SLOVENSKI STANDARD
SIST EN 14985:2012

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Nadomešča:
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Žerjavi - Vrtljivi žerjavi z ročico

Cranes - Slewing jib cranes

Krane - Ausleger-Drehkrane

Appareils de levage à charge suspendue - Grues à flèche pivotante

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53.020.20 Dvigala Cranes

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This European Standard was approved by CEN on 9 December 2011.

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Foreword

This document (EN 14985:2012) has been prepared by Technical Committee CEN/TC 147 “Cranes - Safety”, the secretariat of which is held by BSI.

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of an identical text or by endorsement, at the latest by August 2012, and conflicting national standards shall be withdrawn at the latest by August 2012.

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 14985:2007.

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

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

This revision does not contain any fundamental changes. However, a number of clauses have been redrafted for reasons of clarity and technical and editorial accuracy.

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

Introduction

This European Standard has been prepared to be a harmonised standard to provide one means for slewing jib cranes to conform with the essential health and safety requirements of the Machinery Directive, as mentioned in Annex ZA.

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

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

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

This European Standard applies to electrically or hydraulically powered slewing jib cranes mounted in one position or free to travel on horizontal rails. It does not apply to wall mounted, pillar, derrick, railway, tower or workshop jib cranes. This European Standard is not applicable to erection, dismantling operations, or changing the configuration of the crane.

This European Standard gives requirements for all significant hazards, hazardous situations and events relevant to slewing jib cranes, when used as intended and under conditions foreseen by the manufacturer (see Clause 4).

The specific hazards due to potentially explosive atmospheres, ionising radiation, and operation in electromagnetic fields beyond the range of EN 61000-6-2 are not covered by this European Standard.

This European Standard does not include requirements for the lifting of persons.

This European Standard is applicable to slewing jib cranes, which are manufactured after the date of approval by CEN of this European Standard.

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 547-1, *Safety of machinery — Human body measurements — Part 1: Principles for determining the dimensions required for openings for whole body access into machinery*

EN 547-2, *Safety of machinery — Human body measurements — Part 2: Principles for determining the dimensions required for access openings*

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 894-2, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 2: Displays*

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

EN 12077-2:1998+A1:2008, *Cranes safety — Requirements for health and safety — Part 2: Limiting and indicating devices*

EN 12644-1, *Cranes — Information for use and testing — Part 1: Instructions*

EN 12644-2, *Cranes — Information for use and testing — Part 2: Marking*

EN 13001-1, *Cranes — General design — Part 1: General principles and requirements*

EN 13001-2:2011, *Crane safety — General design — Part 2: Load actions*

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

CEN/TS 13001-3-2, *Cranes — General design — Part 3-2: Limit states and proof of competence of wire ropes in reeving systems*

EN 13135-1, *Cranes — Equipment — Part 1: Electrotechnical equipment*

EN 13135-2, *Cranes — Equipment — Part 2: Non-electrotechnical equipment*

EN 13155, *Cranes — Safety — Non-fixed load lifting attachments*

EN 13557:2003+A2:2008, *Cranes — Controls and control stations*

EN 13586, *Cranes — Access*

EN 60204-11, *Safety of machinery — Electrical equipment of machines — Part 11: Requirements for HV equipment for voltages above 1 000 V a.c. or 1 500 V d.c. and not exceeding 36 kV (IEC 60204-11)*

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

EN 60825-1, *Safety of laser products — Part 1: Equipment classification and requirements (IEC 60825-1)*

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

EN ISO 6892-1, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature (ISO 6892-1)*

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 13732-1:2008, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces (ISO 13732-1:2006)*

EN ISO 13849-1:2008, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design (ISO 13849-1:2006)*

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

ISO 3864 (all parts), *Graphical symbols — Safety colours and safety signs*

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 7752-4, *Cranes — Controls — Layout and characteristics — Part 4: Jib cranes*

ISO 8566-4, *Cranes — Cabins — Part 4: Jib cranes*

ISO 9374-4, *Cranes — Information to be provided — Part 4: Jib cranes*

ISO 12210-4, *Cranes — Anchoring devices for in-service and out-of-service conditions — Part 4: Jib cranes*

ISO 12488-4, *Cranes — Tolerances for wheels and travel and traversing tracks — Part 4: Jib cranes*

FEM 1.001:1998, booklets 9 and 10, *Rules for the design of hoisting appliances*

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
rated capacity
m_{RC}
maximum net load (the sum of the payload and non-fixed load-lifting attachment) that the crane is designed to lift for a given crane configuration and load location during normal operation

3.2
hoist load
m_H
sum of the masses of the load equal to the rated capacity, the fixed lifting attachment and the hoist medium

3.3
slewing jib crane
power operated crane designed for permanent installation, mounted in either a fixed position or free to travel on horizontal rails, equipped with a jib which is able to rotate around a vertical axis

3.4
direct acting lifting force limiter
device that limits the force on the system to a specified level

3.5
indirect acting force limiter
device that measures the force on the system and activates a second device to stop the motion

4 List of hazards

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

Table 1 — List of significant hazards and associated requirements

No.	Hazard	Relevant clause(s) in this European Standard
1	**Mechanical hazards**	
1.1	Generated by machine parts or workpieces, e.g. by:	
1.1.1	Shape	
1.1.2	Relative location	5.7.2
1.1.3	Mass and stability	5.2
1.1.4	Mass and velocity	5.4.4, 5.4.5,
1.1.5	Inadequacy of mechanical strength	5.2
1.2	Accumulation of energy inside the machinery, e.g. by:	
1.2.1	Elastic elements (springs)	
1.3	Elementary forms of mechanical hazards	
1.3.1	Crushing	5.1, 5.7.2, 7.2
1.3.2	Shearing	5.7.2
1.3.3	Cutting or severing	
1.3.4	Entanglement hazard	
1.3.5	Drawing-in or trapping hazard - moving transmission parts	5.7.2
1.3.6	Impact	5.5.3, 7.2
1.3.7	Stabbing or puncture hazard	
1.3.8	Friction or abrasion hazard	
2	**Electrical hazards** due to:	5.3
2.1	Contact of persons with live parts (direct contact)	5.3.6.1
2.2	Contact of persons with parts which have become live under faulty conditions (indirect contact)	5.3.6.2
2.3	Approach to live parts under high voltage	5.3.5.
2.4	Electrostatic phenomena	7.4
3	**Thermal hazards,** resulting in:	
3.1	Burns and scalds, by possible contact of persons with objects or materials with an extreme temperature, by flames, by radiation, etc.	5.6.1, 7.5
4	**Hazards generated by noise,** resulting in:	
4.1	Hearing losses	5.7.4, 7.3
4.2	Interference with speech communication, signals, etc.	5.7.4, 7.3
6	**Radiation**	
6.0	External radiation	See Introduction
6.1	Low frequency, radio frequency radiation, micro waves	5.6.2
6.2	Infrared, visible, UV-light	
6.3	X and gamma rays	
6.4	Alpha, beta rays, electron or ion beams; neutrons	
6.5	Lasers	5.6.3
7	**Processed materials and substances, used materials, fuels**	

7.1	Hazards from contact with harmful fluids, gases, mists, fumes and dusts	5.6.4, 5.6.5, 5.6.6 See Introduction
7.2	Fire or explosion hazard	See Introduction
8	**Neglected ergonomic principles in machine design,** e.g. hazards from:	
8.1	Unhealthy postures or excessive efforts	5.7.1.2
8.2	Inadequate consideration of hand-arm or foot-leg anatomy	
8.3	Neglected use of personal protection equipment	7.3
8.4	Inadequate local lighting	5.7.3
8.5	Mental overload or underload, stress	7.3
8.7	Inadequate design, location or identification of manual controls	5.7.1
8.8	Inadequate design or location of visual display units	5.8.2
10	**Unexpected start-up, unexpected overrun/over-speed** (or any similar malfunction) from:	5.3, 5.5
10.1	Failure/ disorder of control systems	5.7.1
10.3	External influences on electrical equipment	5.3.2
10.4	Other external influences (gravity, wind, etc.)	5.4.2.2, 5.4.4.1, 5.4.5.1/2
10.5	Errors in the software	5.3.9
10.6	Errors made by the operator (due to mismatch of machinery with human characteristics and abilities)	7.2
11	**Impossibility of stopping the machine in the best possible conditions**	5.4.5.1
13	**Failure of the power supply**	5.4.2
16	**Break-up during operation**	5.2, 7.4, 7.5
17	**Falling or ejected objects or fluid**	5.7.2
19	**Slip, trip and falling of persons** (related to machinery)	5.7.2
Additional hazards and hazardous events due to mobility		
20	**Relating to the travelling function**	
20.1	Uncontrolled movement of crane when starting the engine	5.3.8
20.2	Movement without a driver at the driving position	5.3.8
20.3	Movement without all parts in a safe position	5.3.8
20.4	Excessive speed of pedestrian controlled machinery	
20.5	Excessive oscillations when moving	5.2.8.6
20.6	Insufficient ability of machinery to be slowed down, stopped and immobilised	5.4.5.1, 7.3
21	**Linked to the work position** (including driving station) on the machine	
21.1	Fall of persons during access to (or at/from) the work position	5.7.2

21.2	Exhaust gases / lack of oxygen at the work position	5.6.5
21.3	Fire (flammability of the cab, lack of extinguishing means)	5.6.4
21.4	Mechanical hazards at the work position: - Contact with the wheels - Fall of objects, penetration by objects - Contact of persons with machine parts or tools (ped. contr.)	5.7.2
21.5	Insufficient visibility from the working position	5.7.1.3, 5.7.3, 5.8.2
21.6	Inadequate lighting	5.7.3
21.7	Inadequate seating	5.7.1.3
21.8	Noise at the driving position	5.7.4, 7.3
21.9	Vibration at the driving position	5.2.8.6
21.10	Insufficient means of evacuation/emergency exit	5.6.4
22	**Due to the control system**	
22.1	Inadequate location of controls /control devices	5.3.9.1, 5.7.1.1
22.2	Inadequate design of the actuation mode and/or action mode of controls	5.7.1.1
25	**From/to third persons**	
25.1	Unauthorised start-up/use	5.4.2
25.2	Drift of a part away from its stopping position	5.4.6.2
25.3	Lack or inadequacy of visual or acoustic warning means	5.8
26	**Insufficient instructions for the driver / operator**	
26.1	Movement into prohibited area	7.3
26.2	Tipping - Swinging	7.2, 7.3
26.3	Collision: machines-machines	7.3
26.4	Collision: machines-men	7.3
26.5	Ground conditions	
26.6	Supporting conditions	7.3
27	**Mechanical hazards and events**	
27.1	From load falls, collision, machine tipping caused by:	
27.1.1	Lack of stability	5.2.1
27.1.2	Uncontrolled loading - overloading – overturning moment exceeded	5.5.2
27.1.3	Uncontrolled amplitude of movements	7.2
27.1.4	Unexpected/unintended movement of loads	7.2, 7.3
27.1.5	Inadequate holding devices / accessories	7.2
27.1.6	Collision of more than one machine	7.3
27.1.7	Two-block of hook to hoist	5.5.1.3.1
27.2	From access of persons to load support	7.2
27.3	From derailment	
27.4	From insufficient mechanical strength of parts	5.2, 5.4.7
	Loss of mechanical strength, or inadequate mechanical strength	5.2, 7.4
27.5	From inadequate design of pulleys, drums	

27.6	From inadequate selection/ integration into the machine of chains, ropes, lifting accessories	5.4.4
27.7	From lowering of the load by friction brake	5.4.2.3, 7.2
27.8	From abnormal conditions of assembly/ testing/ use/ maintenance	7.1
28	**Electrical hazard**	
28.1	From lightning	7.4
34	**Mechanical hazards and hazardous events** due to:	
34.1	Inadequate working coefficients	5.2, 5.5
34.2	Failing of load control	5.4.2.3

5 Safety requirements and/or protective measures

5.1 General

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 for relevant but not significant hazards, which are not dealt with by this European Standard.

5.2 Requirements for strength and stability

5.2.1 Selection of classification parameters

Service parameters shall be selected in accordance with EN 13001-1 and used as the basis of design.

NOTE Guidance on the selection of classification parameters is given in Annex A.

5.2.2 Selection of loads and load combinations

The basic load combinations for the load calculation shall be selected in accordance with EN 13001-2, using the descriptions given in Annex B of this standard.

The recurrence period according to EN 13001-2 for out of service wind shall be minimum 25 years.

5.2.3 Determination of factor ϕ_2

The factor ϕ_2 shall be determined according to the principles of EN 13001-2:2011.

When experiments or analysis are used without reference to a hoisting class, the hoist speed applied shall be as specified for the particular HD-class of EN 13001-2:2011. Analysis shall cover all the dynamic and elastic properties of the crane, including the hoist mechanism and the behaviour of the drive system.

Alternatively a slewing jib crane may be assigned to one of the hoisting classes HC1 to HC4 of EN 13001-2:2011. The class is dependent upon the vertical hoist load displacement δ. This hoist load m_H being applied statically at the point of suspension and the resultant displacement δ takes account of the elasticity within the cranes own structure and that of the rope system. The resultant HC class shall be determined as per Table 2.

Table 2 — Hoisting class selection

Vertical load displacement δ	Hoisting class
1,6 m ≤ δ	HC1
0,55 m ≤ δ < 1,6 m	HC2
0,20 m ≤ δ < 0,55 m	HC3
δ < 0,20 m	HC4

The load displacement δ shall be calculated using the appropriate maximum hoist load value without amplifying factors.

The load displacement may vary for differing load/radius combinations and so result in different hoisting classes. Account shall be taken of these variances in the design calculations.

5.2.4 Stall load condition

5.2.4.1 Cranes with direct acting lifting force limiter

The maximum force, F_{DAL}, which is applied to the crane when the direct acting lifting force limiter operates, shall be calculated as follows:

$$F_{DAL} = \phi_{DAL} \cdot m_H \cdot g$$

where

ϕ_{DAL} is the factor for the limit load setting;

m_H is the mass of the hoist load;

g is the acceleration due to gravity.

For hydraulic systems, the factor ϕ_{DAL} shall be less than, or equal to 1,4.

The force F_{DAL} shall be assigned to the load combination C1 of Table 10 in EN 13001-2:2011 and as a load to line 13 in the stability combination C3 of Table 11 in the same standard.

5.2.4.2 Cranes with indirect acting lifting force limiter

The maximum force, F_{IAL}, which is applied to the crane, resulting from the operation of the indirect acting lifting force limiter, shall be calculated as follows:

$$F_{IAL} = \phi_{IAL} \cdot m_H \cdot g$$

where

ϕ_{IAL} is the load factor for the stall load condition;

m_H is the mass of the hoist load;

g is the acceleration due to gravity.

NOTE 1 The F_{IAL} represents the final load in the hoist system after the triggering has operated and the hoist motion is brought to rest.