



SLOVENSKI STANDARD
SIST EN 13135:2013+A1:2018
01-julij-2018

Žerjavi - Varnost - Konstruiranje - 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

(standards.iteh.ai)

Ta slovenski standard je istoveten z: EN 13135:2013+A1:2018

<https://standards.iteh.ai/catalog/standards/sist/7c4e4001-bada-4bfe-ac08-5a6962804a7c/sist-en-13135-2013a1-2018>

ICS:

53.020.20 Dvigala Cranes

SIST EN 13135:2013+A1:2018 **en,fr,de**

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 13135:2013+A1:2018

<https://standards.iteh.ai/catalog/standards/sist/7c4e4001-bada-4bf8-ac08-5a6962804a7c/sist-en-13135-2013a1-2018>

EUROPEAN STANDARD

EN 13135:2013+A1

NORME EUROPÉENNE

EUROPÄISCHE NORM

April 2018

ICS 53.020.20

Supersedes EN 13135:2013

English Version

Cranes - Safety - Design - Requirements for equipment

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

Krane - Sicherheit - Konstruktion - Anforderungen an
die Ausrüstungen

This European Standard was approved by CEN on 5 January 2013 and includes Amendment 1 approved by CEN on 22 November 2017.

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-CENELEC 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-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

[SIST EN 13135:2013+A1:2018](https://standards.iteh.ai/catalog/standards/sist/7c4e4001-bada-4bf8-ac08-5a6962804a7c/sist-en-13135-2013a1-2018)

<https://standards.iteh.ai/catalog/standards/sist/7c4e4001-bada-4bf8-ac08-5a6962804a7c/sist-en-13135-2013a1-2018>



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Contents	Page
European foreword.....	4
Introduction	5
1 Scope.....	6
2 Normative references	6
3 Terms and definitions	8
4 List of significant hazards	11
5 Safety requirements and/or protective measures	14
5.1 General.....	14
5.2 Electrical equipment.....	14
5.2.1 General.....	14
5.2.2 Physical environment and operating conditions	15
5.2.3 Electrical supply	15
5.2.4 Protection against electric shock by direct contact.....	15
5.2.5 Control circuits and control functions.....	15
5.2.6 Operator interface and mounted control devices	16
5.2.7 Power driven motions	16
5.2.8 Selection of motors.....	16
5.3 Mechanical equipment.....	25
5.3.1 General.....	25
5.3.2 Clutches and couplings.....	25
5.3.3 Brakes.....	25
5.3.4 Gear drives.....	28
5.3.5 Wheels on rails.....	29
5.3.6 Rope systems	30
5.3.7 Chain systems	33
5.3.8 Belt systems	34
5.3.9 Adjustment rods	36
5.3.10 Compensating means.....	36
5.4 Structures associated with mechanical equipment.....	36
5.4.1 Structures.....	36
5.4.2 Structural equipment	37
5.5 Fluid power systems	38
5.5.1 Controls and control devices of fluid power systems	38
5.5.2 Protective measures	38
5.5.3 Overload testing	39
5.5.4 Hydraulic equipment.....	39
5.5.5 Pneumatic equipment	42
5.6 Fixed load lifting attachments.....	43
5.6.1 General.....	43
5.6.2 Hooks.....	44
5.7 Equipment for safeguarding	45
5.7.1 General.....	45
5.7.2 Safety related functions of control systems.....	46
5.7.3 Measures to decrease the consequences of loss of drive power.....	46

5.7.4	Safety devices to prevent overrunning of movements.....	46
5.7.5	Derailment safety device	47
5.7.6	Provisions to prevent tipping.....	48
5.7.7	Storm-locking.....	48
5.7.8	Anti-collision device	49
5.8	Environmental effects	49
5.8.1	Protection against weakening of material	49
5.8.2	Temperature	49
5.9	High risk applications	50
5.9.1	General	50
5.9.2	Decreasing of the probability of occurrence of harm.....	50
5.9.3	Additional requirements for the transportation of hot molten metal	52
6	Verification of the safety requirements and/or protective measures	56
7	Information for use	60
7.1	General	60
7.2	Instructions for operation in special situations.....	60
7.3	Instructions for installation and maintenance	60
7.4	Maintenance instructions in the case of high risk applications	61
7.5	Marking	61
Annex A (informative)	Selection of a suitable set of crane standards for a given application	63
Annex B (informative)	Design of rail wheel flanges.....	65
Annex C (informative)	Guidance on rope systems.....	68
Annex D (informative)	Specification of endurance of equipment.....	69
D.1	Basic approach.....	69
D.2	Examples of application.....	70
D.2.1	Roller bearing	70
D.2.2	Lifting attachment, fixed or non-fixed.....	70
D.2.3	Turnbuckle.....	71
D.2.4	Electromechanical component	71
Annex ZA (informative)	Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC.....	72
Bibliography	73

EN 13135:2013+A1:2018 (E)**European foreword**

This document (EN 13135:2013+A1:2018) 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 October 2018, and conflicting national standards shall be withdrawn at the latest by October 2018.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document includes Amendment 1 approved by CEN on 22 November 2017.

This document supersedes A1 EN 13135-1:2013 A1.

The start and finish of text introduced or altered by amendment is indicated in the text by tags A1 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 Directive(s), see informative Annex ZA, which is an integral part of this document.

Since the previous edition, major changes have been made in 5.2.8, 5.3.3.2, 5.3.3.5, 5.3.6.2, 5.6.2, 5.7.2, 5.9 and in Annex D, which deals with a new issue. There are several updates in standard references, and 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 organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

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

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.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN 13135:2013+A1:2018](https://standards.iteh.ai/catalog/standards/sist/7c4e4001-bada-4bf8-ac08-5a6962804a7c/sist-en-13135-2013a1-2018)

<https://standards.iteh.ai/catalog/standards/sist/7c4e4001-bada-4bf8-ac08-5a6962804a7c/sist-en-13135-2013a1-2018>

EN 13135:2013+A1:2018 (E)**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 cableless controls.

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.

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

In general, the proof of competence calculations and related strength requirements or safety margins of equipment and components are not covered by this standard. These questions are covered in EN 13001 parts 1 and 2, and in the 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 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 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 1561, *Founding — Grey cast irons*

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 12644-2, *Cranes — Information for use and testing — Part 2: Marking*
- EN 13001-1, *Cranes — General design — Part 1: General principles and requirements*
- EN 13001-2, *Crane safety — General design — Part 2: Load actions*
- EN 13001-3-1, *Cranes — General design — Part 3-1: Limit states and proof competence of steel structure*
- EN 13001-3-2, *Cranes — General design — Part 3-2: Limit states and proof of competence of wire ropes in reeving systems*
- EN 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 60034-1:2010, *Rotating electrical machines — Part 1: Rating and performance*
- 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, *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 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction (ISO 12100:2010)*
- 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)*

EN 13135:2013+A1:2018 (E)

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

ISO 4306-1:2007, *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*

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 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 wormgears*

3 Terms and definitions

For the purposes of this standard, the terms and definitions given in EN ISO 12100:2010, ISO 4306-1:2007, EN 60204-32:2008 and the following apply.

3.1

backup brake

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

Note 1 to entry: A backup brake can have fewer design cycles than the service brake.

Note 2 to entry: Such a brake is also known as emergency brake or safety brake.

3.2

backup limiter

limiter that is only activated if other (primary) limiting means fail to operate as intended

3.3**belt system**

system for supporting and moving load or crane part via belt and wheel arrangement, comprising the belts and all the attachments and parts which are in contact with the belts

EXAMPLE Belt drive wheels, belts, belt reversing wheels, belt terminations and belt guides.

3.4**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 1 to entry: In case of variable frequency drives, the breakdown torque can be defined in a similar manner for each combination of voltage and frequency.

[SOURCE: EN 60034-1:2010, 3.15]

3.5**chain system**

system for supporting and moving load or crane part via chain and wheel arrangement, comprising the chains and all the attachments and parts which are in contact with the chains

EXAMPLE Chain drive wheels, chains, chain reversing wheels, chain terminations and chain guides.

3.6**compensating beam**

beam to equalise forces at the ends of two ropes

Note 1 to entry: The amount of compensation is limited by the permitted movement of the beam.

3.7**compensating sheave**

sheave which performs the function of compensating beam in a continuous rope system

Note 1 to entry: The amount of compensation is not limited by the movement of the sheave.

3.8**crane**

machine for cyclic lifting, or cyclic lifting and moving, of loads suspended on hooks or other load lifting attachments

Note 1 to entry: "Suspension" can include additional means fitted to prevent swinging or rotation of the load.

3.9**hoisting mechanism**

system for supporting and moving load or crane part against gravity, comprising all components from fixed load lifting attachment to the motor

3.10**load bearing chain**

assembly of load bearing components

3.11**load bearing component**

mechanical or structural component which is stressed by the hoist load

EN 13135:2013+A1:2018 (E)

3.12

load hook

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

3.13

load suspension system

common term for belt, chain and rope systems employed to suspend a load

3.14

low-voltage electrical equipment

electrical equipment operating with voltages not exceeding 1 000 V a.c. or 1 500 V d.c.

3.15

maximum motor speed

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

3.16

mechanical limit speed of the motor

speed above which the motor can suffer mechanical damage

3.17

multi-plate hook

load hook consisting of several plates

EXAMPLE Typically used for transporting hot molten substances.

3.18

rated capacity for lifting attachment

rated load for lifting attachment and maximum load that the lifting attachment is designed to lift

3.19

rated capacity**rated load**

maximum **net load** that the crane is designed to lift for a given crane configuration, load location and operating condition

Note 1 to entry: For mobile cranes, replace **net load** in the definition by **hoist medium load**.

Note 2 to entry: For net load and hoist medium load, see ISO 4306-1.

3.20

rated speed of motor

speed corresponding to the rating of the motor used

Note 1 to entry: 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

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

Note 1 to entry: The function may be with limited performance.

3.22**rope anchorage**

arrangement comprising the parts between the rope termination and the fixed load bearing structure

EXAMPLE Pins, bolts, compensating beams, 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**

system for supporting and moving load or crane part via rope and sheave arrangement, comprising the ropes and all the attachments and parts which are in contact with the ropes

EXAMPLE Wire ropes, sheaves, compensating sheaves, rope terminations and rope guides.

Note 1 to entry: Rope attachment on the drum is included but the rope drum itself is outside of this definition.

3.25**rope termination**

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

3.26**self-locking braking device** (standards.iteh.ai)

braking device whose braking effect is accomplished solely as a result of movement to be braked

3.27**single failure proof hoisting mechanism**

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

Note 1 to entry: After the failure, the mechanism is not necessarily functional as such.

3.28**single-plate hook**

load hook made from a single 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 5 % 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.

Requirements set for equipment included in this standard do not necessarily cover all hazards, which can 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.	Type or group	Origin (sources)	Subclause of this standard
1	Mechanical hazards	Contact of a person with the crane or its moving parts	5.3.5.1; 5.4.2.1; 5.5.2.2; 5.5.2.3; 5.5.4.4.2; 5.5.5.5.1; 5.7.4; 5.7.8
		Contact of a person with a swaying or dropping load	5.3.4.4; 5.5.2.2; 5.6.1; 5.6.2; 5.7.8; 5.9.2.3
		Contact of a person with falling parts	5.4.2.1; 5.3.5.2
		Contact with moving transmission parts or other moving or rotating machine parts	5.3.6.1; 5.3.7.1; 5.3.8.1; 5.3.8.3; 5.5.2.2; 5.5.2.3
		Projection of high pressure fluids	5.5.1; 5.5.2.3; 5.5.4.4.2
		Sharp edges	5.3.6.6.1; 5.3.8.3;
		Rough or slippery surfaces	5.7.4; 5.7.7
		Contact of a person with bursting parts due to exceeding of kinetic energy	5.7.4
		Contact of a person with ejected objects	5.2.8.4; 5.5.2.3
		Loss of stability or overturning of crane	5.3.5.1; 5.4.2.3; 5.7.4; 5.7.5; 5.7.6; 5.7.7, 5.7.8
		Fitting together parts, which should not be fitted or fitting parts in a wrong order.	5.4.2.3
2	Electrical hazards	Contact of persons with live parts (direct contact)	5.2.1, 5.2.4
		Contact of persons with parts which have become live under faulty conditions (indirect contact)	5.2.1
		Contact of persons with electric arc	5.2.1
		Lightning	5.2.1
		Thermal radiation from molten particles and chemical effects from short-circuits, overloads, etc.	5.2.1; 5.5.4.5.2; 5.8.2; 5.9.3
3	Thermal hazards	Contact of objects or materials with a high or low temperature	5.5.5.5.2; 5.8.2.2; 5.8.2.3; 5.9.3.3.1
		Heat radiation, e.g. from hot molten substances	5.4.2.1; 5.9.1; 5.9.3.2.7; 5.9.3.3.1
5	Vibration hazards	Vibrations of the mechanisms and structures, causing: <ul style="list-style-type: none"> — whole body vibration, particularly when combined with poor postures — fatigue, loosening of connections or damage 	5.2.1; 5.3.1; 5.4.1

No.	Type or group	Origin (sources)	Subclause of this standard
		to electrical components, which may lead to further hazards	
6	Radiation hazards	External radiation	5.2.1
		Infrared, visible and ultraviolet light	5.8.1; 5.9.3.3.1
7	Material and substances hazards	Hazards from contact with or inhalation of harmful fluids, gases, mists, fumes, and dusts or material of the crane	5.5.4.2
		Influence of harmful material of the ambient environment (or the load)	5.5.4.2; 5.9.3.3
		Fire or explosion in the operating area of the crane	5.5.4.4.2; 5.5.4.5.2; 5.9.3.3
8	Ergonomic hazard	Inadequate design, location or identification of manual controls	5.2.6; 5.5.1
9	Hazards associated with the environment in which the machine is used	Lightning, wind, snow, temperature, water	5.2.2; 5.5.4.1, 5.8.1; 5.8.2
10	Unexpected start-up or uncontrolled movements	Unexpected start-up of the crane due to a failure in the control system	5.2.1; 5.2.5; 5.5.1
		Uncontrolled movements of the crane due to a failure in the control system	5.2.1; 5.5.1
		Overspeed with load lowering (gravity)	5.2.3; 5.2.7; 5.2.8.4; 5.3.3; 5.5.4.5.1; 5.9.2
		Wind or a sloped track captures the crane	5.2.7; 5.2.8; 5.3.3.4; 5.7.4; 5.7.7
		Unexpected start-up or uncontrolled movement of the crane due to an error in the software	5.2.1; 5.7.1; 5.7.2; 5.7.4
		Unintended or unexpected use by a third person	5.2.1; 5.5.2.2; 5.5.2.3; 7
		Hazardous events following faulty adjustments made by the operator or a third person	5.2.1; 5.5.2.3; 7
		Leakage of pressurised fluid causes lowering of the load or the jib	5.5.4.3.1; 5.5.4.3.2; 5.5.5.5.3
		Hazardous movements due disconnection from the fluid power supply	5.5.2.2;
11	Impossibility of stopping the machine in the	A failure in stopping the crane, jib, trolley or hoist due to any failure in the crane (e.g. brake failure)	5.2.8.2; 5.3.2; 5.3.3.5; 5.3.4; 5.5.2.1; 5.5.4.3.1; 5.5.5.2; 5.5.5.5.3; 5.9