in which the machine is used** | |
| | Damage to health by hot or cold working environment | 5.2.12, 5.3, G.2 |
| | External influences on electrical equipment | 5.9, Annex J |
| | Failure of the power supply | 5.10 |
| | Failure of the control circuit | 5.10, Annex K |
| | Impossibility of stopping the machine in the best possible conditions | 5.4.3.4.2, 5.5.1.8 |
| | Unexpected start-up, unexpected overrun/overspeed (or any similar malfunction) from: | 5.2.11.2.4, 5.5.1.8, 5.6.2, 5.10 |
| | Failure/disorder of the control system | Annex K |
| | Restoration of energy supply after an interruption | 5.10 |
| | Failing of loading control | 5.5.1.1, 5.6.2 |
| | Failing of controls in person carrier (function, priority) | 5.5.1.6 |
| | Overspeed of person carrier | 5.5.1.8, 5.6.2, G.2 |

# 5 Safety requirements and/or protective measures

## 5.1 General

Accessible goods only lifts shall comply with the safety requirements and/or protective measures of the following clauses. In addition the accessible goods only lifts shall be designed according to the principles of EN ISO 14121-1 for hazards relevant but not significant that are not dealt with by this document (e.g. sharp edges).

## 5.2 Lift well

### 5.2.1 General provisions

The requirements of this clause relate to wells containing one or more accessible goods only lifts.

The counterweight or the balancing weight of an accessible goods only lift shall be in the same well as the load carrying unit.

### 5.2.2 Well enclosure

**5.2.2.1** An accessible goods only lift shall be separated from its surroundings by an enclosure.

**5.2.2.2** Where the type A accessible goods only lift is located in a restricted area and the well is not required to contribute against the spread of fire, the well enclosure can be perforated and:

a) it shall comply with EN ISO 13857:2008, Table 2;

b) it shall not be possible to interfere with the operation of the lift by reaching lift equipment within the well.

**5.2.2.3** The well shall be totally enclosed by imperforate walls, floor and ceiling (see **0.2.5**) in the following cases:

a) type B accessible goods only lifts;

b) type A accessible goods only lifts not placed in a restricted area;

c) in sections of the building where the well is required to contribute against the spread of fire.

**5.2.2.4** The only permissible openings in imperforate enclosures 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 accessible goods only lift between the well and the machine or pulley rooms;

f) openings in partition between lifts (passenger, goods passenger, goods only, etc.) according to 5.2.10.

### 5.2.3 Inspection doors – Vertically hinged inspection traps

**5.2.3.1** Inspection doors and inspection traps to the well shall not be used except on grounds of the requirements of maintenance.

The dimensions of the inspection doors and traps shall be adapted to their position in the well, their purpose and the visibility for the work to be undertaken.

**5.2.3.2** Inspection doors and vertically hinged inspection traps shall not open towards the interior of the well.

**5.2.3.2.1** The inspection doors and inspection traps shall be provided with a key-operated lock, capable of being re-closed and re-locked without a key.

Any inspection door or trap greater than 0,50 m × 0,50 m shall be capable of being opened from inside the well without a key, even when locked.

**5.2.3.2.2** Operation of the accessible goods only lift shall automatically depend on maintaining these inspection doors and inspection traps in the closed position. For this purpose, electric safety devices in conformity to 5.10.1.2 shall be used.

This requirement does not apply to doors and traps giving exclusive access to the machine and its associated parts, but applies to doors and traps giving access to overspeed governor, if any, installed in the well.

**5.2.3.3** For type A accessible goods only lifts inspection doors and inspection traps shall be in compliance with EN ISO 13857:2008, Table 5 and for type B accessible goods only lifts they shall be imperforate. They shall satisfy the same requirements for mechanical strength as the landing doors.

NOTE Relevant regulations to the fire protection for the building concerned need to be taken into account (see 0.2.5).

**5.2.3.4** Safe access to these inspection doors and inspection traps shall be provided according to 5.3.2.

### 5.2.4 Ventilation of the well

The well shall be ventilated. The stale air from other parts of the building shall not be extracted via the well.

### 5.2.5 Walls, floor and ceiling of the well

The structure of the well shall be able to support at least the loads which may be applied by the accessible goods only lift, e.g. by the machine, the guide rails at the moment of safety gear operation, due to eccentric loading in the load carrying unit as intended by the manufacturer, by the action of the fixed stops or buffers (see 0.2.5).

### 5.2.6 Strength of the walls

For the safe operation of the accessible goods only lift the walls shall have a mechanical strength such that when a force of at least 300 N, being evenly distributed over an area of 5 cm² in round or square section, is applied at a right angle to the wall at any point on either face they shall resist without:

a) permanent deformation;

b) elastic deformation greater than 15 mm.

See also 0.2.5, 0.3.9 and 5.2.8.

### 5.2.7 Strength of the pit floor

The floor of the pit shall be designed to withstand all dead and live loads with due allowance for moving masses and inertia forces, such as the application of the safety gear, if fitted and the action of stops, buffered or not, etc. (see 0.2.5 and 5.2.9).

NOTE EN 81-1:1998, Annex G, Table G.2 gives a value of the impact factor K that could be taken into account.

### 5.2.8 Construction and clearances of the walls of lift wells and landing doors facing a load carrying unit entrance

**5.2.8.1** The horizontal distance between the sill of the load carrying unit and the sill of the landing doors shall not exceed 35 mm.

Where the load carrying unit entrance is provided with suitable protection means (see 5.5.1.2.3), the free distance between the landing sill and the landing doors facing the load carrying unit shall not exceed 35 mm.

**5.2.8.2** Where the load carrying unit entrances are not provided with means as specified in 5.5.1.2.3, walls including doors facing load carrying unit access(es) shall have:

a) a resistance in accordance with 5.2.6;

b) a distance to the load carrying unit sill in accordance with 5.2.8.1; and

c) the wall surface facing the load carrying access(es) plus 25 mm on both sides for a height of at least the unlocking zone extending above and below the load carrying unit entrance shall be:

   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.

**5.2.8.3** When manual levelling with door open is provided according to 5.10.2.2 below each landing doorsill 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 10 mm and whose width is at least the clear opening of the load carrying unit 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 or equivalent. It shall be capable of withstanding a force of 300 N (see also 0.3.9) 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 without:

   1) permanent deformation;

   2) 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.

### 5.2.9 Protection of any spaces located below the load carrying unit, the counterweight or the balancing weight

If accessible spaces do exist below the load carrying unit, 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 either:

a) 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 (see 0.2.5); or

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

NOTE Accessible goods only lift wells should preferably not be situated above a space accessible to persons.

### 5.2.10 Protection in the well

**5.2.10.1** In the lower part of a well accessible to maintenance personnel the travelling area of the counterweight or balancing weight shall be guarded by either:

a) a rigid screen extending from a position not more than 0,30 m above the accessible goods only lift pit floor to a position at least 2,50 m.

   The width shall be at least equal to that of the counterweight plus 0,10 m on each side. If this partition is perforate, EN ISO 13857:2008, 4.2.4.1 shall be respected;

b) or a means in accordance with 5.2.11.2.3.1, a), 3), limiting the travel of the counterweight or balancing weight at least 1,80 m above the pit floor.




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

If this partition is perforate, EN ISO 13857:2008, 4.2.4.1 has to be respected.

**5.2.10.2.1** This partition shall extend at least from the pit floor 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.

**5.2.10.2.2** The partition shall extend through the full height of the well if the horizontal distance between the outer edge of the load carrying unit and a moving part (load carrying unit, 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.

### 5.2.11 Headroom and pit

#### 5.2.11.1 Top clearances

**5.2.11.1.1** Where the load carrying unit is not provided with a roof and the load carrying unit is in the extreme upward position it can reach, the following three conditions shall be satisfied at the same time:

a) the load carrying unit guide rail lengths shall be such as would accommodate a further guided travel of at least 0,1 m;

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

   1) the highest pieces of equipment fixed on the load carrying unit enclosure, except for those covered in 2) below, shall be at least 0,30 m;

   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, and of an upward travelling part of the machinery assembly (ram head, etc.) shall be at least 0,10 m;

c) the clearance between the load carrying unit floor and the lowest parts of the ceiling of the well shall be at least equal to the clear height of the tallest landing door plus 0,10 m. In no case shall it be less than 1,80 m.

**5.2.11.1.2** For load carrying units with a roof (see 5.5.1.6):

a) where no inspection control station is provided on the load carrying unit roof, a stopping device according to 5.10.2.4 shall be provided on the load carrying unit roof and requirements of 5.2.11.1.1, a) and 5.2.11.1.1, b) apply with the exception that the minimum clearance given in 5.2.11.1.1, b), 1) is reduced to 0,10 m;

b) where an inspection control station is provided on the load carrying unit roof, in addition to the requirements of 5.2.11.1.1, clearances and free spaces according to 3) below shall be provided and,

   1) obtained by means of well dimensions; or

   2) achieved with the application of the requirements listed in L.2 or L.3 as applicable;

   3) when the counterweight or balancing weight rests on its fixed stops or fully compressed buffer(s), the following two conditions shall be satisfied at the same time:

      i) the free vertical distance between the level of the highest area on the load carrying unit roof whose dimensions comply with 5.5.1.6.1 (areas on parts according to 5.2.11.1.1, b), 2) excluded) and the level of the lowest part of the ceiling of the well (including beams and




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components located under the ceiling) situated in the projection of the load carrying unit shall be at least 1,0 m;

ii) there shall be above the load carrying unit sufficient space to accommodate a rectangular block not less than 0,50 m × 0,60 m × 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;

c) type B accessible goods only lifts shall comply with the requirements of 5.2.11.1.2, b);

d) for type A accessible goods only lifts with positive drive and type B accessible goods only lifts with positive drive and a speed of not more than 0,30 m/s the guided travel of the load carrying unit upwards from the top floor until it strikes the upper fixed stop(s) or buffer(s) shall be at least 0,20 m;

e) for type B accessible goods only lifts with positive drive and a speed of more than 0,30 m/s the guided travel of the load carrying unit upwards from the top floor until it strikes the upper fixed stop(s) or buffer(s) shall be at least 0,50 m. The load carrying unit shall be guided to the limit of its buffer stroke.

**5.2.11.1.3** When the load carrying unit rests on its fixed stops or fully compressed buffers, the counterweight or balancing weight guide rail lengths shall be such as would accommodate a further guided travel of at least 0,10 m.

### 5.2.11.2 Pit

#### 5.2.11.2.1 General

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

After the building-in of guide rail fixings, stops or buffers, any grids, etc., the pit shall be impervious to infiltration of water (see 0.2.5).

#### 5.2.11.2.2 Access to the pit

A permanent means shall be provided inside the well, easily accessible from the landing door (see EN ISO 14122), to permit competent persons to descend safely to the floor of the pit. This shall not project into the clear running space of the lift equipment.

#### 5.2.11.2.3 Pit clearances

**5.2.11.2.3.1** Pit clearances and/or refuge spaces shall be provided either:

a) at least according to the following requirements:

1) there shall be a vertical clearance of at least 10 mm between the lowest parts of the moving equipment and the highest parts of the pit or the equipment installed in it when the fully loaded load carrying unit rests on its fixed stop(s) or fully compressed buffer(s); and

2) a stopping device in accordance with 5.10.2.4 shall be provided to prevent the load carrying unit from moving at the latest when a person is in the pit.

If the stopping device is manually operated it shall be accessible from outside of the well pit only when the lowest access door is open; and

3) for maintenance purposes, mechanical means, electrically checked with a safety switch according to 5.10.1.2.2, shall be provided to physically limit the travel of the load carrying unit behaving as fixed stops under the load carrying unit, to assure a clearance of minimum 1,80 m height between the floor of the pit and the lowest part of the load carrying unit or its supporting structure.




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NOTE This means can be the same as the one used to prevent the load carrying unit from leaving the landing (5.6.2.3).

i) If the effort required to position the mechanical means exceeds 200 N or the lower effort applicable according to EN 1005-3, its actuation has to be powered;

ii) the operation of the mechanical means, with the exception of means in accordance with 5.6.2.3, shall cause the illumination of an indicating lighting placed under the load carrying unit, and visible from the pit;

iii) the mechanical means shall be capable of taking a static load at least equal to three times the weight of the fully loaded load carrying unit, without permanent deformation, in such a way that the floor of the load carrying unit resting on these means, after having hit the stop, shall not depart by more than 5 % from the normal level;

b) or when the load carrying unit rests on its fixed stops or fully compressed buffers, the following five conditions shall be satisfied at the same time:

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

2) the free vertical distance between the bottom of the pit and the lowest parts of the load carrying unit 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:

i) clamping device blocks, pawl devices, apron or parts of the vertical sliding door(s) and the adjacent wall(s);

ii) the lowest parts of the load carrying unit and the guide rails;

3) the free vertical distance between the highest parts fixed in the pit, for instance jack supports, pipes and other fittings, and the lowest parts of the load carrying unit, except for items detailed in 2), i) and 2), ii) above, shall be at least 0,30 m;

4) the free vertical distance between the bottom of the pit or the top of equipment installed there and the lowest parts of the downward travelling ram-head assembly of an inverted jack shall be at least 0,50 m.

However, if it is impossible to gain involuntary access under the counterweight or the ram head assembly (for example by providing screens in accordance with 5.2.10.1), this vertical distance may be reduced from 0,50 m to 0,10 m minimum;

5) the free vertical distance between the bottom of the pit and the lowest guiding yoke of a telescopic jack below the load carrying unit of a direct acting lift shall be at least 0,50 m.

**5.2.11.2.3.2** In case of type B accessible goods only lifts having rated speed greater than 0,30 m/s pit clearances and refuge spaces shall be provided according to:

a) 5.2.11.2.3.1, b); or

b) the requirements listed in L.4.

#### 5.2.11.2.4 Equipment in the pit

There shall be in the pit:

a) stopping device(s) accessible on opening the door(s) giving access to the pit, and from the pit floor, in conformity with the requirements of 5.10.2.4 and 7.1.9;

b) a socket outlet (5.9.5.5.2).

In the pit of type B accessible goods only lifts there shall also be means to switch the lift well lighting (5.9.5.6.2), accessible on opening the access door(s) to the pit.

#### 5.2.12 Exclusive use of the lift well

The well shall be exclusively used for the accessible goods only lift. It shall not contain cables or devices, etc., other than for the accessible goods only 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 of the well.

#### 5.2.13 Lighting of the well

At least a socket outlet shall be provided in the well for lighting by means of portable lamp (see 0.2.5).

Where the load carrying unit roof is intended to be used as a working platform for maintenance and service operation, such as for type B accessible goods only lifts, there shall be lighting in the well giving a minimum light intensity of 50 lux at the working places.

#### 5.2.14 Alarm device

If there is a risk for persons working in the well being trapped and no means are provided to escape, either through the load carrying unit, or through the well, or no means of communication within the user's premises are present (see 0.2.5), alarm devices shall be installed at places where this risk exists.

The alarm devices shall fulfil at least the following requirements:

a) the power for this device shall be from an electric charging supply which is capable of feeding the device for 1 h in case of interruption of the normal power supply;

b) this device shall at least cause the operation of an audible and visible alarm in an area close to the accessible goods only lift well and/or in an area close to potential rescuers. The sound level shall be appropriate to the environment with a minimum of 60 dB(A) (see also 0.2.5);

c) the device activating the alarm shall be easily recognisable and accessible, visible even in case of power supply failure.

### 5.3 Machinery spaces

#### 5.3.1 General provisions

**5.3.1.1** Machinery and pulleys shall be located in machinery spaces. These spaces and the associated working areas shall be only accessible to authorised persons (e.g. maintenance personnel, inspection personnel). The spaces and the associated working areas shall be suitably protected against environmental influences intended by the manufacturer to be taken into consideration and provisions shall be made for suitable areas for maintenance/inspection work. See 0.2.3 and 0.2.5.

**5.3.1.2** Machinery spaces shall not be used for purposes other than accessible goods only lifts. They shall not contain ducts, cables or devices other than for the accessible goods only lift.

These spaces may, however, contain:

a) machines for lifts;

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.




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**5.3.1.3** Machinery spaces may be:

a) rooms, comprising solid walls, ceiling, floor and door and/or trap;

b) cabinet(s), consisting of imperforate walls, floor, roof and door(s);

c) part of the lift well (see also 5.2.2.2).

**5.3.1.4** The only permissible openings in the machinery spaces imperforate enclosures are:

a) ventilation openings;

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

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

**5.3.1.5** These openings when accessible to non-authorised persons shall comply with the following requirements:

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

b) degree of protection of at least IP 2XD against contact with electrical equipment.

**5.3.1.6** Diverter pulleys may be installed in the headroom of the well provided that:

a) protection means are fitted according to 5.6.3, Table 4;

b) retaining devices to prevent diverter pulleys from falling in the event of a mechanical failure. The devices shall be able to support the weight of the pulley and the suspended loads;

c) examinations and tests and maintenance operations can be carried out in complete safety from the load carrying unit roof/floor or from outside of the well.

### 5.3.2 Access

#### 5.3.2.1 General

Access to the machine and its associated equipment shall be possible only for authorised persons. Access means shall comply with the requirements of EN ISO 14122-3.

Safe and unobstructed access door(s) and trap door(s) shall be provided to the lift machine and its associated equipment.

The clear dimensions of openings giving access for replacement of the lift machine and its associated equipment shall allow the possible replacement of the accessible goods only lift components. This might include the dismantling of machine room enclosure panels.

Their dimensions shall be at least 0,60 m $\times$ 0,60 m or, where the size of the machine room does not allow, other openings can be adapted to suit the replacement of components.

In the open position the doors and traps shall not penetrate into the clear spaces mentioned in 5.3.1.3.

#### 5.3.2.2 Accessible machinery spaces

A machinery space is regarded as accessible to maintenance personnel if:

a) the openings giving access have a minimum size of 0,60 m $\times$ 0,60 m; and

b) the height of the machinery space is at least 1,80 m.

Where maintenance is intended to be carried out from inside of the machinery spaces, the sill of the access door shall not be higher than 0,40 m above the access level. The access doors and access traps shall be provided with a key-operated lock, capable of being re-closed and re-locked without a key. They shall be capable of being opened from inside the space without a key, even when locked.

#### 5.3.2.3 Non accessible machinery spaces

Where maintenance is intended to be carried out from outside of the machinery spaces, the distance from the sill of doors or traps to any components requiring maintenance, adjustment or inspection shall not exceed 0,60 m.

The level of the lower edge of the doors or traps shall be placed at least at 1,10 m above the level of the working area.

The door or trap door shall:

a) not open towards the inside of the machinery spaces;

b) be provided with a key-operated lock, capable of being re-closed and relocked without a key.

Suitable provisions shall be taken where the maximum forces to be exerted during maintenance operation exceed the values given in EN 1005-3.

### 5.3.3 Construction and equipment of machinery spaces

#### 5.3.3.1 General

Standing areas used for maintenance shall be slip resistant (e.g. chequer plate, grids).

#### 5.3.3.2 Dimensions

**5.3.3.2.1** In no case shall the clear height, for movement or for standing to work, be less than 1,80 m.

This full height for movement or working is taken to the underside of the ceiling or the structural roof beams and measured from:

a) the floor of the access area;

b) the floor of the working area(s).

NOTE See also 0.2.3 for National Regulations and 0.2.5 for negotiations.

**5.3.3.2.2** In front of control panels and cabinets there shall be a clear horizontal area. This is defined as follows:

a) depth, measured from the external surface of the panels, at least 0,70 m;

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

**5.3.3.2.3** In front of mechanical parts where inspection, maintenance or manual operation (see G.1.5) is intended by the manufacturer, there shall be a clear horizontal area of at least 0,50 m $\times$ 0,60 m.

**5.3.3.2.4** Where inspection and maintenance is intended to be carried out from outside of the machinery spaces, in front of the sill of the inspection door there shall be a clear space of at least the height of the door lintel. The projection of which on the horizontal section is a minimum of 0,70 m $\times$ 0,60 m, allowing in all cases the door to be fully opened.

**5.3.3.2.5** There shall be a clear space of at least 0,30 m height above the pulleys, or protection has to be fitted.

#### 5.3.3.3 Handling of equipment

Provisions with the indication of the safe working load (7.1.6.6) shall be provided in the machinery spaces ceiling or on the beams, conveniently positioned to permit the hoisting of heavy equipment (see 0.2.5 and 0.3.13).

## 5.4 Landing doors

### 5.4.1 General provisions

The openings in the well giving access to the load carrying unit shall be provided with doors to prevent persons from falling into the well or being damaged because of the relative movement of the lift equipment.

The landing doors shall comply with the regulations relevant to the fire protection for the building concerned.

### 5.4.2 Height, width, sills of openings at landings

#### 5.4.2.1 Height

The clear height of the openings at landings shall be more than 1,20 m.

When the clear height is less than 2,00 m, loading and unloading of the load carrying unit shall be carried out from outside of the well, e.g. by use of containers or pallets.

#### 5.4.2.2 Width

The clear width of the openings at landings shall not extend more than 50 mm beyond the clear load carrying unit entrance on both sides.

#### 5.4.2.3 Sills

Every opening at landings shall incorporate a sill of sufficient strength to withstand the passage of loads being introduced into the load carrying unit.

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.

#### 5.4.2.4 Guides for landing doors

**5.4.2.4.1** 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.

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

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

#### 5.4.2.5 "Load carrying unit here" indication

An indication of the presence of the load carrying unit at the landing shall be given by means of:

a) an illuminated signal, which can only light up when the load carrying unit is about to stop or has stopped at the particular landing. The signal shall remain illuminated whilst the load carrying unit remains there; or

b) one or more transparent vision panels conforming to the following five conditions at the same time:




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1) mechanical strength as specified in 5.4.3.2;

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;

5) the load carrying unit shall be continuously electrically illuminated (see 5.5.1.9).

### 5.4.3 Doors

#### 5.4.3.1 General

Doors of accessible goods only lifts, including their frame, shall be imperforate.

#### 5.4.3.2 Mechanical strength

**5.4.3.2.1** 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 a right angle to the panel at any point on either face they shall resist without:

a) permanent deformation;

b) elastic deformation greater than 15 mm

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

See also 0.2.5 and 0.3.9.

**5.4.3.2.2** 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.

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 above may exceed 10 mm, but they shall not exceed:

a) 30 mm for side opening doors;

b) 45 mm in total for centre opening doors.

**5.4.3.2.3** Landing doors made of glass shall not be used with the exception of vision panel (5.4.2.5, b)).

#### 5.4.3.3 Suspension of vertically sliding doors

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

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

**5.4.3.3.3** The pitch diameter of suspension rope pulleys shall be at least 20 times the rope diameter.

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




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#### 5.4.3.4 Protection in relation to door operation

##### 5.4.3.4.1 General

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

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

##### 5.4.3.4.2 Power operated doors

Automatic power operated doors shall not be used.

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

The movement of non-automatic power operated doors shall depend on:

a) a hold to run control device located such as to allow supervision of the door movement by the operator;

b) a stopping device in conformity with 5.10.2.4 adjacent to the manual control actuator; and

c) the maximum speed of the closing edge of the door limited to 0,3 m/s.

### 5.4.4 Protection against risk of falling and shearing

**5.4.4.1** A locking device in conformity with 5.4.5 shall be provided to prevent, in normal operation, the opening of a landing door (or any of the panels in the case of a multi-panel door) unless the load carrying unit has stopped, or is on the point of stopping, in the unlocking zone of that landing.

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

Operation with landing doors open is permitted in the unlocking zone to permit levelling and re-levelling at the corresponding floor level provided the requirements of 5.10.2.2 are met.

**5.4.4.2** It shall not be possible in normal operation to start the accessible goods only 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 (see 5.4.6).

### 5.4.5 Locking and manual unlocking

**5.4.5.1** Each landing doors shall be provided with a locking device satisfying the conditions of 5.4.4.1. This device shall be protected against deliberate misuse.

**5.4.5.2** For hinged landing doors, locking shall be effected as near as possible to the vertical closing edge(s) of the landing doors, and maintained even in the case of wear of the hinge.

**5.4.5.3** For sliding doors with multiple, mechanically linked panels, it is permitted to lock only one panel provided that:

a) this single locking prevents the opening of the other panel(s); and

b) these are not fitted with a handle.

**5.4.5.4** The load carrying unit shall not be able to start until the locking elements are engaged by at least 7 mm; see Figure 1.




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Dimensions in millimetres

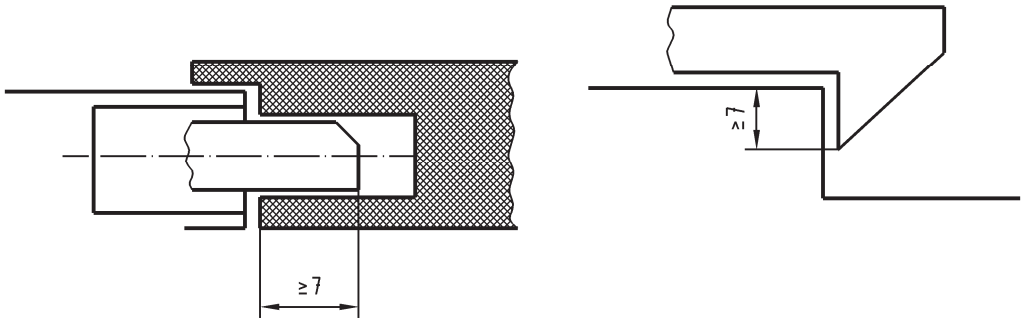


**Figure 1 — Examples of locking elements**

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

**5.4.5.6** 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.

**5.4.5.7** The lock shall resist without permanent deformation a test according to F.2.2.2 or equivalent.

**5.4.5.8** 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).

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

**5.4.5.10** In the case of accessible goods only lifts with landing doors, the locking element shall be fitted with an electric safety device in conformity with 5.10.1.2. The elements of the electric safety device proving the locked condition of the landing doors shall be positively operated without any intermediate mechanism by the locking element. It shall be foolproof but adjustable if necessary.

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

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

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.

The locking device is regarded as a safety component. F.2 gives a method to test the locking device.

**5.4.5.11** Each landing door with a locking device shall be fitted with an emergency unlocking device operated from the outside of the well with the aid of a key, which fits to the unlocking triangle as defined in Annex B.

In case of type B accessible goods only lifts with reduced headroom *(*5.2.11.1.2, b), 2)), only the lowest and highest landing doors shall be provided with the manual unlocking device.




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After a manual 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 load carrying unit 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 load carrying unit is outside of the unlocking zone.

#### 5.4.6 Electrical device for proving the landing doors closed

**5.4.6.1** Each landing door shall be provided with an electric safety device in conformity with 5.10.1.2 for proving the closed position, so that the conditions imposed by 5.4.4.2 are satisfied.

Operation of the load carrying unit with landing doors not in their closed position is permitted in the unlocking zone to permit levelling or manual re-levelling at the corresponding floor level, provided the requirements of 5.10.2.2 are met (see 5.4.4.1).

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

**5.4.6.3** Where horizontally sliding landing doors are coupled with load carrying unit 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.

**5.4.6.4** For sliding doors with multiple, mechanically linked panels, it is permitted to place the device required in 5.4.5.1 or 5.4.5.3, on a single panel.

Where the mechanical link is indirectly made (e.g. by rope, belt or chain) the closed position of the panel(s) not locked by the locking device and not hooked in the closed position, shall be proved by an electric safety device in conformity with 5.10.1.2.

### 5.5 Load carrying unit, counterweight and balancing weight

#### 5.5.1 Load carrying unit

##### 5.5.1.1 General

**5.5.1.1.1** The load carrying unit structure can range from a platform with protection means in accordance with 5.5.1.2.1 up to a fully enclosed load carrying unit.

**5.5.1.1.2** The rated load shall be linked to the weight of the goods to be transported (see 0.2.5).

To prevent an overloading of the load carrying unit by goods, the relation between the rated load and available area of the load carrying unit shall not be less than 200 kg/m².

Where the rated load exceeds 1 000 kg, an overload device shall be provided (5.10.2.7).

The floor of the load carrying unit shall be capable of supporting the local load caused by the weight of the goods to be transported and the weight of the persons and/or handling equipment when loading or unloading according to the intended use (see 0.2.5).

**5.5.1.1.3** The assembly of the load carrying unit comprising components such as the sling, guide shoes, walls, guarding, floor and roof shall have sufficient mechanical strength to resist the forces which will be applied in normal lift operation and in safety devices operation or impact of the load carrying unit on its stops, buffered or not.

In addition, design calculations for the load carrying unit shall take into account not only the load carried but also the weight of handling devices, which may enter the load carrying unit (see 0.2.5).

#### 5.5.1.2 Enclosure

**5.5.1.2.1** Means shall be provided to prevent the risk of persons falling off the load carrying unit during loading and unloading. This can be achieved by guarding at the load carrying unit sides. The guarding shall consist of a handrail at 1,10 m height, a toe guard of 0,15 m height and an intermediate bar at half the height of the guarding.

Each guarding shall have at least a mechanical strength such that when a force of 1 000 N is applied on the handrail in the most unfavourable position, it shall resist without any permanent deformation and with elastic deformation not greater than 10 mm.

If a load carrying unit wall replaces the guarding, requirement for mechanical strength at least according to 5.2.6 apply (see also 5.5.1.1.3).

A guarding can be replaced by a well enclosure provided its strength is according to 5.2.6 and the distance between the outer edge of the load carrying unit and the surface of the wall does not exceed 35 mm. This surface shall be continuous and be composed of smooth and hard elements, such as metal sheets, hard facings or materials equivalent with regard to friction.

The enclosure shall be of limited flammability, e.g. according to EN 13501-1:2007, class C.

Particular attention shall be given to load carrying units constructed with openings on opposite or adjacent sides to prevent goods from projecting outside of the load carrying unit (see examples in Annex H). See also 0.2.5.

**5.5.1.2.2** For type B accessible goods only lifts the load carrying unit 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) trap doors;

c) ventilation openings.

The walls may be perforated with openings in conformity with EN ISO 13857:2008, Table 4.

**5.5.1.2.3** Where the goods to be transported could move during travel, devices, e.g. walls, ceiling, retainers, barriers, roller blinds, doors, shall be provided to prevent the goods from falling outside of the load carrying unit. These means shall be part of the load carrying unit and appropriate in strength and design to the goods to be transported. See also 0.2.5.

**5.5.1.2.4** The entrances to the load carrying unit and its interior clear height shall be at least 2,00 m except if loading and unloading do not require the load carrying unit to be entered, e.g. by use of container or pallet.

Where the load carrying unit is not fitted with a ceiling, the minimum clear height above the platform shall be considered as equal to the minimum clear height of the landing entrances and the maximum shall be related to the goods to be transported (see also 0.2.5).

#### 5.5.1.3 Doors at load carrying unit entrances

##### 5.5.1.3.1 General

With the exception of the unlocking zone as specified in 5.4.4.1, it shall not be possible in normal operation to start the accessible goods only lift nor keep it in motion if a load carrying unit entrance door, where fitted, is open. This shall be achieved by means of an electric safety device in conformity with 5.10.1.2.

Where vertically opening doors are used, any unintended movement of them shall be prevented.

Where manually operated doors are used, ergonomic principles shall be taken into consideration




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(see EN 1005-3).

Automatic power operated entrance doors shall not be used.

Non-automatic power operated entrance doors and their surrounds shall be designed in such a way as to minimise risk of damage or injury due to jamming of a part of the person, clothing or other objects.

The movement of any power-operated load carrying unit doors, where fitted, shall depend on:

a) a hold to run control device located at the landings such as to allow supervision, by the user actuating the control device, of the movement of the door;

b) a stopping device in conformity with 5.10.2.4 adjacent to the hold to run control device; and

c) the speed of the closing edge of the door limited to 0,30 m/s.

NOTE The devices in a) and b) above can be the same as those mentioned in 5.4.3.4.2 if landing and load carrying unit doors are operated simultaneously.

The horizontal distance between the load carrying unit door and the closed landing doors or the access distance between the doors during the whole of their normal operation shall not exceed 0,12 m.

In the case of the combination of a hinged landing door and a folding load carrying unit door it shall not be possible to place a ball with a diameter of 0,15 m in any gap between the closed doors.

#### 5.5.1.3.2 Doors

**5.5.1.3.2.1** The load carrying unit door, where provided, shall be fitted with a vision panel(s) complying with 5.4.2.5, b) requirements when the landing door has a vision panel(s) for the purpose of "Load carrying unit here" indication.

The vision panel(s) shall be positioned in the load carrying unit door such that it is in visual alignment with the landing door vision panel(s) when the load carrying unit is at the level of the landing.

**5.5.1.3.2.2** For sliding door with multiple, mechanically linked panels it is permitted to place the device required to prove the closed position (5.5.1.3) either:

a) on a single panel (the leading panel in the case of telescopic doors); or

b) on the door-driving element if the mechanical connection between this element and the panels is direct.

Where the mechanical link is indirectly made (e.g. by rope, belt or chain), the closed position of the panel(s) not hooked in the closed position, shall be proved by an electric safety device in conformity with 5.10.1.2.

### 5.5.1.4 Apron

When manual re-levelling is fitted according to 5.10.2.2, under the load carrying unit sill an apron shall be provided equal to that required under the landing door sill (5.2.8.2).

### 5.5.1.5 Trap doors

If there is a trap door in the load carrying unit roof, it shall conform to 5.5.1.6.1, a) and also to the following. It shall:

a) measure at least 0,35 m $\times$ 0,50 m;

b) be opened from outside of the load carrying unit without a key and from inside of the load carrying unit with a key suited to the triangle defined in Annex B;

c) not open towards the inside of the load carrying unit;

d) not project, in the open position, beyond the edge of the lift load carrying unit;

e) be provided with a means for manual locking. This manual locking shall be proved by means of an electric safety device in conformity with 5.10.1.2 and shall cause the lift to stop if the locking ceases to be effective.

Restoring the lift to service shall only be possible after deliberate relocking.

#### 5.5.1.6 Load carrying unit roof

In addition to 5.5.1.2.1, the load carrying unit roof shall fulfil the following requirements:

**5.5.1.6.1** It shall:

a) be able to support at any position the mass of two persons, each counting for 1 000 N on an area of 0,20 m $\times$ 0,20 m, without permanent deformation;

b) have at one point a clear area for standing of at least 0,12 $m^2$, in which the lesser dimension is at least 0,25 m;

c) be provided with a balustrade (5.5.1.6.2) where the free distance in a horizontal plane, beyond and perpendicular to its outer edge exceeds 0,30 m. The free distances shall be measured to the wall of the well allowing a larger distance in recesses, the width or height of which is less than 0,30 m.

**5.5.1.6.2** The balustrade shall fulfil the following requirements:

a) considering the free distance in a horizontal plane beyond the outer edge of the handrail of the balustrade, its height shall be at least:

   1) 0,70 m where the free distance is up to 0,85 m;

   2) 1,10 m where the free distance exceeds 0,85 m;

b) it shall consist of a handrail, a toe guard of 0,15 m height and an intermediate bar at half the height of the balustrade;

c) the balustrade at the access side(s) shall provide safe and easy access to the load carrying unit roof;

d) the balustrade shall be located within 0,15 m maximum of the edges of the load carrying unit roof;

e) where maintenance operations from the load carrying unit roof need movement of the load carrying unit:

   1) the horizontal distance between the outer edge of the handrail and any part in the well (counterweight or balancing weight, switches, rails, brackets, etc.) shall be at least 0,10 m;

   2) a warning sign or a notice (7.1.4.2, d)) about the danger of leaning over the balustrade shall be fixed to it, where appropriate.

#### 5.5.1.7 Pulleys and/or sprockets

Pulleys and/or sprockets fixed to the load carrying unit shall have protection according to 5.6.3 where maintenance operations from the load carrying unit need movement of the load carrying unit.

#### 5.5.1.8 Equipment on top of the load carrying unit

Where the load carrying unit roof is intended to be used as a working platform for maintenance and service operations, the following shall be provided:

a) stopping device(s) in conformity with 5.10.2.4.1, d) and 7.1.4.2, a);

b) socket outlet in conformity with 5.9.5.5 at the working area;

c) an inspection control station box in conformity with 5.10.2.3 (inspection operation) if the maintenance operations are intended to be carried out with movement of the load carrying unit.

Provisions of 5.5.1.8, c) above shall always apply to type B accessible goods only lifts.

#### 5.5.1.9 Lighting

The load carrying unit shall be continuously illuminated with a light intensity of at least 50 lux at floor level when the landing door is open.

The lighting of the landing can contribute to the lighting of the load carrying unit if it is always available when the lift is used (see also 0.2.5).

If lighting is of the incandescent type and where vision panels are provided (see 5.4.2.5, b)), there shall be at least two lamps connected in parallel.

### 5.5.2 Counterweight and balancing weight

**5.5.2.1** If the counterweight or the balancing weight incorporates filler weights, necessary measures shall be taken to prevent their displacement. To this effect the following shall be used either:

a) a frame in which the fillers are secured; or

b) if the fillers are made of metal, a minimum of two tie-rods on which the fillers are secured.

**5.5.2.2** Pulleys and/or sprockets fixed to the counterweight or to the balancing weight shall have protection according to 5.6.3.

## 5.6 Suspension, uncontrolled movement and overspeed protection

### 5.6.1 Suspension

#### 5.6.1.1 General

**5.6.1.1.1** Suspension means for traction drive lifts, positive drive lifts, indirect acting hydraulic lifts and/or for the connection between the load carrying unit and the counterweight/balancing weight shall comply with the following requirements.

**5.6.1.1.2** Load carrying units, counterweights or balancing weights shall be suspended from steel wire ropes, or steel chains with parallel links (Galle type) or roller chains.

**5.6.1.1.3** The ropes shall correspond to the following requirements:

a) the ratio between the minimum breaking load, in newtons (N), of one suspension rope/chain and the maximum force, in newtons (N), in this rope/chain, when the load carrying unit is stationery at the lowest landing with its rated load, shall be at least 8;

b) the tensile strength of the wires shall be:

1) 1 570 N/mm² or 1 770 N/mm² for ropes of single tensile; or

2) 1 370 N/mm² for the outer wires and 1 770 N/mm² for the inner wires of ropes of dual tensile;

c) the other characteristics (construction, extension, ovality, flexibility, tests, etc.) shall at least correspond to those specified in EN 12385-4 or EN 12385-5.

**5.6.1.1.4** The minimum number of separate ropes or chains shall be two.

#### 5.6.1.2 Sheave, pulley, drum and rope diameter ratios, rope/chain terminations

The ratio between the pitch diameter of sheaves, pulleys or drums and the nominal diameter of the suspension ropes shall be at least 30.

The fixing of the ropes on the drums, where present, shall be carried out using a system of blocking with wedges, or using at least two clamps or any other system with equivalent safety.

The ends of each rope/chain shall be fixed to the load carrying unit, counterweight or balancing weight, or suspension points of the dead parts of reeved ropes/chains by means of suitable terminations metal or resin filled sockets, self tightening wedge type sockets, heart shaped thimbles with at least three suitable rope grips, hand spliced eyes, ferrule secured eyes, or any other system with equivalent safety.

The rope termination shall be able to resist at least 80 % of the minimum breaking load of the rope.

#### 5.6.1.3 Winding up of ropes for positive drive lifts

The drum, which can be used in the conditions laid down in G.1.1, b), shall be helically grooved.

When the load carrying unit rests on its fixed stops or fully compressed buffers, one and a half turns of rope shall remain in the grooves of the drum.

There shall only be one layer of rope wound on the drum.

The angle of deflection (fleet angle) of the ropes in relation to the grooves shall not exceed 4°.

#### 5.6.1.4 Distribution of load between the ropes or the chains

**5.6.1.4.1** An automatic device shall be provided for equalizing the tension of suspension ropes or chains, at least at one of their ends.

**5.6.1.4.1.1** For chains engaging with sprockets, the ends fixed to the load carrying unit as well as the ends fixed to the balancing weight shall be provided with such equalization devices.

**5.6.1.4.1.2** For chains in the case of multiple return sprockets on the same shaft, these sprockets shall be able to rotate independently.

**5.6.1.4.2** If springs are used to equalize the tension they shall work in compression.

**5.6.1.4.3** In the case of two rope or two chain suspension of the load carrying unit an electric safety device in conformity with 5.10.1.2 shall cause the lift to stop in case of abnormal relative extension of one rope or chain.

For lifts with two or more jacks this requirement applies for each suspension set.

**5.6.1.4.4** The devices for adjusting the length of ropes or chains shall be made in such a way that these devices cannot work themselves loose after adjustment.

### 5.6.2 Uncontrolled movement and overspeed

#### 5.6.2.1 Means to prevent uncontrolled movement of the load carrying unit

**5.6.2.1.1** Depending on the driving system the uncontrolled movements of the load carrying unit indicated in Table 2 shall be taken into consideration.

**Table 2 — Uncontrolled movement of the load carrying unit**

| Drive system | Downwards movement | Upwards movement | Creeping |
|---|---|---|---|
| Traction drive | X | X | |
| Positive drive | X | | |
| Hydraulic direct acting | X | | X |
| Hydraulic indirect acting | X | | X |

**5.6.2.1.2** Means shall be applied as specified in Table 3 to prevent uncontrolled movement of the load carrying unit from those positions where it needs to be accessed, including access for maintenance purposes either to the platform or to the roof.

**Table 3 — Means against uncontrolled movements**

| Safeties | Downwards movement | Upwards movement | Creeping [a] | Overspeed |
|---|---|---|---|---|
| Safety gear | X | X | X [b] | X [c] |
| Clamping device | X | | X [b] | |
| Pawl device | X | X | X [b] | |
| Rupture valve | X | | | X |
| Restrictor | | | | X |
| Rope brake | X | X | X [b] | X [c] |
| Stops in the pit, with or without buffers | X [d] | | X [d] | |

[a] Creeping only with hydraulic drives.

[b] Tripped at landings.

[c] In combination with an overspeed governor.

[d] Only for uncontrolled movement from the lowest landing.

**5.6.2.1.3** For hydraulic accessible goods only lifts, in the case of creeping, the load carrying unit can be manually re-levelled in accordance with 5.10.2.2 within the distance specified in 5.6.2.2.2, where applicable, or in 5.6.2.3.1, a).

**5.6.2.1.4** Where an inspection control station is provided on the load carrying unit, protection means against overspeed shall be fitted.

### 5.6.2.2 Detecting device for uncontrolled movement from a stopped position

**5.5.2.2.1** A device which detects that a load carrying unit is moving away uncontrolled from a stopped position shall be provided.

**5.6.2.2.2** This device shall have detected the uncontrolled movement of the load carrying unit when the load carrying unit has moved away up to a maximum of 0,10 m in either direction from the stopped position.




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**5.6.2.2.3** After detection of the uncontrolled movement, this device shall operate the mechanical safety device (5.6.2.3) either mechanically or by means of an electric safety circuit (5.10.1.2).

**5.6.2.2.4** Where an overspeed protection means is provided, the same device can be used for detecting the uncontrolled movement.

### 5.6.2.3 Mechanical safety device for stopping uncontrolled movement of the load carrying unit

**5.6.2.3.1** A mechanical safety device shall be provided to stop uncontrolled movement of the load carrying unit. This device shall fulfil the following requirements:

a) it shall be able to stop the fully loaded load carrying unit from rated speed and maintain it stopped;

b) it shall operate in conjunction with either the guide rails, or the ram, or stops fixed in the well;

c) parts of the device shall not be used for the guiding of the load carrying unit;

d) it shall not be tripped by devices that are operated electrically, hydraulically or pneumatically;

e) its operation shall not cause permanent deformation to the parts of the lift, except where they can be removed or replaced, if needed, after release;

f) when it is engaged,

   1) the floor of the load carrying unit without or with the load uniformly distributed, shall not incline more than 5 % from its normal position; and

   2) an electric safety device according to 5.10.1.2 shall be operated to electrically prevent the normal movement of the accessible goods only lift;

g) its release and automatic reset shall:

   1) require the intervention of a competent person;

   2) only be possible by moving the load carrying unit in the opposite direction;

   3) not cause the return of the accessible goods only lift automatically to normal operation.

The combined operation of this mechanical stopping device together with the detecting device for the uncontrolled movement (5.6.2.2) shall cause the load carrying unit to stop within a distance of 0,30 m from the stopped position.

**5.6.2.3.2** The following devices are considered as complying with the above listed requirements:

a) safety gear;

b) clamping devices;

c) pawl devices.

**5.6.2.3.3** For accessible goods only lifts fitted with inspection control station in the load carrying unit or on the load carrying unit roof, the load carrying unit shall be provided with a mechanical safety device according to 5.6.2.3.1 which shall prevent overspeed and uncontrolled movement of the load carrying unit from any position along the travel path.

#### 5.6.2.4 Safety devices for preventing overspeed

##### 5.6.2.4.1 Overspeed governor

**5.6.2.4.1.1** When required by 5.6.2.1.2, Table 3, an overspeed governor shall be provided.

**5.6.2.4.1.2** The overspeed governor shall comply with the following:

a) tripping of the overspeed governor for the load carrying unit and/or the counterweight safety gear shall occur at a speed at least equal to 115 % of the rated speed and not exceeding:

   1) 150 % of the rated speed; or

   2) 0,80 m/s,

   whichever is the higher;

b) the overspeed governor or another device shall, by means of an electric safety device in conformity with 5.10.1.2, initiate the stopping of the lift machine at least when the load carrying unit speed, either up or down, reaches the tripping speed;

c) an electric safety device in conformity with 5.10.1.2 shall prevent the starting of the lift while the overspeed governor is not in the reset position;

d) the overspeed governor shall be accessible and reachable for inspection and maintenance;

e) the overspeed governor is regarded as a safety component.

**5.6.2.4.1.3** For rope driven overspeed governors:

a) the tensile force in the rope produced by the device, when tripped, shall be at least the greater of the following two values:

   1) twice that necessary to engage the safety gear; or

   2) 300 N;

b) overspeed governors using only traction to produce the force shall have grooves, which ensure the necessary traction, and:

   1) have been submitted to an additional hardening process; or

   2) have an undercut.

   NOTE EN 81-1:1998, Annex M gives a method of determining the design elements of the grooves.

c) the direction of rotation, corresponding to the operation of the safety gear, shall be marked on the overspeed governor;

d) the overspeed governor shall be driven by a wire rope designed for that purpose, with a minimum diameter of 6 mm and a safety factor of at least 8 to the tensile force produced in the rope of the overspeed governor when tripped;

e) the overspeed governor rope shall be tensioned by a tensioning pulley. This pulley (or its tensioning weight) shall be guided;

f) the breakage or excessive rope stretch of the overspeed governor rope shall cause the motor to stop by means of an electric safety device in conformity with 5.10.1.2;

g) the overspeed governor is regarded as a safety component. F.4 gives a method for testing the rope driven overspeed governor.

#### 5.6.2.4.2 Rupture valve

When required by 5.6.2.1.2, Table 3, a rupture valve shall be provided and shall comply with the requirements listed in G.2.5.5.

#### 5.6.2.4.3 Restrictor, also one-way-restrictor

When required by 5.6.2.1.2, Table 3, a restrictor/one-way-restrictor shall be provided and shall comply with the requirements listed in G.2.5.6.

### 5.6.3 Protection for traction sheaves, pulleys and sprockets

**5.6.3.1** For traction sheaves, pulleys and sprockets, provisions shall be made according to Table 4 to avoid:

a) bodily injury;

b) the ropes/chains leaving the pulleys/sprockets, if slack;

c) the introduction of objects between ropes/chains and pulleys/sprockets.

Where overhung pulleys or sprockets are used, devices according to Table 4 shall be provided.

Depending on the intended environmental conditions (see 0.2.5) attention shall be paid to avoid the accumulation of dust and debris in the guards.

**Table 4 — Protection for traction sheaves, pulleys and sprockets**

| Location of protections | | | Risk according to 5.6.3.1 | | |
|---|---|---|---|---|---|
| | | | a) | b) | c) |
| Load carrying unit | On the roof | | X | X | X |
| | Under the floor | | | X | X |
| On the counterweight / balancing weight | | | | X | X |
| In the machinery spaces | | | X [a] | X | X [b] |
| In the pulley spaces | | | X [a] | X | |
| Lift well | Headroom | Above load carrying unit | X | X | |
| | | Beside load carrying unit | | X | |
| | Between pit and headroom | | | X | X [b] |
| | Pit | | X | X | X |
| At the rope driven overspeed governor and its tensioning pulley | | | | X | X [b] |
| Jack | Extending upwards | | X [a] | X | |
| | Extending downwards | | | X | X [b] |
| | With mechanical synchronizing means | | X | X | X |

X risk shall be taken into account.

[a] Protection shall be nip guards as a minimum.

[b] Required only if the ropes/chains are entering the traction sheave or the pulley/sprocket horizontally or at any angle above the horizontal up to a maximum of 90°.

**5.6.3.2** The devices used shall be constructed so that the rotating parts are visible, and do not hinder examination and maintenance operation. If they are perforated the gaps shall comply with EN ISO 13857:2008, Table 4.

EN 349 shall be applied to prevent crushing.

The dismantling shall be necessary only in the following cases:

a) replacement of a rope/chain;

b) replacement of a pulley/sprocket;

c) re-cutting of the grooves.

### 5.6.4 Guarding of machinery

Effective protection shall be provided for accessible rotating parts, which may be dangerous, in particular:

a) keys and screws in the shafts;

b) tapes, chains, belts;

c) gears, sprockets;

d) projecting motor shafts;

e) fly-ball type overspeed governors.




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Exception is made for traction sheaves with protections according to 5.6.3.1, hand winding wheels, brake drums and any similar smooth, round parts. Such parts shall be painted yellow, at least in part.

## 5.7 Guiding systems, mechanical stops and final limit switches

### 5.7.1 General provisions concerning guiding system

#### 5.7.1.1 General

The load carrying unit, as well as counterweights/balancing weights, shall be guided by a system composed of elements located at the moving parts (guide shoes, rollers, etc.), guides or similar devices. This system shall be able:

a) to prevent derailing;

b) to keep the load carrying unit and the counterweight/balancing weight, in their travel path so that collision with other parts is excluded;

c) to assure the correct co-ordination of the load carrying unit with other parts located in the well (door locking devices, switches, etc.);

d) to limit to 10 mm horizontal movements of the load carrying unit in the landings during loading and unloading;

e) to operate with the devices against uncontrolled movement, if applicable;

f) to resist to loads and forces during intended use (0.2.5) of the accessible goods only lift and caused by the application of the safety devices with a minimum safety factor of 3 to the breaking load $R_m$ of the material or with a safety factor of 2,5 against buckling.

#### 5.7.1.2 Loads, stresses and deflections

The guide rails, their joints and attachments shall be sufficient to withstand the loads and forces imposed on them in order to ensure a safe operation of the accessible goods only lift.

The aspects of safe operation of the lift concerning guide rails are:

a) load carrying unit, counterweight or balancing weight- guiding shall be assured;

b) deflections shall be limited to such an extent, that due to them:

   1) unintended unlocking of the landing doors shall not occur;

   2) operation of the safety devices shall not be affected; and

   3) collision of moving parts with other parts shall not be possible.

Stresses shall be limited taking into account the distribution of the rated load in the load carrying unit according to the intended use as negotiated (0.2.5).

NOTE EN 81-1:1998, Annex G (G.2, G.3 and G.4) gives a method for determining the distribution of the load.

Materials with elongations less than 8 % are regarded as too brittle and shall not be used.

#### 5.7.1.3 Fixing of the guiding means

The fixing of the guiding means to their brackets and to the building shall permit compensation, either automatically or by simple adjustment, of effects due to normal settling of the building or shrinkage of concrete.




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A rotation of the attachments by which the guiding means could be released shall be prevented.

### 5.7.2 Guiding of the load carrying unit, counterweight or balancing weight

**5.7.2.1** The load carrying unit, counterweight or balancing weight shall each be guided by at least two rigid steel guide rails.

**5.7.2.2** The guide rails shall be made from drawn steel, or the rubbing surfaces shall be machined, if the rated speed exceeds 0,40 m/s.

**5.7.2.3** Guide rails for counterweights or balancing weights may be made of formed metal sheet. They shall be protected against corrosion.

NOTE 1 Type B accessible goods only lifts should preferably be fitted with profile guide rails, for which the requirements for permissible stresses and deflections apply.

NOTE 2 EN 81-1:1998, Annex G describes a method of calculating guide rails.

**5.7.2.3.1** The permissible stresses shall be determined by:

$$\sigma_{perm} = \frac{R_m}{S_t}$$

where

$\sigma_{perm}$ is the permissible stress in newtons per square millimetre (N/mm²);

$R_m$ is the tensile strength in newtons per square millimetre (N/mm²), $= 0{,}75 \times R_{0,2}$ ;

$S_t$ is the safety factor.

The safety factor has to be taken from Table 5.

**Table 5 — Safety factor for guide rails**

| Load cases | Elongation ($A_5$) | Safety factor |
|---|---|---|
| Normal use loading | $A_5 \geq 12$ % | 2,25 |
| | 8 % $\leq A_5 \leq$ 12 % | 3,75 |
| Safety gear operation | $A_5 \geq 12$ % | 1,8 |
| | 8 % $\leq A_5 \leq$ 12 % | 3,0 |

For guide rails in accordance with ISO 7465, the values of $\sigma_{perm}$ given in Table 6 can be used.

**Table 6 — Permissible stresses $\sigma_{perm}$**

| Load cases | $R_m$ N/mm² | | |
|---|---|---|---|
| | **370** | **440** | **520** |
| Normal use loading | 165 | 195 | 230 |
| Safety gear operation | 205 | 244 | 290 |

**5.7.2.3.2** The maximum calculated permissible deflections are:

a) 5 mm in both directions for:

1) load carrying unit guide rails;

2) counterweight or balancing weight guide rails on which safety gears are operating;

b) 10 mm in both directions for guide rails of counterweight or balancing weight without safety gears.

### 5.7.3 Fixed stops and buffers for load carrying unit and counterweight, balancing weight

**5.7.3.1** Accessible goods only lifts shall be provided with fixed stops at the bottom limit of travel of the load carrying unit and counterweight/balancing weight.

The acting point(s) of the fixed stops below the projection of the load carrying unit shall be made obvious by an obstacle (pedestal) of a height so that 5.2.11.2.3 is fulfilled. For fixed stops with the centre of the acting area within 0,15 m from the guide rails and similar fixed devices, excluding walls, these devices are regarded as obstacles.

**5.7.3.2** In addition to the requirements of 5.7.3.1 positive drive accessible goods only lifts shall be provided with cushioned fixed stops on the load carrying unit top to function at the upper limit of travel.

**5.7.3.3** For type B accessible goods only lifts with rated speed higher than 0,30 m/s the fixed stop shall be a buffer.

**5.7.3.3.1** The average retardation caused by the buffer when hit at 115 % of the rated speed shall not exceed 1 $g_n$.

**5.7.3.3.2** The operation of accessible goods only lifts with energy dissipation type buffers shall depend on the return of the buffers to their normal extended position after operation. The device for checking this shall be an electric safety device in conformity with 5.10.1.2.

**5.7.3.3.3** Buffers, if hydraulic, shall be so constructed that the fluid level may be easily checked.

**5.7.3.4** In the case of 5.2.9, accessible goods only lifts shall be provided with buffer(s) at the bottom limit of travel of the load carrying unit and counterweight.

**5.7.3.5** In the case of hydraulic accessible goods only lifts, when the load carrying unit is resting on its fixed stop(s) or when buffer(s) is(are) fully compressed, the ram shall not hit the base of the cylinder.

**5.7.3.6** Fixed stop(s) or buffer(s) shall be designed taking into account that the fully loaded load carrying unit or the counterweight reaches the fixed stop(s) or buffer(s) with a speed equal to 115 % of the rated speed.

No permanent deformation of the fixed stop(s) or buffer(s) shall occur after any actuation.

### 5.7.4 Final limit switches

#### 5.7.4.1 General

Final limit switches shall be provided.

Final limit switches shall be set to function as close as possible to the terminal floors, without risk of accidental operation.

They shall operate before the load carrying unit (or counterweight/balancing weight, if there is one) comes into contact with the fixed stops or the buffers, where provided. The action of the final limit switches shall be maintained whilst the buffers are compressed.




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#### 5.7.4.2 Actuation of the final limit switches

**5.7.4.2.1** Separate actuating devices shall be used for normal terminal stopping and final limit switches.

**5.7.4.2.2** Actuation of the final limit switches shall be effected:

a) in the case of indirect acting lifts either:

   1) directly by the ram; or

   2) indirectly by a device which is linked to the ram, e.g. by a rope;

b) in all other cases either:

   1) directly by the load carrying unit at the top and bottom of the well; or

   2) indirectly by:

      i) a device which is linked to the load carrying unit, e.g. by a rope, belt or chain; or

      ii) the counterweight/balancing weight, if there is one, at the top and bottom of the well; or

      iii) a combination of the above.

In the cases a), 2) and b), 2), i), breakage of or slack in this linkage shall cause the machine to stop by means of an electric safety device in conformity with 5.10.1.2.

**5.7.4.2.3** In the case of direct and indirect acting hydraulic accessible goods only lifts, final limit switch is required only at the top of travel and its actuation shall be effected before the ram comes into contact with its stop.

#### 5.7.4.3 Method of operation of final limit switches

**5.7.4.3.1** The final limit switches shall open the circuits feeding the motor and brake either:

a) directly, by positive mechanical separation of the circuit breaking devices in conformity with 5.10.1.2.2.1; or

b) by means of an electric safety device in conformity with 5.10.1.2.

Provisions shall be made so that the motor cannot feed the brake solenoid.

**5.7.4.3.2** After the operation of the final limit switch load carrying unit movement in response to landing calls only shall no longer be possible.

The final limit switch shall automatically return to its normal operating position when the load carrying unit leaves the actuation zone.

## 5.8 Lift machine

### 5.8.1 General provision

**5.8.1.1** Each lift shall have at least one machine of its own.

The design of the driving and suspension elements shall take into account the actual rating of the driving motor and the possibility of the load carrying unit, the counterweight or the balancing weight resting on its buffers or being stopped along its travel path.




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**5.8.1.2** Use may be made of belts for coupling the motor or motors to the component on which the electro-mechanical brake (G.1.4.2) operates. In this case a minimum of two belts shall be used.

**5.8.1.3** Where electric positive and traction drive accessible goods only lifts are equipped with devices against downward uncontrolled movement other than overspeed governor and safety gear at least one supplementary belt shall be provided.

#### 5.8.2 Speed

The speed of the load carrying unit, half loaded, in upward and downward motion, in mid-travel, excluding all acceleration and retardation periods, shall not exceed the rated speed by more than 10 %, when the supply is at its rated frequency, and the motor voltage is equal to the rated voltage of the equipment.

This tolerance is also applicable for the speed in the case of:

a) re-levelling (5.10.2.2, e));

b) inspection operation (5.10.2.2, f)).

### 5.9 Electric installations and appliances

#### 5.9.1 General provisions

##### 5.9.1.1 Limits of application

**5.9.1.1.1** The requirements of this European Standard relating to the installation and to the constituent components of the electrical equipment apply:

a) to the main switch of the power circuit and dependent circuits;

b) to the switch for the load carrying unit lighting circuit and dependent circuits.

The accessible goods only lift shall be considered as a whole, in the same way as a machine with its built-in electrical equipment.

NOTE The national requirements relating to electricity supply circuits apply as far as the input terminals of the switches. They apply to the whole lighting and socket outlet circuits of the machinery spaces, the pulley spaces and the lift well and pit.

**5.9.1.1.2** The requirements of this European Standard for circuits dependent on the switches referred to in 5.9.1.1.1 are based, as far as possible, taking into account the specific needs of lifts, on existing standards:

a) on the international level: IEC;

b) on the European level: CENELEC.

Whenever one of these standards is used, its references are given, together with the limits within which it is used.

When no precise information is given, the electrical equipment used shall conform to the accepted Codes of Practice relating to safety.

**5.9.1.1.3** The electromagnetic compatibility shall comply with the requirements of EN 12015 and EN 12016.

##### 5.9.1.2 Degree of protection

In the machinery and pulley spaces protection against direct contact shall be provided by means of casings

providing a degree of protection of at least IP 2X.

#### 5.9.1.3 Insulation resistance of the electrical installation (HD 60364-5-54:2007)

**5.9.1.3.1** The insulation resistance shall be measured between each live conductor and earth.

Minimum values of insulation resistance shall be taken from Table 7.

**Table 7 — Minimum value of insulation resistance**

| Nominal circuit voltage<br>V | Test voltage (d.c.)<br>V | Insulation resistance<br>MΩ |
|---|---|---|
| PELV [a] | 250 | ≥ 0,25 |
| ≤ 500 | 500 | ≥ 0,5 |
| > 500 | 1 000 | ≥ 1,0 |
| [a] PELV = Protective Extra-Low Voltage. | | |

When the circuit includes electronic devices, phase and neutral conductors shall be connected together during measurement.

**5.9.1.3.2** The mean value in direct current or the r.m.s. value in alternating current of the voltage between conductors or between conductors and earth shall not exceed 250 V for control and safety circuits.

**5.9.1.3.3** The neutral conductor and the protection conductor shall always be separate.

### 5.9.2 Contactors, relay-contactors, components of safety circuits

#### 5.9.2.1 Contactors and relay-contactors

**5.9.2.1.1** The main contactors, i.e. those necessary to stop the machine as per 5.10.2.5, shall belong to the following categories as defined in EN 60947-4-1:2001:

a) AC-3 for contactors for A.C. motors;

b) DC-3 for contactors for D.C. power.

These contactors shall, in addition allow 10 % of starting operations to be made as inching.

**5.9.2.1.2** If, because of the power they carry, relay-contactors are used to operate the main contactors, those relay-contactors shall belong to the following categories as defined in EN 60947-5-1:2004:

a) AC-15 for controlling A.C. electromagnets;

b) DC-13 for controlling D.C. electromagnets.

**5.9.2.1.3** Both for the main contactors referred to in 5.9.2.1.1 and for the relay-contactors referred to in 5.9.2.1.2, it may be assumed in the measures taken to comply with 5.10.1.1.2 that:

a) if one of the break contacts (normally closed) is closed, all the make contacts are open;

b) if one of the make contacts (normally open) is closed, all the break contacts are open.




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#### 5.9.2.2 Components of safety circuits

**5.9.2.2.1** When relay-contactors as per 5.9.2.1.2 are used as relays in a safety circuit, the assumptions of 5.9.2.1.3 shall also apply.

**5.9.2.2.2** If relays are used which are such that the break and make contacts are never closed simultaneously for any position of the armature, the possibility of partial attraction of the armature (5.10.1.1.2, f)) can be disregarded.

**5.9.2.2.3** Devices (if any) connected after electrical safety devices shall meet the requirements of 5.10.1.2.2.3 as regards the creepage distances and the air gaps (not the separation distances).

This requirement does not apply to the devices mentioned in 5.9.2.1.1, 5.9.2.1.2 and 5.9.2.2.1 and which themselves fulfil the requirements of EN 60947-4-1 and EN 60947-5-1.

**5.9.2.2.4** For printed circuit boards requirements as specified in Annex K, Table K.1 (3.6) are applicable.

### 5.9.3 Protection of motors and other electrical equipment

**5.9.3.1** Motors directly connected to the mains shall be protected against short-circuiting.

**5.9.3.2** Motors directly connected to the mains shall be protected against overloads by means of manual reset (except as provided for in 5.9.3.3) automatic circuit breakers, which shall cut off the supply to the motor in all live conductors.

**5.9.3.3** When the detection of overloads of the accessible goods only lift motor operates on the basis of increase of the temperature of the motor windings the circuit breakers may be closed automatically after sufficient cooling down has taken place.

**5.9.3.4** The provisions of 5.9.3.2 and 5.9.3.3 apply to each winding if the motor has windings supplied by different circuits.

### 5.9.4 Main switches

**5.9.4.1** Machinery spaces shall contain, for each accessible goods only lift, a main switch capable of breaking the supply to the accessible goods only lift on all the live conductors. This switch shall be capable of interrupting the highest current involved in normal conditions of use of the accessible goods only lift.

This switch shall not cut the circuits feeding:

a) load carrying unit lighting or ventilation, if any;

b) socket outlet on the load carrying unit roof, if any;

c) lighting of machinery and pulley spaces;

d) socket outlet in the machinery spaces, in the pulley spaces and in the pit;

e) lighting of the accessible goods only lift well, if any;

f) alarm device, if any.

**5.9.4.2** The main switches as defined in 5.9.4.1 shall have stable open and closed positions, and shall be capable of being locked-off in the open position, with the use of a padlock or equivalent, to ensure no inadvertent operation.

The control mechanism for the main switch shall be easily and rapidly accessible from the entrance(s) to the machinery spaces. If the machine room is common to several lifts, the control mechanism of the main switches shall allow the lift concerned to be identified easily.

If the machinery spaces has several points of access, or if the same lift has several machine rooms/machinery spaces each with its own point(s) of access, a circuit breaker contactor may be used, release of which shall be controlled by an electric safety device, in conformity with 5.10.1.2, inserted in the supply circuit to the coil of the circuit breaker contactor. The re-engagement of the circuit breaker contactor shall not be carried out or made possible except by means of the device, which caused its release. The circuit-breaker contactor shall be used in conjunction with a manually controlled isolating switch.

**5.9.4.3** In the case of a group of lifts, if, after the opening of the main switch for one lift, parts of the operating circuits remain live, these circuits shall be capable of being separately isolated in the machine room, if necessary by breaking the supply to all the lifts in the group.

**5.9.4.4** Any capacitors to correct the power factor shall be connected before the main switch of the power circuit.

If there is a risk of over-voltage, when for example the motors are connected by very long cables, the switch of the power circuit shall also interrupt the connection to the capacitors.

### 5.9.5 Electric wiring

#### 5.9.5.1 General

**5.9.5.1.1** In the machinery and pulley spaces and lift wells, the conductors and cables (with the exception of travelling cables) shall be selected from those standardized by CENELEC and of a quality at least equivalent to that defined by HD 21.3 S3 and HD 22.4 S4 taking into account the information given in 5.9.1.1.2.

**5.9.5.1.2** Conductors such as those in conformity with CENELEC HD 21.3 S3, parts 2 (H07V-U and H07V-R), 3 (H07V-K), 4 (H05V-U) and 5 (H05V-K) shall only be used provided they are installed in conduits (or trunking) made either of metal or plastics or the conductors are protected in an equivalent manner.

NOTE These provisions replace those in the guide to use appearing in Annex 1 of CENELEC HD 21.1 S4:2002.

**5.9.5.1.3** Rigid cables such as those in conformity with Clause 2 of CENELEC HD 21.4 S2:1990 shall only be used in visible mountings fixed to the walls of the well (or of the machinery spaces) or installed in ducting, trunking or similar fittings.

**5.9.5.1.4** Ordinary flexible cables such as those in conformity with Clause 3 (H05RR-F) of CENELEC HD 22.4 S4:2004 and Clause 5 (H05VV-F) of CENELEC HD 21.5 S3:1994 shall only be used in ducting, trunking or fittings ensuring equivalent protection.

Flexible cables with a thick sheath such as those in conformity with Clause 5 (H07RN-F) of CENELEC HD 22.4 S4:2004 may be used like rigid cables in the conditions defined in 5.9.5.1.3, and for connection to a movable appliance (except as travelling cables for connection to the load carrying unit) or if they are subject to vibrations.

Travelling cables in conformity to EN 50214 and CENELEC HD 360 S2 shall be accepted as cables for connection to the load carrying unit, within the limits laid down by these documents. In all cases, the travelling cables selected shall be of at least equivalent quality.

**5.9.5.1.5** The requirements of 5.9.5.1.2, 5.9.5.1.3 and 5.9.5.1.4 need not apply to:

a) conductors or cables not connected to electric safety devices on landing doors, provided that:

   1) they are not subject to a rated output of more than 100 VA;

   2) the voltage, between poles (or phases) or between a pole (or one of the phases) and earth, to which they are normally subject does not exceed 50 V;

b) the wiring of operating or distribution devices in cabinets or on panels either:

1) between different pieces of electric equipment; or

2) between these pieces of equipment and the connection terminals.

#### 5.9.5.2 Cross-sectional area of conductors

In order to provide mechanical strength the cross-sectional area of conductors to electric safety devices of doors shall not be less than 0,75 mm².

#### 5.9.5.3 Method of installation

**5.9.5.3.1** The electric installation shall be provided with the indications necessary to make it easy to understand.

**5.9.5.3.2** Connections, connection terminals and connectors, except those defined in 5.9.1.1.1, shall be located in cabinets, boxes or on panels provided for this purpose.

**5.9.5.3.3** If, after the opening of the main switch or switches of an accessible goods only lift, some connection terminals remain live, they shall be clearly separated from terminals, which are not live and if the voltage exceeds 50 V, they shall be suitably marked and shielded from inadvertent contact.

**5.9.5.3.4** Connection terminals whose accidental interconnection could lead to a dangerous malfunction of the accessible goods only lift shall be clearly separated unless their method of construction obviates this risk.

**5.9.5.3.5** In order to ensure continuity of mechanical protection, the protective sheathing of conductors and cables shall fully enter the casings of switches and appliances, or shall terminate in a suitably constructed gland.

NOTE Enclosed frames of landing and load carrying unit doors are regarded as appliance casings. However, if there is a risk of mechanical damage due to movement of parts or sharp edges of the frame itself, the conductors connected to the electric safety device should be protected mechanically.

**5.9.5.3.6** If the same ducting or cable contains conductors whose circuits have different voltages, all the conductors or cables shall have the insulation specified for the highest voltage.

#### 5.9.5.4 Connectors

Connectors and devices of the plug-in type placed in safety circuits shall be so designed and arranged that, if erroneous interconnection could lead to dangerous malfunction of the accessible goods only lift, or their withdrawal does not require the use of a tool, it is impossible to re-insert the plug incorrectly.

#### 5.9.5.5 Lighting and socket outlets

**5.9.5.5.1** The electric lighting supplies to the load carrying unit, the well and the machinery and pulley spaces, shall be independent of the supply to the machine, either through another circuit or through connection to the machine supply circuit on the supply side of the main switch or the main switches laid down in 5.9.4.

**5.9.5.5.2** The supply to socket outlets required on the load carrying unit roof, in the machinery and pulley spaces and in the pit, shall be taken from the circuits referred to in 5.9.5.5.1.

These socket outlets shall be either:

a) of type 2 P + PE, 250 V, supplied directly; or

b) supplied at a protective extra-low voltage (PELV) in accordance with EN 60204-1:2006, 6.4.

The use of the above socket outlets does not imply that the supply cable has a cross-sectional area corresponding to the rated current of the socket outlet. The cross-sectional area of the conductors may be




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smaller, provided that the conductors are correctly protected against excess currents.

NOTE The type of socket outlets should be in conformance with the national requirements of the country where the lift is installed.

#### 5.9.5.6 Control of the supply for lighting and socket outlets

**5.9.5.6.1** A switch shall control the supply to the circuit for lighting and socket outlets of the accessible goods only lift load carrying unit (see 5.5.1.8). If the machinery space contains several lift machines it is necessary to have one switch per load carrying unit. This switch shall be located close to the corresponding main power switch.

**5.9.5.6.2** In the machinery spaces a switch or a similar device shall be located near to its access(es) controlling the supply for lighting and the supply for the socket outlet(s).

Well lighting switches (or equivalent) shall be located both in the pit and close to the main switch so that the well light, if any, can be operated from either location.

**5.9.5.6.3** Each circuit controlled by the switches laid down in 5.9.5.6.1 and 5.9.5.6.2 shall have its own short circuit protection.

## 5.10 Protection against electric faults; controls; priorities

### 5.10.1 Failure analysis and electric safety devices

#### 5.10.1.1 Failure analysis

**5.10.1.1.1** Any single fault listed in 5.10.1.1.2 in the electric equipment of a lift, if it cannot be excluded under conditions described in 5.10.1.1.3 and/or Annex K shall not, on its own, be the cause of a dangerous malfunction of the accessible goods only lift.

For safety circuits, see 5.10.1.2.3.

**5.10.1.1.2** Faults envisaged:

a) absence of voltage;

b) voltage drop;

c) loss of continuity of a conductor;

d) insulation fault in relation to the metalwork or the earth;

e) short circuit or open circuit, change of value or function in an electrical component such as for instance resistor, capacitor, transistor, lamp, etc.;

f) non-attraction or incomplete attraction of the moving armature of a contactor or relay;

g) non-separation of the moving armature of a contactor or relay;

h) non-opening of a contact;

i) non-closing of a contact;

j) phase reversal.

**5.10.1.1.3** The non-opening of a contact need not be considered in the case of safety contacts conforming to the requirements of 5.10.1.2.2.

**5.10.1.1.4** The earthing to the metalwork or the earth of a circuit in which there is an electric safety device shall either:

a) cause the immediate stopping of the machine; or

b) prevent restarting of the machine after the first normal stop.

Return to service shall only be possible by manual resetting

### 5.10.1.2 Electric safety devices

#### 5.10.1.2.1 General provisions

**5.10.1.2.1.1** During operation of one of the electric safety devices required in several clauses, movement of the machine shall be prevented or it shall be caused to stop immediately as indicated in 5.10.1.2.4. A list of such devices is given in Annex A.

The electric safety devices shall consist of either:

a) one or more safety contacts satisfying 5.10.1.2.2 directly cutting the supply to the contactors referred to in 5.10.2.5 or their relay-contactors; or

b) safety circuits satisfying 5.10.1.2.3, consisting of one or a combination of the following:

   1) either one or more safety contacts satisfying 5.10.1.2.2 not directly cutting the supply to the contactors referred to in 5.10.2.5 or their relay-contactors;

   2) contacts not satisfying the requirements of 5.10.1.2.2;

   3) components in accordance with Annex K.

**5.10.1.2.1.2** Apart from exceptions permitted in this European Standard (see 5.10.2.2 and 5.10.2.3), no electric equipment shall be connected in parallel with an electric safety device.

Connections to different points of the electric safety chain are only permitted for gathering information. The devices used for that purpose shall fulfil the requirements for safety circuits according to 5.10.1.2.3.

**5.10.1.2.1.3** The effects of internal or external induction or capacity shall not cause failure of electric safety devices.

**5.10.1.2.1.4** An output signal emanating from an electric safety device shall not be altered by an extraneous signal emanating from another electric device placed further down the same circuit, which would cause a dangerous condition to result.

**5.10.1.2.1.5** In safety circuits comprising two or more parallel channels, all information other than that required for parity checks shall be taken from one channel only.

**5.10.1.2.1.6** Circuits which record or delay signals shall not, even in event of fault, prevent or appreciably delay the stopping of the machine through the functioning of an electric safety device, i.e. the stopping shall occur in the shortest time compatible with the system.

**5.10.1.2.1.7** The construction and arrangement of the internal power supply units shall be such as to prevent the appearance of false signals at outputs of electric safety devices due to the effects of switching.

#### 5.10.1.2.2 Safety contacts

**5.10.1.2.2.1** The operation of a safety contact shall be by positive separation of the circuit-breaking devices. This separation shall occur even if the contacts have welded together.

The design of a safety contact shall be such as to minimize the risk of a short circuit resulting from

component failure.

NOTE Positive opening is achieved when all the contact-breaking elements are brought to their open position and when for a significant part of the travel there are no resilient members (e.g. springs) between the moving contacts and the part of the actuator to which the actuating force is applied.

**5.10.1.2.2.2** The safety contacts shall be provided for a rated insulation voltage of 250 V if the enclosure provides a degree of protection of at least IP 4X, or 500 V if the degree of protection of the enclosure is less than IP 4X.

The safety contacts shall belong to the following categories as defined in EN 60947-5-1:

a) AC-15 for safety contacts in A.C. circuits;

b) DC-13 for safety contacts in D.C. circuits.

**5.10.1.2.2.3** If the degree of protection is equal or less than IP4X, the clearances shall be at least 3 mm, the creepage distances at least 4 mm and the distances for breaking contacts at least 4 mm after separation. If the protection is better than IP 4X the creepage distance can be reduced to 3 mm.

**5.10.1.2.2.4** In the case of multiple breaks, the distance after separation between the contacts shall be at least 2 mm.

**5.10.1.2.2.5** Abrasion of conductive material shall not lead to short circuiting of contacts.

#### 5.10.1.2.3 Safety circuits

**5.10.1.2.3.1** Safety circuits shall comply with the requirements of 5.10.1.1 relative to the appearance of a fault.

**5.10.1.2.3.2** Furthermore, as illustrated by Figure 2, the following requirements shall apply:

a) if one fault combined with a second fault can lead to a dangerous situation, the lift shall be stopped at the latest at the next operating sequence in which the first faulty element should participate.

   All further operation of the lift shall be impossible as long as this fault persists.

   The possibility of the second fault occurring after the first, and before the lift has been stopped by the sequence mentioned above, is not considered;

b) if two faults which by themselves do not lead to a dangerous situation, when combined with a third fault can lead to a dangerous situation, the lift shall be stopped at the latest at the next operating sequence in which one of the faulty elements should participate.

   The possibility of the third fault leading to a dangerous situation before the lift has been stopped by the sequence mentioned above is not considered;

c) if a combination of more then three faults is possible, then the safety circuit shall be designed with multiple channels and a monitoring circuit checking the equal status of the channels.

   If a different status is detected the lift shall be stopped.

   In case of two channels, the function of the monitoring circuit shall be checked prior to a re-start of the lift at the latest, and in case of failure, re-starting shall not be possible.

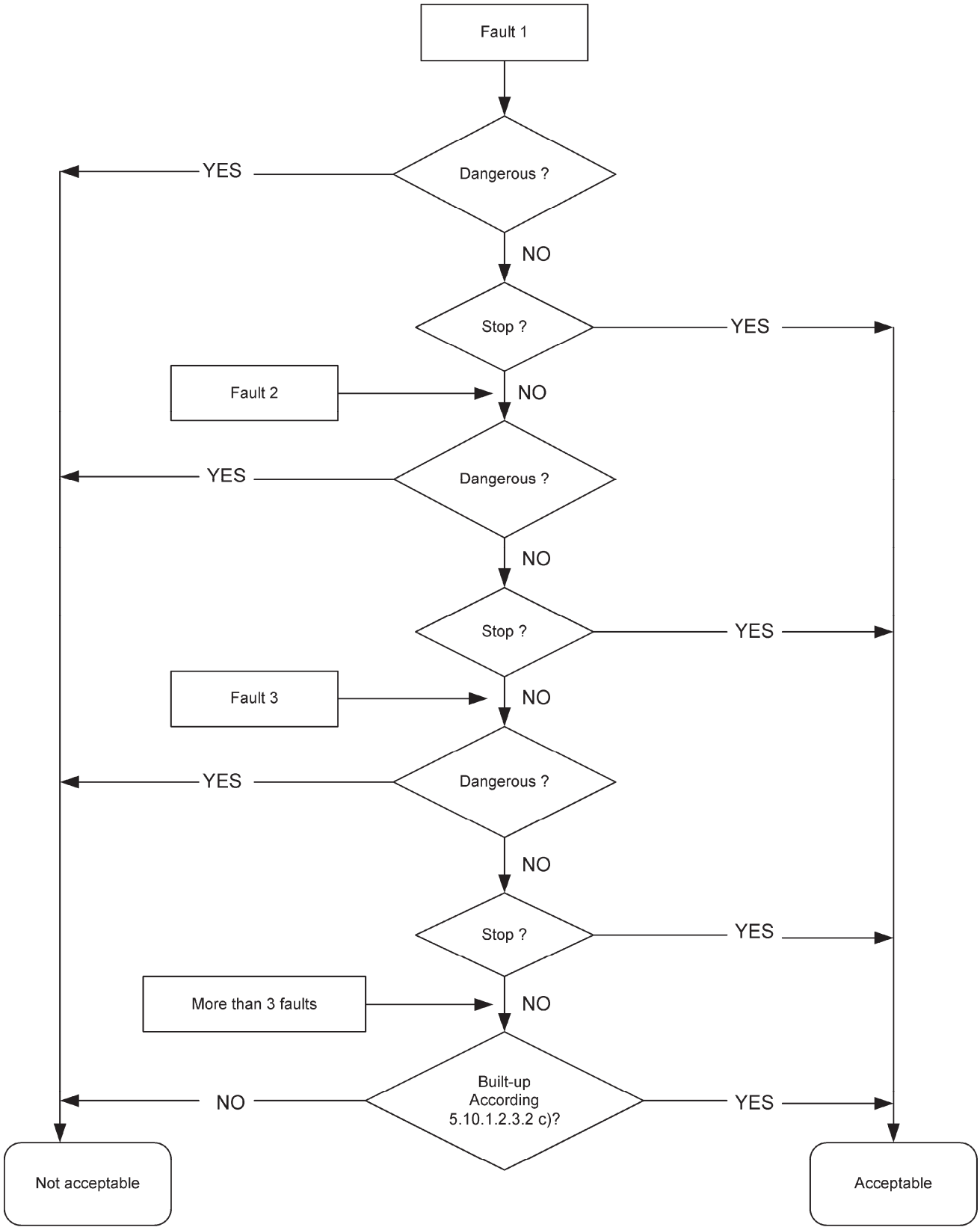


**Figure 2 — Diagram for assessing safety circuits**

d) On restoration of the power supply after it has been disconnected, maintenance of the lift in the stopped position is not necessary, provided that during the next sequence stopping is re-imposed in the cases covered by 5.10.1.2.3.2, a) up to 5.10.1.2.3.2, c).

e) In redundancy-type circuits measures shall be taken to limit as far as possible the risk of defects occurring simultaneously in more than one circuit arising from a single cause.

**5.10.1.2.3.3** Safety circuits containing electronic components are regarded as safety components. F.5 gives a method to test the safety circuits.

#### 5.10.1.2.4 Operation of electric safety devices

When operating to ensure safety, an electric safety device shall prevent the setting in motion of the machine or initiate immediately its stopping. The electric supply to the brake shall likewise be broken.

The electric safety devices shall act directly on the equipment controlling the supply to the machine in accordance with the requirements of 5.10.2.5.

If, because of the power to be transmitted, relay contactors are used to control the machine, these shall be considered as equipment directly controlling the supply to the machine for starting and stopping.

#### 5.10.1.2.5 Actuation of electric safety devices

The components actuating the electric safety devices shall be built so that they are able to function properly under the mechanical stresses resulting from continuous normal operation.

If the devices for actuating electric safety devices are through the nature of their installation accessible to persons, they shall be so built that these electric safety devices cannot be rendered inoperative by simple means.

NOTE A magnet or a bridge piece is not considered a simple means.

In the case of redundancy-type safety circuits, it shall be ensured by mechanical or geometric arrangements of the transmitter elements that a mechanical fault shall not cause loss of redundancy.

For transmitter elements of safety circuits, the requirements of F.5.4.1.2 apply.

### 5.10.2 Controls

#### 5.10.2.1 Control of normal operation

This control shall be by the aid of buttons or similar devices, such as touch control, magnetic cards, etc. These shall be placed in boxes, such that no live parts are accessible to the user.

No control shall be possible from the inside of the load carrying unit.

An open landing door shall respectively not permit registration of calls and the opening of any landing door shall cancel any existing registration.

Control devices shall be protected against unauthorised use. In areas such as public areas, shopping areas, restaurants, hotels, condominiums, etc., where unauthorised or non trained persons have free access or can access to the controls, the accessible goods only lift shall be fitted with key switches, key cards, locked access cabinet, removable hand held controls, etc. (see 0.2.5 and 0.3.15).

#### 5.10.2.2 Control of re-levelling with landing doors open

In the specific case referred to in 5.4.4.1 movement of the load carrying unit with landing and load carrying unit entrance doors open is permitted for levelling and re-levelling on condition that:




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a) the movement is limited to the unlocking zone (5.4.4.1);

b) all movement of the load carrying unit outside of the unlocking zone shall be prevented by at least one switching device mounted in the bridge or shunt of the landing doors and lock electric safety devices;

c) this switching device shall either:

   1) be a safety contact in conformity with 5.10.1.2.2; or

   2) be connected in such a way as to satisfy the requirements for safety circuits in 5.10.1.2.3;

d) if the operation of the switches is dependent upon a device which is indirectly mechanically linked to the load carrying unit, e.g. by rope, belt or chain, the breaking of or slack in the connecting link shall cause the machine to stop through the action of an electric safety device in conformity with 5.10.1.2;

e) the speed of re-levelling does not exceed 0,30 m/s;

f) the movement of the load carrying unit is under hold to run control.

#### 5.10.2.3 Control of inspection operation

The accessible goods only lift shall be provided with at least a removable inspection control station to control the inspection operation from outside of the well, allowing to bring the load carrying unit to preset stopped positions (e.g. by markings clearly visible from the location of the inspection control) where inspection and/or maintenance operations can be carried out either from outside of the well or from the load carrying unit or the load carrying unit roof.

Under no circumstances shall it be possible to move the load carrying unit with inspection controls placed on the load carrying unit.

Type B accessible goods only lifts shall always be provided with an inspection operation control station placed on the load carrying unit roof. The inspection control station may also incorporate special switches protected against accidental operation for controlling the mechanism of doors, if any, from the load carrying unit roof.

The inspection control station shall only be available for use by maintenance/inspection personnel. It shall be prevented from use by unauthorised persons, e.g. by use, if necessary, of a key operated contact.

It shall be brought into operation by a switch (inspection operation switch), which shall satisfy the requirements for electric safety devices (5.10.1.2).

This switch, which shall be bi-stable, shall be protected against involuntary operation.

The following conditions shall be satisfied simultaneously:

a) switching on the inspection operation shall neutralise the normal operation controls, including the operation of any power operated doors;

b) the return to normal service of the accessible goods only lift shall only be effected by switching off the inspection operation;

c) if the switching devices used for this neutralisation (see a) above) are not safety contacts integral with the inspection switch mechanism, precautions shall be taken to prevent all involuntary movement of the load carrying unit in the event of one of the faults listed in 5.10.1.1.2 appearing in the circuit;

d) the movement of the load carrying unit shall be dependent on a constant pressure on a push-button protected against accidental operation and with the direction of movement clearly indicated;

e) the control panel in which the inspection control station is connected shall also incorporate a stopping device in conformity with 5.10.2.4;

f) the load carrying unit speed shall not exceed 0,30 m/s;

g) the limits of normal load carrying unit travel shall not be overrun;

h) in case of headroom in accordance with 5.2.11.1.2, b), 2) the travel limits shall be set according to Annex L;

i) the operation of the accessible goods only lift shall remain dependent on the safety devices.

#### 5.10.2.4 Stopping devices

**5.10.2.4.1** A stopping device shall be provided for stopping and maintaining the accessible goods only lift out of service, including the power operated doors, if any:

a) in the pit (5.2.11.2.4, a)) accessible from the landing;

b) in the machinery spaces;

c) at the lift machine, if there is no main switch nearby;

d) at the inspection control station (5.10.2.3), where provided;

e) on top of the load carrying unit, in a position easily accessible from where the load carrying unit or its roof is accessed for maintenance (5.5.1.8), and not more than 1 m from the entry point.

   This stopping device may be the one located next to the inspection control station if this, where provided, is not placed more than 1 m from the access point.

**5.10.2.4.2** The stopping devices shall consist of electric safety devices in conformity with 5.10.1.2. They shall be bi-stable and such that a return to service cannot result from an involuntary action.

#### 5.10.2.5 Stopping the machine and checking its stopped condition

##### 5.10.2.5.1 General

The stopping of the machine by means of an electric safety device, in conformity with 5.10.1.2, shall be controlled as detailed below.

For hydraulic driven accessible goods only lifts, see the requirements in G.2.4.

##### 5.10.2.5.2 Motors supplied directly from A.C. or D.C. mains

The supply shall be interrupted by two independent contactors, the contacts of which shall be in series in the supply circuit. If, whilst the lift is stationary, one of the contactors has not opened the main contacts, further movement of the load carrying unit shall be prevented at the latest at the next change in the direction of motion.

##### 5.10.2.5.3 A.C. or D.C. motor supplied and controlled by static elements

**5.10.2.5.3.1** One of the following methods shall be used:

a) two independent contactors interrupting the current to the motor.

   If, while the lift is stationary, one of the contactors has not opened the main contacts, any further movement shall be prevented, at the latest at the next change in direction of motion;

b) a system consisting of:

   1) a contactor interrupting the current at all poles.

The coil of the contactor shall be released at least before each change in direction of motion. If the contactor does not release, any further movement of the lift shall be prevented; and

2) a control device blocking the flow of energy in the static elements; and

3) a monitoring device to verify the blocking of the flow of energy each time the lift is stationary.

If, during a normal stopping period, the blocking by the static elements is not effective, the monitoring device shall cause the contactor to release and any further movement of the lift shall be prevented.

**5.10.2.5.3.2** Control devices according to 5.10.2.5.3, b), 2), and monitoring devices according to 5.10.2.5.3, b), 3), need not be safety circuits according to 5.10.1.2.3.

These devices shall only be used provided the requirements of 5.10.1.1 are met to achieve comparability to 5.10.2.5.3, a).

### 5.10.2.6 Priority control

For accessible goods only lifts with manual landing doors, a device shall prevent the load carrying unit leaving a landing for a period of at least 5 s after stopping.

### 5.10.2.7 Load control

**5.10.2.7.1** Where the accessible goods only lift is fitted with a load control device as required by 5.5.1.1.2, it shall prevent the operation of the accessible goods only lift, in the event of overload in the load carrying unit.

**5.10.2.7.2** The overload is considered to occur when the rated load is exceeded by 20 % with a minimum of 100 kg.

**5.10.2.7.3** In the event of overload:

a) operator(s) shall be informed by an audible and/or a visible signal in the load carrying unit;

b) landing doors shall remain unlocked.

### 5.10.2.8 Motor run time limiter

**5.10.2.8.1** Accessible goods only lifts shall have a motor run time limiter causing the de-energising of the machine, and keep it de-energised, if:

a) the machine does not rotate when a start is initiated;

b) the load carrying unit/counterweight is stopped in downward movement by an obstacle, which causes slippage of:

1) the ropes on the traction sheave, for traction drive accessible goods only lift;

2) the belts where belts are used for coupling the motor to the rotating components;

c) the load carrying unit does not reach a floor within a preset time.

**5.10.2.8.2** The motor run time limiter shall function in a time, which does not exceed the smaller of the following two values:

a) 45 s;

b) time for travelling the full travel, plus 10 s, with a minimum of 20 s if the full travel time is less than 10 s.

**5.10.2.8.3** The return to normal operation shall only be possible by manual resetting. On restoration of the power after a supply disconnection, maintaining the machine in the stopped position is not necessary.

**5.10.2.8.4** The motor run time limiter shall not affect the movement of the load carrying unit under the inspection operation.

# 6 Verification of the safety requirements and/or protective measures

## 6.1 Verification and tests

The technical dossier (see Annex C) to be prepared and kept by the manufacturer shall contain the necessary information to ascertain that the constituent parts are correctly designed and the proposed installation is in conformity to this European Standard.

NOTE It may contractually be required to supply all or some of the technical information and calculations, which appear in Annex C.

## 6.2 Verification of design

Table 8 indicates the methods by which the safety requirements and measures described in Clause 5 shall be verified by the manufacturer for each new model of accessible goods only lift, together with a reference to the corresponding subclauses in this standard. Secondary subclauses, which are not listed in the table, are verified as part of the quoted subclause. For example, secondary subclause 5.3.2.3 is verified as part of subclause 5.3.2.

All verification records shall be kept by the manufacturer.

**Table 8 — Means of verification of the safety requirements and/or protective measures**

| Sub-clause | Safety requirements | Visual inspection[a] | Performance check/test[b] | Measurement[c] | Drawing/ Calculation[d] | User information[e] |
|---|---|---|---|---|---|---|
| **5.2** | **Lift well** | | | | | |
| 5.2.1 | General provisions | ✓ | | | ✓ | ✓ |
| 5.2.2 | Well enclosure | ✓ | | ✓ | ✓ | |
| 5.2.5 | Walls, floor and ceiling of the well | ✓ | ✓ | ✓ | ✓ | |
| 5.2.8 | Construction and clearances | ✓ | ✓ | ✓ | ✓ | |
| 5.2.9 | Spaces below load carrying unit, counterweight or balancing weight | ✓ | | | ✓ | ✓ |
| 5.2.10 | Protection in the well | ✓ | | ✓ | ✓ | ✓ |
| 5.2.11 | Headroom and pit | ✓ | | ✓ | ✓ | ✓ |
| 5.2.12 | Exclusive use of lift well | ✓ | | ✓ | ✓ | ✓ |
| 5.2.13 | Lighting of the well | ✓ | | | | ✓ |
| 5.2.14 | Alarm device | ✓ | ✓ | ✓ | | ✓ |
| **5.3** | **Machinery spaces** | | | | | |
| 5.3.1 | General provisions | ✓ | | | ✓ | ✓ |
| 5.3.2 | Access | ✓ | | ✓ | ✓ | ✓ |
| 5.3.3 | Construction and equipment | ✓ | ✓ | ✓ | ✓ | ✓ |

*(to be continued)*

**Table 8 — Means of verification of the safety requirements and/or protective measures** *(continued)*

| Sub-clause | Safety requirements | Visual inspection[a] | Performance check/test[b] | Measurement[c] | Drawing/ Calculation[d] | User informatio[e] |
|---|---|---|---|---|---|---|
| **5.4** | **Landing doors** | | | | | |
| 5.4.1 | General provisions | ✓ | ✓ | ✓ | ✓ | ✓ |
| 5.4.3 | Doors | ✓ | ✓ | | | ✓ |
| 5.4.4 | Protection from falling and shearing | ✓ | ✓ | ✓ | | |
| 5.4.5.4 | Locking and manual unlocking | ✓ | ✓ | ✓ | | ✓ |
| 5.4.6 | Electrical device proving door closed | ✓ | ✓ | | | ✓ |
| **5.5** | **Load carrying unit, counterweight and balancing weight** | | | | | |
| 5.5.1 | Load carrying unit | ✓ | ✓ | ✓ | ✓ | ✓ |
| 5.5.2 | Counterweight and balancing weight | ✓ | | | | ✓ |
| **5.6** | **Suspension, uncontrolled movement, overspeed** | | | | | |
| 5.6.1 | Suspension | | ✓ | ✓ | ✓ | |
| 5.6.2 | Uncontrolled movement and overspeed | ✓ | ✓ | ✓ | ✓ | ✓ |
| 5.6.3 | Protections | ✓ | | ✓ | ✓ | ✓ |
| 5.6.4 | Guarding of machinery | ✓ | | | | ✓ |
| **5.7** | **Guiding systems, mechanical stops and final limit switches** | | | | | |
| 5.7.1 | General provisions | ✓ | ✓ | ✓ | ✓ | ✓ |
| 5.7.2 | Guiding means | | | ✓ | ✓ | ✓ |
| 5.7.3 | Fixed stops and buffers | ✓ | ✓ | | ✓ | ✓ |
| 5.7.4 | Final limit switches | ✓ | ✓ | | | ✓ |
| **5.8** | **Lift machine** | | | | | |
| 5.8.1 | General provisions | ✓ | | | ✓ | ✓ |
| 5.8.2 | Speed | | ✓ | | ✓ | ✓ |
| **5.9** | **Electric installations and appliances** | | | | | |
| 5.9.1 | General provisions | ✓ | ✓ | ✓ | | ✓ |
| 5.9.2 | Contactors, components of safety circuits | ✓ | | ✓ | ✓ | |
| 5.9.3 | Protections | ✓ | ✓ | | ✓ | ✓ |
| 5.9.4 | Main switches | ✓ | ✓ | | ✓ | ✓ |
| 5.9.5 | Electric wiring | ✓ | | | ✓ | ✓ |

*(to be continued)*

**Table 8 — Means of verification of the safety requirements and/or protective measures** *(continued)*

| Sub-clause | Safety requirements | Visual inspection[a] | Performance check/test[b] | Measurement[c] | Drawing/ Calculation[d] | User informatio[e] |
|---|---|---|---|---|---|---|
| **5.10** | **Protections against electric faults; controls; priorities** | | | | | |
| 5.10.1.1 | Failure analysis | | ✓ | | | ✓ |
| 5.10.1.2 | Electric safety devices | ✓ | ✓ | | | ✓ |
| 5.10.2 | Controls | ✓ | ✓ | ✓ | ✓ | ✓ |
| 7.1 | Notices, markings and operating instructions | ✓ | | ✓ | | ✓ |

[a] Visual inspection will be used to verify the features necessary for the requirement by visual examination of the components supplied.

[b] A performance check/test will verify that the features provided perform their function in such a way that the requirement is met.

[c] Measurement will verify by the use of instruments that requirements are met, to the specified limits.

[d] Drawings/calculations will verify that the design characteristics of the components provided meet the requirements.

[e] Verify that the relevant point is dealt with in the instruction handbook or by marking.

## 6.3 Verification tests before putting into service

Before putting the accessible goods only lift into service, the manufacturer shall perform or have performed static and dynamic tests to ensure that the accessible goods only lift has been correctly manufactured and assembled in order to check that all the devices provided are present and operating correctly. These tests shall be carried out at the place of use.

In particular it shall be verified:

— proper function of all limit switches;

— proper function of all controls;

— function of the overspeed governor within specified limits, where provided;

— function of the safety gear, where provided;

— function of the pawl devices, where provided;

— function of the rupture valve/one way restrictor, where provided;

— triggering of overload detection device between 1,0 times and 1,2 times rated load;

— proper value of counterweight/balancing weight mass to suit manufacturer's design;

— braking distance of brake system within specified limits;

— proper function of landing doors locks;

— functional test of the alarm device;

— dynamic test;

— electrical tests as specified in EN 60204-32.

Annex D gives the details of the procedures to be followed for carrying out the tests.




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A test report shall be prepared with a brief description and the result of the tests made and recorded by the manufacturer/vendor.

# 7 Information for use

## 7.1 Notices, markings and operating instructions

### 7.1.1 General

Information for use of the machine shall be provided in accordance with Clause 6 of EN ISO 12100-2:2003 and include the following specific information.

### 7.1.2 General provisions

All labels, notices, markings and operating instructions shall be indelible, legible and readily understandable (if necessary aided by signs or symbols). They shall be untearable, of durable material, placed in a visible position, and written in the language of the country where the lift is installed (or, if necessary, in several languages).

Unless otherwise stated, the minimum height of the characters used for the notices shall be:

a) 10 mm for capital letters and numbers;

b) 7 mm for lower case letters.

### 7.1.3 Rating plate

The manufacturer shall provide the following information on one or more durable labels fixed in a prominent place on the accessible goods only lift:

a) business name and full address of the manufacturer and where applicable, his authorised representative;

b) type designation;

c) serial number;

d) year of construction;

e) rated load, expressed in kilograms (kg).

### 7.1.4 Load carrying unit

#### 7.1.4.1 Inside the load carrying unit

It shall be displayed:

a) the rated load of the accessible goods only lift in kilograms (kg) together with a warning indicating: "TRANSPORT OF PERSONS FORBIDDEN";

b) a warning notice, clearly visible, stating: "IMMOBILISE THE LOAD" where the loading/unloading means are intended to be left inside the load carrying unit during the transport of the goods.

The minimum height of the characters used for the notices above shall be 50 mm for capital letters and numbers and 30 mm for lower case letters.

The vendor's name and the vendor's lift identification number shall be displayed in the load carrying unit.

#### 7.1.4.2 On the load carrying unit

The following information shall be given:

a) the word "STOP" on or near the stopping device(s) (5.10.2.4) where provided, so placed that there can be no risk of error as to the stop position;

b) the words "NORMAL" and "INSPECTION" on or near the inspection operation switch, where provided;

c) the direction of motion on or near the inspection buttons, where provided;

d) warning sign or a notice at the balustrade, where provided (5.5.1.6.2, d), 2)) on the load carrying unit roof.

#### 7.1.4.3 Other information

The control device of the stop switch (where fitted) shall be red in colour and identified by the word "STOP", so placed that there can be no risk of error as to the stop position.

The button (if any) of the alarm switch shall be yellow in colour and identified by the symbol: 

The colours red and yellow shall not be used for other buttons. However, these colours may be used for illuminated "Load carrying unit here" signals.

### 7.1.5 Landings

**7.1.5.1** The control devices shall be clearly identified by reference to their function; for this purpose it is recommended to use for control buttons the markings - 2, - 1, 0, 1, 2, 3, etc.;

**7.1.5.2** Instructions to ensure safe usage of the accessible goods only lift shall be placed near the landing control station whenever the need for these is apparent.

These shall at least indicate that:

a) the use of the accessible goods only lift is restricted to authorised person only;

b) after using the accessible goods only lift, it is necessary to close manually operated doors and power operated doors where closing is carried out under the continuous control of the operators.

### 7.1.6 Machinery spaces

**7.1.6.1** A notice bearing the following minimum inscription:

**"LIFT MACHINERY – DANGER**
**ACCESS FORBIDDEN TO UNAUTHORISED PERSONS"**

shall be fixed to the outside of doors or trap-doors giving access to the machines and pulleys.

In the case of trap doors, a permanently visible notice shall indicate to those using the trap door:

**"DANGER OF FALLING – RECLOSE THE TRAP-DOOR"**

**7.1.6.2** Notices shall be provided to permit easy identification of the main switch(es) and the light switch(es).

If, after release of a main switch, some parts remain live (interconnection between lifts, lighting, etc.) notice(s) shall indicate this.




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**7.1.6.3** In the machinery spaces, there shall be detailed instructions to be followed in the event of lift breakdown, particularly concerning the use of the device, if any, for manual movement, and the unlocking key for landing doors.

**7.1.6.4** The direction of movement of the load carrying unit shall be clearly indicated on the machine, close to the device used for manual movement.

If the device used for manual movement is not removable, the indication may be on the device itself.

**7.1.6.5** On or near the stopping device in the machinery spaces there shall be the word "STOP" so placed that there can be no risk of error as to the stop position.

**7.1.6.6** The maximum permissible load shall be indicated on the lifting beam or hooks (see 5.3.3.3).

### 7.1.7 Well

**7.1.7.1** Outside of the well, near the inspection doors, there shall be a notice stating:

**"LIFT WELL – DANGER**
**ACCESS FORBIDDEN TO UNAUTHORISED PERSONS"**

**7.1.7.2** Landing doors with manual opening, if they can be confused with other adjacent doors, shall bear the inscription: **"ACCESSIBLE GOODS ONLY LIFT"**.

**7.1.7.3** A sign, visible from the landing loading area at all times, shall display the rated load.

### 7.1.8 Safety components

On the following components regarded as safety components, according to Table 9, a data plate shall be fixed indicating:

a) the name of the manufacturer of the component;

b) the relevant adjustment (tripping speed or tripping flow, as applicable);

c) data identifying the type of safety component.

**Table 9 — List of data plate information**

| Safety component | Data plate according to | | |
|---|---|---|---|
| | 7.1.8, a) | 7.1.8, b) | 7.1.8, c) |
| Overspeed governor | X | X [a] | X |
| Buffer [b] | X | | X |
| Locking devices | X | | X |
| Safety gear | X | | X |
| Ascending load carrying unit overspeed protection means | X | X [a] | X |
| Rupture valve/one-way restrictor | X | X [c] | X |

[a] Actual tripping speed.

[b] On buffer other than energy accumulation type buffers.

[c] Tripping flow.

### 7.1.9 Pit

On or near the stop switch in the pit, where fitted, there shall be the word "STOP", so placed that there can be no risk of error as to the stop position.

### 7.1.10 Electrical identification

Contactors, relays, fuses and connection strips for circuits coming into the control panels shall be marked in accordance with the wiring diagram. The necessary fuse specifications such as value and type shall be marked on the fuse or on or near the fuse holders.

In the case of the use of multiple wire connectors, only the connector, and not the wires, needs to be marked.

### 7.1.11 Unlocking key for landing doors

The unlocking key shall have a label attached drawing attention to the danger which may be involved in using this key and the need to make sure that the landing door is locked after it has been closed.

### 7.1.12 Alarm device

The alarm (see 5.2.14, b)) operated during a call for help from the accessible goods only lift shall be clearly marked "LIFT ALARM".

In the case of multiple lifts, it shall be possible to identify the lift from which the call is being made.

### 7.1.13 Groups of lifts

If parts of different lifts are present in one machinery space each lift shall be identified with a number or letter consistently used for all parts (machine, controller, overspeed governor, switches, etc.).

To facilitate maintenance, etc. on the load carrying unit roof, in the pit or other places where necessary, the same identification symbol shall appear.

### 7.1.14 Emergency lowering valve

Near the manually operated valve for manual downward movement there shall be a plate stating:

**"CAUTION − EMERGENCY LOWERING"**

### 7.1.15 Hand pump

Near the hand pump for manual upward movement there shall be a plate stating:

**"CAUTION − EMERGENCY LIFTING"**

### 7.1.16 Tank

On the tank the characteristics of the hydraulic fluid shall be indicated.

### 7.1.17 Reduced top clearances

A notice bearing the following inscription:

**"DANGER − REDUCED TOP CLEARANCES**
**RESPECT INSTRUCTIONS"**

shall be affixed:




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a) in machinery spaces at the emergency operation devices;

b) on or at the device for resetting the lift;

c) on the load carrying unit roof.

This notice should be accompanied by the following warning sign:

**Figure 3 — Warning sign "Overhead crush hazard in lift well"**

#### 7.1.18 Reduced bottom clearances

A notice bearing the following inscription:

**"DANGER − REDUCED BOTTOM CLEARANCES
RESPECT INSTRUCTIONS"**

shall be affixed:

a) in machinery spaces at the emergency operation devices;

b) on or at the device for resetting the lift;

c) in the pit.

This notice should be accompanied by the following warning sign:

**Figure 4 — Warning sign "Pit crush hazard"**

## 7.2 Vendor information for use

### 7.2.1 General

The vendor shall provide an instruction manual with each accessible goods only lift. This instruction manual shall be according to EN 13015 requirements.

### 7.2.2 Contents of the instruction manual

#### 7.2.2.1 General

The vendor shall make available to the user an instruction manual containing at least, information about the following topics (see EN ISO 12100-2:2003, Clause 6).

#### 7.2.2.2 General information

a) Manufacturer's name and address or that of his authorised representative;

b) year and country of manufacture;

c) model designation and serial number;

d) general description of the accessible goods only lift, including:

   1) the intended use and its limits;

   2) restrictions to use;

   3) the intended specific health/safety requirements as consequence of the negotiations (see 0.2.5);

   4) information about use in special environments, e.g. potentially explosive atmosphere;

e) country of installation, if necessary;

f) range of serial numbers for which the instruction manual is valid, if necessary:

g) a repeat of the safety marking and warning signs on the machine and their signification;

h) all compatible parts (well structure and enclosure, landing doors, guides, drive, control systems, etc.) designed to be used in the accessible goods only lift installation for which the declaration of conformity is valid;

i) name and address of repair and maintenance companies.

#### 7.2.2.3 Capacity and design information

— Rated load;

— rated speed;

— maximum allowable freestanding height;

— environmental restrictions such as temperature range, humidity, etc.;

— means of suspension (e.g. rope, chain) data, where applicable;

— sound pressure level (in dB(A)) with the indication of the position and value of the maximum sound pressure.

NOTE The sound pressure level should be measured at a distance of 1 m from the enclosure and at a height of 1,60 m from the floor.

Sufficient information shall be given in the instruction manual such that the user can derive the particular details for each installation.

#### 7.2.2.4 Dimensions and weights

— Internal size of load carrying unit (depth, width and height);

— major components: dimensions and weight;

— well enclosure, if provided: dimensions and weight;

— layout drawings, including information about the forces and efforts exerted on the surrounding of the accessible goods only lift, e.g. supports and anchorages.

#### 7.2.2.5 Power supply data

— Drive unit power in kilowatts (kW);

— supply voltage in volts (V) and frequency in hertz (Hz);

— control voltage in volts (V) and frequency in hertz (Hz);

— maximum starting current in amperes (A);

— maximum power consumption in kilowatts (kW);

— minimum power supply in kilovolt amperes (kVA);

— main power supply fuses (A, type);

— outlets for portable tools: voltage in volts (V) and current in amperes (A);

— for hydraulic drives, hydraulic pressures, e.g. full pressure, test pressure in pascals (Pa).

#### 7.2.2.6 Safety devices

— Type of safety devices, e.g. overspeed governor, safety gear, pawl devices, final limit switches, landing door locks;

— additional safety equipment for erection, dismantling and maintenance, if needed.

#### 7.2.2.7 Additional technical information

— Information about the means of access to the machinery spaces (J.2);

— need for protection regarding hazardous areas around the accessible goods only lifts;

— information concerning limitation of work operations in the vicinity of an accessible goods only lift well and related information about the use of ladders (J.3);

— information regarding any lifting points;

— transport procedure to site.

#### 7.2.2.8 Instructions for erection and dismantling

These instructions shall include at least the following:

— only competent persons shall erect and dismantle the accessible goods only lift;

— connection of the accessible goods only lift to the electrical supply shall be made by a competent person in accordance with local regulations;

— recommendation for the use of a residual current device;

— erection sequence;

— indications on how to reduce noise and vibrations of the accessible goods only lift;

— erection of well supporting structure and enclosure, including information regarding the correct use of bolts (diameter, quality, tightening torque);

— recommendations for lifting of heavy parts;

— illumination of landings;

— any special information about dismantling.

#### 7.2.2.9 Instructions for tests before putting into service

The completed accessible goods only lift shall be tested before putting into service. The instructions shall describe the examinations, tests and verifications that shall be carried out according to Annex D and which are applicable to the specific installation.

#### 7.2.2.10 Instructions for operating and usage

A separate section shall be included in the instruction manual, which gives clear information for:

— all users of the accessible goods only lift regarding the safe operation and the minimum requirements for the training of operating personnel as well as instructions for those persons loading and unloading; and

— the owner regarding the responsibility to implement such requirements.

Detailed instructions shall be given regarding:

— intended use;

— requirement that no person shall be transported during normal operation;

— precaution to be taken in the case of lifts with partially enclosed well;

— operation of landing and load carrying unit doors;

— safe loading and unloading of the load carrying unit and possible restrictions regarding load position and concentration and securing of the load;

— use of castors suitable for the possible gaps;

— no loads to overhang the load carrying unit;

— full vision of the well, where there is a need;

— environmental conditions, e.g. maximum and minimum operating temperatures;

— protection of the enclosure from potential damages by vehicles moving in the environment;

— keeping the machinery space(s) door locked;

— keeping unobstructed the access to machinery spaces;

— events needing the intervention of a competent person;

— use of the emergency unlocking key, which should be given only to a responsible person;

— precautions to be taken to ensure the alarm is audible and responded to;

— precautions to be taken to prevent the use of accessible goods only lift by children, if any;

— keeping the documentation.

#### 7.2.2.11 Breakdown procedures

A separate section shall be included which provides all the information and related training instructions necessary for competent persons regarding the handling of emergencies such as:

— special controls;

— safety devices, e.g. limit switches, overspeed governor, safety gear;

— reacting to failures;

— circuit diagram.

#### 7.2.2.12 Regular inspection and maintenance

The instruction manual shall state the type and the frequency of periodical examinations, tests and maintenance depending on manufacturer's requirements, operating conditions and frequency of use, in order to keep the lift in safe working condition. Detailed information regarding the items to be checked and suitability for use shall be given, including information about checking the presence and legibility of initial markings and notices.

It shall state which parts of the lift can be replaced, which are subject to wear, their identification means and the criteria for replacement, e.g. ISO 4309 for replacement of steel wire ropes.

In particular, it shall give information about:

a) the need to keep the earthing system in good operating conditions;

b) the ropes and/or chains to be used;

c) the hoses and hydraulic fluid to be used with hydraulic drive;

d) repairs and modifications to be made to the manufacturer's specifications;

e) necessary special tools and equipment;

f) safe restarting procedures;

g) use of personnel protective equipment;

h) welding on installations, where needed;

i) regular checks for detecting of failure of:

   1) safety gear, where fitted;

   2) guide rails;

   3) buffers, where fitted;

   4) power transmission belts, where fitted.

The instruction manual shall also state the contents of the logbook, even if that is delivered with the accessible goods only lift.




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#### 7.2.2.13 Minimum documents that need to be provided

— Drawings and documents necessary to install the accessible goods only lift;

— drawings and diagrams necessary for putting into service;

— drawings and diagrams necessary for maintenance, inspection, checking of correct operation, repair.

### 7.2.3 Periodical examinations

Information shall be given about periodical examinations and tests on accessible goods only lifts that should be carried out after they are put into service, where required by national regulations, to verify that they are in safe operating condition.

E.1 gives some guidance for carrying out these periodical examinations and tests.

### 7.2.4 Examinations and tests after important modifications or accidents

Guidance should be given about examinations and tests to be carried out after important modifications or accidents.

These examinations and tests should be carried out to ascertain that accessible goods only lifts continue to conform to this standard.

E.2 gives some guidance for carrying out these examinations and tests.

### 7.2.5 Logbook

The logbook of accessible goods only lift shall be drawn up at the latest at the time the installation is put into service.

The logbook shall contain the following:

a) the date the accessible goods only lift was put into service;

b) record of any event related to the lift. This section of the logbook shall be kept up-to-date in case of:

   1) important modifications to the accessible goods only lift (Annex E);

   2) replacement of ropes or important parts;

   3) accidents;

   4) major repairs;

   5) statutory verifications;

c) and if necessary, a section to keep duplicate dated copies of verification reports, with observations.

NOTE This logbook should be available to those in charge of the maintenance, and to the person or organisation responsible for the periodical examinations and tests.

# Annex A
(normative)

## List of the electric safety devices

| Clause | Devices checked |
|---|---|
| 5.2.3.2.2 | Check on closed position of inspection and emergency doors and inspection traps |
| 5.2.11.1.2, a) | Stop switch on the load carrying unit roof |
| 5.2.11.2.3.1, a), 2) | Safety switch in the pit |
| 5.2.11.2.3.1, a), 3) | Safety switch for mechanical means in the pit |
| 5.2.11.2.4, a) | Stopping device in the pit |
| 5.4.3.4.2, b) | Stopping device for power operated doors |
| 5.4.4.1 | Locking device: levelling in the unlocking zone |
| 5.4.4.2 | Check on closed position of the panels of landing doors |
| 5.4.5.10 | Check on locking of landing doors |
| 5.4.6 | Check on closed position of landing doors |
| 5.5.1.3.1 | Check on closed position of load carrying unit door |
| 5.5.1.3.1, a) | Stopping device for power operated load carrying unit doors |
| 5.5.1.3.2.2 | Check closed position of load carrying unit indirectly linked sliding door panels |
| 5.5.1.5, e) | Safety switch check the locked position of the trap doors on the load carrying unit |
| 5.5.1.8, a) | Stopping device on top of the load carrying unit |
| 5.6.1.4.3 | Check on the abnormal relative extension of a rope or chain in case of a two rope or two chain type suspension |
| 5.6.2.2.3 | Safety switch after detecting uncontrolled movement |
| 5.6.2.3.1, g), 2) | Check engaged position of the mechanical safety device for uncontrolled movement |
| 5.6.2.4.1.2, b) | Safety stopping switch of the overspeed governor |
| 5.6.2.4.1.2, c) | Check on the release of the overspeed governor |
| 5.6.2.4.1.3, f) | Check on the tension in the overspeed governor rope |
| 5.7.3.3.2 | Check on the return to normal extended position of buffers |
| 5.7.4 | Final limit switches |
| 5.9.4.2 | Safety device in circuit breaker contactor coil |
| 5.10.2.4.1, d) | Stopping device at the inspection control station |
| 5.10.2.7 | Overload device |
| G.1.5, d) | Check on the positions of the removable wheel |
| G.1.6 | Safety device against slack rope/chain |
| G.2.4 | Checking of stopped position of the machine |
| G.2.9 | Safety device against slack rope/chain |
| L.2.2.3.3, f) | Check of stopping gear (headroom) |
| L.2.2.6, a) | Check of extended (active) position of movable stops or triggering device (headroom) |




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| Clause | Devices checked |
|---|---|
| L.2.2.6, b) | Check of retracted (inactive) position of movable stops or triggering device (headroom) |
| L.2.3.1 | Bi-stable safety contact for activation of safety system (headroom) |
| L.2.3.3 | Monitoring of electrical reset device (headroom) |
| L.2.3.4 | Additional final limit switch (headroom) |
| L.3.2.3.3, f) | Check of stopping gear (pit) |
| L.3.2.6, a) | Check of extended (active) position of movable stops or triggering device (pit) |
| L.3.2.6, b) | Check of retracted (inactive) position of movable stops or triggering device (pit) |
| L.3.3.1 | Bi-stable safety contact for activation of safety system (pit) |
| L.3.3.1 | Second bi-stable safety contact for activation of safety system (manual landing doors) |
| L.3.3.3 | Monitoring of electrical reset device (pit) |
| L.3.3.4 | Additional final limit switch (pit) |

# Annex B
(normative)

# Unlocking triangle

Dimensions in millimetres

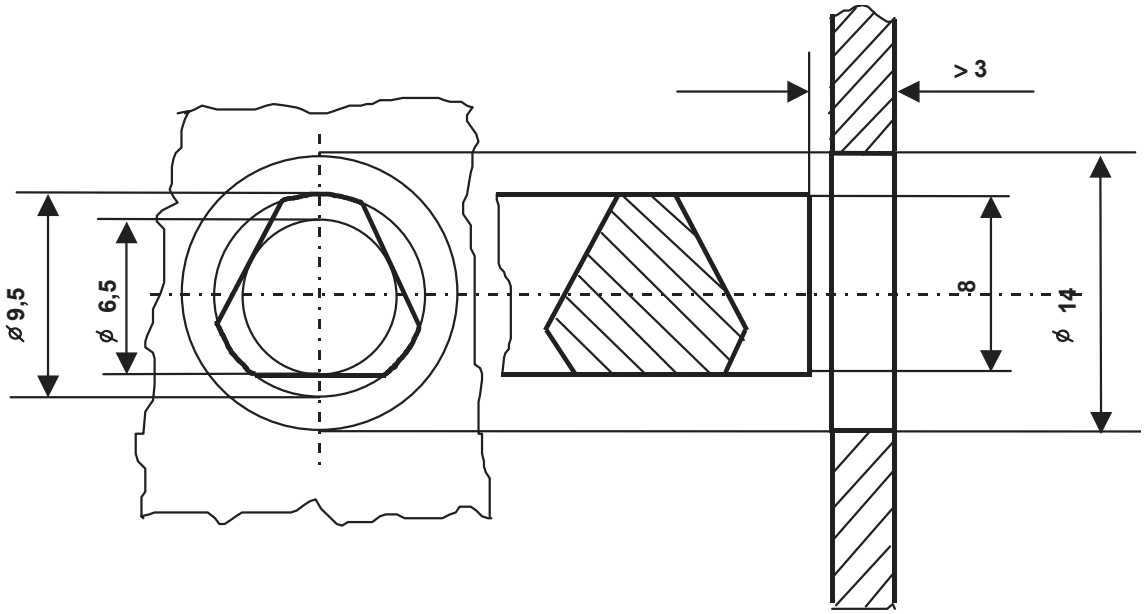


**Figure B.1 — Unlocking triangle**




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# Annex C
(informative)

# Technical dossier

## C.1 General

The technical dossier to be prepared and kept by the manufacturer for each accessible goods only lift shall comprise all or part of the information and documents figuring in the following list, in particular for those items that are supplied by the manufacturer:

a) name and address of the manufacturer;

b) equipment identification information;

c) type of equipment – rated load – rated speed;

d) travel of the accessible goods only lift, number of landings served;

e) mass of the load carrying unit and of the counterweight or balancing weight;

f) means of access to the machinery spaces (5.3.2).

## C.2 Technical details and plans

Necessary plans and sections in order to understand the lift installation, including spaces for machines, pulleys and apparatus are listed below. These plans do not have to give details of construction, but they should contain the necessary particulars to check conformity to this standard, and particularly the following:

a) arrangement and dimensions of inspection doors and inspection traps (5.2.3);

b) any accessible spaces which exist below the well (5.2.9);

c) declaration of the precautions provided in the case of 5.2.9 against free fall and descent with excessive speed;

d) guards between lifts if there are more than one in the same well (5.2.10.2);

e) clearances at the top of the well and in the pit (5.2.11.1, 5.2.11.2.3);

f) access to the pit (5.2.11.2.2);

g) provision for holes for fixings;

h) position and principal dimensions of the machinery spaces with the layout of the machine and principal components (pulleys) and devices. Dimensions of the driving element (e.g. traction sheave, drum). Ventilation holes. Reaction loads on the building and at the bottom of the pit;

i) access to the machinery spaces (5.3.2);

j) arrangement and principal dimensions of landing doors (5.4). It is not necessary to show all the landing doors if they are identical and if the distances between the landing sills are indicated;

k) dimensions of the load carrying unit and of its entrances (5.5.1.2, 5.5.1.3);

l) distances from the sill and from the load carrying unit entrance doors to the inner surface of the well wall (5.2.8.1);

m) principal characteristics of the suspension – safety factor – ropes (number, diameter, composition, breaking load) – chains (type, composition, pitch, breaking load) – compensation ropes (where provided);

n) calculation of the safety factor of the suspension means (e.g. ropes, ram);

o) principal characteristics of the overspeed governor rope and/or safety rope: diameter, composition, breaking load, safety factor;

p) dimensions and proof of the guiding means, condition and finish of the rubbing surfaces (drawn, milled, ground), if any;

q) calculations of the safety factor of the guiding means;

r) proof of the full load pressure;

s) proof of the jack and the piping according to Annex G;

t) characteristics or type of the hydraulic fluid.

## C.3 Electric and hydraulic schematic diagrams

The following shall be provided:

a) outline electric schematic diagrams of:

   1) the power circuits; and

   2) the circuits connected with electric safety devices.

These schematic diagrams shall be clear and use CENELEC symbols;

b) hydraulic circuit diagram.

This diagram shall be clear and use symbols of ISO 1219-1.

# Annex D
(normative)

# Examinations and tests before putting into service

Before the lift is put into service, the following examinations and tests shall be carried out:

## D.1 Examinations

These examinations shall cover in particular the verification of the fulfilment of the requirements of this European Standard.

## D.2 Tests and verifications

These tests and verifications shall cover the following points:

a) locking devices (5.4.4);

b) electric safety devices (Annex A);

c) suspension elements and their attachments.

   It shall be verified that their characteristics are those indicated in the instruction manual (7.2.2.2);

d) braking system, where fitted (G.1.4).

   The test shall be carried out whilst the load carrying unit is descending at rated speed with 125 % of the rated load and interrupting the supply to the motor and the brake;

e) measurements of current or power and of speed (5.8.2);

f) electric wiring:

   1) measurement of the insulation resistance of the different circuits (5.9.1.3). For this measurement all the electronic components are to be disconnected;

   2) verification of the electrical continuity of the connection between the earth terminal of the machinery spaces and the different parts of the lift liable to be made live accidentally;

g) final limit switches (5.7.4);

h) checking of the traction (G.1.2):

   1) the traction shall be checked by making several stops with the most severe braking compatible with the installation. At each test, complete stoppage of the load carrying unit shall occur. The test shall be carried out:

      i) ascending, with the load carrying unit empty, in the upper part of the travel;

      ii) descending, with the load carrying unit loaded with 125 % of the rated load, in the lower part of the travel;

   2) it shall be checked that the empty load carrying unit cannot be raised, when the counterweight rests on its stop/buffer;

3) it shall be checked that the balance is as stated by the manufacturer; this check can be made by means of measurements of current combined with speed measurements;

i) overspeed governor:

1) the tripping speed of the overspeed governor shall be checked in the direction corresponding to the descent of the load carrying unit or the counterweight or the balancing weight (5.6.2.4.1.2, a));

2) the operation of the stopping control laid down in 5.6.2.4.1.2, b) shall be checked in both directions of movement;

j) detecting device (5.6.2.2) and stopping device (5.6.2.3) for uncontrolled movement from stopped position.

The proper combined operation of the devices just above shall be checked by manual operation of the lift within the set operating distances.

Where pawl devices or clamp devices are used, tests shall be carried out as follows:

1) in down direction with 125 % rated load in the load carrying unit;

2) in up direction with load carrying unit empty;

k) load carrying unit safety gear (5.6.2.3).

The energy which the safety gear is capable of absorbing at the moment of engagement will have been verified in accordance with F.3. The aim of the test before putting into service is to check the correct mounting, correct setting and the soundness of the complete assembly, comprising load carrying unit, safety gear, guide rails and their fixing to the building.

The test shall be made while the load carrying unit is descending with the rated load uniformly distributed over the load carrying unit area under the following conditions:

1) in the case of an electric machine, the brake is open at rated speed and the machine continues to run until the ropes slip or become slack;

2) in the case of a hydraulic machine, the down direction valve is open.

After the test, it shall be ascertained that no deterioration, which could adversely affect the normal use of the lift has occurred. If necessary, friction components may be replaced. Visual check is considered to be sufficient;

NOTE In order to facilitate disengagement of the safety gear, it is recommended that the test be carried out opposite a door in order to be able to unload the load carrying unit.

l) counterweight or balancing weight safety gear (5.6.2.3).

The energy, which the safety gear is capable of absorbing at the moment of engagement, will have been verified in accordance with F.3. The aim of the test before putting into service is to check the correct mounting, correct setting and the soundness of the complete assembly, comprising counterweight or balancing weight, safety gear, guide rails and their fixing to the building.

The test shall be made while, load carrying unit empty, the counterweight or balancing weight is descending and under the following conditions:

1) in the case of an electric machine, the brake is open at rated speed and the machine continues to run until the ropes slip or become slack;

2) in the case of a hydraulic machine, the up direction valve is open.

After the test, it shall be ascertained that no deterioration, which could adversely affect the normal use of

the lift has occurred. If necessary, friction components may be replaced. Visual check is considered to be sufficient;

m) buffers (5.7.3):

1) energy accumulation type buffers.

The test shall be carried out in the following manner: the load carrying unit with its rated load shall be placed on the buffer(s), the ropes shall be made slack and it shall be checked that the compression corresponds to the figures given in the technical dossier according to C.3;

n) alarm device (5.2.14 b)):

functional test;

o) full load pressure:

measurement of the full load pressure;

p) pressure relief valve (G.2.5.3):

check of the correct adjustment;

q) rupture valve (G.2.5.5).

A system test shall be carried out, with rated load uniformly distributed in the descending load carrying unit at an overspeed to operate the rupture valve. The correct adjustment of the tripping speed can be checked, for instance, by comparison with the adjustment diagram;

r) restrictor/one-way restrictor (G.2.5.6).

Check that maximum speed $v_{max}$ does not exceed $v_d$ + 0,30 m/s:

1) either by measuring; or

2) by using the following equation:

$$v_{max} = v_t \sqrt{\frac{p}{p - p_t}}$$

where

$p$ is the full load pressure in megapascals (MPa);

$p_t$ is the pressure measured during a downward journey with rated load in the load carrying unit in megapascals (MPa). If necessary, pressure losses and friction losses shall be taken into account;

$v_{max}$ is the maximum downward speed in the case of a rupture in the hydraulic system in metres per second (m/s);

$v_t$ is the speed measured during a downward journey with rated load in the load carrying unit in metres per second (m/s);

s) pressure test.

A pressure of 200 % full load pressure is applied to the hydraulic system between the non return valve and the jack (included). The system is then observed for evidence of pressure drop and leakage during a period of 5 min (taking into account the possible effects of temperature change in the hydraulic fluid).

After this test it shall be visually ascertained that the integrity of the hydraulic system is maintained;

t) creeping test.

It shall be checked that the load carrying unit with the rated load, stopped at the highest level served does not move by more than 10 mm downwards within 10 min (taking into account the possible effects of temperature change in the hydraulic fluid);

u) manual operation downwards (G.2.8.2.5) (in the case of indirect acting accessible goods only lifts).

Hand-lower the load carrying unit onto a prop (or actuate the safety gear) and check that slack rope or slack chain condition does not occur;

v) motor run time limiter (5.10.2.8).

Check of the time adjustment (by simulating the running of the machine).

# Annex E
(informative)

# Periodical examinations and tests, examinations and tests after an important modification or after an accident

## E.1 Periodical examinations and tests

Periodical examinations and tests should not be more stringent than those required before the lift was the first time put into service.

These periodical tests should not, through their repetition, cause excessive wear or impose stresses likely to reduce the safety of the lift. This is the case in particular of the test on components such as the safety gear and the buffers. If tests on these components are made, they should be carried out with empty load carrying unit and at a reduced speed.

The person appointed to make the periodical test should assure himself that these components (which do not operate in normal service) are still in an operating condition.

A duplicate copy of the report should be attached to the logbook in the part covered by 7.2.3.

## E.2 Examinations and tests after an important modification or after an accident

The important modifications and accidents should be recorded in the technical part of the logbook covered in 7.2.3.

In particular, the following are considered as important modifications:

a) change of:

   1) the rated speed;

   2) the rated load;

   3) the mass of the load carrying unit;

   4) the travel;

b) change or replacement of:

   1) the type of locking devices (the replacement of a locking device by a device of the same type is not considered as an important modification);

   2) the control system;

   3) the type of guide rails;

   4) the type of door (or the addition of one or more landing or load carrying unit doors);

   5) the machine or the traction sheave;

   6) the overspeed governor;

   7) the buffers;

8) the safety gear;

9) the jack;

10) the pressure relief valve;

11) the rupture valve;

12) the restrictor/one-way restrictor.

For the tests after an important modification or after an accident the documents and the necessary information should be submitted to the responsible person or organization, if any.

Such person or organisation will decide on the advisability of carrying out tests on the modified or replaced components.

These tests will, at the most, be those required for the original components before the lift was put into service.

# Annex F
(normative)

# Safety components − Test procedures for verification of conformity

## F.1 Introduction

### F.1.1 General provisions

**F.1.1.1** Tests shall be carried out to verify the compliance of the safety components listed in 5.4.4, 5.6.2.3.2, 5.6.2.4 and 5.10.1.2.3.3 with the requirements of this European Standard.

The manufacturer who wants to carry out or to have carried out alternative tests to those described below has to demonstrate that they give at least the same level of safety.

**F.1.1.2** The precision of the instruments shall allow, unless particularly specified, measurements to be made within the following tolerances:

a) ± 1 % masses, forces, distances, speeds;

b) ± 2 % accelerations, retardations;

c) ± 5 % voltages, currents;

d) ± 5 °C temperatures;

e) recording equipment shall be capable of detecting signals, which vary in time of 0,01 s;

f) ± 2,5 % flow rate;

g) ± 1 % pressure p ≤ 200 kPa;

h) ± 5 % pressure p > 200 kPa.

### F.1.2 Model form of a test report

The test report shall contain the following information:

— reference number of the test report;

— category, type and make or trade name;

— manufacturer's name and address;

— name and address of test laboratory;

— date and number of laboratory report;

— the list of documents, bearing the type-test number shown above, attached to the report;

— any additional information;

— place, date and signature of the responsible person.

## F.2Landing door locking devices

### F.2.1 General provisions

#### F.2.1.1 Field of application

These procedures are applicable to locking devices for lift landing doors. It is understood that each component taking part in the locking of landing doors and in the checking of the locking forms part of the locking device.

#### F.2.1.2 Object and extent of the test

The locking device shall be submitted to a test procedure to verify that insofar as construction and operation are concerned, it conforms to the requirements imposed by this standard.

It shall be checked in particular that the mechanical and electrical components of the device are of adequate size and that in the course of time the device does not lose its effectiveness, particularly through wear.

If the locking device is needed to satisfy particular requirements (waterproof, dust proof or explosion proof construction) the manufacturer shall specify this and supplementary examinations and/or tests under appropriate criteria shall be made.

#### F.2.1.3 Documents that shall be made available to the test laboratory

##### F.2.1.3.1 Schematic arrangement drawing with description of operation

This drawing shall show clearly all the details relating to the operation and the safety of the locking device, including:

a) the operation of the device in normal service showing the effective engagement of the locking elements and the point at which the electrical safety device operates;

b) the operation of the device for mechanical checking of the locking position if this device exists;

c) the control and operation of the emergency unlocking device;

d) the type (A.C. and/or D.C.) and the rated voltage and rated current.

##### F.2.1.3.2 Assembly drawing with key

This drawing shall show all parts, which are important to the operation of the locking device, in particular those required to conform to requirements of this European Standard. A key shall indicate the list of principal parts, the type of materials used, and the characteristics of the fixing elements.

#### F.2.1.4 Test samples

One door locking device shall be submitted to the laboratory.

If the test is carried out on a prototype, it shall be repeated later on a production model.

If the test of the locking device is only possible when the device is mounted in the corresponding landing door (for example, sliding doors with several panels or hinged doors with several panels) the device shall be mounted on a complete landing door in working order. However, the landing door dimensions may be reduced by comparison with a production model, on condition that this does not falsify the test results.

## F.2.2 Examination and tests

### F.2.2.1 Examination of operation

This examination has the aim of verifying that the mechanical and electrical components of the locking device are operating correctly with respect to safety, and in conformity with the requirements of this standard, and that the device is in conformity with the particulars provided in the application.

In particular it shall be verified that:

a) there is at least 7 mm engagement of the locking elements before the electric safety device operates. Examples are shown in 5.4.5.4;

b) it is not 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 operation (5.4.5.10).

### F.2.2.2 Mechanical tests

#### F.2.2.2.1 General

These tests have the purpose of verifying the strength of the mechanical locking components and the electrical components.

The sample to the locking device in its normal operating position is controlled by the devices normally used to operate it.

The sample shall be lubricated in accordance with the requirements of the manufacturer of the locking device.

When there are several possible means of control and positions of operation, the endurance test shall be made in the arrangement which is regarded as the most unfavourable from the point of view of the forces on the components.

The number of complete cycles of operation and the travel of the locking components shall be registered by mechanical or electrical counters.

#### F.2.2.2.2 Endurance test

**F.2.2.2.2.1** The locking device shall be submitted to 1 000 000 (± 1 %) complete cycles; one cycle comprises one forward and return movement over the full travel possible in both directions.

The driving of the device shall be smooth, without shocks, and at a rate of 60 (± 10 %) cycles per minute.

During the endurance test the electrical contact of the lock shall close a resistive circuit under the rated voltage and at a current value double that of the rated current.

**F.2.2.2.2.2** If the locking device is provided with a mechanical checking device for the locking pin or the position of the locking element, this device shall be submitted to an endurance test of 100 000 (± 1 %) cycles.

The driving of the device shall be smooth, without shocks, and at a rate of 60 (± 10 %) cycles per minute.

#### F.2.2.2.3 Static test

For locking devices intended for hinged landing doors, a test shall be made consisting of the application over a total period of 300 s of a static force increasing progressively to a value of at least 3 000 N, in any case to a value adequate to the intended use of the locking device.




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This force shall be applied in the opening direction of the landing door and in a position corresponding as far as possible to that which may be applied when a user attempts to open the door. The force applied shall be at least 1 000 N in the case of a locking device intended for sliding doors.

#### F.2.2.2.4 Dynamic test

The locking device, in the locked position, shall be submitted to a shock test in the opening direction of the landing door.

The shock shall correspond to the impact of a rigid mass of 4 kg falling in free fall from a height of 0,50 m.

### F.2.2.3 Criteria for the mechanical tests

After the endurance test (F.2.2.2.2), the static test (F.2.2.2.3) and the dynamic test (F.2.2.2.4), there shall not be any wear, deformation or breakage, which could adversely affect safety.

### F.2.2.4 Electrical test

#### F.2.2.4.1 Endurance test of contacts

This test is included in the endurance test laid down in F.2.2.2.2.1.

#### F.2.2.4.2 Test of ability to break circuit

##### F.2.2.4.2.1 General

This test is to be carried out after the endurance test. It shall check that the ability to break a live circuit is sufficient. This test shall be made in accordance with the procedure in EN 60947-4-1 and EN 60947-5-1, the values of current and rated voltage serving as a basis for the tests shall be those indicated by the manufacturer of the device.

If there is nothing specified, the rated values shall be as follows:

a) alternating current: 230 V, 2 A;

b) direct current: 200 V, 2A.

In the absence of an indication to the contrary, the capacity to break circuit shall be examined for both A.C. and D.C. conditions.

The tests shall be carried out with the locking device in the working position. If several positions are possible, the test shall be made in the most unfavourable position.

The sample tested shall be provided with covers and electric wiring as used in normal service.

**F.2.2.4.2.2** A.C. locking devices shall open and close an electric circuit under a voltage equal to 110 % of the rated voltage 50 times, at normal speed, and at intervals of 5 s to 10 s. The contact shall remain closed for at least 0,5 s.

The circuit shall comprise a choke and a resistance in series. Its power factor shall be $0,7 \pm 0,05$ and the test current shall be 11 times the rated current indicated by the manufacturer of the device.

**F.2.2.4.2.3** D.C. locking devices shall open and close an electric circuit under a voltage equal to 110 % of the rated voltage 20 times, at normal speed, and at intervals of 5 s to 10 s. The contact shall remain closed for at least 0,5 s.

The circuit shall comprise a choke and a resistance in series having values such that the current reaches 95 % of the steady-state value of the test current in 300 ms.




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The test current shall be 110 % of the rated current indicated by the manufacturer of the device.

**F.2.2.4.2.4** The tests are considered as satisfactory if no tracking or arcing is produced and if no deterioration occurs which could adversely affect safety.

#### F.2.2.4.3 Test for resistance to leakage currents

This test shall be made in accordance with the procedure in EN 60112. The electrodes shall be connected to a source providing an A.C. voltage, which is sinusoidal at 175 V, 50 Hz.

#### F.2.2.4.4 Examination of clearances and creepage distances

The clearances in air and creepage distances shall be in accordance with 5.10.1.2.2.3.

#### F.2.2.4.5 Examination of the requirements appropriate to safety contacts and their accessibility (5.10.1.2.2)

This examination shall be made taking into account the mounting position and the layout of the locking device, as appropriate.

### F.2.3 Test particular to certain types of locking devices

#### F.2.3.1 Locking device for horizontally or vertically sliding doors with several panels

The devices providing mechanical linkage between panels according to 5.4.3.3 are considered as forming part of the locking device.

These devices shall be submitted in a reasonable manner to the tests mentioned in F.2.2. The number of cycles per minute in such endurance tests shall be suited to the dimensions of the construction.

#### F.2.3.2 Flap type locking device for hinged landing doors

**F.2.3.2.1** If this device is provided with an electric safety device required checking the possible deformation of the flap and if, after the static test envisaged in F.2.2.2.3 there are any doubts on the strength of the device, the load shall be increased progressively until the safety device begins to open. No component of the locking device or of the landing door shall be damaged or permanently deformed by the load applied.

**F.2.3.2.2** If, after the static test, the dimensions and construction leave no doubt as to its strength, it is not necessary to proceed to the endurance test on the flap.

### F.2.4 Type test report

**F.2.4.1** The test report shall be drawn up in an appropriate number of copies according to the different parties involved (manufacturer, laboratory, etc.).

**F.2.4.2** The test report shall indicate the following:

a) information according to F.1.2;

b) type and application of locking device;

c) the type (A.C. and/or D.C.) and values of rated voltage and rated current;

d) in the case of flap type door locking devices: the necessary force to actuate the electric safety device for checking the elastic deformation of the flap.




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## F.3 Safety gear

### F.3.1 General provisions

The manufacturer shall state the range of use provided, i.e.:

— minimum and maximum masses;

— maximum rated speed and maximum tripping speed.

Detailed information shall be provided on the materials used, the type of guide rails and their surface condition (drawn, milled, ground).

The following documents shall be made available to the test laboratory: detailed and assembly drawings showing the construction, operation, materials used, the dimensions and tolerances on the construction components.

### F.3.2 Instantaneous safety gear

#### F.3.2.1 Test samples

Two gripping assemblies with wedges or clamps and two lengths of guide rail shall be submitted to the laboratory.

The arrangement and the fixing details for the samples shall be determined by the laboratory in accordance with the equipment that it uses.

If the same gripping assemblies can be used with different types of guide rail, a new test shall not be required if the thickness of the guide rails, the width of the grip needed for the safety gear and the surface state (drawn, milled, ground) are the same.

#### F.3.2.2 Test

##### F.3.2.2.1 Method of test

The test shall be made using a press or similar device, which moves without abrupt speed change. Measurements shall be made of:

a) the distance travelled as a function of the force;

b) the deformation of the safety gear block as a function of the force or as a function of the distance travelled.

##### F.3.2.2.2 Test procedure

The guide rail shall be moved through the safety gear.

Reference marks shall be traced onto the blocks in order to be able to measure their deformation.

The distance travelled shall be recorded as a function of the force.

After the test:

a) the hardness of the block and the gripping element shall be compared with the original values quoted by the manufacturer. Other analyses may be carried out in special cases;

b) if there is no fracture, deformations and other changes shall be examined (for example, cracks, deformations or wear of the gripping elements, appearance of the rubbed surfaces);

c) if necessary, photographs shall be taken of the block, the gripping elements and the guide rail for evidence of deformations or fractures.

#### F.3.2.3 Documents

**F.3.2.3.1** Two charts shall be drawn up as follows:

a) the first shall show the distance travelled as a function of the force;

b) the other shall show the deformation of the block. It shall be done in such a way that it can be related to the first chart.

**F.3.2.3.2** The capacity of the safety gears shall be established by integration of the area of the distance-force chart.

The area of the chart to be taken into consideration shall be:

a) the total area if there is no permanent deformation;

b) if permanent deformation or rupture has occurred, either:

1) the area up to the value at which the elastic limit has been reached; or

2) the area up to the value corresponding to the maximum force.

#### F.3.2.4 Determination of the permissible mass

#### F.3.2.4.1 Energy absorbed by the safety gear

A distance of free fall, calculated with reference to the maximum tripping speed of the overspeed governor fixed in 5.6.2.4.1.2 shall be adopted.

The distance of free fall in metres (m) shall be taken as:

$$h = \frac{v_1^2}{2 \times g_n} + 0{,}1 + 0{,}03$$

where

$v_1$ is the tripping speed of overspeed governor in metres per second (m/s);

$g_n$ is the standard acceleration of free fall in metres per square second (m/s²);

0,10 m corresponds to the distance travelled during the response time;

0,03 m corresponds to the travel during take-up of clearance between the gripping elements and the guide rails.

The total energy the safety gear is capable of absorbing:

$$2 \times K = (P + Q)_1 \times g_n \times h$$

from which:

$$(P + Q)_1 = 2 \times \frac{K}{g_n \times h}$$

where

$(P + Q)_1$ is the permissible mass in kilograms (kg);

$P$ are the masses of the empty load carrying unit and components supported by the load carrying unit, i.e. part of the travelling cable, compensating ropes/chains (if any), etc. in kilograms (kg);

$Q$ is the rated load in kilograms (kg);

$K$, $K_1$, $K_2$ is the energy absorbed by one safety gear block in joules (J) (calculated in accordance with the chart).

#### F.3.2.4.2 Permissible mass

a) If the elastic limit has not been exceeded:

1) $K$ is calculated by the integration of the area defined in F.3.2.3.2, a);

2) 2 is taken as the safety coefficient. The permissible mass in kilograms (kg) will be:

$$(P + Q)_1 = \frac{K}{g_n \times h}$$

b) if the elastic limit has been exceeded:

two calculations shall be made taking the one which is the more favourable to the manufacturer;

1) $K_1$ is calculated by the integration of the area defined in F.3.2.3.2, b), 1); 2 is adopted as the safety coefficient and this will give the permissible mass in kilograms (kg) as:

$$(\mathrm{P} + \mathrm{Q})_1 = \frac{\mathrm{K}_1}{g_n \times \mathrm{h}}$$

2) $K_2$ is calculated by the integration of the area defined in F.3.2.3.2, b), 2); 3,5 is adopted as the safety coefficient, and this will give the permissible mass in kilograms (kg) as:

$$(\mathrm{P} + \mathrm{Q})_1 = \frac{2 \times \mathrm{K}_2}{3{,}5 \times \mathrm{g_n} \times \mathrm{h}}$$

#### F.3.2.5 Checking the deformation of the block and of the guide rail

If too great a deformation of the gripping elements in the block or the guide rail might cause difficulty in disengaging the safety gear, the permissible mass shall be reduced.

### F.3.3 Comments

a) To evaluate the validity of welded parts, reference shall be made to standards on this subject;

b) a check shall be made that the possible travel of the gripping elements is sufficient under the most unfavourable conditions (accumulation of manufacturing tolerances);

c) the friction parts shall be suitably retained so that it can be certain that they will be in place at the moment of operation.

### F.3.4 Type test report

**F.3.4.1** The test report shall be drawn up in an appropriate number of copies according to the different parties involved (manufacturer, laboratory, etc.).

**F.3.4.2** The test report shall indicate the following:

a) information according to F.1.2;

b) type and application of safety gear;

c) the limits of the permissible masses (see F.3.2.5);

d) the tripping speed of the overspeed governor;

e) the type of guide rail;

f) the permissible thickness of the guide rail blade;

g) the minimum width of the gripping areas;

and, for progressive safety gear only:

h) the surface condition of the guide rails (drawn, milled, ground);

i) the state of lubrication of the guide rails. If they are lubricated, the category and specification of the lubricant.

## F.4Rope driven overspeed governors

### F.4.1 General provisions

The manufacturer shall indicate the following to the laboratory:

a) the type (or the types) of safety gear which will be operated by the overspeed governor;

b) the maximum and minimum rated speeds of lifts for which the overspeed governor may be used;

c) the anticipated value of the tensile force produced in the rope by the overspeed governor when tripped.

The following documents shall be made available to the test laboratory: detailed and assembly drawings showing the construction, operation, materials used, the dimensions and tolerances on the construction components.

### F.4.2 Check on the characteristics of the overspeed governor

#### F.4.2.1 Test samples

The following shall be submitted to the laboratory:

a) one overspeed governor;

b) one rope of the type used for the overspeed governor and in the normal condition in which it should be installed. The length to be supplied is fixed by the laboratory;

c) a tensioning pulley assembly of the type used for the overspeed governor.

#### F.4.2.2 Test

##### F.4.2.2.1 Method of test

The following shall be checked:

a) the speed of tripping;

b) the operation of the electric safety device called for in 5.6.2.4.1.2, b) causing the machine to stop, if this device is mounted on the overspeed governor;

c) the operation of the electric safety device called for in 5.6.2.4.1.2, c) preventing all movement of the lift when the overspeed governor is tripped;

d) the tensile force produced in the rope by the overspeed governor when tripped.

##### F.4.2.2.2 Test procedure

At least 20 tests shall be made in the speed range for tripping corresponding to the range of rated speeds of the lift, indicated in F.4.1, b).

NOTE 1 The laboratory may carry out the tests in the component manufacturer's works.

NOTE 2 The majority of tests should be made at the extreme values of the range.

NOTE 3 The acceleration to reach the tripping speed of the overspeed governor should be as low as possible, in order to eliminate the effects of inertia.

##### F.4.2.2.3 Interpretation of the test results

**F.4.2.2.3.1** In the course of 20 tests the tripping speeds shall lay within the limits called for in 5.6.2.4.1.2, a).

**F.4.2.2.3.2** In the course of the 20 tests the operation of the devices for which the test is required in F.4.2.2.1, b) and c) shall occur within the limits laid down in 5.6.2.4.1.2, b) and 5.6.2.4.1.2, c).

**F.4.2.2.3.3** The tensile force in the rope produced by the overspeed governor when tripped shall be at least 300 N or any higher value, which is specified by the manufacturer.

NOTE 1 Unless otherwise requested by the manufacturer of the device and specified in the test report, the arc of engagement should be 180°.

NOTE 2 In the case of a device, which operates by gripping the rope, it should be checked that there is no permanent deformation of the rope.

### F.4.3 Type test report

**F.4.3.1** The test report shall be drawn up in an appropriate number of copies according to the different parties involved (manufacturer, laboratory, etc.).

**F.4.3.2** The test report shall indicate the following:

a) information according to F.1.2;

b) type and application of overspeed governor;

c) the maximum and minimum rated speeds of the lift for which the overspeed governor may be used;

d) the diameter of the rope to be used and its construction;

e) in the case of an overspeed governor with traction pulley, the minimum tensioning force;

f) the tensile force in the rope which can be produced by the overspeed governor when tripped.

## F.5 Safety circuits containing electronic components

### F.5.1 General

In the following, mention is made to printed circuit board. If a safety circuit is not assembled in such a manner, then the equivalent assembly shall be assumed.

### F.5.2 General provisions

The manufacturer shall indicate to the laboratory:

a) the identification on the board;

b) working conditions;

c) listing of used components;

d) layout of the printed circuit board;

e) layout of the hybrids and marks of the tracks used in safety circuits;

f) function description;

g) electrical data together with wiring diagram, if applicable, including input and output definitions of the board.

### F.5.3 Test samples

There shall be submitted to the laboratory:

a) one printed circuit board;

b) one printed circuit board bare (without components).

### F.5.4 Tests

#### F.5.4.1 Mechanical tests

##### F.5.4.1.1 General

During the tests, the tested object (printed circuit) shall be kept under operation. During and after the tests, no unsafe operation and condition shall appear within the safety circuit.

##### F.5.4.1.2 Vibration

Transmitter elements of safety circuits shall withstand the requirements of:

a) EN 60068-2-6:2008, Endurance by sweeping: Table C.2: 20 sweep cycles in each axis, at amplitude 0,35 mm or 5 $g_n$, and in the frequency range 10 Hz to 55 Hz;

and also to:

b) EN 60068-2-27:2009, Acceleration and duration of pulse: Table 1: the combination of:

1) peak acceleration 294 m/s$^2$ or 30 $g_n$;

2) corresponding duration of pulse 11 ms; and

3) corresponding velocity change 2,1 m/s half sine.

NOTE Where shock absorbers for transmitter elements are fitted, they are considered as part of the transmitter elements.

After tests, clearances and creepage distances shall not become smaller than the minimum accepted.

#### F.5.4.1.3 Bumping

##### F.5.4.1.3.1 General

Bumping tests, according to the relevant requirements in EN 60068-2-29, are to simulate the cases when printed circuits fall, introducing the risk of rupture of components and unsafe situation.

Tests are divided into:

a) partial shockings;

b) continuous shockings.

The tests object shall satisfy the following minimum requirements.

##### F.5.4.1.3.2 Partial shocking

a) Shocking shapes: half-sinus;

b) amplitude of acceleration: 15 $g_n$;

c) duration of shock: 11 ms.

##### F.5.4.1.3.3 Continuous shocking

a) Amplitude of acceleration: 10 $g_n$;

b) duration of shock: 16 ms;

c) shocks:

1) number of shocks: 1 000 ± 10;

2) shock frequency: 2/s.

#### F.5.4.2 Temperature tests

Operating ambient limits are: 0 °C, + 65 °C (the ambient temperature is of the safety device).

Test conditions (according to the relevant requirements in EN 60068-2-14):

— the printed circuit board shall be in operational position;

— the printed circuit board shall be supplied with normally rated voltage;

— the safety device shall operate during, and after the test. If the printed circuits board includes components other than safety circuits, they also shall operate during the test (their failure is not considered);

— tests are carried out for minimum and maximum temperature (0 °C, + 65 °C). Tests last a minimum of 4 h;

— if the printed circuit board is designed to operate within wider temperature limits, it shall be tested for these values.

### F.5.5 Type test report

**F.5.5.1** The test report shall be drawn up in an appropriate number of copies according to the different parties involved (manufacturer, laboratory, etc.).

**F.5.5.2** The test report shall indicate:

a) information according to F.1.2;

b) type and application in the circuitry;

c) design for pollution degree according to EN 60664-1;

d) operating voltages;

e) distances between the safety circuits and the rest of the control circuits on the board.

NOTE Other tests like humidity test, climatic shock test, etc. are not subject for tests because of the normal environmental situation where lifts are operating.

## F.6 Rupture valve/one-way restrictor

### F.6.1 General

In the following the term "rupture valve" means "rupture valve/one-way restrictor with mechanical moving parts".

### F.6.2 General provisions

For the rupture valve to be examined the manufacturer shall state:

a) the range of flow;

b) the range of pressure;

c) the range of viscosity;

d) the range of ambient temperature;

e) the method of mounting.

The following shall be made available to the test laboratory: detailed and assembly drawings showing the construction, operation, adjustment, materials, dimensions and tolerances of the rupture valve and the construction components.

### F.6.3 Test samples

There shall be submitted to the laboratory:

a) one rupture valve;




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b) a list of liquids which may be used together with the rupture valve or a sufficient amount of special liquid to be used;

c) if necessary adaptation means to the test facilities of the laboratory.

## F.6.4 Test

### F.6.4.1 Test installation

The rupture valve, mounted in its intended method, shall be tested in a hydraulic system, where:

a) the required testing pressure is depending from a mass;

b) the flow is controlled by adjustable valves;

c) the pressure before[2)] and behind the rupture valve can be recorded;

d) installations to vary the ambient temperature of the rupture valve and the viscosity of the hydraulic liquid are provided.

The system shall allow recording the flow over the time. To determine the values of flow, the measurement of another figure, i.e. the speed of the ram, from which the flow can be derived, is permitted.

### F.6.4.2 Measuring instruments

The measuring instruments shall have accuracy according to F.1.1.2 (see ISO 6403).

## F.6.5 Test procedure

### F.6.5.1 General

The test shall:

a) simulate a total piping failure occurring at a moment when the speed of the load carrying unit is zero;

b) evaluate the resistance of the rupture valve against pressure.

### F.6.5.2 Simulation of a total piping failure

Simulating a total piping failure, the flow shall be initiated from a static situation by opening a valve under the condition that the static pressure before the rupture valve decrease to less than 10 %.

It shall be taken into account tolerance of the closing value within the stated range of:

a) flow;

b) viscosity;

c) pressure;

d) ambient temperature.

That can be achieved by two test series with:

e) maximum pressure, maximum ambient temperature, minimum adjustable flow and minimum viscosity;

---

2) "Before the rupture valve" means between the cylinder and the rupture valve.




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f) minimum pressure, minimum ambient temperature, maximum adjustable flow and maximum viscosity.

In each test series at least ten tests shall be carried out, to evaluate the tolerances of operation of the rupture valve under these conditions.

During the tests the relation between:

g) flow and time; and

h) pressure before and behind the rupture valve and time

shall be recorded.

The typical characteristics of these curves are shown in the Figure F.1.

#### F.6.5.3 Resistance against pressure

When testing the resistance of the rupture valve against pressure it shall be submitted to a pressure test with five times the maximum pressure over 2 min.

### F.6.6 Interpretation of the tests

#### F.6.6.1 Closing operation

The rupture valve fulfils the requirements of the standard if the curves recorded according to F.6.5.2 show that:

a) the time $t_o$ between rated flow (100 % flow) and the maximum flow $Q_{max}$ does not exceed 0,16 s;

b) the time $t_d$ for the decrease of flow is:

$$\frac{|Q_{max}|}{6 \times A \times 9{,}81} \leq t_d \leq \frac{|Q_{max}|}{6 \times A \times 1{,}96}$$

where

$Q_{max}$ is the maximum flow of the hydraulic fluid in litres per minute (l/min);

$t_d$ is the braking time in seconds (s);

$A$ is the area of jack, where pressure is acting in square centimetres (cm²);

c) pressure of more than $3{,}5 \times P_s$ shall not be longer than 0,04 s;

d) the rupture valve shall be tripped before the speed is equal to rated speed + 0,30 m/s.

#### F.6.6.2 Pressure resistance

The rupture valve fulfils the requirements of the standard if after the pressure test according to F.6.5.3 it shows no permanent damage.

#### F.6.6.3 Readjustment

If the limits of flow decrease or pressure peaks are exceeded, the manufacturer is allowed to modify the adjustment of the rupture valve. After that another test series may be carried out.

### F.6.7 Type test report

**F.6.7.1** The test report shall be drawn up in an appropriate number of copies according to the different parties involved (manufacturer, laboratory, etc.).

**F.6.7.2** The test report shall indicate:

a) information according to F.1.2;

b) type and application of the rupture valve;

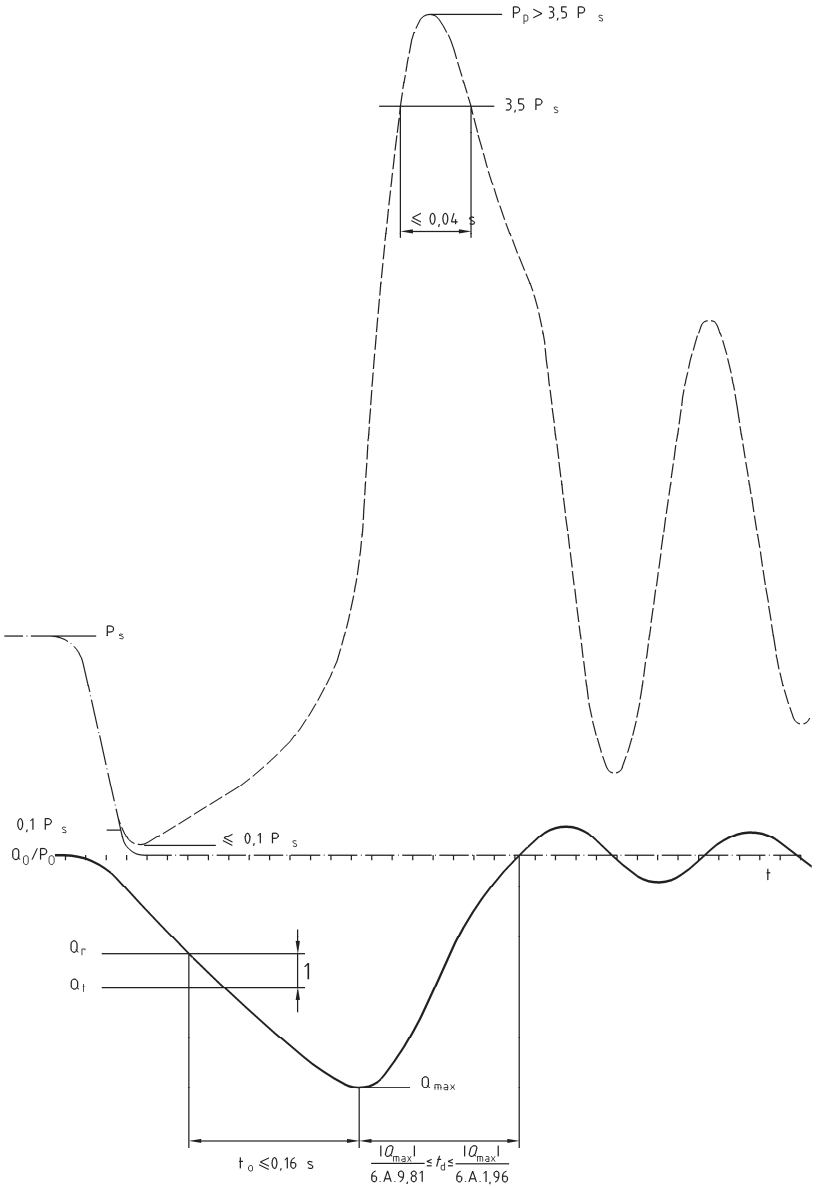
c) the range of flow of the rupture valve;

d) the range of pressure of the rupture valve;

e) the range of viscosity of hydraulic fluids to be used;

f) the range of ambient temperature of the rupture valve.

The certificate shall be accompanied with a graph according to Figure F.1 showing the relationship between flow of hydraulic fluid and pressure from which $Q_{max}$ and $t_d$ can be obtained.




**Key**

| | | | |
|---|---|---|---|
| $P_p$ | pressure peak | —·—· | pressure after rupture valve |
| $P_s$ | pressure static | ——— | hydraulic fluid flow |
| t | time | — — — | pressure before rupture valve |
| $Q_0$ | flow of the hydraulic fluid in litres per minute | | |
| $Q_r$ | rated flow of the hydraulic fluid in litres per minute | | |
| $Q_t$ | flow of the hydraulic fluid in litres per minute after rupture valve is triggered | | |
| $Q_{max}$ | maximum flow of the hydraulic fluid in litres per minute | | |

1 the rupture valve shall be tripped before the speed is equal to rated speed + 0,30 m/s.

**Figure F.1 — Hydraulic fluid flow through, pressure before and after the rupture valve**

# Annex G
(normative)

# Requirements for traction, positive or hydraulic driving systems

## G.1 Traction and positive drive

### G.1.1 Drive of the load carrying unit and the counterweight or balancing weight

The following two methods of drive are permissible:

a) by traction (use of sheaves and ropes);

b) by positive drive, i.e. either use of:

1) a drum and ropes; or

2) sprockets and chains.

The rated speed shall not exceed 0,63 m/s. Counterweights shall not be used. The use of a balancing weight is permitted.

The calculations of the driving elements shall take into account the possibility of the counterweight or the load carrying unit resting on its fixed stops or buffers.

### G.1.2 Rope traction

Rope traction shall be such that the following three conditions are fulfilled:

a) it shall not be possible to raise the empty load carrying unit when the counterweight is resting on the buffers or fixed stop(s), and the lift machine is rotated in the "up" direction;

b) under all loading conditions from empty load carrying unit to load carrying unit loaded with 125 % of rated load, it shall be possible to move the load carrying unit without uncontrolled movement from rope slippage of the ropes (see D.2, h));

c) when the load carrying unit is brought to a stop with the loading conditions given in b) above there shall also be no rope slippage (see D.2, h)).

NOTE EN 81-1:1998, Annex M gives a method of evaluating traction.

### G.1.3 Winding up of ropes for positive drive lifts

**G.1.3.1** The drum, which can be used in the conditions laid down in G.1.1, b), shall be helically grooved and the grooves shall be suited to the ropes used.

**G.1.3.2** When the load carrying unit rests on its fully compressed buffers, one and a half turns of rope shall remain in the grooves of the drum.

**G.1.3.3** There shall only be one layer of rope wound on the drum.

**G.1.3.4** The angle of deflection (fleet angle) of the ropes in relation to the grooves shall not exceed 4°.

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## G.1.4 Braking system

### G.1.4.1 General provisions

**G.1.4.1.1** The lift shall be provided with a braking system, which operates automatically in the event of loss of:

a) the mains power supply;

b) the supply to control circuits.

**G.1.4.1.2** The braking system shall have an electro-mechanical brake (friction type), but may, in addition, have other braking means (e.g. electric).

### G.1.4.2 Electro-mechanical brake

**G.1.4.2.1** This brake on its own shall be capable of stopping the machine when the load carrying unit is travelling downward at rated speed and with the rated load plus 25 %.

For type B accessible goods only lifts, all the mechanical components of the brake which take part in the application of the braking action on the drum or disk shall be installed in two sets. If one of the components is not working a sufficient braking effort to slow down the load carrying unit, travelling downwards at rated speed and with rated load shall continue to be exercised.

Any solenoid plunger is considered to be a mechanical part, any solenoid coil is not.

**G.1.4.2.2** The component on which the brake operates shall be coupled to the traction sheave or drum or sprocket by direct and positive mechanical means.

**G.1.4.2.3** To hold off the brake, in normal operation, shall require a continuous flow of current.

**G.1.4.2.3.1** The interruption of this current shall be effected by at least two independent electrical devices, whether or not integral with those, which cause interruption of the current feeding the lift machine.

If, whilst the lift is stationary, one of the contactors has not opened the main contacts, further movement of the load carrying unit shall be prevented at the latest at the next change in the direction of motion.

**G.1.4.2.3.2** When the motor of the lift is likely to function as a generator, it shall not be possible for the electric device operating the brake to be fed by the driving motor.

**G.1.4.2.3.3** Braking shall become effective without supplementary delay after opening of the brake release circuit.

NOTE The use of a diode or capacitor connected directly to the terminals of the brake coil is not considered as a means of delay.

**G.1.4.2.4** Any machine fitted with a manual operating device (G.1.5) shall be capable of having the brake released by hand and require a constant effort to keep the brake open.

**G.1.4.2.5** The brake shoe or pad pressure shall be exerted by guided compression springs or weights.

**G.1.4.2.6** Band brakes shall not be used.

**G.1.4.2.7** Brake linings shall be incombustible.

## G.1.5 Manual operation

Where means are provided to manually operate the lift in order to bring the load carrying unit to a landing, the following requirements apply:




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a) the manual effort required to move the load carrying unit in the upward direction with its rated load shall not exceed 400 N;

b) if the means for moving the load carrying unit can be driven by the lift moving, then it shall be a smooth, spokeless wheel;

c) if the means is removable, it shall be located in an easily accessible place in the machinery space. It shall be suitably marked if there is any risk of confusion as to the machine for which it is intended;

d) an electric safety device in conformity with 5.10.1.2 shall be actuated when the means is put on the machine at the latest.

### G.1.6 Safety device against slack rope or slack chain

Positive drive lifts shall have a slack rope/chain device actuating an electric safety device in conformity with 5.10.1.2. This device may be the same as the one required in 5.6.1.4.3.

## G.2 Hydraulic drive

### G.2.1 General provisions

**G.2.1.1** The two following methods of drive are permissible:

a) direct acting;

b) indirect acting.

**G.2.1.2** If several jacks are used to raise the load carrying unit they shall be hydraulically connected to ensure pressure equilibrium.

**G.2.1.3** The mass of the balancing weight, if any, shall be calculated such that in case of a rupture of the suspension gear (load carrying unit/balancing weight), the pressure in the hydraulic system does not exceed two times full load pressure.

In the case of several balancing weights, the rupture of only one suspension gear shall be taken into consideration for the calculation.

### G.2.2 Jacks

#### G.2.2.1 Calculations of jacks (cylinder and ram)

##### G.2.2.1.1 Pressure calculations

**G.2.2.1.1.1** The cylinder and the ram shall be designed such that under the forces resulting from a pressure equal to 2,3 times the full load pressure a safety factor of at least 1,7 referred to the proof stress $R_{P0,2}$ is assured.

**G.2.2.1.1.2** For the calculation of the elements of telescopic jacks with hydraulic synchronizing means the full load pressure shall be replaced by the highest pressure, which occurs in an element due to the hydraulic synchronizing means.

NOTE It could be possible that, due to incorrect adjustment of the hydraulic synchronizing means, abnormally high pressure conditions arise during installation. Account of this should be taken.

**G.2.2.1.1.3** In the thickness calculations a value shall be added of 1,0 mm for cylinder walls and cylinder bases, and 0,5 mm for walls of hollow rams for single and telescopic jacks.




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**G.2.2.1.1.4** The calculations shall be carried out according to Annex I.

**G.2.2.1.2 Buckling calculations**

**G.2.2.1.2.1** Jacks under compressive loads shall fulfil the following requirements.

**G.2.2.1.2.2** They shall be designed such that, in their fully extended position, and under the forces resulting from a pressure equal to 1,4 times full load pressure a safety factor of at least two against buckling is assured.

**G.2.2.1.2.3** The calculations shall be carried out according to Annex I.

**G.2.2.1.2.4** As a deviation from G.2.2.1.2.3 more complex calculation methods may be used provided that at least the same safety factor is assured.

**G.2.2.1.3 Tensile stress calculations**

Jacks under tensile loads shall be designed such that under the forces resulting from a pressure equal to 1,4 times full load pressure a safety factor of at least 2 referred to the proof stress $R_{P0,2}$ is assured.

**G.2.2.2 Connection load carrying unit/ram (cylinder)**

**G.2.2.2.1** In case of a direct acting lift the connection between the load carrying unit and the ram (cylinder) shall be flexible.

**G.2.2.2.2** The connection between the load carrying unit and the ram (cylinder) shall be so constructed to support the weight of the ram (cylinder) and the additional dynamic forces. The connection means shall be secured.

**G.2.2.2.3** In case of a ram made with more than one section, the connections between the sections shall be so constructed to support the weight of the suspended ram sections and the additional dynamic forces.

**G.2.2.2.4** In the case of indirect acting lifts, the head of the ram (cylinder) shall be guided.

This requirement does not apply for pulling jacks provided the pulling arrangement prevents bending forces on the ram.

**G.2.2.2.5** In the case of indirect acting lifts, no parts of the ram head guiding system shall be incorporated within the vertical projection of the load carrying unit roof.

**G.2.2.3 Means of protection**

**G.2.2.3.1** If a jack extends into the ground it shall be installed in a protective tube. If it extends into other spaces it shall be suitably protected.

In the same manner*:*

a) the rupture valve(s)/restrictor(s);

b) the rigid pipes connecting a rupture valve(s)/restrictor(s) with the cylinder;

c) the rigid pipes connecting rupture valve(s)/restrictor(s) with each other

shall be protected.

**G.2.2.3.2** Leak and scrape fluid from the cylinder head shall be collected.

**G.2.2.3.3** The jack shall be provided with an air venting device.

#### G.2.2.4 Telescopic jacks

The following requirements apply additionally*:*

**G.2.2.4.1** Stop shall be provided between successive sections to prevent the rams from leaving their respective cylinders.

**G.2.2.4.2** In the case of a jack below the load carrying unit of a direct acting lift, and 5.2.11.2.3.1, a) is not applied, the clear distance:

a) between the successive guiding yokes; and

b) between the highest guiding yoke and the lowest parts of the load carrying unit (parts mentioned in 5.2.11.2.3.1, b), 2), ii) excluded)

shall be at least 0,30 m when the load carrying unit rests on the mechanical means placed in the pit to limit the travel of the load carrying unit (5.2.11.2.3.1, a), 2)) or on its fixed stop(s) or fully compressed buffers (5.2.11.2.3.1, b), 3)).

**G.2.2.4.3** The length of the bearing of each section of a telescopic jack without external guidance shall be at least two times the diameter of the respective ram.

**G.2.2.4.4** These jacks shall be provided with mechanical or hydraulic synchronising means.

**G.2.2.4.5** When jacks with hydraulic synchronising means are used an electric device shall be provided to prevent a start for a normal journey when the pressure exceeds the full load pressure by more than 20 %.

**G.2.2.4.6** When ropes or chains are used as synchronising means the following requirements apply:

a) there shall be at least two independent ropes or chains;

b) the requirements of 5.6.3.1 apply;

c) the safety factor shall be at least 8.

   The safety factor is the ratio between the minimum breaking load in newtons (N) of one rope (or chain) and the maximum force in this rope (or chain).

   For the calculation of the maximum force the following shall be taken into consideration:

   1) the force resulting from the full load pressure;

   2) the number of ropes (or chains);

d) a device shall be provided which prevents the speed of the load carrying unit in downward movement exceeding the rated speed downward $v_d$ by more than 0,30 m/s in the event of failure of the synchronising means where an inspection control station is fitted on the load carrying unit and on type B accessible goods only lifts.

### G.2.3 Piping

#### G.2.3.1 General

**G.2.3.1.1** Piping and fittings, which are subject to pressure (connections, valves, etc.) as in general all components of the hydraulic system shall be:

a) appropriate to the hydraulic fluid used;

b) designed and installed in such a way to avoid any abnormal stress due to fixing, torsion or vibration;

c) protected against damage, in particular of mechanical origin.

**G.2.3.1.2** Pipes and fittings shall be appropriately fixed and accessible for inspection.

Negotiations (0.2.5) shall take place concerning the need for the pipes (either rigid or flexible) passing through walls or floor. They shall be protected by means of ferrules, the dimensions of which allow the dismantling, if necessary, of the pipes for inspection. No coupling shall be sited inside a ferrule.

#### G.2.3.2 Rigid pipes

**G.2.3.2.1** Rigid pipes and fittings between cylinder and non-return valve or down direction valve(s) shall be designed such that under the forces resulting from a pressure equal to 2,3 times the full load pressure a safety factor of at least 1,7 referred to the proof stress $R_{P0,2}$ is assured.

In the thickness calculations a value shall be added of 1,0 mm for the connection between the cylinder and the rupture valve, if any, and 0,5 mm for the other rigid pipes.

The calculations shall be carried out according to I.1.1.

**G.2.3.2.2** When telescopic jacks with more than two stages and hydraulic synchronising means are used an additional safety factor of 1,3 shall be taken into account for the calculation of the pipes and fittings between the rupture valve and the non-return valve or the down direction valve(s).

Pipes and fittings, if any, between the cylinder and the rupture valve shall be calculated on the same pressure basis as the cylinder.

#### G.2.3.3 Flexible hoses

**G.2.3.3.1** The flexible hose between cylinder and non-return valve or down direction valve shall be selected with a safety factor of at least 8 relating full load pressure and bursting pressure.

**G.2.3.3.2** The flexible hose and its couplings between cylinder and non-return valve or down direction valve shall withstand without damage a pressure of five times full load pressure, this test to be carried out by the manufacturer of the hose assembly.

**G.2.3.3.3** The flexible hose shall be marked in an indelible manner with:

a) the name of the manufacturer or the trade mark;

b) the test pressure;

c) the date of the test.

**G.2.3.3.4** The flexible hose shall be fixed with a bending radius not less than that indicated by the hose manufacturer.

### G.2.4 Stopping the machine and checking its stopped condition

#### G.2.4.1 General

A stop of the machine due to the operation of an electrical safety device, in conformity with 5.10.1.2, shall be controlled as detailed below.

#### G.2.4.2 Upwards motion

For upwards motion, either:

a) the supply to the electric motor shall be interrupted by at least two independent contactors, the main contacts of which shall be in series in the motor supply circuit; or




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b) the supply to the electric motor shall be interrupted by one contactor, and the supply to the by-pass valves (in accordance with G.2.5.4.2) shall be interrupted by at least two independent electrical devices connected in series in the supply circuit of these valves.

#### G.2.4.3 Downwards motion

For downwards motion, the supply to the down direction valve(s) shall be interrupted either:

a) by at least two independent electrical devices connected in series; or

b) directly by the electrical safety device, provided it is suitably rated electrically.

#### G.2.4.4 Prevention from starting

If whilst the lift is stationary, one of the contactors has not opened the main contacts or one of the electrical devices has not opened, a further start shall be prevented, at the latest at the next change in the direction of motion.

### G.2.5 Hydraulic control and safety devices

#### G.2.5.1 Shut-off valve

**G.2.5.1.1** A shut-off valve shall be provided. It shall be installed in the circuit, which connects the cylinder(s) to the non-return valve and the down direction valve(s).

**G.2.5.1.2** It shall be located close to the other valves on the lift machine.

#### G.2.5.2 Non-return valve

**G.2.5.2.1** A non-return valve shall be provided. It shall be installed in the circuit between the pump(s) and the shut-off valve.

**G.2.5.2.2** The non-return valve shall be capable of holding the lift load carrying unit with the rated load at any point when the supply pressure drops below the minimum operating pressure.

**G.2.5.2.3** The closing of the non-return valve shall be effected by the hydraulic pressure from the jack and by at least one guided compression spring and/or by gravity.

#### G.2.5.3 Pressure relief valve

**G.2.5.3.1** A pressure relief valve shall be provided. It shall be connected to the circuit between the pump(s) and the non-return valve. The hydraulic fluid shall be returned to the tank.

**G.2.5.3.2** The pressure relief valve shall be adjusted to limit the pressure to 140 % of the full load pressure.

**G.2.5.3.3** If necessary due to high internal losses (head loss, friction), the pressure relief valve may be set to a greater value but not exceeding 170 % of full load pressure. In this case, for the calculations of the hydraulic equipment (including jack) a fictitious full load pressure equal to: $\frac{Selected\ \ pressure\ \ setting}{1,4}$ shall be used.

In the buckling calculation the over pressure factor of 1,4 shall then be replaced by a factor corresponding to the increased setting of the pressure relief valve.




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#### G.2.5.4 Direction valves

##### G.2.5.4.1 Down direction valves

Down direction valves shall be held open electrically. Their closing shall be effected by the hydraulic pressure from the jack and by at least one guided compression spring per valve.

##### G.2.5.4.2 Up direction valves

If the stopping of the machine is effected in accordance with G.2.4.2, b), only by-pass valves shall be used for this. They shall be closed electrically. Their opening shall be effected by the hydraulic pressure from the jack and by at least one guided compression spring per valve.

#### G.2.5.5 Rupture valve

**G.2.5.5.1** When required by 5.6.2.1.2, Table 3 and an inspection control station is fitted on the load carrying unit or for type B accessible goods only lift, a rupture valve shall be provided which satisfies the following conditions:

**G.2.5.5.2** The rupture valve shall be capable of stopping the load carrying unit in downward movement, and maintaining it stationary. The rupture valve shall be tripped at the latest when the speed reaches a value equal to rated speed downwards $v_d$ plus 0,3 m/s.

Where an inspection control station is provided on the load carrying unit or for type B accessible goods lifts, the following applies:

a) the selected rupture valve shall be so that the average retardation $a$ lies between 0,2 $g_n$ and 1 $g_n$;

b) retardation of more than 2,5 $g_n$ shall not last longer than 0,04 s;

c) the average retardation $a$ can be evaluated by the formula:

$$a = \frac{Q_{max.}\, r}{6 \times A \times n \times t_d}$$

where

$Q_{max}$ is maximum flow in litres per minute (l/min);

$r$ is the reeving factor;

$A$ is the area of jack, where pressure is acting in square centimetres (cm²);

$n$ is the number of parallel acting jacks with one rupture valve;

$t_d$ is the braking time in seconds (s);

the values of which can be taken from the technical dossier and the type test report.

**G.2.5.5.3** The rupture valve shall be accessible for adjustment and inspection.

The rupture valve shall be either:

a) integral with the cylinder; or

b) directly and rigidly flange-mounted; or

c) placed close to the cylinder and connected to it by means of short rigid pipes, having welded, flanged or threaded connections; or

d) connected directly to the cylinder by threading.

The rupture valve shall be provided with a thread ending with a shoulder. The shoulder shall butt up against the cylinder.

Other types of connections such as compression fittings or flared fittings are not permitted between the cylinder and the rupture valve.

**G.2.5.5.4** On lifts with several jacks, operating in parallel, one common rupture valve may be used. Otherwise the rupture valves shall be interconnected to cause simultaneous closing, in order to avoid the floor of the load carrying unit from inclining by more than 5 % from its normal position.

**G.2.5.5.5** The rupture valve shall be calculated as the cylinder.

**G.2.5.5.6** If the closing speed of the rupture valve is controlled by a restricting device a filter shall be located as near as possible before this device.

**G.2.5.5.7** There shall be in the machinery space a manually operated means allowing reaching the tripping flow of the rupture valve without overloading the load carrying unit. The means shall be safeguarded against unintentional operation. It shall not neutralise the safety devices adjacent to the jack.

**G.2.5.5.8** The rupture valve is regarded as a safety component. F.6 gives a method for testing the rupture valve.

### G.2.5.6 Restrictor, also one-way restrictor

**G.2.5.6.1** When required by 5.6.2.1.2, Table 3 and an inspection control station is fitted on the load carrying unit or for type B accessible goods only lift, a restrictor/one-way restrictor shall be provided which satisfies the following conditions.

**G.2.5.6.2** In the case of a major leakage in the hydraulic system the restrictor shall prevent the speed of the load carrying unit with rated load in downward movement exceeding the rated speed downwards $v_d$ by more than 0,3 m/s.

**G.2.5.6.3** The restrictor shall be accessible for inspection.

**G.2.5.6.4** The restrictor shall be either:

a) integral with the cylinder; or

b) directly and rigidly flange-mounted; or

c) placed close to the cylinder and connected to it by means of short rigid pipes, having welded, flanged or threaded connections; or

d) connected directly to the cylinder by threading.

The restrictor shall be provided with a thread ending with a shoulder. This shall butt up against the cylinder.

Other types of connections such as compression fittings or flared fittings are not permitted between the cylinder and the restrictor.

**G.2.5.6.5** The restrictor shall be calculated as the cylinder.

**G.2.5.6.6** There shall be in the machinery space a manually operated means allowing reaching the tripping flow of restrictor without overloading the load carrying unit. The means shall be safeguarded against unintentional operation. In no case shall it neutralise the safety devices adjacent to the jack.

**G.2.5.6.7** Only the one-way restrictor where mechanical moving parts are used is regarded as a safety component. F.6 gives a method for testing the one-way restrictor.

#### G.2.5.7 Filters

In the circuit between the tank and the pump(s) and in the circuit between the shut-off valve and the down direction valve(s), filters or similar devices shall be installed. The filter or similar device between the shut-off valve and the down direction valve shall be accessible for inspection and maintenance.

### G.2.6 Checking the pressure

**G.2.6.1** A pressure gauge shall be provided. It shall be connected to the circuit between the non-return valve or the down direction valve(s) and the shut-off valve.

**G.2.6.2** A gauge shut-off valve shall be provided between the main circuit and the connection for the pressure gauge.

### G.2.7 Tank

The tank shall be designed and constructed for:

a) easy check of the level of the hydraulic fluid in the tank;

b) easy filling and draining.

### G.2.8 Manual operation

#### G.2.8.1 General

Where means are provided to manually operate the accessible goods only lift in order to bring the load carrying unit to a landing, the following requirements apply.

#### G.2.8.2 Moving the load carrying unit downwards

**G.2.8.2.1** The lift shall be provided with a manually operated lowering valve located in the machinery space allowing the load carrying unit, even in the case of a power failure, to be lowered to a landing.

**G.2.8.2.2** The lowering speed of the load carrying unit shall not exceed 0,30 m/s.

**G.2.8.2.3** The operation of this valve shall require a continual manual force.

**G.2.8.2.4** This valve shall be protected against involuntary action.

**G.2.8.2.5** In the case of indirect acting lifts where slack rope/chain can occur, manual operation of the valve shall not cause the sinking of the ram beyond that causing the slack rope/chain.

#### G.2.8.3 Moving the load carrying unit upwards

**G.2.8.3.1** A hand-pump which causes the load carrying unit to move in the upward direction may be installed and shall comply with the following requirements.

**G.2.8.3.2** The hand-pump shall be connected to the circuit between the non-return valve or down direction valve(s) and the shut-off valve.

**G.2.8.3.3** The hand-pump shall be equipped with a pressure relief valve limiting the pressure to 2,3 times the full load pressure.

#### G.2.8.4 Release of safety gear, clamping device or pawl device

Where the load carrying unit is fitted with a safety gear, a clamping device or a pawl device, a hand-pump in conformity with G.2.8.3 shall be permanently installed.




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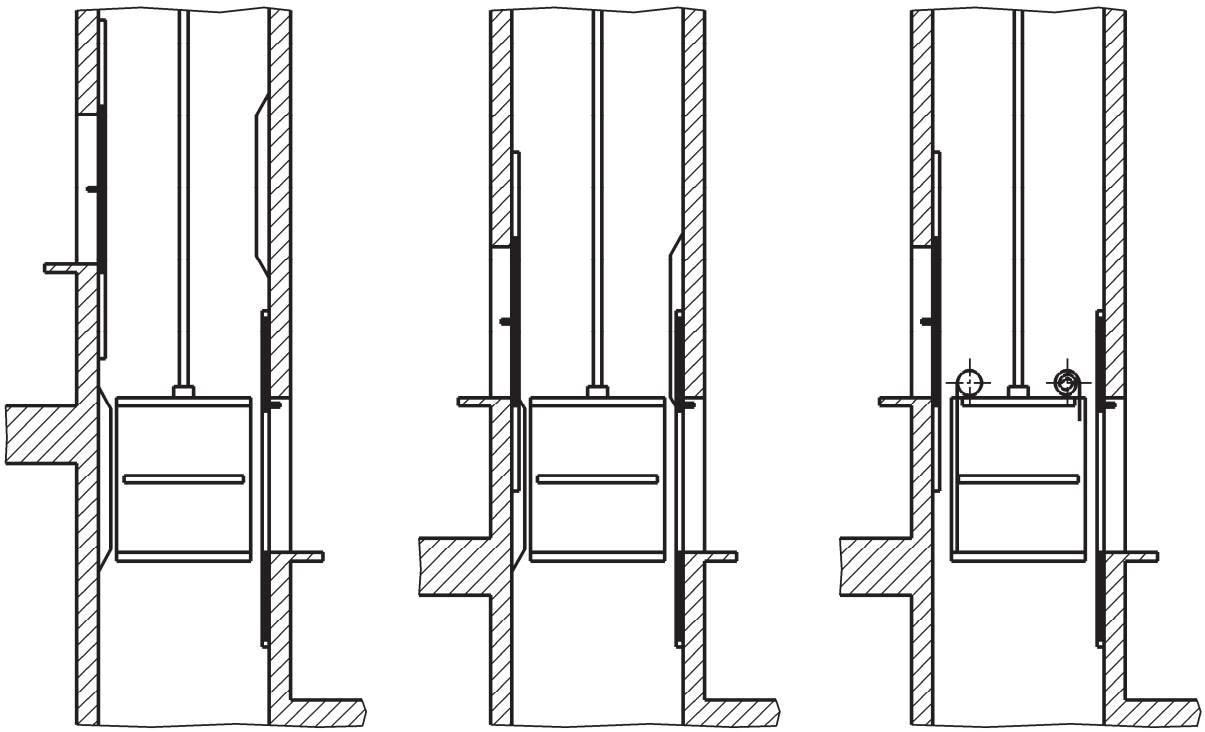
### G.2.9 Safety device against slack rope or slack chain for indirect acting lift

If the risk of slack ropes/chains exists an electric safety device in conformity with 5.10.1.2 shall be provided. This device shall cause the machine to stop and keep it stopped when slack occurs. This device may be the same as the one required in 5.6.1.4.3.

# Annex H
(informative)

## Construction of walls of lift well and landing doors facing a load carrying unit entrance



**a) Example 1: Additional hard facing**

**b) Example 2: Protecting guards**

**c) Example 3: Load carrying unit doors**

The angle to the horizontal of the chamfer of the deflectors shall be at least 60°.

**Figure H.1 — Protection to prevent entanglement of goods**

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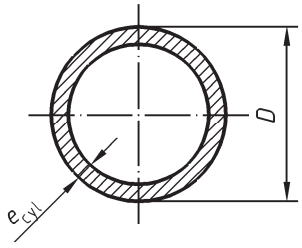
# Annex I
(normative)

# Calculations of rams, cylinder and pipes

## I.1 Calculations against over pressure

### I.1.1 Calculation of wall thickness of rams, cylinders, rigid pipes and fittings




**Key**

*D* external diameter of the cylinder

$e_{cyl}$ wall thickness of the cylinder

**Figure I.1 — Wall thickness of rams, cylinders, rigid pipes and fittings**

$$e_{cyl} \geq \frac{2{,}3 \times 1{,}7 \times \mathrm{p}}{R_{p0,2}} \times \frac{D}{2} + e_0$$

where

$e_o$ = 1,0 mm for wall and base of cylinders and rigid pipes between the cylinder and the rupture valve, if any;

= 0,5 mm for rams and other rigid pipes;

2,3 = factor for friction losses (1,15) and pressure peaks (2);

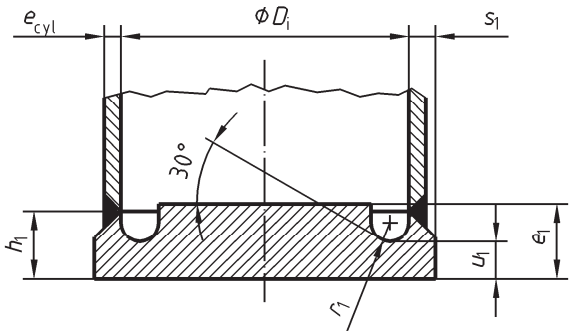
1,7 = safety factor referred to the proof stress.

### I.1.2 Calculation of the base thickness of cylinders (examples)

#### I.1.2.1 General

The examples shown do not exclude other possible constructions.

### I.1.2.2 Flat bases with relieving groove




**Key**

$e_{cyl}$ wall thickness of the cylinder

$D_i$ internal diameter of the cylinder

$s_1$ relieving groove edge thickness

$r_1$ bottom radius of relieving groove

$e_1$ overall thickness of base

$h_1$ base thickness at top of relieving groove

$u_1$ base thickness at bottom of relieving groove

**Figure I.2 — Flat bases with relieving groove**

Conditions for the stress relief of the welding seam:

$r_1 \geq 0{,}2 \times s_1 \quad and \; r_1 \geq 5 \; mm$

$u_1 \leq 1{,}5 \times s_1$

$h_1 \geq u_1 + r_1$

$$e_1 \geq 0{,}4\, D_i \sqrt{\frac{2{,}3 \times 1{,}7 \times p}{R_{p0,2}}} + e_o$$

$$u_1 \geq 1{,}3 \times \left( \frac{D_i}{2} - r_1 \right) \times \frac{2{,}3 \times 1{,}7 \times p}{R_{p0,2}} + e_o$$

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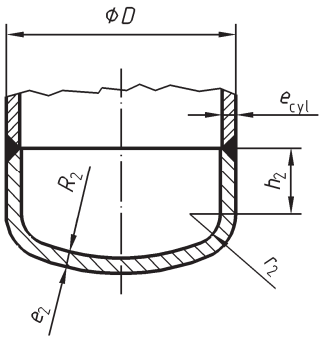
### I.1.2.3 Cambered based




**Key**

$D$ external diameter of the cylinder

$R_2$ internal radius of base bottom

$e_{cyl}$ wall thickness of the cylinder

$h_2$ height of cylindrical part of base

$r_2$ internal radius of base fillet

$e_2$ thickness of cambered base

**Figure I.3 — Cambered based**

Conditions:

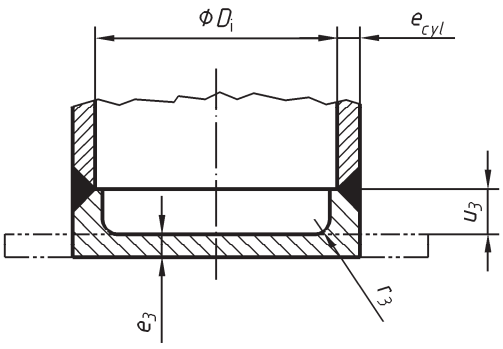
$$h_2 \geq 3{,}0 \times e_2$$

$$r_2 \geq 0{,}15 \times D$$

$$R_2 = 0{,}8 \times D$$

$$e_2 \geq \frac{2{,}3 \times 1{,}7 \times p}{R_{p0,2}} \times \frac{D}{2} + e_o$$

#### I.1.2.4 Flat bases with welded flange




**Key**

$D_i$ internal diameter of the cylinder

$e_{cyl}$ wall thickness of the cylinder

$e_3$ thickness of flat base bottom

$u_3$ height of cylindrical part of base

$r_3$ internal radius of base fillet

**Figure I.4 — Flat bases with welded flange**

Conditions:

$$u_3 \geq e_3 + r_3$$

$$r_3 \geq \frac{e_{cyl}}{3} \quad and \; r_3 \geq 8\,mm$$

$$e_3 \geq 0{,}4 \times D_i \sqrt{\frac{2{,}3 \times 1{,}7 \times p}{R_{p0,2}}} + e_o$$

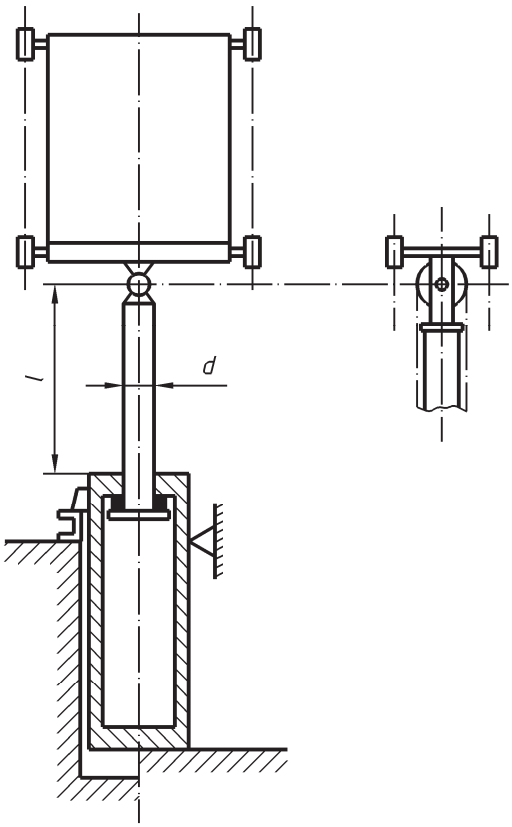
## I.2 Calculations of the jacks against buckling

### I.2.1 General

The examples shown do not exclude other possible configurations.

The buckling calculation shall be made on the part with least buckling resistance.

### I.2.2 Single jacks




**Key**

*d* external diameter of ram

*l* maximum length of rams subject to buckling

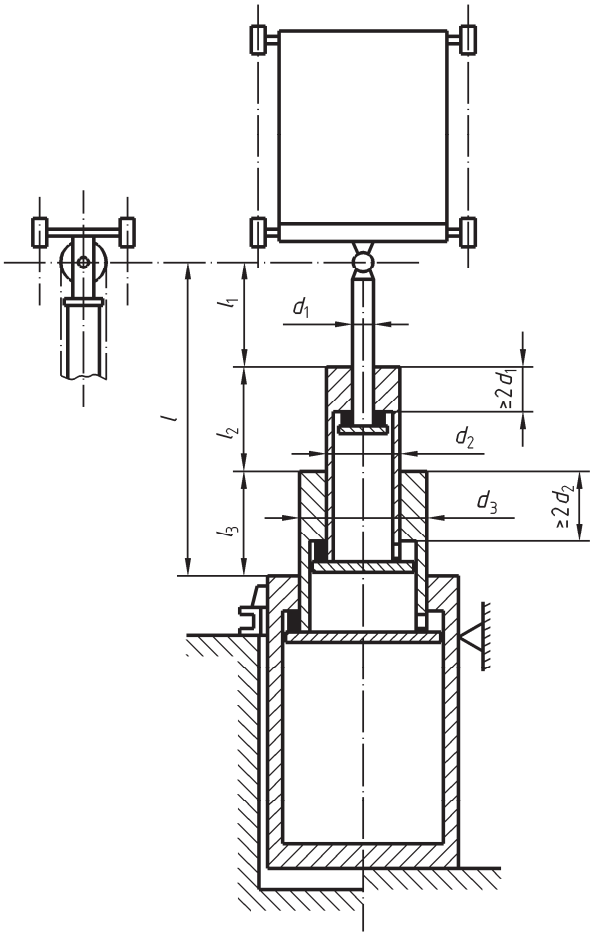
**Figure I.5 — Single jacks**

| For $\lambda_n \geq 100$ : | For $\lambda_n < 100$ : |
|---|---|
| $F_5 \leq \frac{\pi^2 \times E \times J_n}{2 \times l^2}$ | $F_5 \leq \frac{A_n}{2}\left[R_m - (R_m - 210)\left(\frac{\lambda_n}{100}\right)^2\right]$ |

3) $$F_5 = 1{,}4 \times g_n \left[c_m \left(P_3 + Q\right) + 0{,}64\ P_r + P_{rh}\right]$$

3) Valid for rams extending in upward direction.

### I.2.3 Telescopic jacks without external guidance, calculation of ram




**Key**

$l$ maximum length of rams subject to buckling

$l_1$ maximum length of ram section 1 subject to buckling

$l_2$ maximum length of ram section 2 subject to buckling

$l_3$ maximum length of ram section 3 subject to buckling

$d_1$ external diameter of ram section 1

$d_2$ external diameter of ram section 2

$d_3$ external diameter of ram section 3

**Figure I.6 — Telescopic jacks without external guidance**

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| | |
|---|---|
| $l = l_1 + l_2 + l_3, \quad l_1 = l_2 = l_3$<br><br>$v = \sqrt{\frac{J_1}{J_2}}; \quad (J_3 \geq J_2 > J_1)$<br><br>(assumption for simplified calculation: $J_3 = J_2$)<br><br>For two sections:<br>$\varphi = 1{,}25 \times v - 0{,}2 \quad for\ 0{,}22 < v < 0{,}65$<br><br>For three sections:<br>$\varphi = 1{,}5 \times v - 0{,}2 \quad for\ 0{,}22 < v < 0{,}65$<br>$\varphi = 0{,}65 \times v + 0{,}35 \quad for\ 0{,}65 < v < 1$ | $\lambda_e = \frac{l}{i_e}$ with $i_e = \frac{d_m}{4}\sqrt{\sqrt{\varphi}\left[1 + \left(\frac{d_{mi}}{d_m}\right)^2\right]}$<br><br>For $\lambda_e \geq 100$<br>$F_5 \leq \frac{\pi^2 E J_2}{2 l^2}\ \varphi$<br><br>For $\lambda_e < 100$:<br>$F_5 \leq \frac{A_n}{2}\left[R_m - (R_m - 210)\left(\frac{\lambda_n}{100}\right)^2\right]$ |

4) $F_5 = 1{,}4 \times g_n \times [c_m \times (P + Q) + 0{,}64 \times P_r + P_{rh} + P_{rt}]$

4) Valid for rams extending in upward direction.




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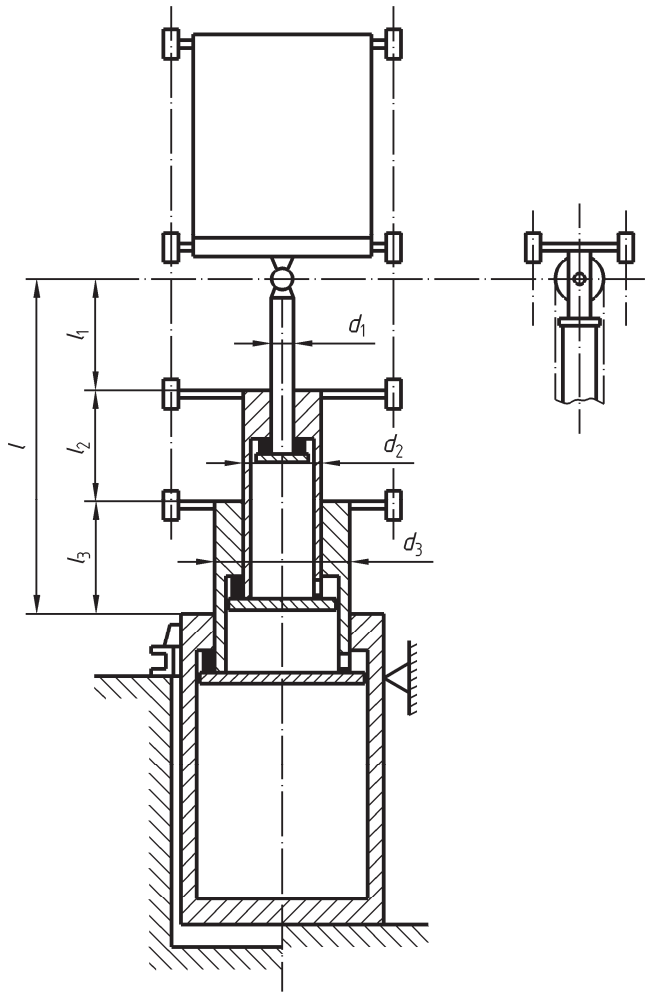
### I.2.4 Telescopic jacks with external guidance




**Key**

$l$ maximum length of rams subject to buckling

$l_1$ maximum length of ram section 1 subject to buckling

$l_2$ maximum length of ram section 2 subject to buckling

$l_3$ maximum length of ram section 3 subject to buckling

$d_1$ external diameter of ram section 1

$d_2$ external diameter of ram section 2

$d_3$ external diameter of ram section 3

**Figure I.7 — Telescopic jacks with external guidance**

| For $\lambda_n \geq 100$ : | For $\lambda_n < 100$ : |
|---|---|
| $F_5 \leq \frac{\pi^2 E J_n}{2\ l^2}$ | $F_5 \leq \frac{A_n}{2}\left[R_m - (R_m - 210)\left(\frac{\lambda_n}{100}\right)^2\right]$ |

5) $F_5 = 1{,}4 \times g_n \times \left[c_m \times (P_3 + Q) + 0{,}64 \times P_r + P_{rh} + P_{rt}\right]$

**Symbols**

$A_n$ is the cross-sectional area of the material of the ram to be calculated in square millimetres (mm²) (n =1, 2, 3);

$c_m$ is the reeving ratio;

$d_m$ is the outside diameter of the biggest ram of a telescopic jack in millimetres (mm);

$d_{mi}$ is the inner diameter of the biggest ram of a telescopic jack in millimetres (mm);

$E$ is the modulus of elasticity in newtons per square millimetre (N/mm²) (for steel: E = $2{,}1 \times 10^5$ N/mm$^2$);

$e_o$ is the additional wall thickness in millimetres (mm);

$F_s$ is the actual buckling force applied in newtons (N);

$g_n$ is the standard acceleration of free fall in metres per square second (m/s²);

$i_e$ is the equivalent radius of gyration of a telescopic jack in millimetres (mm);

$i_n$ is the radius of gyration of the ram to be calculated in millimetres (mm) (n =1,2,3);

$J_n$ is the second moment of area of the ram to be calculated in fourth power millimetres (mm$^4$) (n = 1, 2, 3);

$l$ is the maximum length of rams subject to buckling in millimetres (mm);

$p$ is the full load pressure in megapascals (MPa);

$P$ is the sum of the mass of the empty load carrying unit and the mass of the portion of the travelling cables suspended from the load carrying unit in kilograms (kg);

$P_r$ is the mass of the ram to be calculated in kilograms (kg);

$P_{rh}$ is the mass of the ram head equipment, if any, in kilograms (kg);

$P_{rt}$ is the mass of the rams acting on the ram to be calculated (in the case of telescopic jacks) in kilograms (kg);

$Q$ is the rated load (mass) displayed in the load carrying unit in kilograms (kg);

5) Valid for rams extending in upward direction.

$R_m$ is the tensile strength of material in newtons per square millimetre (N/mm²);

$R_{P0,2}$ is the proof stress (non-proportional elongation) in newtons per square millimetre (N/mm²);

$\lambda_e = \frac{l}{i_e}$ is the equivalent coefficient of slenderness of a telescopic jack;

$\lambda_n = \frac{l}{i_n}$ is the coefficient of slenderness of the ram to be calculated;

$\nu$, $\varphi$ are the factors used to represent approximate values given by experimentally determined diagrams;

1,4 is the over pressure factor;

2 is the safety factor against buckling.

# Annex J
(informative)

# Information to the user/owner of an accessible goods only lift

## J.1 General

Means of access to the machinery space entrance of the accessible goods only lift are generally not part of the accessible goods only lift and usually not provided by the vendor (see 0.2.5). The purpose of this annex is to provide information to owner/user of an accessible goods only lift about access and maintenance with ladders.

## J.2 Means of access to machinery space entrance of the accessible goods only lift

The means of access to the machinery space entrance of the accessible goods only lift should comply with the following:

a) safe and unobstructed access needs to be provided to the accessible goods only lift machinery space entrance;

b) useful information about permanent access can be found in EN ISO 14122-3;

c) if ladders are used for access, they shall satisfy the following conditions:

   1) the height of the ladder shall not exceed 3 m;

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

   3) the clear width of the ladder shall be at least 0,28 m, the depth of the steps shall not be less than 50 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 at least 1 500 N. The steps shall be slip resistant (e.g. chequer plate);

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

   5) 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.

## J.3 Maintenance work carried out from a step of a ladder

Maintenance work may be carried out from a step of a ladder, provided:

a) the ladder is inclined according to J.2;

b) the depth of the surface of the steps is for a fixed ladder, according to EN ISO 14122-3;

c) for a portable ladder, the requirements of EN 131-1 apply;

d) the sill of the inspection trap is situated in a height not exceeding 2,70 m from the access floor level;

e) the components requiring inspection or maintenance are positioned in such a way that a ladder(s) can be placed in front of them and a fixing for the ladder is provided.

## J.4 Lighting and socket outlets

The machinery spaces should be provided with permanently installed electric lighting, giving an intensity of an illumination of at least 200 lux at the equipment and in the walking areas. The supply for this lighting should be in conformity with 5.9.5.5.

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

One or more socket outlet(s) in conformity with 5.9.5.6.2 should be provided in the machinery spaces.

NOTE For lighting, see 5.9.5.6.

## J.5 Local lighting of openings at landings

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

# Annex K
(normative)

# Electronic components − Failure exclusion

The faults to be considered in the electric equipment of a lift are listed in 5.10.1.1.2. In 5.10.1.1 it is stated that certain faults can be excluded under specified conditions.

Failure exclusion shall only be considered provided that components are applied within their worst case limits of characteristics, value, temperature, humidity, voltage and vibrations.

The following Table K.1 describes the conditions under which the faults envisaged in 5.10.1.1.2, e) can be excluded.

In the table:

— the "NO" in the cell means: failure not excluded, i.e. shall be considered;

— the unmarked cell means: the identified fault type is not relevant.

NOTE Design guidelines.

Some dangerous situations are recognized coming from the possibility of bridging one or several safety contacts by short circuiting or by local interruptions of common lead (earth) combined with one or several other failures. It is good practice to follow the recommendations given below, when information is collected from the safety chain for control purposes, for remote control, alarm control, etc.:

— design the board and circuits with distances in accordance with specifications 3.1 and 3.6 of Table K.1;

— organize common of the connections to the safety chain on the printed circuit board so that the common to the contactors or relay-contactors as mentioned in 5.10.1.2.4 will switch off at interruption of the common lead on the printed board;

— make always failure analyses for the safety circuits as mentioned in 5.10.1.2.3 and in accordance with EN ISO 12100. If modifications or additions are made after the lift installation the failure analyses involving new and existing equipment should be carried out again;

— always use outside (out of element) resistors as protective devices of input elements; internal resistor of the device should not be considered as safe;

— components should only be used within to the manufacturer specification;

— backwards voltage coming from electronics should be considered. Using galvanically separated circuits can solve the problems in some cases;

— electrical installations regarding to earthing should be in accordance with HD 60364-5-54. In that case, the interruption of the earth from the building to the controller collection bar (rail) can also be excluded.




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**Table K.1 — Exclusions of failures**

| Component | Possible failure exclusion | | | | | Conditions | Remarks |
|---|---|---|---|---|---|---|---|
| | Open circuit | Short circuit | Change to higher value | Change to lower value | Change of function | | |
| **1 Passive components** | | | | | | | |
| 1.1 Resistor fixed | NO | (a) | NO | (a) | | (a) Only for film resistors with varnished or sealed resistance film and axial connection according to applicable IEC standards, and for wire wound resistors if they are made of a single layer winding protected by enamel or sealed. | |
| 1.2 Resistor variable | NO | NO | NO | NO | | | |
| 1.3 Resistor, non linear NTC, PTC, VDR, IDR | NO | NO | NO | NO | | | |
| 1.4 Capacitor | NO | NO | NO | NO | | | |
| 1.5 Inductive components<br>- coil<br>- choke | NO | NO | | NO | | | |
| **2 Semiconductors** | | | | | | | |
| 2.1 Diode, LED | NO | NO | | | NO | | Change of function refers to a change in reverse current value. |
| 2.2 Zener Diode | NO | NO | | NO | NO | | Change to lower value refers to change in Zener voltage.<br>Change of function refers to change in reverse current value. |

*(to be continued)*

**Table K.1** (*continued*)

<table>
<tr><th rowspan="2">Component</th><th colspan="5">Possible failure exclusion</th><th rowspan="2">Conditions</th><th rowspan="2">Remarks</th></tr>
<tr><th>Open circuit</th><th>Short circuit</th><th>Change to higher value</th><th>Change to lower value</th><th>Change of function</th></tr>
<tr><td>2 Semiconductors<br>(continued)</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2.3 Thyristor, Triac, GTO</td><td>NO</td><td>NO</td><td></td><td></td><td>NO</td><td></td><td>Change of function refers to self triggering or latching of components.</td></tr>
<tr><td>2.4 Optocoupler</td><td>NO</td><td>(a)</td><td></td><td></td><td>NO</td><td>(a) May be excluded under condition that the optocoupler is according to EN 60747-5-1 and EN 60747-5-2, and the isolation voltage is at least according to table below, EN 60664-1:2007, Table F.1.<br><table><tr><th>Voltage phase-to-earth derived from rated system voltage up to and including $V_{rms}$ and d.c.</th><th>Preferred series of impulse withstand voltages in volts for installation</th></tr><tr><td></td><td>Category III</td></tr><tr><td>50<br>100<br>150<br>300<br>600<br>1 000</td><td>800<br>1 500<br>2 500<br>4 000<br>6 000<br>8 000</td></tr></table></td><td>Open circuit means open circuit in one of the two basic components (LED and photo transistor). Short circuit means short circuit between them.</td></tr>
</table>

*(to be continued)*

**Table K.1** *(continued)*

| Component | Possible failure exclusion | | | | | Conditions | Remarks |
|---|---|---|---|---|---|---|---|
| | Open circuit | Short circuit | Change to higher value | Change to lower value | Change of function | | |
| **2 Semiconductors (continued)** | | | | | | | |
| 2.5 Hybrid circuit | NO | NO | NO | NO | NO | | |
| 2.6 Integrated circuit | NO | NO | NO | NO | NO | | Change in function to oscillation, "and" gates becoming "or" gates, etc. |
| **3 Miscellaneous** | | | | | | | |
| 3.1 Connectors<br>Terminals<br>Plugs | NO | (a) | | | | (a) The short circuits of connectors may be excluded if the minimum values are according to the tables (taken over from EN 60664-1) with the conditions:<br>- the pollution degree is 3;<br>- the material group is III;<br>- inhomogeneous field.<br>The column "printed wiring material" of Table 4 is not used.<br>These are absolute minimum values, which can be found on the connected unit, not pitch dimension or theoretical values.<br>If the protection of the connector is IP 5X or better, the creepage distances may be reduced to the clearance value, e.g. 3 mm for 250 $V_{rms}$. | |
| 3.2 Neon bulb | NO | NO | | | | | |

*(to be continued)*

**Table K.1** *(continued)*

| Component | Possible failure exclusion | | | | | Conditions | Remarks |
|---|---|---|---|---|---|---|---|
| | Open circuit | Short circuit | Change to higher value | Change to lower value | Change of function | | |
| **3 Miscellaneous** *(continued)* | | | | | | | |
| 3.3 Transformer | NO | (a) | (b) | (b) | | (a) (b)<br>May be excluded under condition that isolation voltage between windings and core is in line with EN 61558-1, and the working voltage is the highest possible voltage of Table 6 between live and earth | Short-circuits include short-circuits of primary or secondary windings, or between primary and secondary coils. Change in value refers to change of ratio by partial short-circuit in a winding. |
| 3.4 Fuse | | (a) | | | | (a) May be excluded if the fuse is correctly rated, and constructed according to the applicable IEC standards. | Short circuit means short circuit of the blown fuse. |
| 3.5 Relay | NO | (a)<br>(b) | | | | (a) Short-circuits between contacts, and between contacts and coil may be excluded if the relay fulfils the requirements of 5.9.2.2.3 (5.10.1.2.2.3).<br>(b) Welding of contacts may not be excluded.<br>However, if the relay is constructed to have mechanically forced interlocked contacts, and made according to EN 60947-5-1, the assumptions of 5.9.2.1.3 apply. | |

*(to be continued)*

**Table K.1** *(continued)*

| Component | Possible failure exclusion | | | | | Conditions | Remarks |
|---|---|---|---|---|---|---|---|
| | Open circuit | Short circuit | Change to higher value | Change to lower value | Change of function | | |
| **3 Miscellaneous** *(continued)* | | | | | | | |
| 3.6 Printed circuit board (PCB) | NO | (a) | | | | (a) The short circuit may be excluded provided:<br>a) the general specifications of PCB are in accordance with EN 62326-1;<br>b) the base material is in accordance with the specifications of one of the EN 61249-2 series;<br>c) the PCB is constructed according to the above requirements and the minimum values are according to the tables (taken over from EN 60664-1) with the conditions:<br>1) the pollution degree is 3;<br>2) the material group is III;<br>3) inhomogeneous field;<br>4) the column "printed wiring material" of Table 4 is not used.<br>That means that the creepage distances are 4 mm and the clearances 3 mm for 250 $V_{rms}$. For other voltages refer to EN 60664-1.<br>If the protection of the PCB is IP 5X or better, or the material involved of higher quality, the creepage distances may be reduced to the clearance value, e.g. 3 mm for 250 $V_{rms}$. For multi-layer boards comprising at least three prepreg or other thin sheet insulating materials short circuit may be excluded (see EN 60950 (all parts)). | |

*(to be continued)*

**Table K.1** *(continued)*

| Component | Possible failure exclusion | | | | | Conditions | Remarks |
|---|---|---|---|---|---|---|---|
| | Open circuit | Short circuit | Change to higher value | Change to lower value | Change of function | | |
| **4 Assembly of components on printed circuit board (PCB)** | NO | (a) | | | | (a) Short circuit may be excluded under circumstances where the short circuit of the component itself may be excluded and the component is mounted in a way that the creeping distances and clearances are not reduced below the minimum acceptable values as listed in 3.1 and 3.6 of this table, neither by the mounting technique nor by the PCB itself. | |

# Annex L
(normative)

# Reduced clearances in headroom and pit

## L.1 General

Where existing top and/or bottom clearances are smaller than those given by applying 5.2.11.1.2, b), c) and d) or 5.2.11.2.3.1, b) according to the type of drive provided on the lift, the requirements for the top (L.2) and bottom (L.3) reduced clearances can be fulfilled by the use of the following.

## L.2 Reduced top clearances

The requirements of 5.2.11.1.2, b), c) and d) can be replaced by the following:

### L.2.1 General

The lift shall be equipped with devices providing safety spaces in the headroom (L.2.2) and a safety system (L.2.3) controlling the operation of the lift.

### L.2.2 Devices providing safety spaces in the headroom

#### L.2.2.1 General

The devices providing safety spaces in the headroom shall be either:

a) movable stops; or

b) a pre-triggered stopping system.

#### L.2.2.2 Movable stops

##### L.2.2.2.1 General

Automatically operated movable stops shall be designed to prevent damage due to any unintended collision when they are moved between the fully retracted and extended position.

##### L.2.2.2.2 Arrangement

**L.2.2.2.2.1** In the case of traction drive lifts the movable stops shall be installed under the counterweight to mechanically stop the load carrying unit.

**L.2.2.2.2.2** In the case of positive drive lifts the movable stops shall be installed above the load carrying unit to mechanically stop the load carrying unit.

**L.2.2.2.2.3** In the case of hydraulic lifts the movable stops shall consist of one or more devices external to the jack situated outside the load carrying unit projection, the resultant force of which is exerted on the centre line of the jack.

##### L.2.2.2.3 Buffering of movable stops

The movable stops shall be fitted with buffers which comply with the requirements of 5.7.3.3.1, 5.7.3.3.2 and 5.7.3.3.3.

### L.2.2.3 Pre-triggered stopping system

**L.2.2.3.1** The pre-triggered stopping system shall include a triggering device with its actuation means for tripping a mechanical stopping gear by a linkage when the load carrying unit reaches a fixed tripping point in the up direction.

**L.2.2.3.2** The triggering device shall always be easily accessible so that examinations, tests and maintenance operations can be carried out in complete safety from the pit, or from the load carrying unit roof or from outside of the well.

**L.2.2.3.3** The pre-triggered stopping system shall comply with the following:

a) the stopping gear shall be fixed on the load carrying unit and act on the guide rails of the load carrying unit;

b) the stopping gear shall be tripped by a mechanical triggering device using a mechanical linkage for the tripping operation;

c) the stopping gear shall be kept tripped by the triggering device and the linkage when the load carrying unit is at any position above the tripping point.

   In case of a release of the stopping gear due to dynamic effects or rescue operations it shall be re-engaged when the load carrying unit moves again in up direction above the tripping point keeping the required safety space;

d) the stopping gear shall be operated positively:

   1) where springs are used they shall act by compression;

   2) where a rope is used the safety factor of the rope shall not be less than 8;

e) the activation force on the stopping gear, taking into consideration the tolerances due to friction shall be at least the greater of the following two values:

   1) twice that necessary to engage the stopping gear; or

   2) 300 N;

f) the stopping gear shall operate an electric safety device in conformity with 5.10.1.2, if it is engaged;

g) when the stopping gear has been tripped its release shall require the intervention of a competent person;

h) after the release, the stopping gear shall be in a condition to operate;

i) the correct operation of the pre-triggered stopping system shall not be influenced by the intrusion of foreign objects, dirt and by corrosion;

j) the pre-triggered stopping system shall be able to stop the load carrying unit and keep it stopped from any speed between zero and the tripping speed of the ascending load carrying unit overspeed protections means;

k) the maximum retardation by the stopping gear shall not exceed 1 $g_n$ in the worst condition as validated according to Annex M;

l) when the stopping gear operates, the floor of the load carrying unit without or with the load uniformly distributed shall not incline more than 5 % from its normal position;

m) the pre-triggered stopping system shall be designed and verified according to the requirements in Annex M.




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#### L.2.2.4 Clearances

When the buffering parts of the movable stops are fully compressed or when the load carrying unit is stopped by the pre-triggered stopping system (see Annex M), the following conditions shall be satisfied at the same time:

a) the free vertical distance between the level of the highest area on the load carrying unit roof whose dimensions comply with 5.5.1.6.1, b) (areas on parts according to 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 load carrying unit, expressed in metres (m), shall be at least 1,20 + 0,035 $v^2$ [6)]);

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

   1) the highest pieces of equipment fixed on the load carrying unit roof, except for those covered in 2) below, shall be at least 0,30 + 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 0,10 + 0,035 $v^2$;

   3) the highest part of the balustrade, if any, shall be at least 0,30 + 0,035 $v^2$;

c) there shall be above the load carrying unit sufficient space to accommodate a rectangular block not less than 0,50 m $\times$ 0,60 m $\times$ 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;

d) the value of 0,035 $v^2$ mentioned in a) and b) shall only be taken into account for traction and indirect hydraulic lifts with movable stops.

NOTE For hydraulic lifts the upward speed $v_m$ should be used for calculation of the term 0,035 $v^2$.

#### L.2.2.5 Operation

##### L.2.2.5.1 General

The movable stops or the triggering device shall be operated:

a) automatically at the latest when the safety system (L.2.3) has been activated; or

b) manually.

**L.2.2.5.2** In the case of power failure:

a) the automatic movable stops or the automatic triggering device shall be activated and maintained in the active position at least up to the power restoration;

b) for manually operated movable stops or for manually operated triggering device, a mechanical safety device (e.g. in accordance with EN 81-1:1998, 9.10) which keeps the load carrying unit stationary shall be activated and maintained in the active position at least up to the power restoration.

**L.2.2.5.3** For traction drive lifts, in the case of manual operation, the mechanical safety device according to L.2.2.5.1, b) shall be operated by the safety system (L.2.3), in order to prevent any movement of the load carrying unit in the up direction if the movable stops or the triggering device is not in the active position.

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6) The improvement of the refuge space from 1,0 m (EN 81-1 and EN 81-2) to 1,20 m is possible due to the arrangement of the mechanical devices providing safety spaces and does not require an alteration of the existing building.

#### L.2.2.6 Electrical monitoring

The movable stops or the triggering device shall be provided with electric safety devices according to 5.10.1.2 that monitor:

a) the fully extended (active) position; and

b) the fully retracted (inactive) position.

### L.2.3 Safety system

**L.2.3.1** An electric safety device according to 5.10.1.2 shall activate a safety system that neutralises normal operation. This electric safety device shall be operated when any door/trap door giving access to the load carrying unit roof is opened by means of a key.

This electric safety device shall operate a bi-stable safety contact that shall be reset only together with the resetting of the safety system (see L.2.3.2).

For lifts with manual landing doors a second non accessible switch according to 5.10.1.2 shall prevent any movement of the load carrying unit if any door giving access to the load carrying unit roof is open.

**L.2.3.2** The resetting of the safety system and the return of the lift to normal operation shall only be made by operation of an electrical reset device.

**L.2.3.2.1** The resetting shall be effective only when:

a) the lift is not in inspection mode;

b) the stopping devices in the pit and on the load carrying unit roof (EN 81-1 and EN 81-2:1998, 14.2.2.1, a), c) and d)) are not in the STOP position;

c) any door/trap door giving access to the load carrying unit roof is closed and locked;

d) the devices providing the safety spaces are in the inactive position (see L.2.2.6, b)).

**L.2.3.2.2** A power failure or other electrical disturbance shall not reset the safety system automatically.

**L.2.3.3** The electrical reset device shall be:

a) lockable with the use of a padlock or equivalent, to ensure no inadvertent operation; and

b) placed outside of the well and accessible to authorised persons only (maintenance, inspection and rescue); and

c) monitored by an electric safety device according to 5.10.1.2, which prevents normal operation when the reset device remains activated.

**L.2.3.4** An additional final limit switch in conformity with 5.10.1.2 shall interrupt movements of the load carrying unit under inspection operation in up direction before the buffering parts of the movable stops are hit or before the triggering device is tripping the stopping gear. The load carrying unit shall be stopped before the stopping gear is tripped.

This switch shall allow the movement of the load carrying unit only in the down direction.

In the position the load carrying unit has stopped, examinations and test and maintenance operations for all components, which are located in the headroom shall be able to be carried out in complete safety from the load carrying unit roof or from outside of the well.

**L.2.3.5** Normal operation of the lift shall only be possible if the movable stops or the triggering device are in the inactive position and the safety system is not activated.




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**L.2.3.6** When the safety system has been activated, inspection operation shall only be possible if the movable stops or the triggering device are in the active position.

### L.2.4 Visible and/or audible information

On opening by means of a key of any door/trap door giving access to the load carrying unit roof, a visible and/or audible signal shall inform about the active position of:

a) the movable stops; or

b) the triggering device.

If both ends of the travel are protected by the movable stop(s) and/or by pre-triggered stopping system, this information shall allow noticing whether it is from top or bottom end of the well.

The audible signal may be switched off after 60 s provided that the movable stops or the triggering device are in the active position.

### L.2.5 Balustrade on the load carrying unit roof

The requirements of 5.5.1.6.2 are completed as follows:

Where the requirements of 5.5.1.6.2 cannot be fulfilled, an easily and safely extendable balustrade shall be permanently installed on the load carrying unit roof.

See also 7.1.17.

## L.3 Reduced bottom clearances

The requirements of 5.2.11.2.3.1, b) can be replaced by the following:

### L.3.1 General

The lift shall be equipped with devices providing safety spaces in the pit (L.3.2) and a safety system (L.3.3) controlling the operation of the lift.

### L.3.2 Devices providing safety spaces in the pit

#### L.3.2.1 General

The devices providing safety spaces in the pit shall be either:

a) movable stops; or

b) a pre-triggered stopping system.

#### L.3.2.2 Movable stops

Movable stops shall comply with the following:

a) the movable stops shall be installed in the pit to mechanically stop the load carrying unit;

b) the movable stops shall be fitted with buffers complying with 5.7.3.3.1, 5.7.3.3.2 and 5.7.3.3.3;

c) automatically operated movable stops shall be designed to prevent damages due to any collision when they are moved between the fully retracted and extended position.

### L.3.2.3 Pre-triggered stopping system

**L.3.2.3.1** The pre-triggered stopping system shall include a triggering device with its actuation means for tripping a mechanical stopping gear by a linkage when the load carrying unit reaches a fixed tripping point in the down direction.

**L.3.2.3.2** The triggering device shall always be easily accessible so that examinations, tests and maintenance operations can be carried out in complete safety from the pit, or from the load carrying unit, from load carrying unit roof or from outside of the well.

**L.3.2.3.3** The pre-triggered stopping system shall comply with the following:

a) the stopping gear shall be fixed on the load carrying unit and act on the guide rails of the load carrying unit;

b) the stopping gear shall be tripped by a mechanical triggering device using a mechanical linkage for the tripping operation;

c) the stopping gear shall be kept tripped by the triggering device and the linkage when the load carrying unit is at any position below the tripping point.

   In case of a release of the stopping gear due to dynamic effects or rescue operations it shall be re-engaged when the load carrying unit moves again in down direction below the tripping point keeping the required safety space;

d) the stopping gear shall be operated positively:

   1) where springs are used they shall act by compression;

   2) where a rope is used the safety factor of the rope shall not be less than 8;

e) the activation force on the stopping gear, taking into consideration the tolerances due to friction shall be at least the greater of the following two values:

   1) twice that necessary to engage the stopping gear; or

   2) 300 N;

f) the stopping gear shall operate an electric safety device in conformity with 5.10.1.2, if it is engaged;

g) when the stopping gear has been tripped its release shall require the intervention of a competent person;

h) after the release, the stopping gear shall be in a condition to operate;

i) the correct operation of the pre-triggered stopping system shall not be influenced by the intrusion of foreign objects, dirt and by corrosion;

j) the pre-triggered stopping system shall be able to stop the load carrying unit and keep it stopped from any speed between zero and the tripping speed of the safety gear;

k) the maximum retardation by the stopping gear shall not create a retardation higher than the one created by the safety gear;

l) when the stopping gear operates, the floor of the load carrying unit without or with the load uniformly distributed shall not incline more than 5 % from its normal position;

m) the pre-triggered stopping system shall be designed and verified according to the requirements in Annex M.




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#### L.3.2.4 Clearances

When the load carrying unit rests on the fully compressed buffers of the movable stops or when the load carrying unit is stopped by the pre-triggered stopping system (see Annex M), the following 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 × 0,60 m × 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 load carrying unit, shall be at least 0,60 m. This distance may be reduced to a minimum of 0,10 m within a horizontal distance of 0,15 m between:

   1) clamping device blocks, pawl devices, apron or parts of the vertically sliding load carrying unit door(s) and the adjacent wall(s);

   2) the lowest parts of the load carrying unit and the guide rails;

   When the load carrying unit rests on the fully compressed buffers for normal operation any collision between the lowest parts of the load carrying unit and the bottom of the pit shall be prevented.

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 load carrying unit, except for items detailed in b), 1) and b), 2) above, shall be at least 0,30 m;

d) the free vertical distance between the bottom of the pit or the top of equipment installed there and the lowest parts of the downwards-travelling ram-head assembly of an inverted jack shall be at least 0,50 m.

   However, if it is impossible to gain involuntary access under the ram head assembly (for example by providing screens in accordance with 5.2.10), this vertical distance may be reduced from 0,50 m to 0,10 m minimum;

e) the free vertical distance between the bottom of the pit and the lowest guiding yoke of a telescopic jack below the load carrying unit of a direct acting lift shall be at least 0,50 m.

#### L.3.2.5 Operation

**L.3.2.5.1** The movable stops or the triggering device shall be operated:

a) automatically at the latest when the safety system (L.3.3) has been activated; or

b) manually.

**L.3.2.5.2** In the case of power failure:

a) the automatic movable stops or the automatic triggering device shall be activated and maintained in the active position at least up to the power restoration;

b) for manually operated movable stops or for manually operated triggering device, a mechanical safety device (e.g. in accordance with 5.6.2.3) which keeps the load carrying unit stationary shall be activated and maintained in the active position at least up to the power restoration.

**L.3.2.5.3** In the case of manual operation, the mechanical safety device according to L.3.2.5.2, b) shall be operated by the safety system (L.3.3), in order to prevent any movement of the load carrying unit in the down direction if the movable stops or the triggering device is not in the active position.

#### L.3.2.6 Electrical monitoring

The movable stops or the triggering device shall be provided with electric safety devices according to 5.10.1.2 that monitor:

a) the fully extended (active) position; and

b) the fully retracted (inactive) position.

### L.3.3 Safety system

**L.3.3.1** An electric safety device according to 5.10.1.2 shall activate a safety system that neutralises normal operation. This electric safety device shall be operated when any door/trap door giving access to the pit is opened by means of a key.

This electric safety device shall be a bi-stable switch and it shall be reset together with the resetting of the safety system (see L.3.3.2).

For lifts with manual landing doors a second non accessible switch according to 5.10.1.2 shall prevent any movement of the car if any door giving access to the pit is open.

Any door/trap door whose sill having a distance less than 2,50 m from the pit floor is considered as access door to the pit.

**L.3.3.2** The resetting of the safety system and the return of the lift to normal operation shall only be made by operation of an electrical reset device.

**L.3.3.2.1** The resetting shall be effective only when:

a) the lift is not in inspection mode;

b) the stopping device(s) in the pit (5.2.11.2.4, a)) and on the load carrying unit roof (5.10.2.3, e)) is (are) not in the STOP position;

c) any door/trap door giving access to the pit are closed and locked;

d) the movable stops or the triggering device are in the inactive position (see L.3.2.6, b)).

**L.3.3.2.2** A power failure or other electrical disturbance shall not reset the safety system automatically.

**L.3.3.3** The electrical reset device shall be

a) lockable with the use of a padlock or equivalent, to ensure no inadvertent operation; and

b) placed outside of the well and accessible to authorised persons only (maintenance, inspection and rescue); and

c) monitored by an electric safety device according to 5.10.1.2, which prevents normal operation when the reset device remains activated.

**L.3.3.4** An additional final limit switch in conformity with 5.10.1.2 shall interrupt movements of the load carrying unit under inspection operation in down direction before the buffering parts of the movable stops are hit or before the triggering device is tripping the stopping gear. This switch shall allow the movement of the load carrying unit in the up direction.

In the position the load carrying unit has stopped, examinations and tests and maintenance operations for all components which are located in the lower part of the load carrying unit shall be able to be carried out in complete safety from the pit or from outside the well.

**L.3.3.5** Normal operation of the lift shall only be possible if the movable stops or the triggering device are in the inactive position and the safety system is not activated.

**L.3.3.6** When the safety system has been activated, inspection operation shall only be possible if the movable stops or the triggering device are in the active position.




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### L.3.4 Visible and/or audible information

On opening by means of a key of any door/trap door giving access to the pit (see L.3.3.1), a visible and/or audible signal shall inform about the positions (active and not active) of:

a) the movable stops; or

b) the triggering device.

If both ends of the travel are protected by movable stop(s) and/or by pre-triggered stopping system(s), this information shall allow noticing whether it is from top or bottom end of the well.

The audible signal may be switched off after 60 s provided that the movable stops or the triggering device are in the active position.

See also 7.1.18.

# Annex M
(normative)

# Examination of pre-triggered stopping system

## M.1 General

This annex defines test procedures for verification of conformity of pre-triggered stopping systems. For general provisions EN 81-1 and EN 81-2, F.1 applies.

## M.2 General provisions

The following information shall be provided:

a) minimum and maximum tripping speed;

b) minimum and maximum rated load;

c) minimum and maximum masses of load carrying unit, counterweight, ropes, travelling cables and compensating ropes or other compensating means;

d) minimum and maximum inertia of rotating masses of the lift machine and other relevant rotating components;

e) detailed information on the guide rails used: materials, type, surface condition (drawn, milled, ground, etc.), type and specifications of lubrication and any other relevant information which could influence the stopping behaviour;

f) list of foreseeable failures, which could lead to uncontrolled movements and which have to be considered for calculation of braking distances;

g) intended use including ranges of temperature, humidity, climatic conditions and any other special application which could influence the stopping behaviour;

h) calculation formulas for calculation of braking distances under test conditions and worst-case conditions;

i) detailed and assembly drawings showing the construction, operation, materials used, the dimensions and tolerances on the construction components;

j) if necessary, also a load diagram relating to elastic parts;

k) instruction manual for pre-triggered stopping system including instructions for maintenance and periodical checking of functionality, braking distances, wear, aging, etc.

## M.3 Statement and test samples

**M.3.1** It shall be stated for which lift parameters and applications the device shall be certified. If the device has to be certified for a range of parameters, it shall be indicated in addition whether adjustment is by stages or continuous.

**M.3.2** A number of sets of the pre-triggered stopping systems shall be supplied, which are needed to test the relevant conditions. The sets may include the load carrying unit sling and other components, which are

associated to the system. The guide rails on which the device acts shall also be supplied with the appropriate dimensions.

## M.4 Laboratory tests

### M.4.1 Method of test

The method of test shall be defined in order to achieve a realistic function of the system. The real situation on a lift shall be simulated as far as possible, e.g. with a test stand in form of a lift system with flexible masses on both sides of a traction sheave and detachable inertia masses. The test shall include the triggering device, the linkages and the stopping gear.

Measurements shall be made of:

a) the acceleration and speed;

b) the braking distance;

c) the retardation.

Measurements shall be recorded as a function of the time.

### M.4.2 Determination of the nominal braking force of the stopping gear

At least six tripping tests shall be made with the maximum tripping speed for the maximum adjustment and for the minimum adjustment of the stopping gear. These tests shall demonstrate the tolerances in the braking force and the wear after these tests.

The tests shall be made on the same part of the guide rail for which criteria shall be specified when it has to be replaced.

For each test the retardation shall be averaged over time. No peak value shall increase the average retardation by more than 2. From the average retardation the average braking force shall be calculated.

For none of six consecutive tests with one adjustment and the same brake jaws the average braking force shall differ more than ± 25 % from the nominal braking force specified for this adjustment.

The nominal braking force shall be approximately two times (± 20 %) the maximum static unbalance of the forces on the traction sheave in the test stand.

Additional tests, performed on a different part of the guide rail, shall demonstrate the stopping behaviour with expected influences under normal operation, e.g. with low or excessive lubrication, tolerances of the safety gear, etc.

Further tests, performed on a different part of the guide rail with reduced tripping speeds (50 %, 10 % and 0 % of maximum tripping speed) shall demonstrate that the lift will be stopped and be kept stopped for the intended load conditions.

### M.4.3 Checking after the tests

After the tests:

a) the hardness of the gripping element shall be compared with the values originally quoted. Other analyses may be carried out in special cases;

b) the test samples shall be checked, if there are no fractures, deformations and other changes (for example, cracks, deformations or wear of the gripping elements, appearance of the rubbing surfaces);




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c) if necessary, photographs shall be taken of the elements for evidence of deformations or fractures.

## M.5 Calculation

### M.5.1 Calculation method

The calculation method shall allow the calculation of braking distances and retardation on basis of the nominal braking forces for the site test case and the foreseeable worst cases.

### M.5.2 Site test case

The calculation shall demonstrate the nominal, the minimum and the maximum braking distances under these site test conditions according to 6.2 taking into consideration influences due tolerances, friction, wear and others which can be expected under normal operating conditions.

Tables M.1 and M.2 show examples how the influences can be combined for minimum and maximum conditions. The tolerances in braking force have to be validated in the tests according to M.4.

### M.5.3 Worst cases

The calculation shall demonstrate the minimum and maximum braking distances under the foreseeable worst cases which shall take into consideration loading conditions, tripping speed, failures on the lift machine (e.g. broken shaft, brake failure) and tolerances, friction, wear and other influences. Tables M.1 and M.2 show examples how the influences can be combined for minimum and maximum worst cases.

The maximum worst case braking distance shall be the relevant value for location of the triggering device. The minimum worst-case braking distance shall be the relevant value for calculation of the maximum retardation.

**Table M.1 — Influences and combinations for site test case and worst case conditions in up direction − Examples**

| Parameters | Conditions | | | | |
|---|---|---|---|---|---|
| | Site test case | | Worst case | | |
| | Maximum | Minimum | Maximum | Minimum | |
| **Load in or on load carrying unit** | 0 | 0 | 75 kg [a] | 100 % [b] | 200 kg [c] |
| **Brake engaged** | No | No | No | Yes | No |
| **Inertia masses of geared machine attached** | Yes | Yes | Yes | Yes | No |
| **Tolerances of components** | Maximum expected reducing braking forces | Maximum expected increasing braking forces | Maximum foreseeable reducing braking forces | Maximum foreseeable increasing braking forces | |
| **Tolerances of friction** | Maximum expected reducing braking forces | Maximum expected increasing braking forces | Maximum foreseeable reducing braking forces | Maximum foreseeable increasing braking forces | |
| **Wear** | Maximum expected reducing braking forces | 0 | Maximum foreseeable reducing braking forces | 0 | |
| **Others** | Maximum expected reducing braking forces | Maximum expected increasing braking forces | Maximum foreseeable reducing braking forces | Maximum foreseeable increasing braking forces | |

[a] 75 kg reflects one person in the load carrying unit or on the load carrying unit roof.

[b] 100 % reflects the rated load condition.

[c] 200 kg reflects the condition of two persons standing on the load carrying unit roof.

**Table M.2 — Influences and combinations for site test case and worst case conditions in down direction − Examples**

| Parameters | Conditions | | | |
|---|---|---|---|---|
| | Site test case | | Worst case | |
| | Maximum | Minimum | Maximum | Minimum |
| **Load in or on load carrying unit** | 100 % [a] | 100 % | 100 % | 75 kg [b] |
| **Brake engaged** | No | No | No | Yes |
| **Inertia masses of geared machine attached** | Yes | Yes | Yes | Yes |
| **Tolerances of components** | Maximum expected reducing braking forces | Maximum expected increasing braking forces | Maximum foreseeable reducing braking forces | Maximum foreseeable increasing braking forces |
| **Tolerances of friction** | Maximum expected reducing braking forces | Maximum expected increasing braking forces | Maximum foreseeable reducing braking forces | Maximum foreseeable increasing braking forces |
| **Wear** | Maximum expected reducing braking forces | 0 | Maximum foreseeable reducing braking forces | 0 |
| **Others** | Maximum expected reducing braking forces | Maximum expected increasing braking forces | Maximum foreseeable reducing braking forces | Maximum foreseeable increasing braking forces |

a 100 % reflects the rated load condition.

b 75 kg reflects the condition of one person in the load carrying unit or on the load carrying unit roof.

## M.6 Test report

In order to achieve reproducibility the test report shall be recorded in all details, such as:

— type and application of pre-triggered stopping system;

— limits of the permissible masses and other lift parameters;

— maximum tripping speed;

— type of parts on which the braking elements act;

— defined method of test;

— description of the testing arrangement;

— location of the device to be tested in the testing arrangement;

— number of tests carried out;

— record of measured values;

— report of observations during the test;

— evaluation of the test results to show compliance with the requirements.

# Annex ZA
(informative)

## Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 2006/42/EC on machinery.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard, except clauses listed below, confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that directive, except Essential Requirements listed further below and associated EFTA regulations.

a) List of clauses of this standard that do not refer to essential safety requirements laid down by the Machinery Directive:

   1) 1.1 (excluding transportation of persons when the speed does not exceed 0,15 m/s);

   2) 5.2.5 (Well structure when it is not part of the supply);

   3) 5.2.9, 5.2.12, 5.5.1.9, 5.8.2, 5.10.2.8 and J.5.

b) List of Essential Safety Requirements of the Machinery Directive that are not fully addressed: 1.5.6, 1.5.7, 1.5.8, 1.5.9, 1.5.10, 1.5.11, 1.5.12, 1.5.13 and 1.5.16.

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

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[11] ISO 4309, *Cranes — Wire ropes — Care, maintenance, installation, examination and discard*

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