SLOVENSKI STANDARD
SIST EN 14985:2007

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Dvigala (ģerjavi) - Vrtljiva roļ iļ na dvigala

Cranes - Slewing jib cranes

Krane - Ausleger-Drehkrane

Appareils de levage a charge suspendue - Grues a fleche pivotante

Ta slovenski standard je istoveten z: **EN 14985:2007**

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53.020.20	Dvigala	Cranes

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Cranes - Slewing jib cranes

Appareils de levage à charge suspendue - Grues à flèche pivotante

Krane - Ausleger-Drehkrane

This European Standard was approved by CEN on 19 March 2007.

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Foreword

This document (EN 14985:2007) 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of an identical text or by endorsement, at the latest by November 2007, and conflicting national standards shall be withdrawn at the latest by November 2007.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, see informative Annex ZA, which is an integral part 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 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.

Absolute safety of cranes cannot be ensured by design alone, as their operation depends on the skill of operators, maintenance personnel and inspectors as well as on the numerous technical parameters relating to the crane and its operating environment, which may have large scatter.

As many of the hazards related to slewing jib cranes relate to their operating environment and use, it is assumed in the preparation of this European Standard that all the relevant information relating to the use and operating environment of the crane has been exchanged between the manufacturer and user (as recommended in

ISO 9374, Parts 1 and 4), covering such issues as, for example:

- clearances;
- requirements concerning protection against hazardous environments;
- processed materials, such as potentially flammable or explosive material (e.g. coal, powder type materials).

This European Standard is a type C standard as stated in EN ISO 12100-1.

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 power operated slewing jib cranes mounted in one position or free to travel on horizontal rails. It does not apply to wall mounted, pillar 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.

This European Standard is not applicable to slewing jib cranes which are manufactured before the date of its publication as EN.

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 294, *Safety of machinery — Safety distance to prevent danger zones being reached by the upper limbs*

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 10002-1, *Metallic materials — Tensile testing — Part 1: Method of test at ambient temperature*

EN 12077-2:1998, *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 13001-2:2004, *Cranes — 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 — Safety — Design — Requirements for 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, *Cranes — Controls and control stations*

EN 13586: 2004, *Cranes — Access*

EN 60204-11, *Safety of machinery — Electrical equipment of machines — Part 11: Requirements for HV equipment for voltages above 1000 V a.c. or 1500 V d.c. and not exceeding 36 kV (IEC 60204- 11:2000)*

EN 60204-32:1998, *Safety of machinery — Electrical equipment of machines — Part 32: Requirements for hoisting machines (IEC 60204-32:1998)*

EN 60825-1, *Safety of laser products — Part 1: Equipment classification, requirements and user's guide (IEC 60825-1:1993)*

EN ISO 4871:1996, *Acoustics — Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996)*

EN ISO 11201, *Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specified positions — Engineering method in an essentially free field over a reflecting plane (ISO 11201:1995)*

EN ISO 11688-1, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning (ISO/TR 11688-1:1995)*

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 13732-1:2006, *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, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design (ISO 13849-1:2006)*

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 (all booklets), *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 12100-1:2003 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 (as listed in EN 1050)	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, 5.7.1.3
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)	
1.2.2	fluids under pressure	5.3.1
1.2.3	the effect of vacuum	
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	
1.3.9	high pressure fluid injection or ejection hazard	7.4
2	**Electrical hazards** due to:	5.3
2.1	Contact of persons with live parts (direct contact)	5.3.5.1
2.2	Contact of persons with parts which have become live under faulty conditions (indirect contact)	5.3.5.2
2.3	Approach to live parts under high voltage	5.3.5.1
2.4	Electrostatic phenomena	5.3.3
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	5.9
8.4	Inadequate local lighting	5.7.3
8.5	Mental overload or underload, stress	7.3
8.6	Human errors, human behaviour	5.2.9.3, 5.4.1, 5.4.4.1, 5.4.5.2, 5.7.1, 7.1
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
10.2	Restoration of energy supply after an interruption	5.3, 5.5
10.3	External influences on electrical equipment	5.3.1
10.4	Other external influences (gravity, wind etc.)	5.4.1.1/2, 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, see 8.6)	5.5
11	**Impossibility of stopping the machine in the best possible conditions**	5.4.5.1
13	**Failure of the power supply**	5.3.2
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	
20.2	Movement without a driver at the driving position	
20.3	Movement without all parts in a safe position	
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)	
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	
21.8	Noise at the driving position	5.7.7, 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**	5.4.1
22.1	Inadequate location of controls /control devices	
22.2	Inadequate design of the actuation mode and/or action mode of controls	5.4.5.1, 5.7.1.1
25	**From/to third persons**	
25.1	Unauthorised start-up/use	
25.2	Drift of a part away from its stopping position	
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	
27.1.2	Uncontrolled loading - overloading – overturning moment exceeded	5.5.2
27.1.3	Uncontrolled amplitude of movements	
27.1.4	Unexpected/unintended movement of loads	5.7.1.1
27.1.5	Inadequate holding devices / accessories	
27.1.6	Collision of more than one machine	
27.1.7	Two-block of hook to hoist	
27.2	From access of persons to load support	7.2
27.3	From derailment	
27.4	From insufficient mechanical strength of parts	

	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	
27.7	From lowering of the load by friction brake	
27.8	From abnormal conditions of assembly/ testing/ use/ maintenance	7.1
28	**Electrical hazard**	
28.1	From lightning	5.3.3
34	**Mechanical hazards and hazardous events** due to:	
34.1	Inadequate working coefficients	5.2, 5.5
34.2	Failing of load control	5.3.7

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 12100-1 and EN ISO 12100-2 for relevant but not significant hazards, which are not dealt with by this European Standard.

All the crane motions shall be electrically or hydraulically driven.

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 13001-2:2004, Table 10, using the descriptions given in Annex B.

The recurrence period according to EN 13001-2:2004, 4.2.4.2 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.

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. 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. 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 (m)	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 13001-2:2004, 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.