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Dvigala - Oprema - 2. del: Neelektrotehnična oprema (vključno z dopolnilom A1)

Cranes - Equipment - Part 2: Non-electrotechnical equipment

Krane -Ausrüstungen - Teil 2: Nicht-elektrotechnische Ausrüstungen

Appareils de levage à charge suspendue - Équipements - Partie 2: Équipements non électrotechniques

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Cranes - Equipment - Part 2: Non-electrotechnical equipment

Appareils de levage à charge suspendue - Equipements -
Partie 2: Equipements non électrotechniques

Krane - Ausrüstungen - Teil 2: Nicht-elektrotechnische
Ausrüstungen

This European Standard was approved by CEN on 9 July 2004 and includes Corrigendum 1 issued by CEN on 19 October 2005 and Amendment 1 approved by CEN on 15 July 2010.

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EN 13135-2:2004+A1:2010 (E)**Foreword**

This document (EN 13135-2:2004+A1:2010) 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of an identical text or by endorsement, at the latest by February 2011, and conflicting national standards shall be withdrawn at the latest by February 2011.

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 includes Amendment 1, approved by CEN on 2010-07-15 and Corrigendum 1, issued by CEN on 2005-10-19.

This document supersedes EN 13135-2:2004.

The start and finish of text introduced or altered by amendment is indicated in the text by tags **A1** **A1**.

The modifications of the related CEN Corrigendum have been implemented at the appropriate places in the text and are indicated by the tags **AC** **AC**.

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 standard is one part of EN 13135 The other part is:

— *Cranes - Safety - Design - Requirements for equipment - Part 1: Electrotechnical equipment*

For the relationship with other European Standards for cranes, see informative annex A.

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 and United Kingdom.

Introduction

This document is a harmonised standard to provide one means for non-electrotechnical equipment for cranes to conform with the relevant Essential Health and Safety Requirements of the Machinery Directive.

Ⓐ This European Standard is a type C standard as stated in EN ISO 12100-1:2003. Ⓐ

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

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EN 13135-2:2004+A1:2010 (E)**1 Scope**

This document specifies requirements for design and selection of non-electrotechnical equipment for all types of crane with the objectives of protecting personnel from hazards affecting their lives and health and of ensuring reliability of function. The fixed load lifting attachments are integral part of the crane and therefore belong also to the scope of this standard.

Non-electrotechnical equipment comprises:

- Structure and structural equipment;
- driving mechanisms;
- rope and chain drives;
- fixed load lifting attachments;
- safety devices;
- fluid power systems.

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

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

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.

This standard does not give the additional requirements for:

- equipment requiring a high level of cleanliness for hygiene reasons, e.g. in direct contact with foodstuffs or pharmaceuticals;
- equipment operating in clean rooms with a dust controlled environment, (e.g. satellite assembling room, electronic industry, food processing, pharmaceuticals processing);
- hazards resulting from handling explosives and radiating material;
- hazards caused by operation subject to special regulations (e.g. explosive atmospheres);
- the risk related to lifting of persons.



This document is applicable to non-electrotechnical equipment which is manufactured after the date of approval 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.

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

 EN 818-7:2002+A1:2008 , *Short-link chain for lifting purposes — Safety — Part 7: Fine tolerance hoist chain, Grade T (Types T, DAT and DT)*

 EN 982:1996+A1:2008 , *Safety of machinery — Safety requirements for fluid power systems and their components — Hydraulics*

 EN 983:1996+A1:2008 , *Safety of machinery — Safety requirements for fluid power systems and their components — Pneumatics*



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



EN 1050:1996, *Safety of machinery — Principles for risk assessment*



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 EN 12644-1:2001+A1:2008 , *Cranes — Information for use and testing — Part 1: Instructions*

 EN 12644-2:2000+A1:2008, *Cranes — Information for use and testing — Part 2: Marking* 



 EN 13001-1:2004+A1:2009 , *Cranes — General design — Part 1: General principles and requirements*
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 EN 13001-2:2004+A3:2009, *Crane safety — General design — Part 2: Load effects* 

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

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 EN 13135-1:2003+A1:2010, *Cranes — Equipment — Part 1: Electrotechnical equipment* 

 EN 13155:2003+A2:2009 , *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 13411-7 , *Terminations for steel wire ropes — Safety — Part 7: Symmetric wedge socket*

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

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

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

Ⓐ 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 13732-1:2006)*

EN ISO 13850:2008, *Safety of machinery — Emergency stop — Principles for design (ISO 13850:2006)* Ⓐ

ISO 2408, *Steel wire ropes for general purposes — Minimum requirements*

Ⓐ ISO 4306-1:2007 Ⓐ, *Cranes — Vocabulary — Part 1: General*

Ⓐ deleted text Ⓐ

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

Ⓐ ISO 5598:2008 Ⓐ, *Fluid power systems and components — Vocabulary*

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

3 Terms and definitions

Ⓐ For the purposes of this document, the terms and definitions given in EN ISO 12100-1:2003, EN 982:1996+A1:2008, EN 983:1996+A1:2008, ISO 5598:2008 and ISO 4306-1:2007 and the following apply. Ⓐ

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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 lifetime than the service brake.

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

3.2**chain drive**

device 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

3.3**clamp**

load handling device which generates the load holding forces by means of compression and friction

3.4**compensating lever**

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

3.5**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

3.6**crane**

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

NOTE "Suspension" may include additional means to prevent swinging/rotation of the load.

3.7 driving mechanism

complete mechanism for each crane movement such as lifting, travelling, rotating, telescoping

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 grappler

load handling device for gripping pipes

3.10 load closing clamp or tong

clamp or tong in which the clamping force is produced by the working load

3.11 load handling magnet

load handling device in which the adhesive forces are generated magnetically

3.12 load hook

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

3.13 maximum static force/torque

force/torque created at a particular point of the force flow due to gravity applied to the mechanism, $\boxed{A_1}$ taking into account $\boxed{A_1}$:

- 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 multi-plate hook

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

3.15 rated capacity for crane

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

3.16 rated capacity for lifting attachment

load that the lifting attachment is designated to lift

3.17 rated load

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

EN 13135-2:2004+A1:2010 (E)**3.18****redundancy**

multiple arrangement of components and/or sub-assemblies arranged so that if one of the components or sub-assemblies fails, the function remains unaltered

3.19**rope drive**

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, rope drums, wire ropes, sheaves, compensating sheaves, rope terminations and rope guides

3.20**rope anchorage**

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

3.21**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

3.22**rope termination**

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

3.23**single-plate hook**

load hook consisting of one segment

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3.24**slipping limit force**

passive tangential limit force available to resist slipping at the contact surface between two objects compressed together; magnitude is the compressive force between two objects multiplied by the minimum expected friction coefficient

3.25**structure (of the crane)**

all load bearing components necessary to support the mechanical and electrical components and the handled load

NOTE The main structure components comprise for example:

- structure of the bridge girders;
- structure of the end truck;
- structure of the trolleys;
- structure of the base frames of the mobile cranes;
- structure of the jib(s);
- structure of the gantry crane rotating platforms;
- structure of the floating cranes floating bodies;
- devices to prevent derailment;
- guy ropes;
- structures for cables dragging or contact conductor installations

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3.26**tear-off force**

minimum force, perpendicular to the gripping surface, which disconnects the load from the gripping device based on adhesion

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3.27**tong**

load handling device that provides clamping forces, a positive fit, or friction plus positive fit between two jaws

3.28**traffic zone**

area which is accessible to persons without:

- opening a guard;
- activating a trip device;
- using additional means

3.29**vacuum lifter**

load handling device in which the adhesive forces are generated pneumatically

3.30**working zone**

area where persons work at or operate under operational conditions

NOTE This does not include inspection, maintenance or cleaning activities.

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4 List of significant hazards

Table 1 shows a list of significant hazardous situations and hazardous events that could result in risks to persons during normal use and foreseeable misuse. It also contains the corresponding relevant clauses in this standard that are necessary to reduce or eliminate the risks associated with those hazards.

Table 1 — List of hazards

N° in Table A.1 of EN 1050:1996	Hazards (as listed in EN 1050:1996)	Relevant clause(s) in this standard
1	Mechanical hazards	5.3.1; 5.3.3; 5.4.2.2
	Generated by machine parts or workpieces caused, for example, by:	
1.b)	relative location	5.2.2.1; 5.6.6
1.c)	mass and stability (potential energy of elements which may move under the effect of gravity)	5.2.2.1; 5.7.4.3
1.d)	mass and velocity (kinetic energy of elements in controlled or uncontrolled motion)	5.2.2.1; 5.6.2; 5.6.6; 5.7.4.3
1.e)	inadequacy of mechanical strength	5.2.1; 5.5.1; 5.13.2.2
	Accumulation of energy inside the machinery caused, for example, by:	
1.g)	liquids and gases under pressure	5.7.2.2, 5.7.2.3; 5.7.4.3; 5.7.4.4; 5.7.4.5
1.5	Drawing-in or trapping hazard	5.4.1.4; 5.4.2.3
1.9	High pressure fluid injection or ejection hazard	5.5.1; 5.7.4.3
2	Electrical hazards due to:	
2.5	Thermal radiation or other phenomena such as the projection of molten particles and chemical effects from short circuits, overloads, etc.	5.9; 5.13.2.4; 5.13.2.1
3	Thermal hazards, resulting in:	5.3.1; 5.13.2.1; 5.13.2.4
3.1	Burns and scalds by a possible contact of persons, by flames or explosions and also by the radiation of heat sources	5.7.4.5; 5.10.2
3.2	Health damaging affects by hot or cold work environment	5.7.4.4; 5.7.5.5; 5.10.2
5	Hazards generated by vibration	
5.2	Whole body vibration, particularly when combined with poor postures	5.2.1; 5.3.1; 5.7.4.4
6	Hazards generated by radiation	
6.2	Infrared, visible and ultraviolet light	5.9; 5.13.2
7	Hazards generated by materials and substances processed, used by the machinery and by its constituent materials	5.7.4; 5.7.4.2; 5.7.5; 5.13
7.1	Hazards from contact with or inhalation of harmful fluids, gases, mists, fumes, and dusts	5.7.4.2
7.2	Fire or explosion hazard	5.7.4.5.2; 5.7.4.5.3
8	Hazards generated by neglecting ergonomic principles in machinery design as - e.g. - hazards from:	
8.6	Human error, human behaviour	5.6.2; 5.6.5.2
10	Unexpected start-up, unexpected overrun/overspeed (or any similar malfunction) from:	
10.1	Failure / disorder of the control system	5.3.2; 5.3.3; 5.5.1; 5.7.1; 5.7.4.2
10.2	Restoration of energy supply after an interruption	5.3.3; 5.7.1
10.4	Other external influences (gravity, wind, etc.)	5.2.1; 5.6.5.1; 5.6.5.2; 5.6.5.3; 5.7.2.2; 5.7.4.4; 5.7.4.5; 5.8; 5.9

N° in Table A.1 of EN 1050:1996	Hazards (as listed in EN 1050:1996)	Relevant clause(s) in this standard
10.6	Errors made by the operator (due to mismatch of machinery with human characteristics and abilities, see 8.6)	5.3.3; 5.7.1
13	Failure of the power supply	5.3.3; 5.5.3.3; 5.7.1; 5.7.2.1; 5.7.2.2; 5.7.4.3; 5.7.5; 5.7.5.2; 5.7.5.6; 5.12
14	Failure of the control circuit	5.7.1
15	Errors of fitting	5.2.2.3
16	Break-up during operation	5.3.1; 5.3.3; 5.3.4.1; 5.3.4.2; 5.4.1; 5.4.1.3; 5.4.2.2; 5.5.1; 5.5.2.1; 5.5.2.2; 5.5.2.3; 5.5.5; 5.7.1; 5.7.4.2; 5.7.4.3; 5.7.4.4; 5.13.1.4
16T	Thermal effect on crane	5.4.1; 5.4.1.3; 5.5.2.1; 5.5.2.2; 5.5.5
17	Falling or ejected objects or fluids	5.7.2.3; 5.7.4.4
20	Relating to the travelling function	
20.3	Movement without all parts in a safe position	5.3.6
20.6	Insufficient ability of machinery to be slowed down, stopped and immobilised	5.6.5.1; 5.6.5.2; 5.6.5.3
21	Linked to the work position (including driving station) on the machine	
21.3	Fire (flammability of the cab, lack of extinguishing means)	5.7.4.5
21.4	Mechanical hazards at the work position: a) contact with the wheels b) rollover c) fall of objects, penetration by objects d) break-up of parts rotating at high speed e) contact of persons with machine parts or tools (pedestrian controlled machines)	5.2.2.1; 5.7.2.3
22	Due to the control system	
22.1	Inadequate location of manual controls	5.7.1
22.2	Inadequate design of the manual controls and their mode of operation	5.7.1
24	Due to the power source and to the transmission of power	
24.1	Hazards from the engine and the batteries	5.7.4.3; 5.7.5.5
24.2	Hazards from transmission of power between machines	5.3.2; 5.3.4.1; 5.3.4.2; 5.13.1.4
25	From / to third persons	
25.1	Unauthorised start-up / use	5.3.6
25.2	Drift of a part away from its stopping position	5.7.4.3; 5.7.5.5
26	Insufficient instructions for the driver / operator	5.2.2.1
27	Mechanical hazards and hazardous events	
27.1	From load falls, collisions, machine tipping caused by:	5.6.6
27.1.1	Lack of stability	5.2.2.3; 5.6.4
27.1.2	Uncontrolled loading – overloading – overturning moments exceeded	5.6.4; 5.7.3
27.1.3	Uncontrolled amplitude of movements	5.7.3; 5.7.4.3; 5.7.5; 5.7.5.3; 5.7.5.5
27.1.4	Unexpected/unintended movement of loads	5.3.2; 5.5.3.1; 5.6.1; 5.7.1; 5.7.3; 5.7.5.3; 5.7.5.5
27.1.5	Inadequate holding devices/accessories	5.5.1; 5.5.2.1; 5.5.3.1; 5.5.3.2; 5.5.3.3; 5.5.4; 5.5.6; 5.7.4.4
27.1.6	Collision of more than one machine	5.6.6