SLOVENSKI STANDARD
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Gradbena dvigala za prevoz materiala - 1. del: Dvigala z dostopno dvižno ploščadjo

Builders' hoists for goods - Part 1: Hoists with accessible platforms

Bauaufzüge für den Materialtransport - Teil 1: Aufzüge mit betretbarer Plattform

Monte-matériaux - Partie 1: Monte-matériaux à plates-formes accessibles

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Builders' hoists for goods - Part 1: Hoists with accessible platforms

Monte-matériaux - Partie 1: Monte-matériaux à plates-formes accessibles

Bauaufzüge für den Materialtransport - Teil 1: Aufzüge mit betretbarer Plattform

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 10.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

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European foreword

This document (prEN 12158-1:2020) has been prepared by Technical Committee CEN/TC 10 “Lifts, escalators and moving walks”, the secretariat of which is held by AFNOR.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 12158-1:2000+A1:2010.

In comparison with the previous edition, the following technical modifications have been made:

a) static calculations;

b) out of service wind;

c) safety requirements for platform locking;

d) requirements for platform inclination on twin-masted units;

e) integration of performance levels according to EN ISO 13849-1:2015;

f) monitoring of the inadvertent brake release.

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

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

Introduction

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

The document is a type-C standard relating to safety for builder’s hoists for goods.

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

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

a) machine manufacturers (small, medium and large enterprises);

b) health and safety bodies (regulators, accident prevention organizations, market surveillance, etc.).

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

c) machine users/employers (small, medium and large enterprises);

d) machine users/employees (e.g. trade unions, organizations for people with special needs);

e) service providers, e.g. for maintenance (small, medium and large enterprises);

f) consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

The machinery concerned and the extent to which hazards, hazardous situations or hazardous events are covered are indicated in the scope of this document. In addition, machinery shall comply as appropriate with EN ISO 12100:2010 for hazards which are not covered by this document.

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 deals with power-operated temporarily installed builder's 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 load-carrying device:

— designed for the transportation of goods only;

— guided;

— travelling vertically or along a path within 15 degrees max. of the vertical;

— supported or sustained by drum-driven wire rope, chain, rack and pinion or an expanding linkage mechanism;

— where masts, when erected, may or may not require support from separate structures;

— which permits the access of instructed persons during loading and unloading;

— which are driven by appointed persons;

— which permits, if necessary, during erection, dismantling, maintenance and inspection, the access and travel by persons who are competent and authorized.

1.2 The document identifies hazards as listed in Annex D 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:

— 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 document is not applicable to

— builder's hoists for persons and materials;

— lifts according to EN 81-3:2000+A1:2008 and EN 81-20:2020;

— inclined hoists according to EN 12158-2:2000+A1:2010;

— 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 document 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

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 81-20:2020, *Safety rules for the construction and installation of lifts - Lifts for the transport of persons and goods - Part 20: Passenger and goods passenger lifts*

EN 60204-1:2018, *Safety of machinery - Electrical equipment of machines - Part 1: General requirements*

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

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

EN 60947-5-1:2017, *Low-voltage switchgear and controlgear - Part 5-1: Control circuit devices and switching elements - Electromechanical control circuit devices*

EN IEC 60947-4-1:2019, *Low-voltage switchgear and controlgear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters*

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

EN ISO 13849-1:2015, *Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design (ISO 13849-1:2015)*

EN ISO 13849-2:2012, *Safety of machinery - Safety-related parts of control systems - Part 2: Validation (ISO 13849-2:2012)*

EN ISO 13850:2015, *Safety of machinery - Emergency stop function - Principles for design (ISO 13850:2015)*

EN ISO 13854:2019, *Safety of machinery - Minimum gaps to avoid crushing of parts of the human body (ISO 13854:2017)*

EN ISO 13857:2019, *Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2019)*

EN ISO 14118:2018, *Safety of machinery - Prevention of unexpected start-up (ISO 14118:2017)*

EN ISO 14119:2013, *Safety of machinery - Interlocking devices associated with guards - Principles for design and selection (ISO 14119:2013)*

ISO 2408:2017, *Steel wire ropes — Requirements*

ISO 2394:2015, *General principles on reliability for structures*

ISO 4302:2016, *Cranes — Wind load assessment*

ISO 4309:2017, *Cranes — Wire ropes — Care and maintenance, inspection and discard*

ISO 6336-1:2019, *Calculation of load capacity of spur and helical gears — Part 1: Basic principles, introduction and general influence factors*

ISO 6336-2:2019, *Calculation of load capacity of spur and helical gears — Part 2: Calculation of surface durability (pitting)*

ISO 6336-3:2019, *Calculation of load capacity of spur and helical gears — Part 3: Calculation of tooth bending strength*

ISO 6336-5:2016, *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
builder's 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 platform 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 other than friction

3.6
hydraulic hoist
hoist which uses a hydraulic cylinder to directly or indirectly carry the load

3.7
rack and pinion hoist
hoist which uses a toothed rack and pinion as the load suspension system

3.8
expanding linkage mechanism
mechanical linkage system (e.g. scissors) which supports and guides the platform by means of expansion or contraction under the control of an actuator

3.9
base frame
lowest framework of the hoist upon which all other components are mounted

3.10
guides
rigid elements which determine the travel way of the platform

3.11
mast
structure that supports and guides the platform

3.12
mast section
indivisible piece of mast, between two adjacent mast joints

3.13
mast tie
connection system between the mast and any building structure, providing lateral support for the mast

3.14
hoistway
total space which is travelled by the platform and its load

3.15
platform
load-carrying device including the floor, sides and entrances

3.16
stopping distance
distance the platform moves from the moment when the control or safety circuit is broken until the platform has come to a full stop

3.17
overspeed safety device
mechanical device for stopping and maintaining stationary the platform in the event of overspeed in down direction

3.18
slack rope
rope, normally under tension, from which all external loads have been removed

3.19
wire rope termination
adaptation at the end of a wire rope permitting attachment

3.20
landing
level in a building or construction intended for loading and unloading the platform

3.21
safety distance
minimum acceptable distance between any moving part of a hoist and any point of access

3.22
guard rail
fixed equipment, other than gates, which is used to prevent people from falling or from reaching hazardous areas

3.23
normal operation
usual operating conditions for the equipment when in use for carrying loads but excluding routine maintenance, erection, dismantling, etc

3.24
in service
condition during use of the hoist when the platform is in any position, laden or unladen, moving or stationary

3.25
out of service
installed condition when the unladen platform is positioned such that it is provided with the most shelter from the wind (normally, but not necessarily, on the ground level)

3.26
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 Safety requirements and/or measures

4.1 General

4.1.1 Design considerations

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 platform 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 make available suitable lifting equipment. All removable and detachable covers shall be retained by captive fastenings.

Builders' hoists for goods 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 12100:2010 for relevant, but not significant hazards, which are not dealt with by this document (e.g. sharp edges).

4.1.2 Proof calculation

The objective of this calculation is to prove theoretically that a hoist, taking into account the service conditions agreed between the user, designer and/or manufacturer, as well as the states during erection, dismantling and transport, has been designed in conformance to the safety requirements to prevent mechanical hazards.

The proof of competence according to this standard shall be carried out by using the general principles and methods appropriate for this purpose and corresponding with the recognized state of the art in mechanical design. For guidance governing analysis of structural members and their connections (e.g. fatigue, welding, bolts), EN 13001-3-1:2012+A2:2018 is recommended. For aluminium, consider EN 1999-1-1:2007/A2:2013.

Alternatively, advanced and recognized theoretical or experimental methods may be used in general, provided that they conform to the principles of this document.

4.1.3 Load combinations

Loads shall be superimposed in such a way that the resulting load effects attain their instantaneous extreme values for the considered situation of use. Such superimpositions are called load combinations. Basic load combinations are given in 4.2.

When establishing load combinations, consideration shall be given to the use of the hoist, taking into account its control systems, its normative instructions for use and any other inherent conditions, where they relate to the specific aim of the proof of competence.

Magnitude, position and direction of all loads which act simultaneously in the sense of a load combination shall be chosen in such a way that extreme load effects occur in the component or design detail under consideration. Consequently, in order to establish the extreme stresses in all the design critical points, several loading events shall be studied within the same load combination, e.g. different positions of the hoist and wind directions.

For the proof of fatigue strength, the number and magnitude of significant stress cycles shall be specified.

4.1.4 Limit states

During analysis of the hoist, its components or materials, two different limit states need to be considered (ultimate limit state which concerns safety of people and structure, service limit state which concerns function and appearance of the structure as well as the comfort of the user).

There is a distinction between ultimate limit states and serviceability limit states as follows:

a) Ultimate limit states, given by:

1) plastic deformations from the effect of nominal stresses or sliding of frictional connections;

2) failure of components or connections (e.g. static failure, failure by fatigue or formation of critical cracks);

3) elastic instability of the hoist or its parts (e.g. buckling, bulging);

4) rigid body instability of the hoist or its parts (e.g. tilting, shifting).

b) Serviceability limit states, examples of which are:

1) deformations which impair the intended utilization of the hoist (e.g. function of moving components, clearances of parts);

2) exceeding temperature limits (e.g. overheating of motors and brakes).

4.1.5 Proof of competence

The limit states applicable to the combination of material selection, manufacturing techniques and the specified service conditions shall be stated in the proof of competence. For the verification that the ultimate limit states are not exceeded, the following proofs shall be established:

a) proof of strength of members, connections and components:

1) under static and quasi-static loading;

2) under cycling loading (fatigue);

b) proof of elastic stability of the hoist and its parts;

c) proof of hoist stability.

For the verification that the serviceability limit states are not exceeded, the following aspects shall be considered and a proof be established where appropriate:

d) proof of deformation;

e) thermal performance.

4.1.6 Methods for the proof of competence

4.1.6.1 Limit state method

The limit state method defined in ISO 2394:2015 is applicable without any restriction for all structural systems covered by this standard.

Where necessary individual characteristic loads shall be calculated and amplified by a dynamic factor to create quasi static characteristic loads, the static and quasi static characteristics shall then be amplified by the appropriate partial safety factors γ_p and combined into F_j according to the load combination under consideration. The result F_j shall be used to determine the resulting load effects S_k, i.e. the inner forces in structural or mechanical components or the forces in supports.

For the proof that yielding and elastic instability will not occur, the nominal design stresses due to the action of the loads on a particular component are calculated and combined with any stresses resulting

from local effects, calculated using the appropriate partial safety factors γ_p (recommended γ_p is shown in Table 2).

Other criteria may be used, e.g. attainment of a limiting value of the principal membrane strain, attainment of the yielding criterion or limitation of the yielding zone.

4.1.6.2 Allowable stress method

For analyses where all masses act only unfavourable and with a linear relationship between load actions and load effects, the allowable stress method is applicable for the proof of competence calculation. The allowable stress method is a special case of the limit state method, where the partial safety factors are given the same value, which combined with the resistance coefficient, forms an overall safety factor S_y. Due to its special character, the allowable stress method is only reliable in specific cases.

All loads shall be combined as in limit state method but with the partial load factor set to 1. The combined load shall be used to determine the resulting load effects, i.e. the inner forces in structural and mechanical components or the forces in articulations and supports.

For the proof that yielding and elastic instability do not occur, the nominal stress due to the action of the load effects on a particular element or component shall be calculated and combined with any stresses resulting from local effects. The resulting stress shall be compared with the allowable stress. It is derived from the yield strength of the material, connection or component with at least 95 % probability of survival divided by the overall safety factor S_y (see Table 2 for S_y and Table 4 for S_o).

a) steel structures (permissible stresses)

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

b) aluminium structures (permissible stresses)

$$\sigma_0 = Min\left\{\frac{f_y}{S_y}, \frac{f_u}{S_u}\right\}$$

Where:

f_y yield strength

f_u tensile strength

S_y safety factor on yield strength

S_u safety factor on tensile strength

4.1.6.3 Elastic stability

The deflection of a structure shall be taken into account when calculating stresses in slender designs or using materials with a low modulus of elasticity. This shall be done by using state-of-the-art methods that take 2nd order effects into consideration.