



**SLOVENSKI STANDARD**  
**SIST EN 13135-1:2004+A1:2010**

**01-oktober-2010**

**Nadomešča:**

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**Dvigala (žerjavi) - Oprema - 1. del: Elektrotehnična oprema (vključno z dopolnilom A1)**

Cranes - Equipment - Part 1: Electrotechnical equipment

Krane - Ausrüstungen - Teil 1: Elektrotechnische Ausrüstungen

Appareils de levage à charge suspendue - Équipements - Partie 1: Équipements électrotechniques

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 13135-1:2003+A1**

May 2010

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English Version

## Cranes - Equipment - Part 1: Electrotechnical equipment

Appareils de levage à charge suspendue - Équipements -  
Partie 1: Équipements électrotechniques

Krane - Ausrüstungen - Teil 1: Elektrotechnische  
Ausrüstungen

This European Standard was approved by CEN on 1 September 2003, includes Amendment 1 approved by CEN on 16 April 2010 and includes Corrigendum 1 issued by CEN on 7 June 2006.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

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## Foreword

This document (EN 13135-1:2003+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of an identical text or by endorsement, at the latest by November 2010, and conflicting national standards shall be withdrawn at the latest by November 2010.

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 2010-04-16 and includes Corrigendum 1 issued by CEN on 2006-06-07.

This document supersedes EN 13135-1:2003.

The start and finish of text introduced or altered by amendment is indicated in the text by tags  $\square_{A1}$   $\square_{A1}$ .

The modifications of the related CEN Corrigendum have been implemented at the appropriate places in the text and are indicated by the tags  $\square_{AC}$   $\square_{AC}$ .

$\square_{A1}$  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 Directives, see informative Annex ZA, which is an integral part of this document.  $\square_{A1}$

To select a suitable set of cranes standards for a given application see annex A.

NOTE Some of the standards listed are in preparation.

Annexes A and C are informative. Annex B is normative.

This document includes a Bibliography.

This European Standard is one Part of EN 13135. The other part is as follows:

Part 2: Non-Electrotechnical equipment.

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.

**EN 13135-1:2003+A1:2010 (E)****Introduction**

**A1** This document is a harmonised European Standard to provide one means for electrotechnical equipment of cranes to conform with the essential health and safety requirements of the Machinery Directives 98/37/EC and 2006/42/EC. **A1**

NOTE 1 For the selection of motors, reference has been made to 5.8 of FEM 1.001 Booklet 5. For the convenience of the reader this has been reproduced as annex B.

NOTE 2 As far as possible reference has been made to the relevant CEN and CENELEC standards, in particular, to EN 60204-32.

**A1** This European Standard is a type C standard as stated in EN ISO 12100-1:2003. **A1**

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 a type B standard, the provisions of this type C standard take precedence over the provisions of other standards, for machines that have been designed and built according to the provisions of this type C standard.

**1 Scope**

This European Standard specifies requirements for the design and selection of low voltage electrotechnical equipment for all type of cranes, with the objectives of ensuring reliability of safety-related function and protecting personnel from hazards affecting their health and safety.

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

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

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

**A1** Hazards due to noise are not covered by this standard. They are addressed in safety standards specific to each type of crane. **A1**

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

This standard doesn't deal with voltages over 1000 V a.c. and 1500 V d.c..

This standard does not cover hazards related to the lifting of persons.

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

Authors of Product-Specific-Standards should copy the relevant clauses of this standard instead of referring to EN 13135, and should refer directly to EN 60204-32 whenever possible.

## 2 Normative references

**[A1]** 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. **[A1]**

**[A1]** *deleted text* **[A1]**

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

**[A1]** *deleted text* **[A1]**

EN 12077-2, *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 13155, *Cranes — Safety — Non-fixed load lifting attachments*

EN 50014, *Electrical apparatus for potentially explosive atmospheres — General requirements*

EN 50019, *Electrical apparatus for potentially explosive atmospheres — Increased safety "e"*

EN 50020, *Electrical apparatus for potentially explosive atmospheres — Intrinsic safety "i"*

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

**[A1]** EN ISO 12100-1:2003, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology (ISO 12100-1:2003)* **[A1]**

**[A1]** EN ISO 12100-2:2003, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles (ISO 12100-2:2003)* **[A1]**

IEC 60034-1:1999, *Rotating electrical machines — Part 1: Rating and performance*

IEC 60034-5, *Rotating electrical machines — Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code); Classification*

IEC 60050-826, *International Electrotechnical Vocabulary — Chapter 826: Electrical installations of buildings*

## 3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 60204-32, IEC 60050-826 and **[A1]** EN ISO 12100-1:2003 **[A1]** apply (to be considered according this priority order). Additional terms and definitions specifically needed for this document are added below :

NOTE Definitions are in alphabetical order for this language version only.

### 3.1 cranes

machines 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, rotation of the load.

### 3.2 low-voltage electrotechnical equipment

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

**EN 13135-1:2003+A1:2010 (E)****3.3****rated speed**

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.

**3.4****maximum permissible operating speed**

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

NOTE For variable speed drives the motor torque can also be reduced.

**3.5****mechanical limit speed of the motor**

speed above which the motor can be damaged

**3.6****rated torque of the motor ( $M_n$ )**

torque to which the motor may be loaded without its thermal limit exceeded when used according to its specified utilisation (see annex B)

**3.7****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 (IEC 60034-1:1999, 2.15)

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

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#### 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 this type of machinery and which require action to eliminate or reduce the risk.

**Table 1 — List of significant hazards and associated requirements**

NOTE Hazards numbering follows EN 1050:1996, annex A.

N° in Table A1 of EN 1050:1996	Hazard	Relevant clause(s) in	
		EN 60204-32:1998	and/or this standard
<b>1</b>	<b>Mechanical hazards</b> due to:		
1.c)	Mass and stability (potential energy of elements which may move under the effect of gravity)		5.5
1.d)	Mass and velocity (kinetic energy of elements in controlled or uncontrolled motion)		5.5
1.6	Impact hazard		5.5
<b>2</b>	<b>Electrical hazards</b> due to:		
2.1	Contact of persons with live parts (direct contact)	6.2	
2.2	Contact of persons with parts which have become live under faulty conditions (indirect contact)	6.3	
2.5	Thermal radiation or other phenomena such as the projection of molten particles and chemical effects from short circuits, overloads, etc.	7	
<b>3</b>	<b>Thermal hazards</b> , resulting in:		
3.1	Burns, scalds and other injuries by a possible contact of persons with objects or materials with an extreme high or low temperature, by flames or explosions and also by the radiation of heat sources		5.8
<b>5</b>	<b>Hazards generated by vibration</b>	4.4.8	
<b>7</b>	<b>Hazards generated by materials and substances</b> (and their constituent materials) processed or used by the machinery		
7.2	Fire or explosion hazard		5.8
<b>8</b>	<b>Hazards generated by neglecting ergonomic principles in machinery design</b> as e.g. hazards from:		
8.6	Human error, human behaviour	5, 9.2, 10 and 12	
<b>10</b>	<b>Unexpected start-up, unexpected overrun/overspeed</b> (or any similar malfunction) from:		
10.1	Failure/disorder of the control system		5.2

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N° in Table A1 of EN 1050:1996	Hazard	Relevant clause(s) in	
		EN 60204-32:1998	and/or this standard
10.2	Restoration of energy supply after an interruption	9.2.5.4 and 10.7.3	
10.3	External influences on electrical equipment	4.4 and 11	
10.5	Errors in the software		5.9
10.6	Errors made by the operator (due to mismatch of machinery with human characteristics and abilities, see 8.6)	5, 9.2, 10 and 12	5.5
10.7	Overspeed	7.6 and 9.2.5.5	5.4.2 and 5.5
10.8	Overtravel	9.2.5.5, 9.3.2 and 10.1.4	5.4.2 and 5.5
<b>11</b>	<b>Impossibility of stopping the machine in the best possible conditions</b>	9.2 and 9.4	
<b>13</b>	<b>Failure of the power supply</b>	7.5	
<b>14</b>	<b>Failure of the control circuit</b>		5.2,
<b>20</b>	<b>Relating to the travelling function</b>		
20.6	Insufficient ability of machinery to be slowed down, stopped and immobilised	9.2.5.4 and 10.7	5.5
<b>22</b>	<b>Due to the control system</b>		
22.1	Inadequate location of manual controls	10	
22.2	Inadequate design of the manual controls and their mode of operation	10	
<b>25</b>	<b>From/to third persons</b>		
25.1	Unauthorised start-up/use	5.6	
<b>26</b>	<b>Insufficient instructions for the driver/operator</b>		7
<b>27</b>	<b>Mechanical hazards and hazardous events</b>		
27.1	From load falls, collisions, machine tipping caused by :		
27.1.2	Uncontrolled loading - overloading - overturning moments exceeded		5.5
27.1.3	Uncontrolled amplitude of movements		5.5
27.1.4	Unexpected/unintended movement of loads		5.4
27.1.5	Inadequate holding devices/accessories		5.3
<b>28</b>	<b>Electrical hazards:</b>		
28.1	From lightning		5.6

## 5 Safety requirements and/or safety measures

### 5.1 General

The safety requirements of EN 60204-32 identified in Table 1 shall apply with the following extensions.

### 5.2 Control circuits and control functions

The provisions of clause 9 and 11 of EN 60204-32:1998 shall apply.

With regard to 9.2.2 of EN 60204-32:1998, certain control systems (e.g. for converters) may have a short time delay before the power supply is removed, for ensuring that no additional hazard occurs.

### 5.3 Electrical requirements for the installation of load lifting attachments

#### 5.3.1 General

The relevant provisions of EN 13155 shall apply.

NOTE The load lifting attachment is the same as load holding device in EN 60204-32.

#### 5.3.2 Selection and installation of wiring systems

The provision of clauses 13 and 14 of EN 60204-32:1998 shall apply.

Electric cables to load lifting attachments shall be installed and protected in such a way that damage is avoided during normal operation.

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#### 5.3.3 Battery systems

Battery-supplied load handling magnets and load handling magnets with back up batteries shall be equipped with an automatic warning device indicating clearly before a dangerous situation occurs as a result of the battery becoming exhausted.

### 5.4 Electric motors

#### 5.4.1 General

Motors shall be selected in accordance with annex B where applicable.

Depending on the type of use the motor falls in one of the duty classes S1, S2 or S3 as defined in IEC 60034-1.

Otherwise (e.g. for single phase motor), the relevant calculation methods shall be used.

#### 5.4.2 Mechanical limit speed, maximum permissible operating speed for hoisting and luffing motors

A motor for hoisting or luffing and its over speed protection shall be selected so that the mechanical limit speed will not be reached within the foreseeable braking delay in the event of power loss. A motor for variable speed drive shall be selected so that the mechanical limit speed will not be reached in case of switching off by an over speed protection during lowering with maximum speed and load or in case of converter malfunction.

For three-phase slipring motors the mechanical limit speed shall correspond to the values in Table 2 (at 50 Hz) :

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Table 2 — Limit speeds for three-phase slipring motors

Synchronous speed	1/min	3000	1500	1000	750	600
Mechanical limit speed, at least	1/min	4500	3000	2000	1500	1200
Recommended mechanical limit speed	1/min			2500	1875	1500

## 5.4.3 Torque for hoisting and luffing motors

The maximum torque of the motor shall be sufficient to fulfil the operating requirements and prevent the fall of the load.

Breakdown torque for three-phase slipring motors with contactor control relative to the rated hoist motor torque  $M_n$  at S3 40 % duty shall reach the values given in Table 3:

Table 3 — Breakdown torque for three-phase slipring motors with contractor control

Frame size and speed	Hoist motor breakdown torque at S3 40 % duty
For frame sizes 100 to 160 at 3000, 1500 and 1000 1/min	at least $2,2 \times M_n$
For frame sizes 180 to 225 at 1000 and 750 1/min	at least $2,2 \times M_n$
For frame sizes 250 to 400 at 600 1/min	at least $2,2 \times M_n$
For all other frame sizes and speeds	at least $2,5 \times M_n$

## 5.4.4 A.C motors

## 5.4.4.1 General

Hoist shall incorporate features so that:

- the load cannot move back in an uncontrolled manner if a phase fails;
- the load cannot drop if a phase fails.

## 5.4.4.2 Slipring motors

In case of significant risks due to uncontrolled lowering, the crane equipment shall comprise :

- either devices that prevent start-up of the load or stop movement immediately as soon as the possible cause of uncontrolled lowering has been discovered;
- or devices that stop the crane movement before the lowering speed reaches the mechanical limit speed in accordance with the requirements in 5.4.2.

See also provisions of 7.6 and 9.5 of EN 60204-32:1998.

NOTE An uncontrolled lowering of the load is possible for example under the following conditions: