



SLOVENSKI STANDARD

SIST EN 12159:2002

01-maj-2002

Gradbena dvigala za osebe in tovor z navpično vodeno kletko

Builders hoists for persons and materials with vertically guided cages

Bauaufzüge zur Personen- und Materialbeförderung mit senkrecht geführten Fahrkörben

Ascenseurs de chantier pour personnes et matériaux avec cages guidées verticalement

Ta slovenski standard je istoveten z: EN 12159:2000

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EUROPEAN STANDARD
NORME EUROPÉENNE
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EN 12159

September 2000

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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 6 July 2000.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

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

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

Contents.....	Page
Foreword	3
Introduction	3
1 Scope	4
2 Normative references.....	5
3 Terms and definitions.....	6
4 List of hazards	9
5 Safety requirements and/or measures	12
6 Verification.....	48
7 User information.....	55
Annex A (normative) European stormwind map	62
Annex B (normative) Electric safety devices	63
Annex C (informative) Detailed index to this standard	64

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Foreword

This European Standard has been prepared by Technical Committee CEN/TC 10 "Passenger, goods and service lifts", 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 March 2001, and conflicting national standards shall be withdrawn at the latest by March 2001.

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

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

At the time of granting the mandate it had been assumed that construction site hoists for persons or persons and goods would be reabsorbed into the Machinery Directive, their having been excluded by the second amendment of that Directive. The current proposal for a new draft of the Directive on Machinery (EN – III/4101/97 rev.3) includes these machines under the scope of the Directive.

In order to put forward a meaningful proposal using the current state of the art of the majority of CEN activities, the drafters of this standard presupposed that this category of hoist would find itself in the Machinery Directive as an Annex IV machine possibly with further essential safety requirements in addition to those already covered by Annex I of that Directive.

As hoists for persons and materials are not covered currently by the Machinery Directive (including amendments), then compliance with this Standard cannot provide a presumption of conformity with that Directive or associated EFTA regulations.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland 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.

The standard is a Type C standard relating to the safety for builders hoists for persons and materials.

The extent to which hazards are covered is indicated in the scope of this standard. In addition, machinery shall comply as appropriate with EN 292 for hazards which are not covered by this standard.

1 Scope

1.1 This 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 carrier

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

1.2 The 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
- noise.

1.4 This standard is not applicable to

- builders hoists for the transport of goods only;
- lifts according to EN 81-1:1998, EN 81-2:1998 and prEN 81-3:1999;
- work cages suspended from lifting appliances;
- work platforms carried on the forks of fork trucks;
- work platforms;
- funiculars;
- lifts specially designed for military purposes;
- mine lifts;

- theatre elevators;
- special purpose lifts.

1.5 This 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 anchorage bolts 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

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

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

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

prEN 81-3:1999, *Safety rules for the construction and installation of lifts and service lifts – Part 3: Electric and hydraulic service lifts*

EN 292-1:1991, *Safety of machinery – Basic concepts, general principles for design – Part 1: Basic terminology, methodology*

EN 292-2: 1991 + A1: 1995, *Safety of machinery – Basic concepts, general principles for design – Part 2: Technical principles and specifications*

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

EN 349:1992, *Safety of machinery – Minimum gaps to avoid crushing of parts of the human body*

EN 418: 1992, *Safety of machinery – Emergency stop equipment, functional aspects – Principles for design*

EN 811:1996, *Safety of machinery – Safety distances to prevent danger zones being reached by the lower limbs*

EN 894-1:1997, *Safety of machinery – Ergonomic requirements for the design of displays and control actuators – Part 1: General principles for human interactions with displays and control actuators*

EN 953:1997, *Safety of machinery – General requirements for the design and construction of fixed and movable guards*

EN 954-1: 1996, *Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design*

EN 982:1996, *Safety requirements for fluid power systems and their components – Hydraulics*

- EN 1037:1995, *Safety of machinery – Prevention of unexpected start-up.*
- EN 1088:1996, *Safety of machinery – Interlocking devices associated with guards – Principles for design and selection*
- EN ISO 9000-1:1994, *Quality management and quality assurance standards – Part 1: Guidelines for selection and use (ISO 9000-1:1994)*
- EN 60204-1: 1997, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements (IEC 60204-1:1997)*
- EN 60204-32:1998, *Safety of Machinery – Electrical equipment of Machines – Part 32: Requirements for hoisting machines (IEC 60204-32:1998)*
- EN 60529:1991, *Degrees of protection provided by enclosures (IP-Code)(IEC 60529:1989)*
- EN 60947-4-1:1992, *Low-voltage switchgear and controlgear – Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters (IEC 60947-4-1:1990)*
- EN 60947-5-1: 1997, *Low-voltage switchgear and controlgear – Part 5-1: Control circuit devices and switching elements – Electromechanical control circuit devices (IEC 60947-5-1:1997)*
- ISO 2408:1997, *Steel wire ropes for general purposes – Characteristics*
- ISO 3864:1984, *Safety colours and safety signs*
- ISO 4302:1981, *Cranes – Wind load assessment*
- ISO 4309:1990, *Cranes – Wire ropes – Code of practice for examination and discard*
- ISO 6336-1:1996, *Calculation of load capacity of spur and helical gears – Part 1: Basic principles, introduction and general influence factors*
- ISO 6336-2:1996, *Calculation of load capacity of spur and helical gears – Part 2: Calculation of surface durability (pitting)*
- ISO 6336-3:1996, *Calculation of load capacity of spur and helical gears – Part 3: Calculation of tooth bending strength*
- ISO 6336-5:1996, *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 standard, the following terms and definitions apply:

- 3.1**
builders hoist
a 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**
rated load
the maximum load which the hoist has been designed to carry in service.
- 3.3**
rated speed
the speed of the cage for which the equipment has been designed.

3.4**wire rope hoist**

a hoist which uses wire rope as the load suspension system.

3.5**positive drive**

a drive using means other than friction.

3.6**hydraulic hoist**

a hoist which uses a hydraulic cylinder to directly or indirectly carry the load.

3.7**rack and pinion hoist**

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

3.8**expanding linkage mechanism**

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

3.9**base frame**

the lowest framework of the hoist, upon which all other components are mounted.

3.10**guides**

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

3.11**mast**

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

3.12**mast section**

indivisible piece of mast, between two adjacent mast joints.

3.13**mast tie**

a connection system between the mast and any building structure, providing lateral support for the mast.

3.14**hoistway**

the total space which is travelled by the cage and its load.

3.15**counterweight way**

the total space which is travelled by the counterweight.

3.16**cage**

a carrier including the floor, walls, gates and roof.

3.17**counterweight**

any mass which is used for weight compensation.

3.18

stopping distance

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

3.19

overspeed safety device

a mechanical device for stopping and maintaining stationary the cage or counterweight in the event of overspeed.

3.20

slack rope

a rope, normally under tension, from which all external loads have been removed.

3.21

wire rope termination

the adaptation at the end of a wire rope permitting attachment.

3.22

landing

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

3.23

safety distance

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

3.24

guard rail

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

3.25

normal operation

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

3.26

in service

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

3.27

out of service

an 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 unladen.

3.28

competent person

a 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 292-1 and EN 292-2:1991 + A1:1995.

Tables 1.1, 1.2 and 1.3 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).

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Table 1.1 - 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, 5.7.2, 7.1.2.7, 7.1.2.8
1.2	Shearing	5.5, 5.6.1.2, 5.7.2, 7.1.2.7, 7.1.2.8
1.3	Cutting or severing	5.5, 5.6.1.2, 5.7.2, 7.1.2.7, 7.1.2.8
1.4	Entanglement	5.7.2
1.5	Drawing-in or trapping	5.5.2, 5.5.3, 5.6.1.2, 5.7.2, 7.1.2.7
1.6	Impact	5.4.3, 5.6.2, 7.1.2.7, 7.1.2.8
1.7	Stabbing or puncture	n.a.
1.8	Friction or abrasion	5.5.2, 5.5.3, 7.1.2
1.9	High pressure fluid ejection	5.7.3.3, 5.8
1.10	Ejection of parts	5.6.1.2
1.11	Loss of stability	5.2, 5.3, 5.4.1, 5.4.2, 5.6.3, 7.1.2.7.3
1.12	Slip, trip and fall	5.5, 5.6.1, 5.6.2, 5.7.3.3.8, 7.1.2.7.3
2	Electrical hazards	
2.1	Electrical contact	5.9, 7.1.2.7.3
2.2	Electrostatic phenomena	n.a.
2.3	Thermal radiation	n.a.
2.4	External influences	5.7.4.11, 5.9.3
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	Not dealt with, see 1.3
4.2	Interference with speech	Not dealt with, see 1.3
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	Not dealt with
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.

	Hazards	Relevant clauses in this standard
8	Hazards generated by neglecting ergonomic principles in machine design	
8.1	Unhealthy postures or excessive effort	5.1, 5.6.1.3.2, 7.1.2.7.3
8.2	Inadequate consideration of human hand/arm or foot/leg anatomy	5.5, 5.7.2, 7.1.2.7
8.3	Neglected use of personal protection equipment	n.a.
8.4	Inadequate area lighting	5.9.8, 7.1.2.7.3
8.5	Mental overload or underload, stress	5.10
8.6	Human error	5.6.3, 5.10, 7.1.2.7, 7.1.2.8, 7.2, 7.3
9	Hazard combinations	Not dealt with
10	Hazards caused by failure of energy supply, breaking down of machinery parts and other functional disorders	
10.1	Failure of energy supply	5.7.4.1, 5.9.2, 5.11, 7.1.2.4.1, 7.1.2.5
10.2	Unexpected ejection of machine parts or fluids	5.7.2.3, 5.7.3.3, 5.8
10.3	Failure or malfunction of control system	5.10.2.2, 5.10.3, 5.10.6
10.4	Errors of fitting	5.4.1, 7.1.2.7
10.5	Overturn, unexpected loss of machine stability	5.2, 5.3, 5.4, 7.1.2.7
11	Hazards caused by missing and / or incorrectly positioned safety related measures / means	
11.1	Guards	5.5, 5.6.1.2, 7.1.2.7, 7.1.2.10
11.2	Safety related (protection) devices	5.5.1, 5.6.1.2, 7.1.2.7, 7.1.2.10
11.3	Starting and stopping devices	5.10.5, 5.10.7, 7.1.2.7, 7.1.2.8
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	5.10.6
11.7	Emergency devices	5.6.2, 5.11, 7.1.2.5, 7.1.2.7, 7.1.2.10
11.8	Feeding/removal means of work pieces	n.a.
11.9	Essential equipment and accessories for safe adjusting and/or maintaining	7.1.2.5, 7.1.2.7, 7.1.2.10
11.10	Equipment evacuating gases	n.a.

Table 1.2 - 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	Not dealt with, see 1.3
13	Hazards due to sudden movement instability etc. during handling	Not dealt with, see 1.3
14	Inadequate/non-ergonomic design of operating position	Not dealt with, see 1.3
15	Mechanical hazards	Not dealt with, see 1.3
16	Hazards due to lifting operations	
16.1	Lack of stability	5.2.5, 5.3, 5.4.1, 5.4.2, 7.1.2.7
16.2	Derailment of the cage	5.4.1, 5.6.1, 5.10.7.2.2
16.3	Loss of mechanical strength of machinery and lifting accessories	5.2, 5.3, 5.5.4, 5.6, 5.7, 7.1.2.10
16.4	Hazards caused by uncontrolled movement	5.5.3, 5.6.2, 7.1.2.8
17	Inadequate view of trajectories of the moving parts	5.5, 5.6.1, 7.1.2.8
18	Hazards caused by lightning	Not dealt with, see 1.3
19	Hazards due to loading / overloading	5.2, 5.6, 7.1.2.8

Table 1.3 - 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, 7.1.2.8
21	Unexpected movement of the cage in response to external controls or other movements of the machine	5.7, 5.10.7.1.2, 5.10.7.1.3, 5.10.7.2.3, 5.11.4
22	Excess speed	5.4.3, 5.6.2, 5.7
23	Persons falling from the cage	5.6.1
24	The cage falling or overturning	5.4.1, 5.6.2, 5.7, 5.10.7.2.2
25	Excess acceleration or braking of the cage	5.4.3, 5.6.2, 5.7.4.5, 7.1.2.10
26	Due to imprecise markings	7.3

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.

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 SIST EN 12159:2002

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

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/m². 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.