SLOVENSKI STANDARD
SIST EN 81-43:2009

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Varnostna pravila za konstruiranje in vgradnjo dvigal (liftov) - Posebna dvigala za prevoz oseb in blaga - 43. del: Dvigala za žerjave

Safety rules for the construction and installation of lifts - Special lifts for the transport of persons and goods - Part 43: Lifts for cranes

Sicherheitsregeln für die Konstruktion und Installation von Aufzügen - Besondere Aufzüge für den Transport von Personen und Gütern - Teil 43: Kranführeraufzüge

Règles de sécurité pour la construction et l'installation des élévateurs - Élévateurs particuliers destinés au transport des personnes et des matériaux - Partie 43: Élévateurs pour appareils de levage à charge suspendue

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53.020.20	Dvigala	Cranes
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EUROPEAN STANDARD

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English Version

Safety rules for the construction and installation of lifts - Special lifts for the transport of persons and goods - Part 43: Lifts for cranes

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This European Standard was approved by CEN on 10 April 2009.

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Foreword

This document (EN 81-43:2009) has been prepared by Technical Committee CEN/TC 10 “Lifts, escalators and moving walks”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by November 2009, and conflicting national standards shall be withdrawn at the latest by December 2009.

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 is part of the EN 81 series of standards: "*Safety rules for the construction and installation of lifts*". This is the first edition.

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 Directives 98/37/EC and 2006/42/EC.

For relationship with EU Directives, see informative Annexes ZA and ZB, which are integral parts of this document.

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

Introduction

This document 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 document is a Type C standard as stated in EN ISO 12100:2003.

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

This document gives details for the complete installation.

In order to achieve a safe installation of a lift on a crane negotiations shall take place between the manufacturer of the lift and the crane user organisation about the interfaces (e.g. lift way protection, supporting structure, power supplies, suitability of alarm devices) regarding the responsibility for the supply of these requirements.

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."

1 Scope

1.1 This document specifies the safety requirements for the construction and installation of power operated lifts attached to cranes and intended for access to workplaces on cranes, by authorised persons. This includes intended use, erection, dismantling, inspection and maintenance. The lift serves defined landing levels and has a load carrying unit which is:

a) designed for the transportation of persons and goods;

b) guided;

c) travelling vertically or along a path within 15 degrees maximum from the vertical;

d) supported by rack and pinion or suspended by steel wire ropes;

e) travelling with a speed not more than 1,0 m/s for permanent lifts and not more than 0,4 m/s for temporary lifts.

1.2 This document 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 document does not specify the additional requirements for:

a) operation in severe conditions (e.g. extreme climates, strong magnetic fields);

b) lightning protection;

c) operation subject to special rules (e.g. potentially explosive atmospheres);

NOTE Directive 94/9/EC concerning equipment and protective systems intended for use in potentially explosive atmospheres can be applicable to the type of machine or equipment covered by this European Standard. The present standard is not intended to provide means of complying with the essential health and safety requirements of Directive 94/9/EC.

d) electromagnetic compatibility (emission, immunity);

e) handling of loads the nature of which could lead to dangerous situations;

f) the use of combustion engines;

g) hydraulic drive units;

h) hazards occurring during manufacturing process;

i) hazards occurring as a result of being erected over a public road;

j) earthquakes;

k) noise (see also Directive on noise emissions from machines used outdoors (2000/14/EC)).

1.4 This standard is not applicable to:

a) builders hoists according to EN 12158-1:2000, EN 12158-2:2000 and EN 12159:2000;

b) elevating control stations according to EN 14502-2:2005+A1:2008;

c) lifts according to EN 81-1:1998;

d) work platforms carried on the forks of fork trucks;

e) work platforms;

f) funiculars;

g) lifts specially designed for military purposes;

h) mine lifts;

i) theatre elevators.

1.5 This standard deals with the complete lift design but excludes the design of the crane. 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 and the design of anchorage parts between the mast tie and the crane structure. This standard also includes the design of the landing gates and their fixings.

2 Normative references

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

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

EN 349:1993+A1:2008, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

EN 894-1:1997+A1:2008, *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 1037:1995+A1:2008, *Safety of machinery — Prevention of unexpected start-up*

EN 1088:1995+A2:2008, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*

EN 1808:1999, *Safety requirements on suspended access equipment — Design calculations, stability criteria, construction — Tests*

EN 1999-1-1:2007, *Eurocode 9: Design of aluminium structures — Part 1-1: General structural rules*

EN 12159:2000, *Builders hoists for persons and materials with vertically guided cages*

EN 13001-2:2004, *Cranes — General design — Part 2: Load actions*

CEN/TS 13001-3-1:2004, *Cranes — General design — Part 3-1: Limit states and proof of competence of steel structures*

EN 13586:2004+A1:2008, *Cranes — Access*

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

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

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

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

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

ISO 3864-1:2002, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs in workplaces and public areas*

ISO 4309:2004, *Cranes — Wire ropes — Care, maintenance, installation, examination and discard*

ISO 6336-1:2006, *Calculation of load capacity of spur and helical gears — Part 1: Basic principles, introduction and general influence factors*

ISO 6336-2:2006, *Calculation of load capacity of spur and helical gears — Part 2: Calculation of surface durability (pitting)*

ISO 6336-3:2006, *Calculation of load capacity of spur and helical gears — Part 3: Calculation of tooth bending strength*

ISO 6336-5:2003, *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 12100-1:2003 and the following apply.

3.1
lift
machine with a car which is guided and intended for transport between different levels

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

3.3
rated speed
travelling speed of the car in m/s for which the equipment has been designed

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

3.5
supporting structure
crane and its foundations, giving vertical or horizontal support to the mast of the lift

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

3.7
base frame
lowest framework of the lift, upon which all other components are mounted

3.8
guide rails
rigid elements which determine the travel way of the load carrying unit, that may form part of the mast

3.9
mast
lift mast is the structure that supports the load carrying unit

3.10
mast section
indivisible piece of mast, between two adjacent mast joints

3.11
mast tie
connection system between the mast of the lift and the supporting structure, providing horizontal support for the mast

3.12
liftway
total space which is travelled by the load carrying unit

3.13
car
load carrying unit including floor, walls, gates and roof

3.14
stopping distances
distance the load carrying unit moves from the moment, when the control or safety circuit is broken until the load carrying unit has come to a full stop

3.15
overspeed safety device
combination of a) overspeed detecting device and b) safety gear

a) **overspeed detecting device:** a device which, when the lift attains a predetermined speed causes the safety gear to be triggered/applied

b) **safety gear:** a mechanical device for stopping and maintaining stationary the lift car on the guide rail, rack or rope

3.16
slack rope
rope, normally under tension, from which all external loads have been removed

3.17
wire rope termination
adaptation at the end of a wire rope permitting attachment

3.18
landing
level in the crane structure intended for loading and unloading the load carrying unit

3.19
guard rail
fixed equipment, other than gates, which is used to prevent people from falling or from reaching hazardous areas

3.20
normal operation
usual operating conditions for the lift when in use for carrying loads but excluding routine maintenance, erection, dismantling etc. of the lift (maintenance is considered in this standard)

3.21
in service
condition during use of the lift when the load carrying unit is in any position, loaded or unloaded, moving or stationary

3.22
out of service
installed condition when the load carrying unit is positioned such that it is provided with the most shelter from the wind. This is normally, but not necessarily, ground level. The load carrying unit is unloaded

3.23
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

3.24
overrun
travel of the car beyond the normal stopping positions at its uppermost and its lowermost landing (including jumping)

3.25
authorised person
competent person having permission to use the lift

3.26
safety chain
safety contacts or/and safety circuits in series, stopping the machine

3.27
safety circuit
device(s) instead of a safety contact (e. g. non safety contacts in combination with a safety relay)

3.28
temporary installed lifts for cranes
lifts attached to tower cranes on temporary works e. g. construction sites and intended for access to workplaces by authorised persons, which shall then be removed when the construction is over

3.29
permanent installed lifts for cranes
lifts attached to cranes and intended for access to workplaces by authorised persons, not covered by 3.28

3.30
safety rope
steel wire rope, only carrying the load when the safety device is activated

4 List of significant hazards

This clause contains all the significant hazards, hazardous situations and events, as far as they are dealt with in this standard, identified by risk assessment as significant for this type of machinery and which require action to eliminate or reduce the risk. The significant hazards are based upon EN ISO 14121-1:2007. Also shown are the sub-clause references to the safety requirements and/or protective measures in this standard. Before using this standard it is important to carry out a risk assessment of lifts to check that it has the hazards identified in this clause.

Table 1 — Hazards relating to the general design and construction of lifts 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
1.8	Friction or abrasion	5.5.2, 5.5.3, 7.1.2
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, 7.1.2.7.3
2	**Electrical hazards**	
2.1	Electrical contact	5.8, 7.1.2.7.3
2.4	External influences	5.7.4.10, 5.8.3
3	**Thermal hazards**	Not applicable
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
8.4	Inadequate area lighting	5.8.8, 7.1.2.7.3
8.5	Mental overload or underload, stress	5.9
8.6	Human error	5.6.3, 5.9, 7.1.2.7, 7.1.2.8, 7.3
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, 5.8.2, 7.1.2.5
10.2	Unexpected ejection of machine parts or fluids	5.7.2.3
10.3	Failure or malfunction of control system	5.9.2.2, 5.9.3, 5.9.6
10.4	Errors of fitting	5.4.1, 7.1.2.7
10.5	Overturn, unexpected loss of machine stability	5.2, 5.3, 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
11.2	Safety related (protection) devices	5.5, 5.6.1.2, 7.1.2.7

Table 1 *(continued)*

	Hazards	Relevant clauses in this standard
11.3	Starting and stopping devices	5.9.5, 5.9.7, 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	5.9.6
11.7	Emergency devices	5.6.2, 5.10, 7.1.2.5, 7.1.2.7, 7.1.2.10
11.9	Essential equipment and accessories for safe adjusting and/or maintaining	7.1.2.5, 7.1.2.7, 7.1.2.10
	Hazards due to mobility	
12	**Inadequate lighting of moving/working area**	5.8.8, 7.1.2.7.3
16	**Hazards due to lifting operations**	
16.1	Lack of stability	5.3, 5.4.1, 5.4.2, 7.1.2.7
16.2	Derailment of the car	5.4.1, 5.6.1
16.3	Loss of mechanical strength of machinery and lifting accessories	5.2, 5.3, 5.6.3, 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
19	**Hazards due to loading/overloading**	5.2, 7.1.2.8
20	**Overloading or overcrowding of the car**	5.7.3, 7.1.2.8
21	**Unexpected movement of the car in response to external controls or other movements of the machine**	5.7, 5.9.7.1.2, 5.9.7.2.3, 5.10.4
22	**Excess speed**	5.4.3, 5.6.2, 5.7
23	**Persons falling from the car**	5.6.1
24	**The car falling or overturning**	5.4.1, 5.6.2, 5.7, 5.9.7.2.2
25	**Excess acceleration or braking of the car**	5.4.3, 5.6.2, 5.7.4.5, 7.1.2.10
26	**Due to imprecise markings**	7.2, 7.3

5 Safety requirements and/or protective measures

5.1 General

The design of the lift shall consider intended use, erection, dismantling, inspection and maintenance.

Machinery 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 12100-1:2003 and EN ISO 12100-2:2003 for hazards relevant but not significant, which are not dealt with by this document (e.g. sharp edges)