BS EN 12159:2012

BSI Standards Publication

Builders hoists for persons and materials with vertically guided cages

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National foreword

This British Standard is the UK implementation of EN 12159:2012. It supersedes BS EN 12159:2000+A1:2009 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee MHE/6, Hoists of builders' type.

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.

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

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EN 12159

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Supersedes EN 12159:2000+A1:2009

English Version

Builders hoists for persons and materials with vertically guided cages

Ascenseurs de chantier pour personnes et matériaux avec cages guidées verticalement

Bauaufzüge zur Personen- und Materialbeförderung mit senkrecht geführten Fahrkörben

This European Standard was approved by CEN on 9 September 2012.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 12159:2012) 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of an identical text or by endorsement, at the latest by May 2013, and conflicting national standards shall be withdrawn at the latest by May 2013.

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 supersedes EN 12159:2000+A1:2009.

EN 12159:2012 includes the following significant technical changes with respect to EN 12159:2000+A1:2009:

— Hydraulic driven hoists are removed from the scope of the standard;

— All references to EN 13849 are removed. The electric safety devices (Annex B) are described in each paragraph in a similar way as in EN 81-1;

— Normative references are updated.

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 2006/42/EC, see informative Annex ZA, which is an integral part of this document.

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

Introduction

This standard is one of a series of standards produced by CEN/TC 10/SC 1 as part of the CEN programme of work to produce machinery safety standards.

This standard is a type C standard as stated in EN ISO 12100:2010.

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

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

1 Scope

1.1 This European Standard deals with power operated temporarily installed builders hoists (referred to as "hoists" in this standard) intended for use by persons who are permitted to enter sites of engineering and construction, serving landing levels, having a cage:

- designed for the transportation of persons or of persons and materials;
- guided;
- travelling vertically or along a path within 15° max. of the vertical;
- supported or sustained by drum driven wire rope, rack and pinion, or an expanding linkage mechanism;
- where masts, when erected, may or may not require support from separate structures.

1.2 The European Standard identifies hazards as listed in Clause 4 which arise during the various phases in the life of such equipment and describes methods for the elimination or reduction of these hazards when used as intended by the manufacturer.

1.3 This European Standard does not specify the additional requirements for:

- operation in severe conditions (e.g. extreme climates, strong magnetic fields);
- lightning protection;
- operation subject to special rules (e.g. potentially explosive atmospheres);
- electromagnetic compatibility (emission, immunity);
- handling of loads the nature of which could lead to dangerous situations (e.g. molten metal, acids/bases, radiating materials, fragile loads);
- the use of combustion engines;
- the use of remote controls;
- hazards occurring during manufacture;
- hazards occurring as a result of mobility;
- hazards occurring as a result of being erected over a public road;
- earthquakes.

1.4 This European Standard is not applicable to:

- builders hoists for the transport of goods only EN 12158-1 and EN 12158-2;
- lifts according to EN 81-1, EN 81-2, EN 81-3 and EN 81-43;
- work cages suspended from lifting appliances;
- work platforms carried on the forks of fork trucks;

— work platforms EN 1495;

— funiculars;

— lifts specially designed for military purposes;

— mine lifts;

— theatre elevators;

— builders hoists for persons and material with vertically guided cages which are manufactured before the date of its publication as EN;

— hoists with hydraulic drive/braking systems and hydraulic safety devices.

This document is not applicable to Builders hoists for persons and material with vertical guided cages which are manufactured before the date of its publication as EN.

1.5 This European Standard deals with the hoist installation. It includes the base frame and base enclosure but excludes the design of any concrete, hard core, timber or other foundation arrangement. It includes the design of mast ties but excludes the design of anchor screws to the supporting structure. It includes the landing gates and their frames but excludes the design of any anchorage fixing bolts to the supporting structure.

2 Normative references

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

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

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

EN 894-1, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 1: General principles for human interactions with displays and control actuators*

EN 953, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

EN 1037, *Safety of machinery — Prevention of unexpected start-up*

EN 1088, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*

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

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

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)*

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 ISO 4871, *Acoustics — Declaration and verification of noise emission values of machinery and equipment (ISO 4871)*

EN ISO 11201:2010, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections (ISO 11201:2010)*

EN ISO 11688-1, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning (ISO/TR 11688-1)*

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

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

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

ISO 2408, *Steel wire ropes for general purposes — Minimum requirements*

ISO 3864-1, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs and safety markings*

ISO 4302, *Cranes — Wind load assessment*

ISO 4309, *Cranes — Wire ropes — Care and maintenance, installation and discard*

ISO 6336-1, *Calculation of load capacity of spur and helical gears — Part 1: Basic principles, introduction and general influence factors*

ISO 6336-2, *Calculation of load capacity of spur and helical gears — Part 2: Calculation of surface durability (pitting)*

ISO 6336-3, *Calculation of load capacity of spur and helical gears — Part 3: Calculation of tooth bending strength*

ISO 6336-5, *Calculation of load capacity of spur and helical gears — Part 5: Strength and quality of materials*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12100:2010 and the following apply.

3.1
builders hoist
temporary lifting machine serving landing levels on sites of engineering and construction with a platform, cage or other load carrying device, which is guided

3.2
working load/rated load
maximum load which the hoist has been designed to carry in service

3.3
rated speed
speed of the cage for which the equipment has been designed

3.4
wire rope hoist
hoist which uses wire rope as the load suspension system

3.5
positive drive
drive using means 3.6 other than friction

3.6
rack and pinion hoist
hoist which uses a toothed rack and pinion as the load suspension system

3.7
expanding linkage mechanism
mechanical linkage system (e.g. scissors) which supports and guides the cage by means of expansion or contraction under the control of an actuator

3.8
base frame
lowest framework of the hoist, upon which all other components are mounted

3.9
guides
rigid elements which determine the travel way of the cage or the counterweight (when provided)

3.10
mast
structure that supports and guides the cage and the counterweight (when provided)

3.11
mast section
indivisible piece of mast, between two adjacent mast joints

3.12
mast tie
connection system between the mast and any building structure, providing lateral support for the mast

3.13
hoistway
total space which is travelled by the cage and its load

3.14
counterweight way
total space which is travelled by the counterweight

3.15
cage
carrier including the floor, walls, gates and roof

3.16
counterweight
mass which is used for weight compensation

3.17
stopping distance
distance the cage moves from the moment when the control or safety circuit is broken until the cage has come to a full stop

3.18
overspeed safety device
mechanical device for stopping and maintaining stationary the cage or counterweight in the event of overspeed

3.19
slack rope
rope, normally under tension, from which all external loads have been removed

3.20
wire rope termination
adaptation at the end of a wire rope permitting attachment

3.21
landing
level in a building or construction intended for loading and unloading the cage

3.22
safety distance
minimum acceptable distance between any moving part of a hoist and any point of access

3.23
guard rail
fixed equipment, other than gates, which is used to prevent people from falling or from reaching hazardous areas

3.24
normal operation
usual operating conditions for the equipment when in use for carrying loads, but excluding routine maintenance, erection, dismantling, etc.

3.25
in service
condition during use of the hoist when the cage is in any position, laden or unladen, moving or stationary

3.26
out of service
installed condition when the cage is positioned such that it is provided with the most shelter from the wind. This is normally, but not necessarily, ground level. The cage is empty.

3.27
competent person
designated person, suitably trained, qualified by knowledge and practical experience, and provided with the necessary instructions to enable the required procedures to be carried out

4 List of hazards

The list of hazards according to the following tables are based on EN ISO 12100:2010.

Tables 1, 2 and 3 show the hazards which have been identified and where the corresponding requirements have been formulated in this standard, in order to limit the risk or reduce these hazards in each situation.

A hazard which is not applicable or is not significant and for which, therefore, no requirements are formulated is shown in the relevant clauses column as n.a. (not applicable).

Table 1 — Hazards relating to the general design and construction of hoists for persons and materials

	Hazards	Relevant clauses in this standard
1	**Mechanical hazards**	
1.1	Crushing	5.5.2, 5.5.3, 5.5.6, 5.6, 5.7.2, 7.1.2.8, 7.1.2.9
1.2	Shearing	5.5, 5.6.1.3, 5.7.2, 7.1.2.8, 7.1.2.9
1.3	Cutting or severing	5.5, 5.6.1.3, 5.7.2, 7.1.2.8, 7.1.2.9
1.4	Entanglement	5.7.2, 7.1.2.8, 7.1.2.9
1.5	Drawing-in or trapping	5.5.2, 5.5.3, 5.6.1.3, 5.7.2, 7.1.2.8, 7.1.2.9
1.6	Impact	5.4.3, 5.5.3.9, 5.6.2, 7.1.2.8, 7.1.2.9
1.7	Stabbing or puncture	n.a.
1.8	Friction or abrasion	5.5.2, 5.5.3, 7.1.2.8, 7.1.2.9
1.9	High pressure fluid ejection	n.a.
1.10	Ejection of parts	5.6.1.3
1.11	Loss of stability	5.2, 5.3, 5.4.1, 5.4.2, 5.6.3, 7.1.2.8.4
1.12	Slip, trip and fall	5.5, 5.6.1, 5.6.2, 7.1.2.8.4, 7.1.2.9
2	**Electrical hazards**	
2.1	Electrical contact	5.7.4.11, 5.8, 7.1.2.8.4
2.2	Electrostatic phenomena	n.a.
2.3	Thermal radiation	n.a.
2.4	External influences	5.7.4.11, 5.8.3
3	**Thermal hazards**	
3.1	Burns and scalds	n.a.
3.2	Health-damaging effects	n.a.
4	**Hazards generated by noise**	
4.1	Hearing losses	5.11, 7.1.2.3
4.2	Interference with speech	5.11, 7.1.2.3
5	**Hazards generated by vibration**	n.a.
6	**Hazards generated by radiation**	
6.1	Electrical arcs	n.a.
6.2	Lasers	n.a.
6.3	Ionising radiation sources	n.a.
6.4	Use of H F electromagnetic fields	n.a.
7	**Hazards generated by materials and substances processed, used or exhausted by machinery**	
7.1	Contact with or inhalation of harmful fluids, gases, mists, fumes and dusts	n.a.
7.2	Fire or explosion	n.a.
7.3	Biological and microbiological	n.a.
8	**Hazards generated by neglecting ergonomic principles in machine design**	
8.1	Unhealthy postures or excessive effort	5.1, 5.6.1.3, 7.1.2.8.4
8.2	Inadequate consideration of human hand/arm or foot/leg anatomy	5.5, 5.7.2, 7.1.2.8
8.3	Neglected use of personal protection equipment	n.a.
8.4	Inadequate area lighting	5.8.8, 7.1.2.8.4, 7.1.2.9
8.5	Mental overload or underload, stress	5.9

	Hazards	Relevant clauses in this standard
8.6	Human error	5.6.3, 5.9, 7.1.2.8, 7.1.2.9, 7.2, 7.3
9	**Hazard combinations with the environment in which the machine is used**	n.a.
9.1	Wind conditions	5.2.2.12
10	**Hazards caused by failure of energy supply, breaking down of machinery parts and other functional disorders**	
10.1	Failure of energy supply	5.6.1.6, 5.7.4.1, 5.8.2, 5.10, 7.1.2.5, 7.1.2.6
10.2	Unexpected ejection of machine parts or fluids	5.7.2.3
10.3	Failure or malfunction of control system	5.8.2, 5.9.2.2, 5.9.3, 5.10.26
10.4	Errors of fitting	5.4.1, 7.1.2.8
10.5	Overturn, unexpected loss of machine stability	5.2, 5.3, 5.4, 7.1.2.8
11	**Hazards caused by missing and / or incorrectly positioned safety related measures / means**	
11.1	Guards	5.5, 5.6.1.3, 5.6.1.4**,** 7.1.2.8, 7.1.2.11
11.2	Safety related (protection) devices	5.5, 7.1.2.8, 7.1.2.11
11.3	Starting and stopping devices	5.9.5, 5.9.7, 7.1.2.8, 7.1.2.9
11.4	Safety signs and signals	7.2
11.5	Information or warning devices	5.6.3, 7.2
11.6	Energy supply disconnecting devices	5.9.6
11.7	Emergency devices	5.6.2, 5.10, 7.1.2.6, 7.1.2.8, 7.1.2.11
11.8	Feeding/removal means of work pieces	n.a.
11.9	Essential equipment and accessories for safe adjusting and/or maintaining	7.1.2.6, 7.1.2.8, 7.1.2.11
11.10	Equipment evacuating gases	n.a.

Table 2 — Particular hazards involving the mobility and/or load lifting ability of hoists for persons and materials

	Hazards	Relevant clauses in this standard
	Hazards due to mobility	
12	**Inadequate lighting of moving / working area**	n.a.
13	**Hazards due to sudden movement instability etc. during handling**	n.a.
14	**Inadequate/non-ergonomic design of operating position**	n.a.
15	**Mechanical hazards**	n.a.
16	**Hazards due to lifting operations**	
16.1	Lack of stability	5.2.5, 5.3, 5.4.1, 5.4.2, 7.1.2.8
16.2	Derailment of the cage	5.4.1, 5.6.1, 5.9.7.2.2
16.3	Loss of mechanical strength of machinery and lifting accessories	5.2, 5.3, 5.5.4, 5.6.2, 5.7, 7.1.2.11
16.4	Hazards caused by uncontrolled movement	5.5.3, 5.6.2, 5.10, 7.1.2.9
16.5	Risks due to movements of the cage	5.5, 5.6.1, 5.10.3
16.6	Risk due to objects falling on the cage	5.6.1.4
17	**Inadequate view of trajectories of the moving parts**	5.5, 5.6.1, 7.1.2.9
18	**Hazards caused by lightning**	n.a.
19	**Hazards due to loading / overloading**	5.2, 5.6, 7.1.2.9

Table 3 — Particular hazards involving the lifting of persons by hoists for persons and materials

	Hazards to persons lifted by the hoist	Relevant clauses in this standard
20	**Overloading or overcrowding of the cage**	5.6, 5.7.3, 7.1.2.9
21	**Unexpected movement of the cage in response to external controls or other movements of the machine**	5.7.4.1, 5.9.7.1.2, 5.9.7.2.3, 5.10.4
22	**Excess speed**	5.4.3, 5.6.2, 5.7.4.5
23	**Persons falling from the cage**	5.6.1
24	**The cage falling or overturning**	5.4.1, 5.6.2, 5.7, 5.9.7.2.2
25	**Excess acceleration or braking of the cage**	5.4.3, 5.6.2, 5.7.4.5, 7.1.2.11
26	**Due to imprecise markings**	7.3
27	**Risks to persons in or on the cage**	5.6, 5.4.3, 5.10
28	**Controls at landings**	5.9.7.1
29	**Access to the cage**	5.5

5 Safety requirements and/or measures

5.1 General

The design of the hoist shall consider safe use, erection, dismantling and maintenance. It shall be possible to erect the hoist using safe access methods such as those offered by the roof of the cage or equivalent facilities.

The design of all components that have to be handled during erection e.g. mast sections, shall have their weight assessed against manual handling. Where the permissible weight for manual handling is exceeded,

the manufacturer shall give recommendations in the instruction handbook concerning suitable lifting equipment. All removable and detachable covers shall be retained by captive fastenings.

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

5.2 Load combinations and calculations

5.2.1 The structure of the hoist shall be designed and constructed in such a way that its strength is satisfactory under all intended operating conditions, including erection and dismantling and e.g. low temperature environments.

The design of the structure as a whole and each part of it shall be based on the effects of any possible combination of loads as specified in this subclause 5.2. The load combinations shall consider the least favourable locations of the cage and load relative to the mast and its ties, both during the vertical passage of the cage and any horizontal movement of the cage. Ties between the mast and the supporting structure are considered to be part of the hoist structure.

5.2.2 When calculating the hoist structure and every related component, the following forces and loads shall be taken into account:

5.2.2.1 All dead weights with the exception of the cage and equipment which moves together with the cage.

5.2.2.2 Dead weights of the unladen cage and all equipment which moves together with the cage.

5.2.2.3 Dead weight of landing platforms and gates, if supported by the hoist.

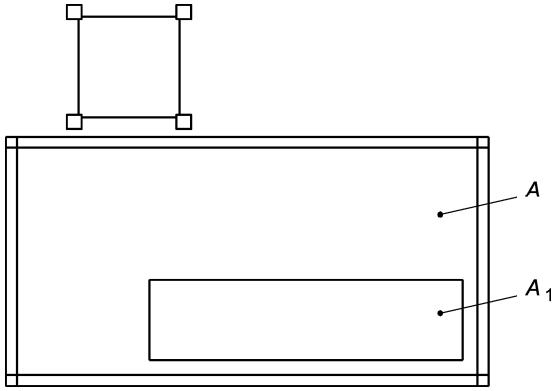
5.2.2.4 Rated load in the cage.

The effect of the forces on the cage and mast resulting from the application of the rated load shall be allowed for in one of the two following ways, which reflect the chosen density of loading on the cage floor:

a) if $\frac{F}{A \times 0{,}8} < 4{,}0\ kN/m^2$

where
F = rated load [kN] and
A = total floor area [m²]

then the rated load shall be assumed to be distributed over a reduced area (A_1) which results in a distribution of 4,0 kN/m^2. The format and the location of this area shall be taken as that which gives the least favourable stress for the mast and also for the cage. One example is shown in Figure 1.



Key

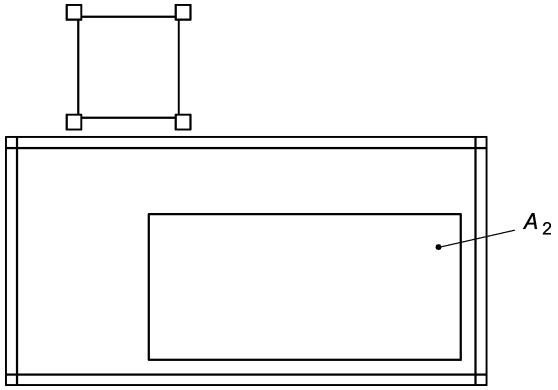
A total floor area [m²]

A_1 = F [kN] / 4 [kN/m²]

Figure 1 — One example of loading according to 5.2.2.4 a)

b) if $\frac{F}{A \; x \; 0{,}8} \geq 4{,}0 \; kN / m^2$

then the rated load shall be assumed to be distributed over an area (A_2) equivalent to 80 % of the total floor area of the cage. The format and the location of this area shall be taken as that which gives the least favourable stress for the mast and also for the cage. One example is shown in Figure 2.



Key

A_2 = 0,8 A

Figure 2 — One example of loading according to 5.2.2.4 b)

5.2.2.5 Where the uniform distribution of the rated load over the full area of the cage floor is less than 4,0 kN/m^2, then, for calculation purposes a minimum of 4,0 kN/m^2 shall be placed over the whole area (A_3)of the cage floor. See Figure 3.

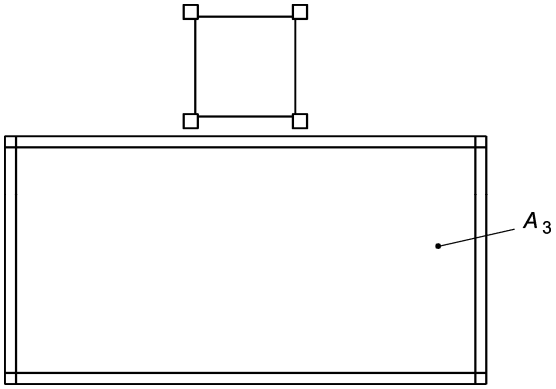


Figure 3 — Evenly distributed load case

5.2.2.6 Forces during loading and unloading (see Figure 4) shall be considered as the concurrent effect of a vertical force and a horizontal force, each calculated as follows:

— a vertical force F_V of 50 % of the rated load but not less than 2,0 kN, or, for rated loads greater than 20 kN, calculated from the equation

$$F_V = 4 + 0{,}3\ F$$

where
F_V = vertical force [kN]
F = rated load [kN]

— a horizontal force F_H of 20 % of the rated load, but not less than 0,5 kN and not more than 2,5 kN,

both forces acting at 1/3 of the width of the cage entrance, at floor level, in the least favourable direction and location; the stresses in the mast and also in the cage shall be calculated for at least the following application points of the loading and unloading forces:

— the cage threshold;

— the leading edge of any ramp or other extension, which is not supported by the landing.

At the same time any remaining part of the rated load shall be applied in the centre of the cage floor (F_{V1}).

Equivalent forces shall be used to design the landing threshold and all relevant supporting structures. Information shall be given in the instruction handbook with regard to these forces.

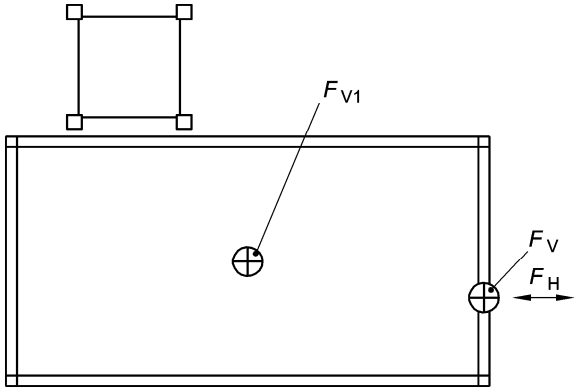


Figure 4 — One example of forces during loading and unloading

5.2.2.7 The effect of moving loads shall be determined by taking the weight of all actual loads (cage, rated load, counterweight, wire ropes etc.) and multiplying them by an impact factor μ = (1,1 + 0,264v) where v is the rated speed in m/s. Alternative factors may be used if they can be proved to be more accurate.

5.2.2.8 To determine the forces produced by an operation of the overspeed safety device, the sum total of the travelling load shall be multiplied by the factor 2,5.

A lower factor, but not less than 1,2 can be used if it can be verified by test under all conditions of loading up to 1,3 times rated load including any inertia effects of the drive system.

5.2.2.9 The cage roof, if intended to be accessible for erection, dismantling, maintenance or emergency escape, shall be designed to withstand a load of at least 3,0 kN placed on the least favourable square area of 1,0 m^2. The roof shall also withstand a load of 1,2 kN applied on any area of 0,1 x 0,1 m.

5.2.2.10 The cage roof intended not to be used as support for persons shall be designed for a load of 1,0 kN applied on any point of 0,1 x 0,1 m.

5.2.2.11 The cage floor surface shall be designed to withstand without permanent deformation a static force of 1,5 kN or 25 % of the rated load, whichever is the greater, but in no case more than 3 kN, the force applied on the least favourable square area of 0,1 m x 0,1 m.

5.2.2.12 Design wind conditions

5.2.2.12.1 General

The aerodynamic pressure q is given by the general equation:

$$q = \frac{v_w^2}{1{,}6}$$

where

q is the pressure in N/m² and v_w the wind velocity in m/s.

In all cases it shall be assumed that the wind can blow horizontally in any direction and the least favourable direction shall be taken into account.

The calculation shall be done according to ISO 4302 with the exception of the following:

5.2.2.12.2 Action of the wind on the cage

When calculating wind pressure on the cage it shall be assumed that the cage walls are solid and an aerodynamic coefficient of c =1,2 shall be applied. The factor 1,2 covers both the shape factor and the shielding factor.

If the design of the cage permits materials to be carried outside the cage according to 5.6.1.4.3, then an additional in service wind area shall be taken into account, at least equivalent to a solid box the plan size of the hatch extending 2 m above the cage roof.

5.2.2.12.3 Wind pressure

5.2.2.12.3.1 General

Three design wind conditions shall be taken into account when calculating wind pressure on hoists:

5.2.2.12.3.2 In service wind

Irrespective of height, the minimum value for wind pressure shall be q = 250 N/m^2 which corresponds to a wind velocity of v_w = 20 m/s.

5.2.2.12.3.3 Out of service wind

Out of service wind pressure depends on the height above ground and the area where the hoist is installed.

The values of out of service wind pressure are given in Table 4. The minimum design wind pressures shall be taken into account.

Table 4 — Minimum design wind pressure

Height H of parts of hoist above ground level [m]	Wind pressure q for geographical Region A to E [N/m²]			
	A/B	C	D	E
0<H≤10	544	741	968	1 225
10<H≤20	627	853	1 114	1 410
20<H≤50	757	1 031	1 347	1 704
50<H≤100	879	1 196	1 562	1 977
100<H≤150	960	1 306	1 706	2 159

The regions A - E are taken from the European Stormwind Map (see Annex A).

5.2.2.12.3.4 Erection and dismantling wind

Irrespective of height, the minimum value for wind pressure shall be q = 100 N/m^2, which corresponds to a wind velocity of v_w = 12,5 m/s.

5.2.2.13 The calculation shall take into account errors of erection of at least 0,5 °.

5.2.2.14 During erection and dismantling the advantage of a counterweight is not permitted to be taken into account.

5.2.2.15 Forces created by the buffers shall be calculated allowing for a retardation of 1 g unless a lower value of retardation can be verified.

5.2.3 Safety factors

5.2.3.1 Steel structures

a) Permissible stresses

$$\sigma_0 = \frac{f_y}{S_y}$$

where

f_y = yield strength [N/mm^2]

S_y = safety factor on yield strength

b) Calculations according to the theory of the second order

The deflection of a structure shall be taken into account when calculating stresses. This is very important when calculating a slender design or using materials with a low modulus of elasticity. This can be done by using the theory of the 2nd order.

$$\sigma_0 = \frac{f_y}{S_y} \text{ or } \frac{f_y}{S_y}$$ whichever is the least favourable

where

f_y' = apparent yield strength [N/mm^2]

The safety factors against f_y and f_y' shall be at least equal to those given in the following Table 5, which is related to Table 7.

Table 5 — Safety factors for steel structures

Load Case	Safety Factor (S_y)
A	1,5
B	1,33
C	1,25

5.2.3.2 Aluminium structures

a) Permissible stresses

$$\sigma_0 = \frac{f_y}{S_y} \text{ or } \frac{f_u}{S_u}$$ whichever gives the lowest value

where

— f_u = tensile strength [N/mm²]

— S_u = safety factor on tensile strength

b) Calculations according to the theory of the second order

The deflection of a structure shall be taken into account when calculating stresses. This is very important when calculating a slender design or using materials with a low modulus of elasticity. This can be done by using the theory of the second order.

$$\sigma_0 = \frac{f_y}{S_y} \text{ or } \frac{f_u}{S_u} \text{ whichever gives the lowest value}$$

The safety factors against f_y and f_u shall be at least equal to those given in the following Table 6, which is related to Table 7.

Table 6 — Safety factors for aluminium structures

Load case	Safety factor S_y on yield strength	Safety factor S_u on tensile strength
A	1,70	2,50
B	1,55	2,25
C	1,41	2,05

5.2.4 Load cases, the different combinations of loads and forces which are to be calculated

Table 7 — Load cases

Load case number	Load case for:	Forces and effects according to subclause 5.2.2.(X) [a]	Load case [b]
Ia	Normal use: (structural parts, incl. mast, mast ties, base frame and all other static parts of the structure)	(1) [c], (3), (12.3.2), (13) (2) multiplied by (7) (4) multiplied by (7)	A
Ib	Normal use: cage	(12.3.2) (2) multiplied by(7) (4) multiplied by (7)	A
IIa	Normal cage loading: masts	(1), (2), (3) (6), (12.3.2)	A
IIb	Normal cage loading: cage	(2), (6) (12.3.2)	A
IIIa	Exceptional forces: mast	(1) [c], (3), (12.3.2), (13) (2) multiplied by (7) (5) multiplied by (7)	C
IIIb	Exceptional forces: cage	(12.3.2) (2) multiplied by(7) (5) multiplied by (7)	C
IVa	Exceptional safety device effects: mast	(1) [c], (3), (12.3.2), (13) (2) multiplied by (8) (4) multiplied by (8)	C
IVb	Exceptional safety device effects: cage	(12.3.2) (2) multiplied by (8) (4) multiplied by (8)	C
IVc	Exceptional safety device effects: safety device	(2) multiplied by (8) (4) multiplied by (8)	C
Va	Occasional use: cage roof for persons	(9) multiplied by (7)	B

Load case number	Load case for:	Forces and effects according to subclause 5.2.2.(X) [a]	Load case [b]
Vb	Exceptional use: cage roof not for persons	(10)	C
VI	Occasional out of service: mast	(1), (3), (12.3.3), (13)	B
VII	Exceptional buffer forces: Effects of the lower buffers on the cage.	 (2), (4), (15)	C
VIII	Separate supporting structure for the landings normal occasional	 (3), (6), (12.3.2) (3), (12.3.3)	 A B
IX	Erection (structural parts, including mast, mast ties, base frame and all other static parts of the structure)	(1) [c], (3), (12.3.4), (13) (2) multiplied by (7) (4) multiplied by (7)	B

[a] X refers to the relevant subsection of subclause 5.2.4. For example, for load case II b (normal cage loading, cage) the following forces and loads shall be taken into account: 5.2.2.2, 5.2.2.6 and 5.2.2.12.3.2. These are thus referred to in the table in the abbreviated form (2), (6), (12.3.2)

[b] See Table 5 and Table 6.

[c] If the cage is guided by an expanding linkage mechanism, the dead load of the linkage mechanism has to be multiplied by the impact factor according to 5.2.2.7.

5.2.5 Stability

For hoists whilst they are in a free-standing condition during erection, and for hoists which are in service in a free-standing condition, the load cases and safety factors in Table 8 shall be used.

All stabilising forces have the factor = 1,0.

Table 8 — Stability safety factors S_o for various overturning forces

Loads or forces	according to 5.2.2.(X) [a]	safety factor S_o
Dead loads, static	(1), (3)	1,1
Dead loads, moving	(2)	1,5
Rated loads	(4), (5), (6)	1,5
In service wind forces	(12.3.2)	1,2
Out of service wind forces	(12.3.3)	1,2
Erection and dismantling wind forces	(12.3.4)	1,2
Errors of erection	(13)	1,0

[a] See Footnote [a] of Table 7.

$$\sum \text{Stabilising moments} \geq \sum \text{Overturning moments multiplied by } S_o$$

5.2.6 Fatigue stress analysis of drive and braking system components

5.2.6.1 A fatigue stress analysis shall be made for all load bearing components and joints which are critical to fatigue, such as shafts and gearing. This analysis shall take into account the degree of stress fluctuation and the number of stress cycles, which can be a multiple of the number of load cycles.

To determine the number of stress cycles, the manufacturer shall take the following into account:

— 80 000 movements with 50 % of the rated load in the cage;

— 80 000 movements with empty cage;

— For the calculation of the drives a travel length of 20 m for each movement (acceleration from rest to rated speed – travel at rated speed – deceleration to full stop) shall be taken into account (see also 7.1.2.11).

For each component the least favourable combination of upwards and downwards movements shall be taken into account.

NOTE The number of movements for a passenger hoist is based on $1,6 \times 10^5$ – intermittent duty (e.g. 10 years, 40 weeks per year, 40 h per week, 10 movements per hour).

5.2.6.2 Each shaft shall possess a minimum safety factor of 2,0 against the appropriate endurance limit, taking into account all notch effects.

5.3 Base frame

5.3.1 The base frame shall be designed to accommodate all forces acting on it generated by the hoist and be able to transfer them onto the supporting surface.

5.3.2 Devices to transfer the forces onto the supporting surface shall not rely on any spring supported or pneumatic wheels.

5.3.3 Where adjustable means are provided to transfer the forces into the ground, the feet shall be free to pivot in all planes to an angle of at least 15° from the horizontal in order to prevent bending stresses in the structure. If the foot does not pivot, the worst resulting bending stress shall be taken into account.

5.4 Mast, ties and buffers

5.4.1 Guide structures and masts

5.4.1.1 The guides can be part of the mast or can be an expanding linkage mechanism. Guides shall be rigid; flexible elements such as wire ropes or chains shall not be used**.**

The deflection of any part of the mast or cage shall be limited such that no collision (e.g. with the landings) can occur.

5.4.1.2 Guides or masts shall be so designed that they can withstand all load cases as stipulated in 5.2.

5.4.1.3 Connections between individual lengths of mast or guides or link arms shall provide effective load transfer and maintain alignment. Loosening shall only be possible by an intentional manual action.

5.4.1.4 Pivot points in the expanding linkage mechanism shall be designed to facilitate external examination.

5.4.1.5 Attachments of drive elements (e.g. rack) to the guide/mast shall ensure that the drive element is kept in correct position so that the stipulated loads can be transferred to the mast and that the fixings are ensured from coming loose, e.g. use of a lock nut.

5.4.2 Mast ties

The ties shall withstand the load cases according to 5.2. Special attention shall be paid to forces generated during erection and dismantling.

5.4.3 Buffers

5.4.3.1 The travel of the cage and any counterweight shall be limited at the bottom of their travel by buffers.

5.4.3.2 The average retardation of the cage during action of the buffers shall not exceed 1 g, with no peak exceeding 2,5 g for more than 0,04 seconds (see 5.2.2.15). This shall not be exceeded for:

a) rated load in the cage and at a speed equal to rated speed plus 0,2 m/s or

b) rated load in the cage and at a speed equal to the rates speed plus 0,4 m/s for:

1) non rack and pinion drive systems or

2) a rack and pinion drive system with a single brake, or

3) for a cage that is disengaged from the drive machinery.

5.4.3.3 Oil buffers shall be provided with a means for checking the oil level. An electrical safety switch shall monitor the stroke of the oil buffer so that the cage cannot be driven by the normal operating means if the buffer is depressed.

5.5 Hoistway protection and landing access

5.5.1 General

A hoist, when installed for use, shall have:

— base enclosure;

— hoistway protection;

— landing gates at every point of access.

These shall prevent persons from being struck by moving parts, and from falling down the hoistway. The design of these elements is dealt with in this subclause 5.5. Instructions for the correct application of the elements are contained in the user information Clause 7, and unit verification is dealt with in Clause 6.

5.5.2 Hoist base enclosure

5.5.2.1 The hoist base enclosure shall protect all sides to a height of at least 2,0 m and shall conform to 5.5.4 and EN ISO 13857:2008, Table 1.

5.5.2.2 Any moving counterweight shall be positioned within the hoist base enclosure.

5.5.2.3 When, for maintenance purposes, the base enclosure is accessed by the base enclosure gate, this shall be openable from the inside.

5.5.3 Landing access

5.5.3.1 The hoist shall be provided with landing gates in the hoistway protection at every point of entry including the base enclosure.

5.5.3.2 Landing gates shall not open towards the hoistway.

5.5.3.3 The landing gates shall comply with the requirements in 5.5.4. Where the gate is made from imperforate material, the user shall be able to know that the cage is at the landing (see 5.6.1.5.1.2).

5.5.3.4 Horizontal and vertical sliding gates shall be guided, and their movement shall be limited by mechanical stops.

5.5.3.5 Vertical sliding gate panels shall be supported by at least two independent suspension elements. Flexible suspension elements shall possess a safety factor of at least 6 against their minimum breaking strength. Means shall be provided for retaining them in their pulleys or sprockets.

Pulleys used in connection with vertical sliding gates shall have a diameter of at least 15 times the rope diameter. Wire ropes shall be terminated according to 5.7.3.2.1.6.

Any counterweight used in connection with a gate shall be guided and shall be prevented from running off the guides even in the event of failure of its suspension.

The difference in weight between door leaf and any counterweight(s) shall not exceed 5,0 kg.

Means shall be provided to prevent crushing of fingers between gate panels.

5.5.3.6 Where power operated landing gates are provided, their operation and control shall be in conformity with 7.5.2 of EN 81-1:1998+A3:2009. Environmental effects of rain, ice, etc. shall be taken into account.

5.5.3.7 Landing gates shall not be opened or shut by a device which is mechanically or with other means operated by movement of the cage.

5.5.3.8 Full height gates (see Figure 5)

5.5.3.8.1 The height of the clear opening in the landing gate frame shall be not less than 2,0 m above the landing threshold. As an exceptional case, when the clear access height into the building is less than 2,0 m, then a reduced height landing gate framework is permitted, but in no case shall the height of the clear opening be less than 1,8 m above the landing threshold.

5.5.3.8.2 Means shall be provided to automatically reduce any horizontal distance between the sill of the cage and the sill of the landing, as well as any openings between the cage and the landing access side protection to not more than 150 mm before access can be achieved between the cage and the landing.

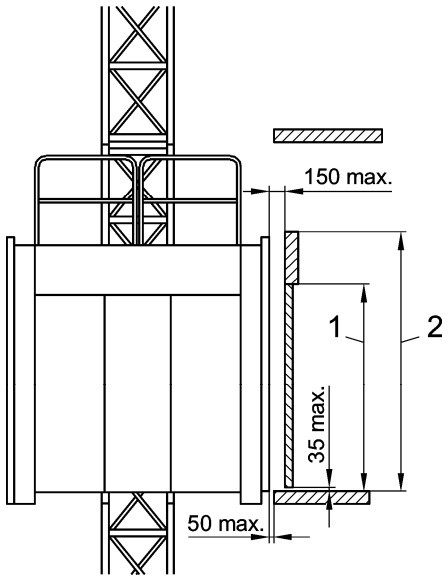
5.5.3.8.3 The horizontal distance between the sill of the cage and the sill of the landing shall not exceed 50 mm during loading and unloading.

5.5.3.8.4 The horizontal distance between the closed cage gate and the closed landing gates or the access distance between the gates during the whole of their normal operation shall not exceed 200 mm.

5.5.3.8.5 When closed, the landing gates shall fill the hoistway openings.

5.5.3.8.6 Any clearances around the edges of each gate or between gate sections shall conform to EN ISO 13857:2008, Table 4 except for under the gate where the clearance shall not exceed 35 mm.

Dimensions in millimetres



Key

1 door min. 2 m

2 protection min. 2,5 m

Figure 5 — One example of a full height landing gate

5.5.3.9 Reduced height gates (see Figure 6 and Figure 7)

Except for the base enclosure a reduced height gate is permissible and 5.5.3.8 does not apply provided that the following measures are fulfilled:

5.5.3.9.1 The gate is between 1,1 m and 1,2 m in height.

5.5.3.9.2 The safety distance (A, see Figures 6 and 7) between the landing side of the top of the gate and any travelling part of the hoist in normal operation is not less than 0,85 m, if the rated speed exceeds 0,7 m/s) or 0,5 m if the rated speed is not more than 0,7 m/s. The safety distance (B, see Figures 6 and 7) between the hoistway side of the top of the gate and any travelling part of the hoist in normal operation is not less than 0,75 m, if the rated speed exceeds 0,7 m/s or 0,4 m if the rated speed is not more than 0,7 m/s.

5.5.3.9.3 The gate covers the full width of the opening and at least consists of a guard rail and an intermediate bar at half height. A toe board having a height of at least 150 mm above the floor, with a clearance to the floor of a maximum of 35 mm shall be provided. If, below the top guard rails at 1,1 – 1,2 m height, any parts of the gate facing the landing are less than 0,5 m from the travelling part of the hoist, any opening in the gate shall be protected with material which does not allow the passage of a 50 mm sphere.

5.5.3.9.4 The outside edge of the closed landing gate facing the hoist is no more than 200 mm from the landing threshold.

5.5.3.9.5 Landing access side protection is provided to a height of between 1,1 and 1,2 m with an intermediate bar at half height and a toe board of at least 150 mm above the floor.

5.5.3.9.6 Means are provided to automatically reduce any horizontal distance between the sill of the cage and the sill of the landing as well as any openings between the cage and the landing access side protection to not more than 150 mm before the landing gate is opened and at all times while it is open with the cage at the landing.

5.5.3.9.7 If the side protection is part of the landing and remains in the safety distance of 0,85 m or 0,5 m during the vertical movement of the platform, then the minimum opening between the cage and the side protection shall be 100 mm.

5.5.3.9.8 Means are provided to reduce any horizontal distance between the sill of the cage and the sill of the landing to not more than 50 mm during loading and unloading.

Dimensions in millimetres

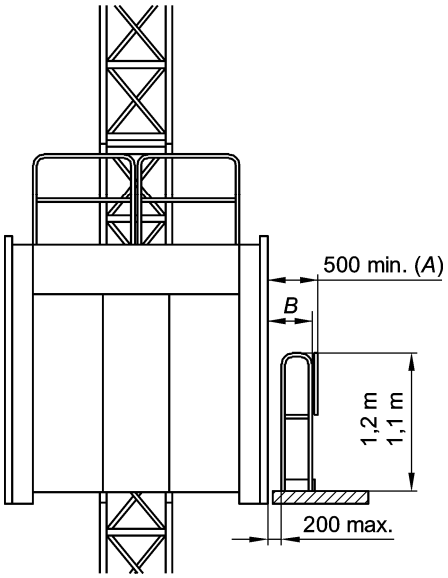


Figure 6 — One example of a reduced height gate with minimum 500 mm safety distance (A)

Dimensions in millimetres

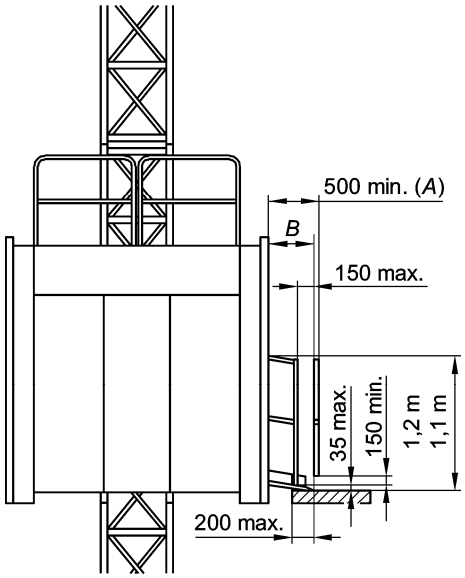


Figure 7 — One example of a low height gate with minimum 500 mm safety distance (A) and ramp on the cage to fill the gap

5.5.4 Materials for enclosure and guarding

5.5.4.1 The full height landing gates shall possess mechanical strength such that in the locked position and when a force of 300 N is applied at right angles to the gate at any point on either face, the force being applied using a rigid square or round flat face of 5.000 mm^2, they shall

— resist without permanent deformation;

— resist without elastic deformation greater than 30 mm;

— operate satisfactorily after such a test.

When a force of 600 N is applied at right angles to the gate at any point on either face, the force being applied using a rigid square or round flat face of 5.000 mm², it may fail the above criteria but shall remain secure.

5.5.4.2 The reduced height landing gates in accordance with 5.5.3.9 shall possess mechanical strength such that when a force of 1 kN is vertically applied at any point along the top of the gate, and separately when a force of 300 N is horizontally applied at any point along the top bar, the intermediate bar and the toe board, they shall:

— resist without permanent deformation;

— operate satisfactorily after such a test.

5.5.4.3 The hoistway protection shall withstand the same force and achieve the same resistance as given in 5.5.4.1 and 5.5.4.2.

5.5.4.4 The size of any perforation or opening in the hoistway protection and gates, when closed, related to the clearances from adjacent moving parts shall be in accordance with EN ISO 13857:2008, Table 4, except where the distance between the hoistway protection and gates and any travelling part of the hoist in normal operation is not less than 0,85 m, if the rated speed exceeds 0,7 m/s or 0,5 m if the rated speed is not more than 0,7 m/s.

5.5.5 Landing gate locking devices

5.5.5.1 Landing gates in accordance with 5.5.3.8 (full height gates)

It shall not be possible under normal operating conditions:

— to open any landing gate unless the cage floor is within ± 0,15 m of that particular landing;

— to start or keep in motion the cage unless all landing gates are in a closed position.

If the maximum stopping distance of the cage with rated load from rated speed is more than 0,25 m then:

— it shall not be possible to open any landing gate unless the cage has stopped within ± 0,25 m of that particular landing, and

— it shall not be possible under normal operating conditions to start or keep in motion the cage unless all landing gates are in a closed and locked position.

Emergency unlocking. Each of the landing gates shall be capable of being unlocked form the landing side with the aid of an unlocking key in accordance with EN 81-1:1998+A3:2009, Annex B.

5.5.5.2 Landing gates in accordance with 5.5.3.9 (reduced height gates)

The landing gates shall be provided with an interlocking device controlling their closed and locked position. This action shall be controlled by the position of the cage entrance. It should not be possible to interfere with this interlocking device by simple means.

It shall not be possible under normal operating conditions to start or keep in motion the cage unless all landing gates are closed and locked.

5.5.5.3 Design

5.5.5.3.1 The electrical contacts in gate locking devices shall be safety contacts. See 5.8.6.

5.5.5.3.2 All gate locking devices fitted to full height gates in accordance to 5.5.3.8, together with any associated actuating mechanism and electrical contacts, shall be so situated or protected as to be accessible only to competent persons from the landing.

5.5.5.3.3 All gate locking devices fitted to reduced height gates in accordance to 5.5.3.9 shall be so built that their electric safety devices cannot be rendered inoperative without the use of tools.

5.5.5.3.4 All gate locking devices shall be fitted securely and the fixings shall be restrained against working loose.

5.5.5.3.5 All gate locking devices and fixings shall be capable of resisting a force of 1 kN at the level of the lock in the opening direction of the gate.

5.5.5.3.6 Gate locking devices shall be designed to permit servicing. Mechanical parts which are not tolerant of dust or water shall be protected to a minimum of IP 44 (EN 60529:1991).

5.5.5.3.7 The removal of any detachable cover shall not disturb any of the lock mechanism or the wiring. All detachable covers shall be retained by captive fastenings.

5.5.5.3.8 The locking element shall be held in the locked position by springs or weights. Where springs are used, they shall be of the compression type and shall be guided. The failure of a spring shall not render a lock unsafe.

5.5.5.3.9 The cage shall not be able to be kept in motion unless all locking elements are engaged by not less than 7 mm.

5.5.5.3.10 The electrical contacts in gate locking devices shall prevent travel of the cage if the gap produced when opening any full height landing gate in accordance with 5.5.3.8 is in excess of that permitted by 5.5.3.8.6.

5.5.5.3.11 In the case of flap type gate locking devices the flaps shall overlap the gate leaves with the gates closed, over the entire width, by an amount sufficient to prevent the gate from opening when maintained as intended by the manufacturer.

5.5.6 Clearances

5.5.6.1 General

All safety distances, where not already stated in this standard, shall comply with EN ISO 13857. All gaps shall comply with EN 349.

5.5.6.2 Clearances beneath the cage

In order to provide safe access beneath the cage for maintenance purposes, means shall be provided to create a minimum vertical clearance (e.g. a moveable prop or equivalent) of at least 1,8 m. The clearance shall extend under the entire area of the cage. It shall be possible to erect and dismantle the means provided without any person having to be beneath the cage.

5.6 Cage

5.6.1 General requirements

5.6.1.1 General

The cage shall take the form of a fully enclosed cage.

For prescribing the maximum number of persons permitted in the cage, a cage floor area of 0,2 m² per person shall be used; each person shall be considered to weigh 80 kg.

The cage structure shall be calculated according to 5.2.

The cage shall have rigid guiding to prevent disengagement or jamming.

The cage shall be provided with effective devices which retain the cage to the cage guides in the event of the normal guide shoes or rollers failing.

The cage shall be provided with mechanical means to prevent it from running off the guides. These means shall be in work as well during normal operation as during erection, dismantling and maintenance.

The cage shall be provided with effective means to both detect an unsecured mast section and prevent the cage from driving onto this section or to ensure the cage cannot become detached from the secured mast section.

5.6.1.2 Cage floor

The floor shall be designed to withstand the forces according to 5.2.2.11, be slip resistant (e.g. chequer plate) and be free draining.

5.6.1.3 Cage walls

The cage shall have walls extended to full height between the floor and the roof and shall conform to 5.5.4.1.

The walls shall as regards perforation meet the requirements in EN ISO 13857:2008, Table 4, but the openings shall not allow the passage of a 25 mm sphere.

Any hazardous projection shall be marked according to ISO 3864-1.

5.6.1.4 Cage roof

5.6.1.4.1 The cage shall be roofed.

5.6.1.4.2 The minimum interior free height shall be 2,0 m.

5.6.1.4.3 For the transportation of long materials a maximum opening of 0,15 m² in the roof may be provided if it is assured that materials do not protrude outside the hoistway. The opening shall be provided with a hatch.

5.6.1.4.4 If the roof is used for erection, dismantling, maintenance or inspection of the hoist itself or is provided with an emergency trapdoor it shall be slip resistant and protected with a guard-rail.

This guard rail shall consist of an upper rail not less than 1,1 m above the roof, an intermediate rail at half height and a toeboard not less than 150 mm. The guard rail shall enclose such part of the cage roof, that erection, maintenance or inspection may be carried out in a safe manner. The guard rail shall not be placed more than 200 mm (horizontally) inside the edge of the roof.

5.6.1.4.5 If any moving part of another hoist cage or counterweight can be within 0,3 m of the inside edge of the guard rail, an additional guard shall be provided which shall provide protection of at least 2 m high and extend the width of the part to be guarded and an additional 0,1 m to each side.

5.6.1.4.6 The roof structure shall be calculated according to 5.2.2.9 and 5.2.2.10.

5.6.1.4.7 If the roof is perforated, the openings shall not allow the passage of a 25 mm sphere.

5.6.1.5 Cage gate

5.6.1.5.1 Manually operated gates

5.6.1.5.1.1 The gate opening shall have a clear height of at least 2,0 m and a clear width of at least 0,6 m.

The gate shall fully cover the opening.

As regards perforations, the gates shall meet the requirements in EN ISO 13857, but the openings shall not allow the passage of a 25 mm sphere.

5.6.1.5.1.2 Imperforate gates, when fitted shall be provided with a vision panel. This vision panel shall have an area of at least 250 cm² which is sized and located so that it is possible to see the sill of the landing.

5.6.1.5.1.3 The design of gates shall be in conformity with 5.5.3.3 to 5.5.3.7 as well as 5.5.3.8.6.

5.6.1.5.1.4 The gates shall be fitted with mechanical locks such that, under operating conditions it shall not be possible to open any cage gate unless the cage floor is within the distance of a landing described in 5.5.5.1.

5.6.1.5.1.5 It shall not be possible under operating conditions to start and keep in motion the cage unless all cage gates are in the closed position.

5.6.1.5.1.6 The cage gates shall be capable of withstanding a force of 300 N applied normally at any position without permanent deformation and without the gates being sprung from their guides. The elastic deformation shall not be more than 30 mm. The 300 N thrust shall be applied by a rigid square or round flat face of 5.000 mm².

5.6.1.5.1.7 Means shall be provided to reduce any horizontal distance between the sill of the cage and the sill of the landing as well as any openings between the cage and the landing access side protection to not more than 150 mm before the cage gate can be opened unless this is achieved by the action of opening the gate.

5.6.1.5.1.8 All mechanical and electrical safety devices associated with the cage entrances shall be designed as described in 5.5.5.3.1 and 5.5.5.3.4 to 5.5.5.3.11.

5.6.1.5.1.9 The cage gate locking device, together with any associated actuating mechanism and electrical contacts, shall be so situated or protected as to be inaccessible to unauthorised persons from within the cage with all the cage gates closed.

5.6.1.5.2 Power operated gates

If the cage door is power operated, the power operation system shall conform to applicable parts of EN 81-1:1998+A3:2009, Clause 8. Environmental effects of rain, ice, etc. shall be taken into account.

5.6.1.6 Emergency escape

5.6.1.6.1 Assistance to passengers in the cage shall always come from the outside, being provided in particular by the emergency operation mentioned in 5.10.

5.6.1.6.2 There shall be at least one gate or trapdoor in the cage which offers a means of escape in emergency, which is openable from the outside of the cage without a key and from the inside of the cage with a special key. This means of escape can be the cage gate, the cage roof trapdoor or an emergency escape door.

5.6.1.6.3 The locking of any emergency escape door shall be proved by electrical safety devices in conformity with 5.8.6 This device shall cause the hoist to stop if the locking ceases to be effective. Restoring the hoist to service shall only be possible after deliberate relocking.

5.6.1.6.4 The closure of any trap door in the roof shall be proved by an electrical safety device in conformity with 5.8.6. This device shall cause the hoist to stop if the closure ceases to be effective.

5.6.1.6.5 Any emergency escape door in the wall shall be at least 0,4 x 1,4 m and shall open inward or slide or by other means give safe access to the mast or the structure.

5.6.1.6.6 Any trapdoor in the roof shall be at least 0,4 x 0,6 m and shall not open inward. A ladder, giving access to such a trapdoor, shall be permanently available inside the cage.

5.6.2 Safety devices against falling of the cage

5.6.2.1 General

An overspeed safety devices, activated in the case of overspeed, shall be provided to prevent the cage from falling.

5.6.2.2 The safety device shall be operational at all times, including erection, dismantling and during resetting after being triggered. No regular drive components with the exception of the rack shall be used for the overspeed safety device.

5.6.2.3 The safety device shall be able to stop and maintain stopped the cage with 1,3 times the rated load. The safety device shall be calculated according to 5.2, especially to 5.2.2.8.

Safety device retardation with any load in the cage up to the rated load shall be between 0,05 g and 1,0 g with no peak exceeding 2,5 g for more than 0,04 s. These values may be exceeded if the safety device triggers before the resetting operation is completed.

5.6.2.4 Movement of the cage by means of the normal controls shall be automatically prevented by an electric safety device to 5.8.6 as soon as the overspeed safety device is triggered.

5.6.2.5 The method for release of the safety device shall require the intervention of a competent person in order to return the hoist to normal operation.

5.6.2.6 Tests of overspeed and safety device shall be made at an adequate safety distance from the cage using a dedicated device connected to a permanent installed connector."

5.6.2.7 Every cage not directly supported by jacks shall be provided with a safety device attached to the cage frame and triggered directly by the overspeed of the cage.

5.6.2.8 Unauthorised adjusting of the triggering speed of a governor shall be prevented e.g., with a seal.

5.6.2.9 Pulleys for overspeed governors shall be mounted independently of any shaft that carries the suspension rope pulleys.

5.6.2.10 An overspeed safety device shall not be triggered by any device which operates electrically or pneumatically.

5.6.2.11 Under all conditions of loading excluding overload, when the safety device(s) operates, the floor of the cage shall not incline by more than 5 % from its normal position and shall recover without permanent deformation.

5.6.2.12 The triggering speed of the safety device shall not exceed the hoists rated speed by more than 0,4 m/s.

5.6.2.13 Provision shall be made to prevent the safety device from becoming inoperative due to the accumulation of extraneous materials or to atmospheric conditions.

5.6.2.14 Wire ropes and wire rope attachments, etc., for overspeed governors, shall be dimensioned and designed as laid down in 5.7.3.2.1.

A wire rope to a governor shall, during the assembly of the hoist, be supported directly by the hoist mast.

The force exerted by the overspeed governor when triggered shall be at least the greater of the following two values:

— either 300 N

— or twice that necessary to engage the safety device.

5.6.2.15 A safety device designed to grip more than one guide shall operate on all guides simultaneously.

In safety devices where the braking action is achieved by means of springs, the failure of any spring shall not lead to a dangerous malfunction of the safety device.

5.6.3 Overload detection device

5.6.3.1 An overload detection device shall be provided, which gives a clear signal in the cage and prevents normal starting, in the event of overload in the cage. The overload is considered to occur when the rated load is exceeded by 20 %.

This European Standard specifies a method of detecting overload, but does not require the provision of a load-moment detecting device as moment is covered by the stability and stress calculations (5.2) in conjunction with the overload detecting device.

There shall be no provision for the user to cancel the warning.

Overload detection shall be carried out at least whilst the cage is stationary.

5.6.3.2 The design and installation of overload indicators and detectors shall take into account the need to test the hoist with overloads without dismantling and without affecting the performance of the indicator or detector.

5.6.3.3 If interruption of the power occurs, all data and calibration of the overload detection device shall be retained.

5.6.3.4 Devices shall be protected to prevent damage from shock, vibration and the general use of hoists including erection, operation, dismantling and maintenance as well as environmental influences as intended by the manufacturer.

5.7 Drive unit

5.7.1 General provisions

5.7.1.1 Each hoist shall have at least one drive unit of its own.

5.7.1.2 Each drive system shall be calculated according to 5.2 including the specific requirements given in 5.2.6.

5.7.1.3 The drive motor shall be coupled to the drum, or drive pinion, by a positive drive system which cannot be disengaged.

5.7.1.4 The cage shall during normal operation, be raised and lowered under power at all times.

5.7.1.5 For all hoists, the speed of the empty cage upwards or of the cage with rated load downwards shall not exceed the rated speed by more than 15 % under normal operating conditions.

5.7.2 Protection and accessibility

5.7.2.1 During normal operation, where the safety distance to parts of the driving machinery and associated equipment is less than 0,50 m, then the machinery and equipment shall be protected in accordance with EN 953. The safety distances of EN 349 and EN ISO 13857 apply.

5.7.2.2 Fixed guarding shall be provided to prevent the entry of any material that might cause damage to any part of the drive system, e.g. gravel, rain, snow, ice, mortar and dust.

5.7.2.3 Effective guards shall be provided for gear wheels, belts and chains, revolving shafts, flywheels, guide rollers, couplings and similar rotating parts unless those parts are made safe by design or by position and be designed to permit easy access for routine inspection and maintenance work.

The size of any perforation or opening in the guard when closed related to the clearances from adjacent moving parts shall be in accordance with EN ISO 13857.

5.7.3 Suspension system

5.7.3.1 Rack and pinion drive

5.7.3.1.1 General

5.7.3.1.1.1 Drive pinions and overspeed safety device pinions shall be positively fastened to their shafts. Methods involving friction and clamping shall not be used.

5.7.3.1.1.2 The safety device pinion shall be situated lower than the drive pinions.

5.7.3.1.1.3 The racks shall be securely attached. Joints in the rack shall be accurately aligned to avoid faulty meshing or damage to teeth.

5.7.3.1.1.4 Steps shall be taken to prevent the penetration of foreign bodies between each drive or safety pinion and the geared rack.

5.7.3.1.1.5 For other gear drives such as pin racks the same provisions as given in 5.7.3.1.1 to 5.7.3.1.4 shall be used and the same safety factors shall be ensured.

5.7.3.1.2 Design

5.7.3.1.2.1 Pinion

Each pinion shall be designed according to ISO 6336-1, ISO 6336-2, ISO 6336-3 and ISO 6336-5 with regard to tooth strength and pitting and shall take into account the requirements of 5.2.6.

Each pinion shall possess a minimum safety factor of 2,0 against the endurance limit for tooth strength, taking into account the maximum wear as stated in the manufacturer's instruction handbook.

Each pinion shall possess a minimum safety factor of 1,4 against the endurance limit for pitting.

5.7.3.1.2.2 Rack

The rack shall be made of material having properties matching those of the pinion in terms of wear and shall be designed according to ISO 6336-1, ISO 6336-2, ISO 6336-3 and ISO 6336-5, with regard to tooth strength and pitting, and shall take into account the requirements of 5.2.6.

The rack shall possess a minimum safety factor of 2,0 against the static limit for tooth strength, taking into account the maximum wear as stated in the manufacturer's instruction handbook.

5.7.3.1.2.3 Load distribution

When there is more than one drive pinion in mesh with the rack, then either a self adjusting means shall be provided to effectively share the loading on each drive pinion or the drive system shall be so designed as to accommodate all normal conditions of load distribution between the pinions.

5.7.3.1.3 Modules

The rack and pinion tooth module shall be not less than:

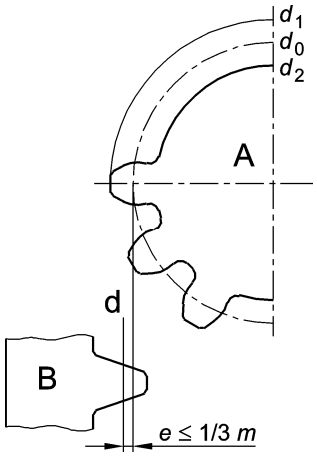
- four (4) for drive systems where the counter roller or other mesh control feature reacts directly on the rack without the interposition of any other mast profiles;
- six (6) where the reaction of the counter roller or other mesh control feature is by means of another element of the mast which is then in immediate contact with the rack.

5.7.3.1.4 Rack and pinion engagement

5.7.3.1.4.1 Means shall be provided to maintain the rack and all the driving and safety device pinions in correct mesh under every load condition. Such means shall not rely solely upon the cage guide rollers or shoes.

The correct mesh shall be when the pitch circle diameter of the pinion is coincident with, or not more than 1/3 of the module out beyond, the pitch line of the rack (see Figure 8).

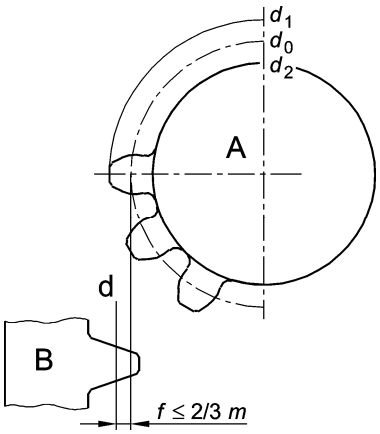
5.7.3.1.4.2 Further means shall be provided to ensure that in the event of failure of the means provided in 5.7.3.1.4.1 the pitch circle diameter of the pinion shall never be more than 2/3 of the module out beyond the pitch line of the rack (see Figure 9).



Key

A pinion
B rack
d_1 outside diameter of pinion
d_0 pitch diameter of pinion
d_2 base diameter of pinion
d pitch line of rack
e 1/3 module max.

Figure 8 — Correct mesh of pinion tooth



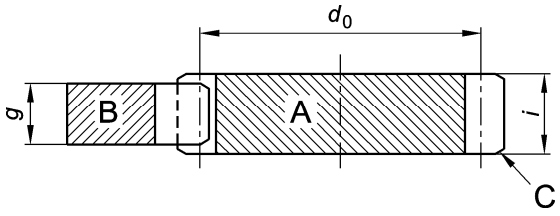
Key

A pinion
B rack
d_1 outside diameter of pinion
d_0 pitch diameter of pinion
d_2 base diameter of pinion
d pitch line of rack
f 2/3 module max.

Figure 9 — Minimum mesh of pinion tooth

5.7.3.1.4.3 Means shall be provided to ensure that the calculated width of engagement of the rack and the pinion is maintained (see Figure 10).

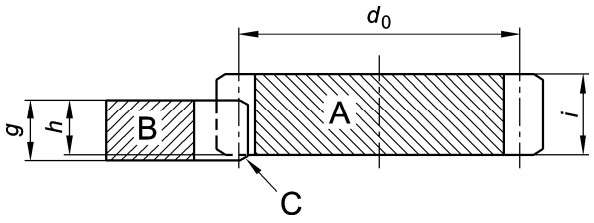
5.7.3.1.4.4 Further means shall be provided to ensure that in the event of failure of the means specified in 5.7.3.1.4.3 not less than 90 % of the calculated width of engagement of the rack and the pinion will remain (see Figure 11).



Key

A pinion
B rack
C chamfer
d_0 pitch diameter of pinion
g rack width
i pinion tooth of full form

Figure 10 — Correct engagement of tooth



Key

A pinion
B rack
C chamfer
d_0 pitch diameter of pinion
g rack width
h 90 % of rack width
i pinion tooth of full form

Figure 11 — Minimum engagement of tooth

5.7.3.2 Wire rope suspension for cage and counterweight

5.7.3.2.1 Wire rope requirements

5.7.3.2.1.1 The wire ropes shall be steel wire ropes.

5.7.3.2.1.2 Not less than two wire ropes, independent of one another, shall be used for suspension. Where reeving is used the number to take into account is that of wire ropes and not the falls.

An automatic device for equalising the tension of suspension wire ropes shall be provided. Any spring shall work in compression.

In case of abnormal extension or breakage of one wire rope, an electric safety device shall cause the hoist to stop (see 5.8.3).

5.7.3.2.1.3 The nominal diameter of the wire ropes shall be at least 8 mm.

5.7.3.2.1.4 The characteristics of the wire rope shall at least correspond to those specified in ISO 2408.

5.7.3.2.1.5 The safety factor of suspension wire ropes shall be at least:

— 12 in the case of drum drive;

— 6 in the suspension of counterweights.

The safety factor is the ratio between the minimum breaking load of one wire rope and the maximum static force in this wire rope.

5.7.3.2.1.6 The strength of the wire rope terminations shall be not less than 80 % of the minimum breaking load of the wire ropes. In the case of the termination on the drum of a drum drive hoist, up to two dead turns may be taken into account.

Wire ropes shall be terminated using a secure method such as:

— a metal or resinfilled socket;

— an eye splice with thimble;

— a ferrule secured eye terminal with thimble;

— a wedge anchor;

— a bridge clamp with dead turns for a drum termination.

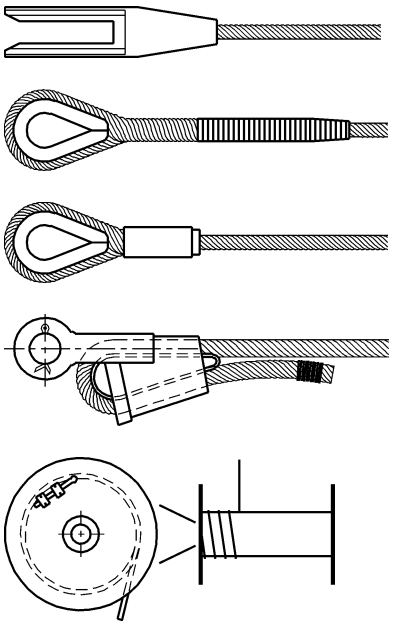


Figure 12 — Wire rope terminations

Terminations which may damage the rope like U-Bolt wire rope grips shall not be used for this purpose.

5.7.3.2.1.7 Wire ropes shall be galvanised or be coated with suitable protective compound to prevent corrosion.

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

5.7.3.2.1.9 Wire rope storage

For the wire rope storage the following requirements shall be fulfilled:

— Surplus wire rope required for subsequent extensions to the hoist, which is stored under tension, shall be anchored and stored on a wire rope drum having helical grooves. The ratio between the pitch diameter of this drum and the nominal diameter of the wire rope shall be at least 15.

— Multi-layering of wire rope is permissible and ungrooved drums may be used if the stored wire rope is not under tension. Devices for relieving the tension in stored wire rope shall not subject the wire rope to bending of less than 15 times the wire rope diameter. Wire rope clamps, which do not cause damage to the wire rope may be used when the wire rope tension in front of the clamping point is relieved by at least three turns around a non-rotating drum with a pitch diameter of not less than 15 times the wire rope diameter.

— The drum shall be fitted with flanges at each end which project beyond the upper layer of wire rope by at least two wire rope diameters.

5.7.3.2.2 Pulley requirements

For the pulleys the following requirements shall be fulfilled:

— the grooves shall be circular with a radius not more than 7,5 % and not less than 5 % in excess of half the nominal diameter of the wire rope. The depth shall be not less than 1,5 times the nominal diameter of the wire rope;

— pulleys having wire ropes leading upwards shall be protected against the penetration of foreign bodies;

— effective precautions shall be taken to avoid wire ropes leaving their grooves;

— the angle of fleet between the wire rope and a plane normal to the axis of a pulley shall not exceed 2,5°.

5.7.3.2.3 Drum drive requirements

The wire ropes may only be wound in one layer, unless an automatic wire rope spooling system is used, in which case two layers are permitted.

At least two dead turns of wire rope shall always remain on the drum.

The drum shall be fitted with flanges at each end which project beyond the upper layer of wire rope by at least two wire rope diameter.

The drum shall be grooved.

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

Wire rope grooves shall comply with the following requirements:

— the contour of the groove shall be circular over an arc of not less than 120° and have a radius of not more than 7,5 % and not less than 5 % in excess of half the nominal diameter of the wire rope;

— the depth of the groove shall not be less than one third of the nominal diameter of the wire rope;

— the pitch of the grooves shall be such that the centre distance between wire rope windings shall be at least 1,15 x diameter of the wire rope.

Jacks under compressive stress shall be calculated for crippling according to general technical rules. When calculating, the load shall consist of 1,4 times the sum of the rated load, theanism. If the slenderness ratio exceeds 250, then a minimum safety factor of 3,0 shall be used.

5.7.4 Braking system

5.7.4.1 Every hoist shall be provided with a braking system which operates automatically:

— in the event of loss of the main power supply;

— in the event of loss of the supply to electric control circuits.

5.7.4.2 The braking system shall have at least one electro-mechanical brake (friction type), but may, in addition, have other braking means (e.g. electric).

5.7.4.3 Band brakes shall not be used.

5.7.4.4 The components on which the brake operates shall be positively coupled to the drum or drive pinion. Belts and chains shall not be used.

5.7.4.5 The brake(s) on its own shall be capable of stopping the cage from rated speed in down direction with 1,25 times the rated load. In addition the brakes on their own shall be capable of stopping the cage when travelling at the triggering speed of the overspeed governor with the rated load. Under all conditions the retardation of the cage shall not exceed 1,0 g.

5.7.4.6 Every spring of the brake(s) which takes part in the application of the braking action on the drum or disc shall be designed and installed in such a way that if a failure in one of the springs occurs, sufficient braking effort to slow down the cage, when containing rated load, would continue to be exercised.

5.7.4.7 The action of the brake shall be exerted by compression springs. The springs shall be adequately supported and shall not be stressed in excess of 80 % of the torsional elastic limit of the material.

5.7.4.8 In normal operation, a continuous supply of current shall be required to hold off the brake.

In the case of an electro-mechanical brake the interruption of the current shall be effected by at least two independent electrical devices, whether or not integral with those that cause the interruption of the current feeding the hoist machine.

If, when the hoist is stationary, one of the devices has not cut off the supply to the brake, further movement shall be prevented at the latest at the next change in the direction of motion.

5.7.4.9 Braking shall become effective without delay after opening of the brake release supply (the use of a diode or capacitor connected directly to the terminals of the brake coil is not considered as a means of delay).

5.7.4.10 Brakes shall be provided with means of adjustment to account for the wear of the friction surfaces.

5.7.4.11 The brake shall be protected at least to IP 23 (EN 60529:1991).

5.7.4.12 Every brake shall be capable of being released by hand and shall require a constant effort to keep the brake open.

5.7.5 Counterweight

5.7.5.1 The cage shall not be used to counterbalance another cage.

5.7.5.2 Counterweights shall be guided by suitable shoes or rollers situated near the upper and lower extremities of their frames.

5.7.5.3 If the counterweights incorporate filler weights, necessary measures shall be taken to prevent their displacement.

A notice shall be displayed stating the total mass of the counterweight required and each individual filler shall have its own mass marked on it.

5.7.5.4 The counterweight shall be in a warning colour to ISO 3864-1.

5.7.5.5 If the manufacturer permits the hoist to be used such that the counterweight is above an accessible space, then the design of the counterweight shall incorporate provision for an overspeed safety device.

5.8 Electric installations and appliances

5.8.1 General

Electrical installations and appliances shall comply with EN 60204-1 which applies in full.

Additionally, for the electronic parts, the ambient temperature for use as stated by the manufacturer shall be taken into account. Where the ambient temperature limits set in EN 60204-1 are exceeded, the appropriate means, such as heating or cooling, shall be used.

5.8.2 Protection against electric faults

5.8.2.1 Any one of the following faults envisaged in the electric equipment of a hoist shall not, on its own, be the cause of dangerous malfunction of the hoist.

Faults envisaged:

a) absence and loss of voltage;

b) voltage drop of at least 20%;

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

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

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

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

g) non-opening of a contact;

h) non-closing of a contact.

5.8.2.2 The non opening of a contact do not need to be considered in the case of safety contacts conforming to the requirements of EN 60947-5-1:2004, Clause 3.

5.8.2.3 In the event of a phase reversal or failure of one phase of the supply it shall not be possible to start the machine.

5.8.2.4 In the event of a failure of one phase of the supply to the directional control device, the machine shall stop, or at least shall not reach the tripping speed of the overspeed governor.

5.8.2.5 The control circuit shall be designed in order to avoid a dangerous situation resulting from the hoist motor acting as a generator.

5.8.2.6 The earthing to the metalwork or the earthing of a circuit in which there is an electric safety device shall immediately stop the machine. The return to normal operation shall only be possible by a competent person.

5.8.3 Protection against the effects of external influences

Any electrical apparatus shall be protected from the harmful or hazardous effects of external influences and falling objects (e.g. rain, snow, mortar, dust). The degree of protection (see EN 60529:1991) shall be at least IP 65 for portable control devices, IP 53 for control cabinets, switches and the electrical components of the brake, and IP 44 for motors.

5.8.4 Electric wiring

All cables and wiring for the hoist shall be located and installed to provide protection from mechanical damage. Special attention shall be paid to electric cables which hang from the cage with regard to cable strength and the effects of climate.

In order to prevent incorrect insertion, plug and socket devices with mechanical coding or equivalent according to EN 60204-1:2006, 13.4.5 shall be used.

5.8.5 Contactors, relay-contactors

The main contactors for AC or DC motors shall respectively belong to the utilisation category of at least AC-3 or DC-3 according to EN 60947-4-1:2001.

Relay contactors used to operate the main contactors shall at least belong to utilisation categories AC-15 for controlling AC electromagnets and DC-13 for controlling DC electromagnets according to EN 60947-5-1:2004.

Both for the main and the relay contactors it may be assumed that, in the course of the measures taken to comply with 5.8.2.1:

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

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

5.8.6 Electric safety devices

5.8.6.1 During operation of one of the electric safety devices listed in Annex B, movement of the machine shall be prevented or it shall be caused to stop immediately according to a Category 0 stop function given in EN 60204-1:2006. The electric safety devices shall consist of either:

— one or more safety contacts satisfying 5.8.7directly cutting the supply to the contactors referred to in 5.9.6.1; or,

— be a safety circuit, according to EN 81-1:1998+A3:2009, 14.1.2.3 being part of a safety chain.

5.8.6.2 No electric equipment shall be connected in parallel with an electric safety contact in normal operation.

5.8.6.3 The components controlling the electric safety devices shall be built so that they are able to function properly under the mechanical stresses resulting from continuous normal operation. It shall not be possible to render the electric safety devices inoperative by simple means (a bridge piece is not considered as a simple means).

5.8.6.4 Safety device switches shall be mounted following the requirements of EN 1088.

5.8.7 Safety contacts

5.8.7.1 The safety contacts shall fulfil 5.8.3 and shall be provided for a rated insulation voltage of at least 250 V.

The safety contacts shall be according to categories AC-15 for AC circuits or DC-13 for DC circuits as defined in EN 60947-5-1:2004.

5.8.7.2 The electric safety contacts shall act on the supply to the machine in accordance with the requirements of 5.9.6.

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.

5.8.8 Lighting

At all times when the hoist is in service, lighting shall be provided in the cage, minimum of 50 lux at control devices.

5.9 Control and limiting devices

5.9.1 General

All control devices shall conform to EN 894-1.

5.9.2 Travel limit switches

5.9.2.1 Terminal stopping switches

Means shall be provided to automatically stop the cage from rated speed at the highest and lowest landings before contacting the final limit switch.

5.9.2.2 Final limit switches

5.9.2.2.1 A final limit switch shall be provided for the upper limit of travel, which can operate before the cage comes into contact with any mechanical stop, e.g. buffer. A final limit switch shall be provided for the lower limit of travel. It shall interrupt the electric supply such that the cage is not powered into the buffers.

5.9.2.2.2 After triggering a final limit switch further movements of the cage shall only be possible after the intervention of a competent person.

5.9.2.2.3 Final limit switches shall not be actuated by the same operating elements as the terminal stopping switches.

5.9.2.2.4 Final limit switches shall conform with 5.8.6.

5.9.2.2.5 Final limit switches shall be directly operated by the movement of the cage or related parts.

5.9.3 Slack rope device

Wire rope hoists and wire ropes for counterweights shall have a slack rope device. The device shall incorporate a slack rope switch in conformity with 5.8.6 which shall interrupt all movements of the cage until corrective action has been taken by a competent person (see also 5.7.3.2.1.2).

5.9.4 Erection accessories

The correct positioning of any erection accessories during travel of the hoist both during normal operation and during erection dismantling and maintenance operations, shall either be inherent by design or be checked by an electric safety device to 5.7.10. Such erection accessories shall include mast lifting equipment, extensions used for access when erecting mast ties, etc.

5.9.5 Stopping devices

A stopping device shall be provided for stopping and maintaining the hoist out of service, including any power operated gates:

a) outside the base enclosure;

b) in the pulley room, if any;

c) on the cage roof, if intended to be accessible;

d) at the erection / service / inspection control device;

e) in the cage.

The stopping devices in a) and b) shall be stopping devices in conformity with EN 1037 and their function shall be clearly marked. The stopping devices shall consist of electric safety devices in conformity with 5.7.10.

The stopping devices in c), d) and e) shall be emergency stopping devices in conformity with EN ISO 13850.

5.9.6 Stopping the machine

5.9.6.1 The stopping of the machine as a result of the operation of an electrical safety device shall be achieved by the interruption of the supply to the motor, by either:

— the electrical safety device itself; or

— by means of two independent contactors, the contacts of which shall be in series in the supply circuit.

Use of devices other than contactors is not covered by this standard. Other devices can be used provided that the same level of safety as this standard is ensured. For this purpose details can be found in EN 81-1.

5.9.6.2 If, whilst the hoist is stationary, one of the contactors in 5.9.6.1 has not opened the main contacts, further movement of the cage shall be prevented at the latest at the next change in the direction of motion.

5.9.7 Control modes

5.9.7.1 Normal operation

5.9.7.1.1 The hoist shall be controllable from inside the cage. It may also be controllable from ground level and from the landings.

5.9.7.1.2 All controls except emergency stop shall be designed in such a way that they can only be actuated by an intentional manual action.

5.9.7.1.3 A device shall prevent a cage leaving a landing for a period of at least two seconds after stopping.

5.9.7.2 Erection, dismantling and maintenance operation

5.9.7.2.1 Control operations during erection, dismantling and maintenance shall only be possible from inside the cage or from the cage roof. Erection, dismantling and maintenance operations from inside the cage with some parts of the sides of the cage removed except for those below 1,1 m, is permitted, provided that the correct closure of these parts is checked by means of electric safety devices to 5.8.6 to permit normal operation of the hoist.

5.9.7.2.2 During erection, dismantling and maintenance operations the maximum cage speed shall not exceed 0,7 m/s and the movement of the cage shall remain dependent upon all safety devices as in normal operation with the following exceptions:

— the upper final limit- and terminal stopping switch may not be functioning, in which case alternative automatic overrun protection means, e.g. by an electrical switch, shall be taken (see also 5.6.1);

— the landing gate switch circuits may be bridged.

5.9.7.2.3 For the erection, dismantling and maintenance operation a control device shall be provided. This device shall incorporate:

— a service / inspection switch which shall satisfy the requirements for electric safety devices to 5.8.6 shall be bi-stable, shall be lockable and shall neutralise all control signals other than those from the service / inspection control station; the return to normal operation of the hoist shall only be effected by this service / inspection switch;

— hold-to-run control devices, designed in such a way that they can only be activated by an intentional manual action and with the direction of movement clearly indicated;

— the emergency stopping devices according to 5.9.5.

5.10 Breakdown conditions

5.10.1 Alarm device

In order to call for outside assistance, passengers shall have available in the cage an easily recognisable and accessible alarm device.

This device shall be a bell or similar device, or intercom system which is capable of working for at least 1 h without normal electrical supplies to the hoist.

5.10.2 Emergency escape

So that passengers can be rescued, it shall be possible to escape from the inside of the cage using the means described in 5.6.1.6.

5.10.3 Manual lowering by persons trapped in the cage

If the cage is provided with a manually operated emergency lowering device to be used by any person, it shall comply with the following:

— the drive system brake shall be capable of being manually released from within the cage and shall require a constant effort of no more than 400 N to keep the brake open;

— the device shall be protected from misuse, e.g. by a protective cover capable of being broken in the event of emergency;

— the speed shall be controlled automatically and shall be less than the overspeed governor triggering speed but shall not be more than 1,0 m/s.

5.10.4 Emergency operation by a competent person

5.10.4.1 The hoist shall be provided with a means of emergency operation allowing the cage to be moved to a landing.

5.10.4.2 Manual emergency operation

The manual effort required to move the cage with its rated load shall not exceed 400 N.

The means shall only be accessible to competent person.

In case of hydraulic drive the hoist shall be provided with a manually operated valve, designed in such a way that it can only be activated by a continuous intentional manuawered.

5.10.4.3 Electrical emergency operation

Where an electrical emergency operation is provided, an emergency operation switch, in conformity with 5.8.6 accessible only to competent persons to prevent all movement of the cage except that controlled by this switch, shall be installed.

The emergency operation switch shall permit the control of cage movement by means of a hold-to-run control device designed in such a way that it can only be actuated by an intentional manual action and situated near the emergency operation switch. The direction of movement shall be clearly indicated adjacent to the up and down push buttons.

It is permissible that the emergency operation switch renders inoperative directly or via another safety device, the electric safety devices required for the overspeed governor, overspeed safety device, buffers, final limit switches and any slack rope switch in circuit when the cage is being raised.

The emergency operation switch and its push button(s) shall be so placed that the movement of the cage can easily be observed when using them.

The cage speed shall not exceed 0,7 m/s.

5.11 Noise

5.11.1 General

Machinery shall be designed and constructed in such a way that risks resulting from the emission of airborne noise are reduced to the lowest level, taking account of technical progress and the availability of means of reducing noise, in particular at source. The level of noise emission may be assessed with reference to comparative emission data for similar machinery.

5.11.2 Noise reduction at the design stage

When designing machinery, the information and technical measures to control noise at the source given in EN ISO 11688-1 shall be taken into account. Also the information given in EN ISO 11688-2 may be taken into account. The most relevant noise source is the rack and pinion drive.

5.11.3 Noise emission measurement

Emission sound pressure levels at landings (1 metre from the base enclosure and at a height of 1,60 m from the floor) and at the workstation inside the car shall be measured in accordance with EN ISO 11201:2010, 5.2.2 2, Accuracy grade 2 (Engineering).

Operating conditions during noise measurement: free of load.

For noise declaration 7.1.2.3 shall be met.

6 Verification

6.1 Verification of design

Table 9 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 hoist, 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 5.2.2.7 is verified as part of subclause 5.2.4. All verification records shall be kept by the manufacturer.

Table 9 — Means of verification of the safety requirements and / or measures

Subclause	Safety requirements	Visual inspection[a]	Performance check / test[b]	Measurement[c]	Drawing / Calculation[d]	User info[e]
5.1	General	✓	✓	✓	✓	✓
5.2	Load combinations and calculations					
5.2.1	Basics				✓	
5.2.2	Calculation of structure				✓	✓
5.2.3	Safety factors				✓	
5.2.4	Load cases				✓	✓
5.2.5	Stability				✓	✓
5.2.6	Fatigue stress analysis				✓	✓
5.3	Base frame					
5.3.1	Design	✓			✓	
5.3.2	Supporting devices	✓				✓
5.3.3	Adjustable supporting devices	✓		✓	✓	✓
5.4	Mast, ties and buffers					
5.4.1	Guide structures and masts					
5.4.1.1	Rigid guides	✓				
5.4.1.2	Design				✓	
5.4.1.3	Mast connections	✓	✓		✓	✓
5.4.1.4	Pivot points	✓				
5.4.1.5	Drive elements	✓			✓	
5.4.2	Mast ties	✓	✓		✓	✓
5.4.3	Buffers					
5.4.3.1	Lower buffers	✓				
5.4.3.2	Retardation		✓	✓	✓	
5.4.3.3	Oil buffers[f]	✓	✓			✓
5.5	Hoistway protection					
5.5.1	General					✓
5.5.2	Base enclosure	✓	✓	✓		✓

Subclause	Safety requirements	Visual inspection[a]	Performance check / test[b]	Measurement[c]	Drawing / Calculation[d]	User info[e]
5.5.3	Landing access	✓	✓	✓	✓	✓
5.5.4	Materials	✓	✓	✓	✓	
5.5.5	Gate locks[f]	✓	✓	✓		
5.5.6	Clearances	✓		✓		✓
5.6	Cage					
5.6.1	General	✓	✓	✓	✓	✓
5.6.2	Safety devices[f] against falling of the cage	✓	✓	✓	✓	✓
5.6.3	Overload detection	✓	✓	✓	✓	✓
5.7	Drive unit					
5.7.1	General	✓	✓	✓		
5.7.2	Protection and accessibility	✓	✓	✓		
5.7.3	Suspension system	✓	✓	✓	✓	
5.7.4	Braking system	✓	✓	✓	✓	✓
5.7.5	Counterweight	✓				✓
5.8	Electrical installation					
5.8.1	General	✓			✓	✓
5.8.2	Electric faults	✓	✓	✓		✓
5.8.3	External influences	✓				✓
5.8.4	Electric wiring	✓				
5.8.5	Contactors, relay contactors	✓				
5.8.6	Electric safety devices	✓	✓			✓
5.8.7	Safety contacts	✓				
5.8.8	Lighting	✓		✓		
5.9	Control and limiting devices					
5.9.1	General	✓				
5.9.2	Travel limit switches	✓	✓			✓
5.9.3	Slack rope device	✓	✓			✓
5.9.4	Erection accessories	✓	✓			✓

Subclause	Safety requirements	Visual inspection[a]	Performance check / test[b]	Measurement [c]	Drawing / Calculation [d]	User info [e]
5.9.5	Stopping devices	✓	✓			
5.9.6	Stopping the machine	✓	✓			✓
5.9.7	Control modes	✓	✓	✓		✓
5.10	Breakdown conditions	✓	✓	✓		✓

[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 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.

[f] See certain special verification tests required for some critical components, in 6.2.

6.2 Special verification tests

6.2.1 Introduction

6.2.1.1 Special verification tests shall be carried out on the following components:

— locking devices for landing and cage gates;

— overspeed safety device and overspeed governor;

— energy accumulation type buffers with buffered return movement and energy dissipation buffers.

Records of the tests shall be made and kept by the manufacturer of the hoist.

6.2.1.2 General

6.2.1.2.1 The tests shall be carried out by an organisation operating an approved full quality assurance system. This organisation can be the manufacturer of the component or his authorised representative or a test laboratory.

6.2.1.2.2 If the manufacturer or his authorised representative or the test laboratory has not available appropriate means for certain tests or examinations, it may under its own responsibility have these made by others.

6.2.1.2.3 The precision of the instruments shall allow measurements to be made within the following tolerances:

— ± 2 % masses, forces, distances, times, speeds;

— ± 4 % accelerations, retardations;

— ± 2 % voltages, currents;

— ± 2 °C temperatures.

6.2.1.3 Content of test report

The report shall at least contain the following information:

— name of the testing facility;

— test report number;

— category, type and make or trade name;

— manufacturer's name and address;

— date of test;

— documents according to 6.2.2.1.3;

— place, date, name of person performing the test.

6.2.2 Locking devices for cage and landing gates

6.2.2.1 General provisions

6.2.2.1.1 Field of application

These procedures are applicable to locking devices for gates. It is understood that each component taking part in the locking of gates and in the checking of the locking forms part of the locking device.

6.2.2.1.2 Object 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.

6.2.2.1.3 Associated documents

The following documents shall be attached to the test report:

— a schematic arrangement drawing with description of operation showing clearly all the details relating to the operation and the safety of the locking device, including the effective engagement of the locking elements and the point at which the electrical safety device operates and the operation of the emergency unlocking device;

— information on the type of locking device (AC and / or DC) and their rated voltage and rated current.

6.2.2.1.4 Test samples

The test shall be carried out on a production model.

If the test of the locking device is only possible when the device is mounted in the corresponding gate (for example, sliding gates with several panels or hinged gates with several panels) the device shall be mounted on a complete gate in working order. However, the gate dimensions may be reduced by comparison with a production model, on condition that this does not falsify the test results.

6.2.2.2 Examinations and tests

6.2.2.2.1 Examination of operation

This test 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.

In particular it shall be verified:

— that there is at least 7 mm engagement of the locking elements before the electric safety device operates (see 5.5.5.3.9);

— that it is not possible from positions normally accessible to persons to operate the hoist with a gate open or unlocked.

6.2.2.2.2 Tests

6.2.2.2.2.1 General

These tests have the purpose of verifying the strength of the mechanical locking components and the electrical components.

The sample of the locking device in its normal operating position shall be controlled by the devices normally used to operate it.

The sample shall be lubricated in accordance with the normal requirements of the manufacturer of the locking device.

The number of complete cycles of operation shall be registered by mechanical or electrical counters.

6.2.2.2.2.2 Endurance test

The locking device shall be submitted to 200 000 complete cycles ($\pm$ 1 %) (one cycle comprises one unlocking and one relocking operation).

The driving of the device shall be smooth, without shocks.

During the endurance test the electrical safety switch shall be mechanically operated by the lock as in normal operation.

6.2.2.2.2.3 Static test

A test shall be made consisting of the application over a total period of 5 min of a static force of 1 kN.

This force shall be applied in the opening direction of the gate and in a position corresponding as far as possible to that which will be applied when a user attempts to open the gate.

6.2.2.2.2.4 Criteria for the tests

After the endurance test (6.2.2.2.1) and the static test (6.2.2.2.2.3) there shall not be any wear, deformation or breakage which could adversely affect safety.

6.2.3 Overspeed safety device and overspeed governors

6.2.3.1 General provisions

The overspeed safety device and its compatible overspeed governor shall be tested in combination, using the suspension and guiding system employed in normal service.

The manufacturer shall state for what mass (kg) and rated speed (m/s) the test is to be carried out. If the overspeed safety device has to be certified for various masses and speeds then these shall be specified.

6.2.3.2 Method of test

6.2.3.2.1 A representative combination of every new version of overspeed safety device and compatible overspeed governor shall be tested to apply stresses to all parts equivalent to those resulting from drop tests with the total permissible mass.

6.2.3.2.2 The tests shall be conducted at the governor tripping speed specified by the manufacturer.

6.2.3.2.3 The total number of repeated tests shall be not less than 30. At least there shall be:

- 10 tests with rated load, drive engaged;
- 5 tests with empty cage, drive engaged;
- 5 tests with 1,3 times rated load, drive engaged;
- 5 tests with rated load, drive disengaged;
- 5 tests with 1,3 times rated load, drive disengaged.

6.2.3.2.4 Direct or indirect measurements shall be made of:

a) the total height of the fall;

b) the braking distance;

c) the speed of tripping;

d) retardation as a function of time.

6.2.3.2.5 The following shall be checked:

a) that retardation conforms with 5.6.2.3;

b) that the maximum speed of tripping conforms to 5.6.2.12;

c) that there are no cracks or deformations;

d) in the case of a rope driven overspeed governor, that the tensile force in the rope conforms to 5.6.2.15.

6.2.3.3 Test report

The report shall indicate:

a) information according to 6.2.1.3;

b) type and application of the overspeed safety device and overspeed governor;

c) type(s) and model(s) of hoist(s);

d) the limits of the permissible total masses for the overspeed safety device incl. inertia effects;

e) the limits of the tripping speed for the overspeed governor;

f) for overspeed safety devices operating on the guides, the permissible thickness of the guide blade, the minimum width of the gripping areas, the state of lubrication of the guides and their surface condition;

g) In the case of overspeed governors driven by rope, the diameter of the rope to be used, its construction, the tensile force on the rope which can be produced by the governor when tripped and, if a traction pulley is used, the minimum tensioning force.

6.2.4 Energy accumulation type buffers with buffered return movement and energy dissipation buffers

Special verification tests for these types of buffer shall be carried out according to the test procedures for type examination given in EN 81-1:1998+A3:2009, F.5.

6.3 Verification tests on each hoist before first use

The manufacturer shall perform or have performed static and dynamic tests to ensure that the hoist has been correctly manufactured and assembled in order to check that all the devices provided are present and operating correctly. These tests may be carried out at the manufacturers' premises or those of his authorised representative or at the place of use under the control of the manufacturer.

In particular the following shall be verified and recorded in a test report:

- Proper function of all limit switches;
- Proper function of all controls;
- Function of the overspeed safety device within specified limits;
- Triggering of overload detection device between 1,0 and 1,2 times rated load;
- Braking distance of brake system within specified limits;
- Proper function of gate locks;
- Dynamic test at 1,1 times rated load;
- Static test at 1,25 times rated load;
- Electrical tests as specified in EN 60204-1.

7 User information

7.1 Instruction handbook

7.1.1 Comprehensive information

Each hoist shall be accompanied by an instruction handbook, which shall be in accordance with 6.4.5 of EN ISO 12100:2010.

7.1.2 Contents of the instruction handbook

7.1.2.1 General

The manufacturer and/or importer/supplier shall make available to the user an instruction handbook containing at the least, information about the following topics:

7.1.2.2 General information

- Manufacturer's or supplier's name and address;
- country of manufacture;
- model designation;
- range of serial numbers for which the instruction handbook is valid;
- a repeat of the safety marking and warning signs on the machine and their signification;
- all compatible parts (mast sections, landing gates, ties, control systems, etc.) designed to be used in the hoist installation;
- the contents of the instructions shall cover not only the intended use of the machinery but also take into account any reasonably foreseeable misuse thereof.

7.1.2.3 Capacity and design information

- Working load;
- rated speed;
- maximum allowable freestanding height in and out of service;
- maximum lifting height, untied mast;
- maximum lifting height, tied mast;
- tie distances;
- top overhang of the mast;
- maximum allowable wind speed during erection and dismantling;
- maximum allowable wind speed in service;
- maximum allowable wind speed out of service; design wind region (see Annex A, deviations due to local environment conditions may be possible!); variations in mast tie intervals, etc., shall be clearly indicated for the appropriate wind regions;
- environmental restrictions as temperature range;
- declaration concerning airborne noise emissions by the machinery, either the actual value or a value established on the basis of measurements made on identical machinery:
- the A-weighted emission sound pressure level at the workstation inside the car;

— the maximum value of A-weighted emission sound pressure level at 1 m distance from the base enclosure and at a height of 1,60 m above the floor; the position where the maximum sound pressure level has been measured shall be indicated;

— the declaration shall be accompanied by a statement of the measuring method used and the operating conditions applied during the test;

— the declaration shall be accompanied by values for the associated uncertainty *K* using the dual-number form of declaration in accordance with EN ISO 4871.

Information about noise emission should also be given in sales literature.

Sufficient information shall be given in the instruction handbook such that the user can derive the particular details for each installation.

7.1.2.4 Dimensions and weights

— Height from the ground to the cage floor at the base level;

— internal size of cage (length x width x height);

— mast section: dimensions;

— mast section: weight;

— base unit (base frame, lowermost mast section(s), cage and drive unit) dimensions and weight;

— minimum area required for installation.

7.1.2.5 Power supply data — Electrical drive

— Power – drive unit [kW];

— supply voltage / frequency [V/Hz];

— control voltage / frequency [V/Hz];

— maximum starting current [A];

— maximum power consumption [kW];

— minimum power supply [kVA];

— main power supply fuses and type [A];

— outlets for portable tools – voltage and current [V, A].

7.1.2.6 Safety equipment

— Type of safety equipment (e.g. overspeed safety device, terminal and final stopping switches, landing gate switches);

— additional safety equipment for erection, dismantling and maintenance;

— emergency lowering arrangements.

7.1.2.7 Additional technical information

— Bolted mast joints (bolt diameter, bolt quality, tightening torque, criteria for replacement, possible restrictions regarding the use of pre-stressed high tensile bolts);

— ground bearing pressure as a function of configuration of the hoist;

— tie arrangement and forces imposed on the supporting structure, for given wind zones;

— forces from loading and unloading action upon the landing;

— need for protection regarding hazardous areas around the hoist;

— information regarding any lifting points;

— wire rope data;

— consideration of the effects of any item which significantly increases the wind area;

— consideration of any effects which significantly increases the wind speed e.g. adjacent tall buildings;

— transport procedure to and from site;

— for lifting accessories information shall be given regarding intended use, limits of use, instruction assemblies, use and maintenance, static test coefficient used.

7.1.2.8 Instructions for erection and dismantling

7.1.2.8.1 General

The instruction manual shall clearly indicate the various configurations foreseen by the manufacturer for installing the hoist. Where any nonstandard configurations are required, these shall be agreed between the manufacturer, the owner and the user, and information shall be added as addendum to the instruction handbook.

7.1.2.8.2 Clearances

7.1.2.8.2.1 Clearances around the hoist

— If the safety distance between any point of access and any adjacent travelling part of the hoist is less than 0,85 m (0,5 m if the rated speed is not more than 0,7 m/s) the hoistway protection shall conform to EN ISO 13857:2008, Table 1 and be a minimum of 2,0 m high or extend the full height from floor to ceiling where this is less than 2 m.

— If the safety distance is 0,85 m or more (0,5 m or more if the rated speed is not more than 0,7 m/s), a fixed protection (hand rail, intermediate rail and toeboard) to a minimum height of 1,1 m shall be provided.

7.1.2.8.2.2 Clearances above the cage

Sufficient guides shall be provided to allow for the overrun of the cage at the upper end of the hoistway. The overrun shall be at least:

— 2 m for any hoist with a counterweight heavier than the empty cage;

— 0,5 m for wire rope suspended hoists or any hoist with a counterweight weighing not more than the empty cage;

— 0,15 m for rack and pinion.

This distance shall apply from the operating position of the final limit switch of the hoist. For hoists with counterweight this distance shall apply from the position where the counterweight makes contact with its buffers.

For rated speeds above 0,85 m/s, the overrun shall be increased by 0,1 v^2 m (v = rated speed in m/s).

When the cage has travelled through the upper overrun the free distance above the hoist shall be at least 1,8 m (0,3 m if the cage roof is not designed to be accessible). In addition, any components or equipment associated with the cage which projects above the cage shall have a free distance above them of not less than 0,3 m.

7.1.2.8.2.3 Clearances above the counterweight

When the cage rests on the fully compressed buffers, the free distance above the counterweight shall be at least 0,3 m.

7.1.2.8.3 Foundation

Information shall be given so that the site for the hoist can be suitably prepared in order that it shall withstand all resultant forces. The base frame and mast structure shall be supported by a foundation able to take all forces and moments as described in 5.2.

If accessible spaces exist underneath the hoist base, any counterweight shall be fitted with a safety device.

7.1.2.8.4 Erection and dismantling

Only competent persons shall erect and dismantle the hoist.

Connection of the hoist to the electrical supply shall be made by a competent person in accordance with local regulations.

The instruction handbook shall at least include the following:

— recommend the use of a Residual Current Device;

— transportation to the site;

— erection of mast sections and mast ties including information regarding the correct use of bolts (diameter, quality, tightening torque);

— recommendations for lifting of heavy parts;

— installation of, and safety requirements for base enclosure and landing gates, which shall be provided in the hoistway protection at every point of access;

— illumination of landings (a statement shall be included to the effect that if the hoist is to be used under poor lighting conditions then adequate site lighting shall be provided to illuminate the landings over the full height of travel of the hoist);

— test of the completed hoist.

The test shall include the following minimum requirements:

— identification of the hoist;

— functional tests of:

— drive systems and brakes;

— travel limits;

— cage and landing gates;

— overload detection device;

— clearances;

— the hoist shall be dynamically tested throughout the full range of travel with the rated load in the cage as specified by the manufacturer;

— the safety device against falling of the cage shall be dynamically tested as specified by the manufacturer;

— dismantling procedure.

7.1.2.9 Instructions for Operating and Usage

A separate section shall be included in the instruction handbook which gives clear information for all users of the hoist regarding the safe operation and the minimum requirements for the training of operating personnel. Loading, unloading and operation of the hoist is allowed for everybody permitted access to the site unless National Regulations state otherwise.

Detailed instructions shall be given regarding:

— intended use;

— operation of landing and cage gates;

— loading the cage and possible restrictions regarding load position and concentration and securing of the load;

— use of castors suitable for the possible gaps;

— no loads on the cage roof;

— control of the hoist, the function of any controls available to the user inside the cage, at the base enclosure and the landings;

— environmental conditions e.g. maximum in service wind speed.

7.1.2.10 Emergency procedures

A separate section shall be included which provides all the information necessary for competent persons, regarding the handling of emergencies such as:

— special controls;

— safety devices, e.g. limit switches, overspeed safety device;

— reacting to failures;

— circuit diagram;

— information about access to the cage (see 5.6.1.5.1.9 and 5.6.1.6.6).

7.1.2.11 Regular inspection and maintenance

The instruction handbook shall state the frequency of periodic examinations, tests and maintenance depending on manufacturers requirements, operating conditions and frequency of use. Detailed information regarding the items to be checked and suitability for use shall be given.

The instruction handbook shall also state the contents of the logbook if that is not delivered with the hoist.

It shall be stated which parts are subject to wear and the criteria for replacement, e.g. ISO 4309 for replacement of steel wire ropes. The instruction handbook shall include a section dealing with thorough examination with regard to fatigue life (see also 5.2.6.1).

7.2 Markings

7.2.1 General

The manufacturer shall provide the following information on one or more durable labels fixed in a prominent place on the hoist, in accordance with 6.4.4 in EN ISO 12100:2010.

7.2.2 Rating plate

— Name and address of the manufacturer or his authorised representative;

— type designation;

— serial number;

— year of construction;

— working load [kg];

— lifting height;

— wire rope data, where applicable;

— weight of base unit;

— rated speed.

7.2.3 Mast or guide section identification label

Each individual mast or guide section shall be marked with an identification or serial number enabling the date of manufacture to be determined.

7.2.4 Basic user information label

— Mast height;

— top overhang of mast;

— bolted mast joints (bolt diameter, bolt quality, tightening torque);

— power supply (residual current device);

— free-standing operation;

— safety clearances;

— sketch of mast ties, with distances between ties;

— out of service position of the cage;

— observation of operating instructions;

— information regarding installations where the counterweight is above an accessible space.

7.2.5 Label in the cage

— Minimum height of characters: 25 mm;

— working load and maximum number of persons;

— restrictions regarding load position and concentration.

7.2.6 Label at ground level

— Access inside ground enclosure by authorised and competent personnel only.

7.2.7 Label at overspeed device

— Name and address of manufacturer;

— number of type examination certificate;

— triggering speed;

— year of construction and serial number.

7.2.8 Drive motor label

— Name and address of manufacturer;

— type designation;

— year of construction and serial number.

7.3 Marking of control elements

All control elements have to be clearly marked. The use of pictograms is recommended.

Annex A
(normative)

European stormwind map

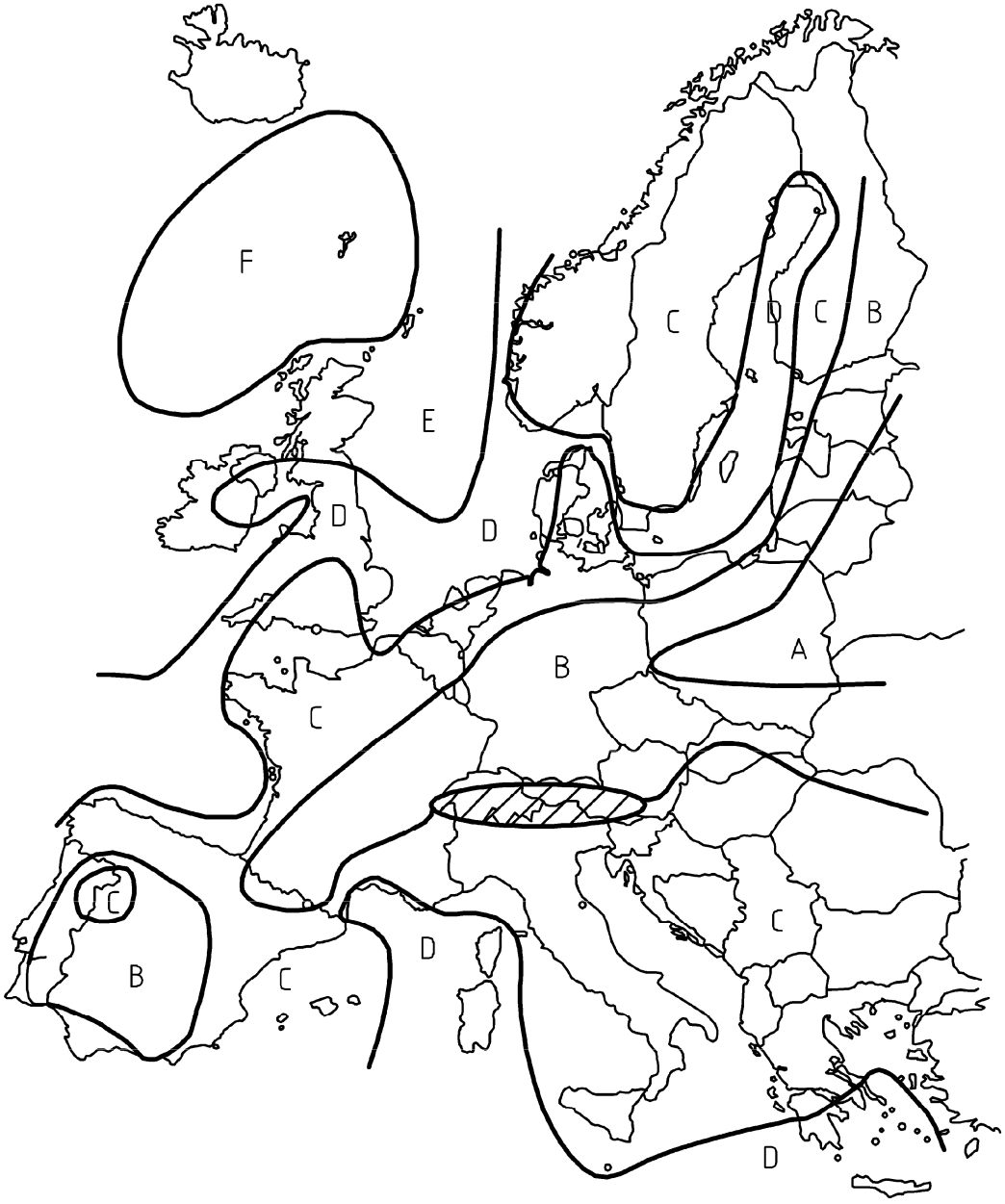


Figure A.1 — European stormwind map

Annex B
(normative)

Electric safety devices

Table B.1 — List of electric safety devices

Clause	Devices checked
5.5.5.1	closed position of landing gates
5.5.5.2	closed position of landing gate locking devices
5.6.1.5.1.5	closed position of cage gates
5.6.1.6	locked position of trap door or escape door
5.6.2.4	operation of overspeed safety devices
5.7.3.2.1.2	abnormal relative extension of wire rope in drive unit
5.9.2.2	final limit switches
5.9.3	slack rope in drive unit
5.9.3	slack rope in suspension of counterweight
5.9.4	erection accessories
5.9.5	stopping devices
5.9.7.2.1	closed position of movable protection (cage)
5.9.7.2.3	Service/inspection switch
5.10.4.3	electrical emergency operation switch

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 one means of conforming to Essential Requirements of the New Approach Directive 2006/42/EC.

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this standard confers, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive and associated EFTA regulations.

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

Bibliography

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

[2] EN 81-3, *Safety rules for the construction and installation of lifts — Part 3: Electric and hydraulic service lifts*

[3] EN 81-43, *Safety rules for the construction and installation of lifts — Special lifts for the transport of persons and goods — Part 43: Lifts for cranes*

[4] EN 1495, *Lifting platforms — Mast climbing work platforms*

[5] EN 12158-1, *Builders' hoists for goods — Part 1: Hoists with accessible platforms*

[6] EN 12158-2, *Builders' hoists for goods — Part 2: Inclined hoists with non-accessible load carrying devices*

[7] EN ISO 9000, *Quality management systems — Fundamentals and vocabulary (ISO 9000)*

[8] EN ISO 11688-2, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 2: Introduction to the physics of low noise design (ISO/TR 11688-2)*

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