



SLOVENSKI STANDARD
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Žerjavi - Varnost - Načrtovanje - Zahteve za opremo

Cranes - Safety - Design - Requirements for equipment

Krane - Sicherheit - Konstruktion - Anforderungen an die Ausrüstungen

Appareils de levage à charge suspendue - Sécurité - Conception - Prescriptions relatives à l'équipement

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Appareils de levage à charge suspendue - Sécurité -
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Ausrüstungen

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (prEN 13135:2011) has been prepared by Technical Committee CEN/TC 147 “Cranes - Safety”, the secretariat of which is held by BSI.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 13135-1:2003+A1:2010.

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.

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Introduction

This European Standard is a type C standard.

This European Standard has been prepared to provide one means for equipment of cranes to conform with the essential health and safety requirements of the Machinery Directive.

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

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1 Scope

This European Standard specifies requirements for the design and selection of electrical, mechanical, hydraulic and pneumatic equipment used in all types of cranes and their associated fixed load lifting attachments with the objectives of protecting personnel from hazards affecting their health and safety and of ensuring reliability of function.

NOTE Specific requirements for particular types of cranes, and for load lifting attachments, are given in the appropriate European standard.

The electrical equipment covered by this European Standard commences at the point of connection of the supply to the crane (the crane supply switch) including systems for power supply and control feeders situated outside the crane, e.g. flexible cables, conductor wires or bars, electric motors and cable less controls.

The standard does not cover the detail design of individual items of equipment except with regard to their selection for specific aspects of use.

The principles to be applied for cranes transporting hazardous loads are given in this standard. Particular requirements are given for cranes transporting hot molten metal.

In general, the proof of competence calculations and related strength requirements or safety margins of equipment and components are not presented in this standard. These questions are covered in EN 13001-1 and -2, and in EN 13001-3 -series that is partly under preparation, see Annex A. Exceptionally some safety margins are given here for items not covered in EN 13001-series.

Hazards due to noise are not covered by this standard. They are addressed in safety standards specific to each type of crane.

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.

The significant hazards covered by this European Standard are identified in clause 4.

This European standard is not applicable to cranes, which are manufactured before the date of publication by CEN of this standard.

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 818-1, *Short link chain for lifting purposes — Safety — Part 1: General conditions of acceptance*

EN 818-7, *Short link chain for lifting purposes — Safety — Part 7: Fine tolerance hoist chain, Grade T (Types T, DAT and DT)*

EN 1037, *Safety of machinery — Prevention of unexpected start-up*

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

EN 12385-4, *Steel wire ropes — Safety — Part 4: Stranded ropes for general lifting applications*

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

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

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

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

CEN/TS 13001-3-5, *Cranes — General design — Part 3-5: Limit states and proof of competence of forged hooks*

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

EN 13411-1, *Terminations for steel wire ropes — Safety — Part 1: Thimbles for steel wire rope slings*

EN 13411-3, *Terminations for steel wire ropes — Safety — Part 3: Ferrules and ferrule-securing*

EN 13411-4, *Terminations for steel wire ropes — Safety — Part 4: Metal and resin socketing*

EN 13411-6, *Terminations for steel wire ropes — Safety — Part 6: Asymmetric wedge socket*

EN 13480-3, *Metallic industrial piping — Part 3: Design and calculation*

EN 13557, *Cranes — Controls and control stations*

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*

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

EN ISO 4413: 2010, *Hydraulic fluid power — General rules and safety requirements for systems and their components (ISO 4413)*

EN ISO 4414, *Pneumatic fluid power — General rules and safety requirements for systems and their components (ISO 4414)*

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

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

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

EN ISO 13850, *Safety of machinery — Emergency stop — Principles for design (ISO 13850)*

IEC 60364-4-41, *CLC/TC 64 Low-voltage electrical installations — Part 4-41: Protection for safety — Protection against electric shock*

ISO 2943, *Hydraulic fluid power — Filter elements — Verification of material compatibility with fluids*

ISO 4306-1, *Cranes — Vocabulary — Part 1: General*

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

ISO 4347, *Leaf chains, clevises and sheaves — Dimensions, measuring forces and tensile strengths*

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

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

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

ISO 6336-5, *Calculation of load capacity of spur and helical gears — Part 5: Strength and quality of materials*

ISO 7745, *Hydraulic fluid power — Fire-resistant (FR) fluids — Requirements and guidelines for use*

ISO 10300-1, *Calculation of load capacity of bevel gears — Part 1: Introduction and general influence factors*

ISO 10300-2, *Calculation of load capacity of bevel gears — Part 2: Calculation of surface durability (pitting)*

ISO 10300-3, *Calculation of load capacity of bevel gears — Part 3: Calculation of tooth root strength*

ISO 12482-1, *Cranes — Condition monitoring — Part 1: General*

ISO 12488-1, *Cranes — Tolerances for wheels and travel and traversing tracks — Part 1: General*

ISO/TR 14521, *Gears — Calculation of load capacity of worm gears*

3 Terms and definitions

For the purposes of this standard, the terms and definitions given in ISO 4306-1, EN 60204-32 and the following apply.

3.1

backup brake

additional brake to the service brake that is able to stop and hold the load

NOTE 1 A backup brake can have less design cycles than the service brake.

NOTE 2 Such a brake is also known as emergency brake or safety brake.

3.2

belt system

system for supporting and moving loads via belt and wheel arrangements, comprising all the attachments and parts which transmit the force to the driving mechanism, for example, belt drive wheels, belts, belt reversing wheels, belt terminations and belt guides.

3.3

breakdown torque (of an a.c. motor)

maximum value of the steady-state asynchronous torque which the motor develops without an abrupt drop in speed, when the motor is supplied at the rated voltage and frequency

NOTE In case of variable frequency drives, the breakdown torque can be defined in a similar manner for each combination of voltage and frequency.

[EN 60034-1:1999, definition 2.15]

3.4

chain system

system for supporting and moving loads via chain and wheel arrangements, comprising all the attachments and parts which transmit the force to the driving mechanism, for example, chain drive wheels, chains, chain reversing wheels, chain terminations and chain guides.

3.5**compensating lever**

beam to equalise forces in the ends of two ropes. The amount of compensation is limited by the permitted movement of the lever

3.6**compensating sheave**

sheave which performs the compensating lever function in a single rope system. The amount of compensation is not limited by the movement of the sheave

3.7**crane**

machine for cyclic lifting, or cyclic lifting and handling, of loads suspended on hooks or other load lifting attachments, whether manufactured to an individual design, in series, or from prefabricated components

NOTE "Suspension" can include additional means fitted to prevent swinging or rotation of the load.

3.8**fixed load-lifting attachment**

equipment, being part of the crane, from which the load or the non-fixed load lifting attachment is supported and which is permanently fastened to the hoist medium(s) (e.g. rope, chain) such as hooks, fixed build-in grabs, traverses, tongs

3.9**load hook**

device attached to chain, rope, pulley block or lifting attachment from which the load, load handling devices or slings can be suspended

3.10**load suspension system**

common term for belt, chain and rope systems

3.11**low-voltage electrical equipment**

electrical equipment operating with voltages not exceeding 1000 V a.c. or 1500 V d.c.

3.12**maximum motor speed**

maximum motor speed during operation between the rated speed and the mechanical limit speed

3.13**maximum static force/torque**

force/torque created at a particular point of the force flow due to gravity applied to the mechanism, taking into account:

- the gross load;
- the given operating conditions e.g. configuration, position of the load;
- reeving;
- unfavourable effect of the efficiency coefficient of the reeving system

3.14**mechanical limit speed of the motor**

speed above which the motor can be damaged

3.15**multi-plate hook**

load hook consisting of several plates principally used for transporting hot molten masses

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3.16**rated capacity for crane**

load that the crane is designed to lift for a given operating condition e.g. configuration, position of the load

3.17**rated capacity for lifting attachment**

load that the lifting attachment is designated to lift

3.18**rated load**

force vector provided by gravity applied to the mass equal to the rated capacity

3.19**rated torque of motor (M_n)**

torque to which the motor may be loaded without its thermal limit exceeded when used according to its specified utilisation

3.20**rated speed of motor**

speed corresponding to the rating of the motor used

NOTE

For variable speed drives the following also applies: Maximum speed of the motor at which it is still able to supply its rated torque.

3.21**redundant, redundancy**

multiple arrangement of components and/or sub-assemblies arranged so that if one of the components or sub-assemblies fails, the function is still available

3.22**rope anchorage**

arrangement comprising the parts between the rope termination and the major load bearing structure, e.g. pins, bolts, compensating levers, tension rods

3.23**rope sheave**

wheel which supports the rope and can change the direction of the rope without change of the rope force, except minor losses due to the efficiency of the rope sheave system

3.24**rope system**

device for supporting and moving loads via rope and sheave arrangements, comprising all the attachments and parts which transmit the force to the driving mechanism, for example, wire ropes, sheaves, compensating sheaves, rope terminations and rope guides

3.25**rope termination**

equipment to connect the end of the rope to a rope anchorage

3.26**self-locking brake**

brake whose braking effect is accomplished solely by movement of the motion to be braked

3.27**single failure proof mechanism**

hoisting mechanism comprising of several parallel, similar chains of components, arranged so that in case of failure of any single component in the total mechanism, the hoisted load is not lost

3.28**(single-)plate hook**

load hook made from steel plate

3.29**vertical movement**

movement of hoist load or of a crane part, where the slope of the path of the moved mass is 3% or steeper in relation to horizontal level

4 List of significant hazards

Table 1 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 equipment within the scope of this standard, and which require action to eliminate or reduce the risk.

NOTE Requirements set for equipment included in this standard do not necessarily cover all hazards, which may occur due to installation of equipment into a crane. Such hazards should be evaluated and actions taken in the design of the crane.

Table 1 — List of hazards

No.	Hazard	Hazardous event or accident scenario	Relevant clause(s) in this standard
1.	Mechanical hazards		
1.1–1.2	Crushing (and shearing hazards)	Contact of a person with the crane or its moving parts	5.4.2.1; 5.7.4; 5.7.8
		Contact of a person with a swaying or dropping load	5.3.4.4; 5.6.1; 5.6.2; 5.7.8; 5.9
1.3, 1.5	Cutting or severing hazards Drawing-in or trapping hazard	Contact with moving transmission parts or other moving or rotating machine parts	5.3.6.1; 5.3.7.1; 5.3.8.1
1.9	High pressure fluid injection or ejection hazard	Projection of high pressure fluids	5.5.1; 5.7.4.2; 5.7.4.3; 5.7.5; 5.7.4; 5.7.7
2.	Electrical hazards		
2.1 – 2.3	Contact of persons with live parts (direct contact)	Electric shock due to direct contact with live parts	5.2.1, 5.2.4
	Contact of persons with parts which have become live under faulty conditions (indirect contact)	Electric shock due to indirect contact with live parts	5.2.1
		Electric arc, short-circuit and fire problems	5.2.1
		Lightning causes an accident	5.2.1

No.	Hazard	Hazardous event or accident scenario	Relevant clause(s) in this standard
2.4	Electrostatic phenomena	Direct contact with an electrostatically charged component and a person	5.2.1
		Failure or a breakage of a component of a crane due to electrostatic phenomena	5.2.1
2.5	Thermal radiation or other phenomena	Molten particles and chemical effects from short-circuits, overloads, etc	5.2.1; 5.8.2; 5.9.3
3	Thermal hazards		
3.1	Hazards generated by high or low temperature materials and objects	Contact of hot or cold objects or materials	5.7.4.5.2; 5.7.7.5.2; 5.8.2.2; 5.8.2.3; 5.9.3
5.	Hazards generated by vibration		
5.2	Whole body vibration, particularly when combined with poor postures	Emission of a level of vibration that can be hazardous	5.3.1; 5.4.1
5.3	Vibration that causes mechanical damage	Fatigue, loosening of connections or damage to electrical components, which may lead to further hazards	5.2.1; 5.3.1; 5.4.1
6	Radiation		
6.0.	External radiation	Emission of radiation fields that may damage electric equipment	5.2.1
6.2	Infrared, visible and ultraviolet light	Emission of radiation fields that can be hazardous	5.8.1; 5.9.3
7	Processed materials and substances, used materials and fuels		

No.	Hazard	Hazardous event or accident scenario	Relevant clause(s) in this standard
7.1	Hazards from contact with harmful materials	Direct contact with harmful fluid or material of the crane	5.5.4.2
		Influence of harmful material of the ambient environment (or the load)	5.5.4.2; 5.9
7.2	Fire or explosion hazards	Fire or explosion in the operating area of the crane	5.9
8	Hazards generated by neglected ergonomic principles		
8.7	Inadequate design, location or identification of manual controls	Any hazard due to confusion with a control device e.g.: <ul style="list-style-type: none"> - wrong direction of movement - collision of a person with the crane or the load - confusion with the state of the crane systems 	5.2.6
10	Unexpected startup, unexpected overrun/overspeed	SIST EN 13135:2013	
10.1	Uncontrolled movements due to failure of control system or any external influence on electrical equipment	Unexpected startup of the crane due to a failure in the control system	5.2.1; 5.2.2; 5.2.5; 5.5.1
10.3		Uncontrolled movements of the crane due to a failure in the control system	5.2.1; 5.2.2; 5.2.3; 5.5.1
10.4	Uncontrolled movements due to other external influences	Overspeed with load lowering (gravity)	5.2.2; 5.2.3; 5.2.7; 5.2.8; 5.3.3; 5.9.2
		Wind or a sloped track captures the crane	5.2.3; 5.2.7; 5.2.8; 5.3.3.4; 5.7.4
10.5	Uncontrolled movements due to errors in the software	Unexpected start-up or uncontrolled movement of the crane due to an error in the software	5.2.1; 5.7.1; 5.7.4