

BS EN 13852-1:2013



BSI Standards Publication

Cranes — Offshore cranes

Part 1: General-purpose offshore cranes

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National foreword

This British Standard is the UK implementation of EN 13852-1:2013. It supersedes BS EN 13852-1:2004 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee MHE/3/-/10, Marine cranes.

A list of organizations represented on this committee can be obtained on request to its secretary.

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- Partie 1: Grues off-shore pour usage général

Krane - Offshore-Krane - Teil 1: Offshore-Krane für
allgemeine Verwendung

This European Standard was approved by CEN on 19 July 2013.

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Foreword

This document (EN 13852-1:2013) 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of an identical text or by endorsement, at the latest by March 2014, and conflicting national standards shall be withdrawn at the latest by March 2014.

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 supersedes EN 13852-1:2004.

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 and Annex ZB which are integral parts of this document.

Since the previous version, major changes have been made including the scope. New requirements are introduced on load chart, electrotechnical and non electrical equipment, mode and rigging selector, back-up brake on luffing winches, wire ropes, lighting, dropped object protection, controls, data recorder, motion limiters, rated capacity limiter, boom backstop, emergency operation system, fire protection and protective earthing, etc. Major changes have also been made to Annexes B, F, G, K, M and O.

There are several updates in standard references, and a number of clauses have been redrafted for reasons of clarity and technical and editorial accuracy.

EN 13852, *Cranes — Offshore cranes*, is composed of the following parts:

- *Part 1: General-purpose offshore cranes* (the present document);
- *Part 2: Floating cranes*.

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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This European Standard has been prepared to be a harmonised standard to provide one means for general purpose offshore cranes to conform to 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 can have large scatter.

As many of the hazards related to general-purpose offshore 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 9374-1:1989 and ISO 9374-4:1989) covering such issues as, for example:

- clearances;
- requirements concerning protection against hazardous environments;
- processed materials, such as potentially flammable or explosive material (e.g. hydrocarbons, combustible dust, etc).

This European Standard is a type C standard as stated in EN ISO 12100:2010.

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

NOTE 1 A floating crane is a crane mounted on a vessel or barge designed for its support and transport, primarily intended for construction/deconstruction operations in a marine environment.

NOTE 2 EN 13852-2 is not a harmonised standard.

1 Scope

This European Standard specifies the requirements for general-purpose offshore cranes including their supporting pedestals or structures.

The standard is applicable to general-purpose offshore cranes covered by the scope of this European Standard which are manufactured after the date of its publication as EN.

This European Standard is not applicable to general-purpose offshore cranes which are manufactured before the date of its publication as an EN.

This European Standard does not cover use of - or hazards relating to the following:

- a) fabrication, transportation, assembly, dismantling, disabling, scrapping or changing the configuration of the crane;
- b) lifting accessories, i.e. any item between the hook and the load;
- c) minimum design temperature below $-20\text{ }^{\circ}\text{C}$;
- d) operations at an ambient temperature above $45\text{ }^{\circ}\text{C}$;

NOTE: For equipment designed for operation in explosive atmospheres, the normal ambient temperature range is $-20\text{ }^{\circ}\text{C}$ to $+40\text{ }^{\circ}\text{C}$, unless otherwise specified and marked. See Annex O and relevant standards indicated for complete information.

- e) lifting operations involving more than one crane;
- f) accidental loads due to collisions;
- g) hand powered cranes and other cranes with a rated capacity less than 2 t or outreach less than 8 m;
- h) emergency rescue operations; (except training)
- i) subsea lifting operations.

The significant hazards covered by this European standard are identified in Clause 4.

This European Standard includes requirements for the lifting of personnel by a general-purpose offshore crane.

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 614-1:2006+A1:2009, *Safety of machinery — Ergonomic design principles — Part 1: Terminology and general principles*

EN 842:1996+A1:2008, *Safety of machinery — Visual danger signals — General requirements, design and testing*

EN 953:1997+A1:2009, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

EN 1127-1:2011, *Explosive atmospheres — Explosion prevention and protection — Part 1: Basic concepts and methodology*

- EN 10025-1:2004, *Hot rolled products of structural steels — Part 1: General technical delivery conditions*
- EN 10025-2:2004, *Hot rolled products of structural steels — Part 2: Technical delivery conditions for non-alloy structural steels*
- EN 10025-3:2004, *Hot rolled products of structural steels — Part 3: Technical delivery conditions for normalized/normalized rolled weldable fine grain structural steels*
- EN 10025-4:2004, *Hot rolled products of structural steels — Part 4: Technical delivery conditions for thermomechanical rolled weldable fine grain structural steels*
- EN 10025-5:2004, *Hot rolled products of structural steels — Part 5: Technical delivery conditions for structural steels with improved atmospheric corrosion resistance*
- EN 10025-6:2004+A1:2009, *Hot rolled products of structural steels — Part 6: Technical delivery conditions for flat products of high yield strength structural steels in the quenched and tempered condition*
- EN 10083-1:2006, *Steels for quenching and tempering — Part 1: General technical delivery conditions*
- EN 10083-2:2006, *Steels for quenching and tempering — Part 2: Technical delivery conditions for non alloy steels*
- EN 10204:2004, *Metallic products — Types of inspection documents*
- EN 12077-2:1998+A1:2008, *Cranes safety — Requirements for health and safety — Part 2: Limiting and indicating devices*
- EN 12385-1:2002+A1:2008, *Steel wire ropes — Safety — Part 1: General requirements*
- EN 12385-2:2002+A1:2008, *Steel wire ropes — Safety — Part 2: Definitions, designation and classification*
- EN 12385-3:2004+A1:2008, *Steel wire ropes — Safety — Part 3: Information for use and maintenance*
- EN 12385-4:2002+A1:2008, *Steel wire ropes — Safety — Part 4: Stranded ropes for general lifting applications*
- 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*
- EN 13001-2:2011¹⁾, *Crane safety — General design — Part 2: Load actions*
- CEN/TS 13001-3-1:2004, *Cranes — General design — Part 3-1: Limit states and proof of competence of steel structures*
- CEN/TS 13001-3-2:2008, *Cranes — General design — Part 3-2: Limit states and proof of competence of wire ropes in reeving systems*
- CEN/TS 13001-3-5:2010, *Cranes — General design — Part 3-5: Limit states and proof of competence of forged hooks*
- EN 13135:2013, *Cranes — Safety — Design — Requirements for equipment*

1) This standard is impacted by the corrigendum EN 13001-2:2011/AC:2012.

- EN 13411-3:2004+A1:2008, *Terminations for steel wire ropes — Safety — Part 3: Ferrules and ferrule-securing*
- EN 13411-4:2011, *Terminations for steel wire ropes — Safety — Part 4: Metal and resin socketing*
- EN 13411-6:2004+A1:2008, *Terminations for steel wire ropes — Safety — Part 6: Asymmetric wedge socket*
- EN 13411-7:2006+A1:2008, *Terminations for steel wire ropes — Safety — Part 7: Symmetric wedge socket*
- EN 13463-1:2009, *Non-electrical equipment for use in potentially explosive atmospheres — Part 1: Basic method and requirements*
- EN 13478:2001+A1:2008, *Safety of machinery — Fire prevention and protection*
- EN 13557:2003+A2:2008, *Cranes — Controls and control stations*
- EN 13586:2004+A1:2008, *Cranes — Access*
- EN 14502-1:2010, *Cranes — Equipment for the lifting of persons — Part 1: Suspended baskets*
- EN 60079-0:2009, *Explosive atmospheres — Part 0: Equipment — General requirements (IEC 60079-0:2007 + corrigendum Dec. 2010)*
- EN 60079-14:2008, *Explosive atmospheres — Part 14: Electrical installations design, selection and erection (IEC 60079-14:2007)*
- EN 60079-15:2010, *Explosive atmospheres — Part 15: Equipment protection by type of protection “n” (IEC 60079-15:2010)*
- EN 60204-32:2008, *Safety of machinery — Electrical equipment of machines — Part 32: Requirements for hoisting machines (IEC 60204-32:2008)*
- EN 61000-6-2:2005, *Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity for industrial environments (IEC 61000-6-2:2005)*
- EN 61000-6-4:2007²⁾, *Electromagnetic compatibility (EMC) — Part 6-4: Generic standards — Emission standard for industrial environments (IEC 61000-6-4:2006)*
- EN 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems (IEC 61508)*
- EN ISO 898-1:2013, *Mechanical properties of fasteners made of carbon steel and alloy steel — Part 1: Bolts, screws and studs specified property classes — Coarse thread and fine pitch thread (ISO 898-1:2013)*
- EN ISO 3744:2010, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for an essentially free field over a reflecting plane (ISO 3744:2010)*
- EN ISO 4413:2010, *Hydraulic fluid power — General rules and safety requirements for systems and their components (ISO 4413:2010)*
- EN ISO 4414:2010, *Pneumatic fluid power — General rules and safety requirements for systems and their components (ISO 4414:2010)*

2) This text is impacted by the stand-alone amendment EN 61000-6-4:2007/A1:2011 (IEC 61000-6-4:2006/A1:2010).

EN ISO 4871:2009, *Acoustics — Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996)*

EN ISO 7731:2008, *Ergonomics — Danger signals for public and work areas — Auditory danger signals (ISO 7731:2003)*

EN ISO 11201:2010, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections (ISO 11201:2010)*

EN ISO 11688-1:2009, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning (ISO/TR 11688-1:1995)*

EN ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction (ISO 12100:2010)*

EN ISO 13849-1:2008, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design (ISO 13849-1:2006)*

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

IEC 60529 ed2.1 (2001)³⁾, *Degrees of protection provided by enclosures (IP Code)*

ISO 8566-1:2010, *Cranes — Cabins and control stations — Part 1: General*

ISO 9927-1:2013, *Cranes — Inspections — Part 1: General*

ISO 12478-1:1997, *Cranes — Maintenance manual — Part 1: General*

ISO 12480-1:1997, *Cranes — Safe use — Part 1: General*

ISO 12482-1:1995, *Cranes — Condition monitoring — Part 1: General*

ISO 20332:2008, *Cranes — Proof of competence of steel structures*

FEM 1.001 (10.1998), *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 12100:2010 and the following apply.

NOTE Additional terms and definitions specifically addressed in this document are added below.

3.1

actual hook load

total static weight of the load including any equipment placed between the load and the hook

3.2

automatic overload protection system

AOPS

system that automatically safeguards and protects the crane against the effects of a gross overload during operation by allowing the hook to be pulled away from the crane in downwards direction within specified offlead and sidelead angles, without causing significant damage to the crane

³⁾ This standard is impacted by IEC Corrigenda 1 (2003) and 2 (2007).

3.3

component

single part or assembly of parts of a crane, which is subjected to load effects (wire ropes, stationary or running, traverse beams, pendant bars, rope sheaves, axles, gears, couplings, brakes, hoists, hydraulic cylinders, shafts, shackles, swivels and pins, etc.)

3.3.1

primary component

component which is essential for the mechanical and structural integrity of the crane, e.g. boom and a-frame lacing members

3.3.2

secondary component

component that is not a primary component

3.4

crane stiffness

vertical static force applied at the hook required to produce unit vertical deflection assuming the pedestal support structure to be rigid

3.5

design load

maximum theoretical load ($R_0 \times \phi_0$) that can be safely lifted by the crane at any given radius in the design condition such that the acceptance criteria are not exceeded

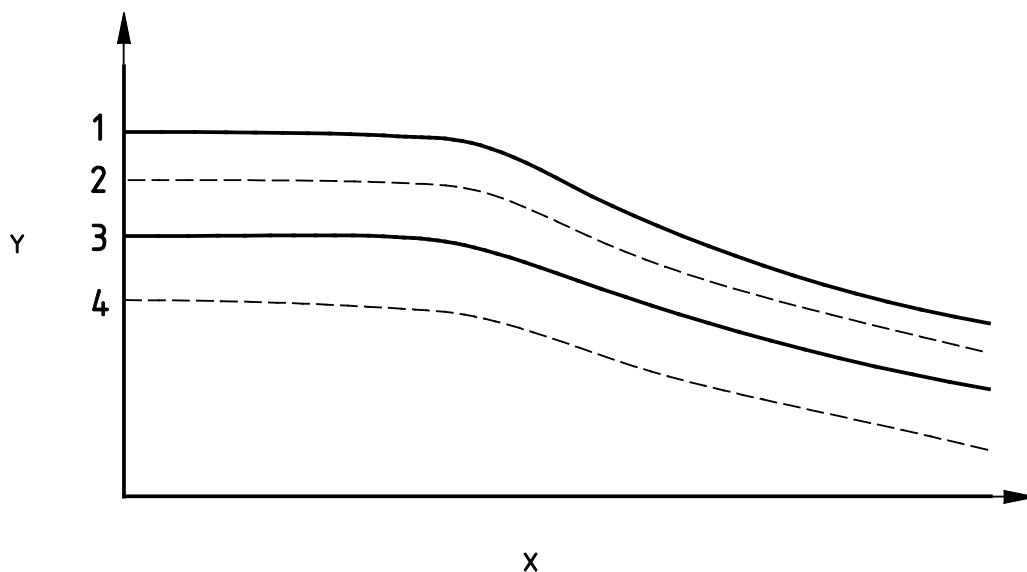
Note 1 to entry: See Figure 1.

3.6

design moment

maximum moment caused by the design load multiplied by radius

Note 1 to entry: See Figure 1.



$$R_0 \times \Phi_0 \geq R_n \times \Phi_n + \text{"Loss"}$$

Key

X radius

Y load

1 design load $R_0 \times \Phi_0$

2 operational load $R_n \times \Phi_n$

3 on-board lift R_0

4 off-board lift R_n

Figure 1 — Design load and design moment

3.7

design temperature

T_d

lowest mean daily temperature

Note 1 to entry: The design temperature is a reference temperature used as a criterion for the selection of materials.

3.8

dynamic coefficient

Φ_n

ratio between the maximum dynamic load at the hook and the actual hook load for any given configuration or operating condition

3.9

emergency operation system

EOS

back-up system for limited operation of the crane, if the normal system of operation is inoperative

3.10

folding

motion from a mechanical system, which enable the knuckle boom assembly to be folded or unfolded

3.11

general-purpose offshore crane

multipurpose slewing jib type offshore crane

3.12

hazardous area

area in which an explosive gas atmosphere is or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of the equipment

3.13

hoisting

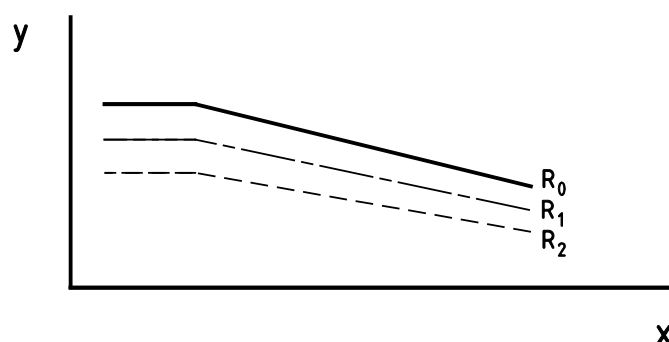
motion from a mechanical system, which enables the hook to be raised and lowered

3.14

load chart

diagram or table showing the rated capacity relative to the radius, environmental conditions, out of plane influences and type of operation

Note 1 to entry: An example is given in Figure 2 showing rated capacity for off-board lifts to and from the deck of supply vessels at 3 fall hoist reeving. Maximum 1° trim and 2° heel, maximum wind speed 25 m/s.



Key

X radius

Y rated capacity

R_0 rated capacity for on-board lifts

R_1 rated capacity for off-board lifts with wave height $H_{1/3} = 1$ m

R_2 rated capacity for off-board lifts with wave height $H_{1/3} = 2$ m

Figure 2 — Load chart

3.15

lowest mean daily temperature

lowest value on the annual mean daily temperature curve for a specific area

3.16

luffing

motion from a mechanical system which enables the boom to be raised or lowered

3.17

manual overload protection system

MOPS

system activated by the crane operator, that protects the crane against possible overload by limiting the hoist rope pull to a low value and allowing the hook to be pulled away from the crane in any direction

3.18

mean daily temperature

statistical 24 hour mean temperature for a specific calendar day, averaged over a number of years of operation

3.19

minimum operating temperature

T_0

lowest temperature the crane can be operated at without compromising the safety of the crane, and which, for the selection of steel materials, is normally 20 °C below the design temperature

3.20

off-board lift

lifting operation between the offshore installation and a floating unit or the sea

3.21

offlead load

horizontal load at the boom tip caused by the radial displacement of the hook and/or the radial acceleration of the boom tip, including the effects of crane base inclination

3.22

offshore crane

crane mounted on an offshore installation and used for on-board and off-board lifts

3.23

offshore installation

structure supported by the seabed or floating unit, exposed to an offshore marine environment

3.24

on-board lift

lifting operation within the offshore installation

3.25

overload

condition where the actual hook load exceeds the design load

3.26

over-moment

condition where the actual hook load multiplied by the radius (at existing inclination and offlead) exceeds the design moment

3.27

personnel lift

lifting operation where personnel are lifted by the crane

3.28

radius

horizontal distance between the crane axis of slewing and a vertical line through the hook when the axis of slewing is vertical and there is no offlead

3.29

rated capacity

R_0 or R_n

actual hook load that the crane is designed to lift for a given operating condition "n" (e.g. boom configuration, reeving arrangement, offlead/sidelead, heel/trim, radius, wave height, etc)

Note 1 to entry: Rated capacity R_0 equates to Safe Working Load (SWL) as used by ILO conventions.

3.30

rated capacity limiter

RCL

device or system that automatically prevents the rated capacity from being exceeded during on-board lifts or personnel lifts

3.31

running rigging

all wire ropes passing over rope sheaves or guide rollers, or wound on winches, irrespective of whether or not the ropes are moved under load

3.32

sidelead load

horizontal load at the boom tip caused by the lateral displacement of the hook and/or the lateral acceleration of the boom tip, including the effects of crane base inclination

3.33

significant damage

state of loading that represents 80 % of the calculated failure load of the weakest load carrying structural or mechanical component

3.34

significant wave height

$H_{1/3}$

average height of the highest one third of the individual wave heights in a short term constant state of sea, typically 3 h

3.35

standing rigging

ropes that are not turned round or wound on to winches (e.g. guided wires, pendants, stays)

3.36

telescoping

motion from a mechanical system, which enable the boom to be extended or retracted

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 European Standard, identified by risk assessment as significant for this type of machinery and which require action to eliminate or reduce the risk.

The significant hazards are based upon EN ISO 12100:2010. Also shown are the subclause references to the safety requirements and/or protective measures in this standard.

A risk assessment of the general-purpose offshore crane shall be carried out to check that the hazards identified Table 1 and any other relevant hazards not identified in Table 1 are dealt with.

Table 1 — List of significant hazards and associated requirements

No	Significant hazards and hazardous events	Machinery Directive 2006/42/EC, Annex I	Requirement clause(s) in this standard
1	Mechanical hazards due to		
	— machine parts or workpieces	1.3	5.7.4
	— accumulation of energy inside the machinery	1.5.3, 1.6.3	5.4.2, 5.4.3
1.1	Crushing hazard	1.3	5.7.2, 5.9.3
1.2	Shearing hazard	1.3	5.7.2, 5.9.3
1.4	Entanglement hazard	1.3	5.3.11, 5.5.2
1.5	Drawing-in or trapping hazard	1.3	5.7.2, 5.9.3

Table 1 (continued)

No	Significant hazards and hazardous events	Machinery Directive 2006/42/EC, Annex I	Requirement clause(s) in this standard
1.9	High pressure fluid injection or ejection hazard	1.3.2	5.4.3
2	Electrical hazards	1.5.1, 1.5.2, 1.6.3	5.3.1, 5.4.4, 5.9.5
3	Thermal hazards 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	1.5.5, 1.5.6, 1.5.7	C.4, C.5
3.2	Damage to health by hot or cold working environment	1.5.5	C.5
4	Hazards generated by noise, resulting in:		
4.1	Hearing loss (deafness), other physiological disorders (e.g. loss of balance, loss of awareness)	1.5.8	5.6.1, 5.6.2
4.2	Interference with speech communication, acoustic signals, etc.	1.5.8	5.6.1, 5.6.2
5	Hazards generated by vibration	1.5.9	5.5.2
7	Hazards generated by materials and substances (and their constituent elements) processed or exhausted by the machinery:		
7.1	Hazards from contact with or inhalation of harmful fluids, gases, mists, fumes and dusts	1.1.3, 1.5.13, 1.6.5	5.7.3
7.2	Fire hazard or explosion hazard	1.5.6, 1.5.7	5.3.1, 5.9.4
8	Hazards generated by neglecting ergonomic principles in machinery design as, e.g. hazards from:		
8.1	Unhealthy postures or excessive efforts	1.1.2 d), 1.1.5, 1.6.2, 1.6.4	5.5.2, 5.7.1, 5.7.5
8.2	Inadequate consideration of hand-arm or foot-leg anatomy	1.1.2 d), 2.2	5.8.2
8.4	Inadequate local lighting	1.1.4	5.5.9
8.6	Human error, human behaviour	1.1.2 d), 1.2.2, 1.2.5, 1.2.8, 1.5.4, 1.7	7.2.1, 7.2.2, 7.2.3, 7.2.4, 7.2.5
8.7	Inadequate design, location or identification of manual controls	1.2.2	5.8.2

Table 1 (continued)

No	Significant hazards and hazardous events	Machinery Directive 2006/42/EC, Annex I	Requirement clause(s) in this standard
8.8	Inadequate design or location of visual display units	1.7.1	5.8.2, 5.8.3
10	Unexpected start-up, unexpected overrun/overspeed:		5.9.3
10.1	Failure/disorder of the control system	1.2.7, 1.6.3	5.8.1
10.2	Restoration of energy supply after an interruption	1.2.6	5.9.2
10.3	External influences on electrical equipment	1.2.1, 1.5.11, 4.1.2.8	5.4.1
10.4	Other external influences (gravity, wind, etc.)	1.2.1	5.2.1, 5.2.2
14	Failure of the control circuit	1.2.1, 1.2.3, 1.2.4, 1.2.5, 1.2.7, 1.6.3	5.8.1, 5.8.2, 5.9.2
18	Loss of stability/overtipping of machinery	1.3.1	5.2.1, 5.9.1
19	Slip, trip and fall of persons (related to machinery)	1.5.15	5.7.1
21.6	Inadequate lighting	3.1.2	5.5.9
21.7	Inadequate seating	3.2.2	5.5.4
21.8	Noise at the work position	3.2.1	5.6.1, 5.6.2
21.9	Vibration at the work position	3.2.1, 3.2.2, 3.6.3	5.5.1, 5.5.2
21.10	Insufficient means for evacuation/emergency exit	3.2.1	5.7.1
22	Additional hazards due to control system:		5.8.2
22.1	Inadequate location of manual controls	3.2.1, 3.3.1, 3.4.5	
22.2	Inadequate design of manual controls and their mode of operation	3.2.1, 3.3.1, 3.3.3	5.8.2
23	Additional hazards from handling the machine, lack of stability	3.1.3	5.7.5
24	Additional hazards due to the power source; hazards from the engine and the batteries	3.4.8, 3.5.1	5.7.3
25	Additional hazards from third persons, unauthorised start-up/use	3.3.2	5.8.2
26	Additional hazards from insufficient instructions for the driver/operator	3.6	7.2
	Additional hazards due to lifting		
27	Mechanical hazards:		
27.1	From load falls, collisions, machine tipping caused by:		

Table 1 (continued)

No	Significant hazards and hazardous events	Machinery Directive 2006/42/EC, Annex I	Requirement clause(s) in this standard
27.1.1	Lack of stability	4.1.2.1	5.2.1
27.1.2	Uncontrolled loading – overloading – overturning moments exceeded	4.2.1.4, 4.3.3, 4.4.2 a)	5.8.3, 5.8.4, 5.9.1, 5.9.3,
27.1.3	Uncontrolled amplitude of movements	4.1.2.6 a), 4.2.1.3	5.8.3, 5.8.4, 5.9.3
27.1.4	Unexpected/unintended movement of loads	4.1.2.6e	5.8.1, 5.8.2, 5.9.3
27.1.5	Inadequate holding devices/accessories	4.1.2.6 e), 4.4.1	5.3.2, 5.3.11
27.4	From insufficient mechanical strength of parts	4.1.2.3	5.2.1, 5.3.2
27.5	From inadequate design of pulleys, drums	4.1.2.4	5.3.2
27.6	From inadequate selection of chains, ropes, lifting and accessories and their inadequate integration into the machine	4.1.2.4, 4.1.2.5, 4.3.1, 4.3.2	5.3.8, 5.3.9, 5.3.10, 5.3.11
27.8	From abnormal conditions of assembly/testing/use/maintenance	4.4.1, 4.4.2 d), 4.4.2 e)	7.1, 7.2, 7.3, 7.4
28	Electrical hazards from lightning	4.1.2.8	5.9.5
29	Hazards generated by neglecting ergonomic principles, insufficient visibility from the driving position	4.1.2.7, 4.4.2 c)	5.5.2, 5.5.3, 5.5.4, 5.5.5
30	From the lifting of persons	6	5.10

5 Safety requirements and/or protective measures

5.1 General

In addition to complying with the requirements of this European Standard, general-purpose offshore cranes shall be designed according to the principles of EN ISO 12100:2010 for relevant hazards, which are not dealt with by this standard.

NOTE 1 For the execution of risk assessment, reference is made to EN ISO 12100:2010, Clause 5.

NOTE 2 For risks related to the use in explosive atmosphere, and for further information, see Annex O.

5.2 Strength and stability

5.2.1 Basic design principles and requirements

General-purpose offshore cranes shall conform to the general principles and requirements for strength and stability given in EN 13001-1:2004+A1:2009.

Load effects shall be calculated in accordance with EN 13001-2:2011⁴⁾. Factors shall be determined in accordance with Annex B.

For the lifting of personnel a risk coefficient γ_n as defined in EN 13001-2:2011⁵⁾ shall be used, see 5.10.2 of this standard.

The competence of steel structures shall be proven in accordance with CEN/TS 13001-3-1:2004.

Strength of components that form parts of mechanisms shall be proved for loads defined in 2.5 of FEM 1.001, booklet 2, applying the allowable stress method for the load combinations referenced in Annex B of this standard. All partial safety factors shall be set to 1,0 for this purpose. If relevant (e.g. for lifting persons), the risk factor referenced in 5.10.2 shall be applied.

Components of mechanisms shall be checked for adequate safety against dynamic load, failure due to fracture, crippling, fatigue and excessive wear in accordance with 4.1 of FEM 1.001, booklet 4.

Reference is also made to the requirements given in EN 13135:2013 for particular components in mechanisms.

The competence of steel wire ropes shall be proven in accordance with Annex G of this standard. See also 5.3.10.

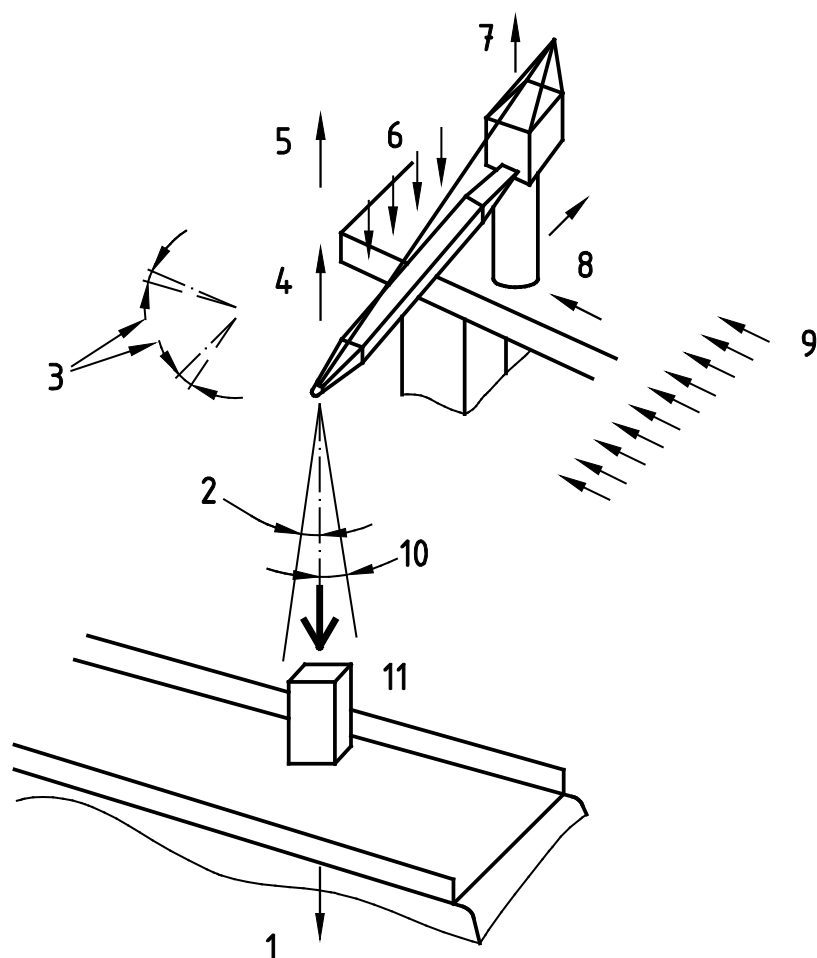
5.2.2 In-service loads

The in-service loads shall include as applicable:

- self weight (see Annex B);
- actual hook load (see Annex B);
- loads due to hoisting velocity (see Annex B);
- loads due to boom tip velocity from installation roll/pitch motion (see Annex B);
- loads due to load supporting deck velocity (see Annex B);
- loads due to sidelead and offlead (see Annex C);
- loads due to installation trim and heel (see Annex C);
- snow and ice loads (see Annex C);
- wind loads (see Annex C);
- loads due to installation accelerations (see Annex C).

In-service loads for off-board lifts are illustrated in Figure 3.

4) This standard is impacted by the corrigendum EN 13001-2:2011/AC:2012.



Key

1 deck velocity	5 boom tip velocity	9 wind
2 offlead	6 snow and ice	10 sidelead
3 installation inclination (trim and heel)	7 vertical installation accelerations	11 actual hook load
4 hoisting velocity	8 horizontal installation accelerations	

Figure 3 — Off-board lifts

5.2.3 Out of service loads

The crane shall withstand the environmental influences as stated in Annex C.

5.2.4 Failure mode analysis

The failure mode analysis shall be carried out in accordance with Annex D.

5.2.5 Seismic loads

Seismic loads shall be taken into account when and as agreed when part of the delivery conditions for the crane.

5.2.6 Load combinations

Determination of load combinations shall be made according to B.5 of this standard.

Actual hook loads shall be multiplied by the dynamic coefficient determined in accordance with B.1 or B.2. Offlead and sidelead loads, and the inclination of the crane base if the crane is mounted on a floating installation, shall be taken into account in the design load as stated in B.3.

5.2.7 Load charts

Each crane shall be provided with load charts; see 3.14. Load charts with rated loads may in principle be included for any realistic set of environmental conditions. The load charts shall state the in-service operational limitations of the crane, e.g. from wind, heel, trim, ice, AOPS, etc.

The load chart shall be displayed at the control station. The information from the load chart shall be programmed into the rated capacity indicator as described in 5.8.3.2.

5.2.8 Materials

Materials shall be selected in accordance with Annex E.

NOTE For the use in explosive atmosphere and further information, see Annex O.

5.3 Equipment and components

5.3.1 Electrotechnical equipment

Electrotechnical equipment shall conform to EN 13135:2013, and conform to the EMC requirements of 5.4.1.

Safety related programmable electronic systems shall follow the principles of EN 61508 (all parts) and conform to EN ISO 13849-1:2008.

Enclosures shall conform to IEC 60529 ed2.1 (2001)⁵⁾ and EN 60204-32:2008.

Minimum degree of Ingress Protection provided by enclosures shall be as follows:

- outdoor, naturally ventilated areas and wash down areas: IP 56;
- dry indoor areas: IP 20;
- other areas: IP 44.

Cable entries for outdoor equipment/enclosure should be in bottom. Side and top entries may be used, if sufficient ingress protection is maintained.

Electrical equipment operating in a hazardous area shall be in accordance with EN 60079-14:2008 and Annex O.

Safety related parts of control systems shall conform to the required performance level in accordance with EN ISO 13849-1:2008, see Annex K.

5.3.2 Non electrical equipment

Non electrical equipment shall in addition to the requirements of this standard, be in accordance with EN 13135:2013.

Safety related parts of control systems shall conform to the required performance level in accordance with EN ISO 13849-1:2008; see Annex K.

⁵⁾ This standard is impacted by IEC Corrigenda 1 (2003) and 2 (2007).

Non electrical equipment operating in a hazardous area shall be in accordance with Annex O.

5.3.3 Power requirements

The crane prime mover shall be such that the full power demands of any loading and speed combinations associated with the various motions are compatible with the operations that the crane is designed for, such that:

- a) a diesel engine shall not stall; or fall below its nominal speed at the rated load
- b) a diesel engine shall not over speed;
- c) an electric motor shall not overheat;
- d) the supply energy is sufficient for simultaneous operation as described below (if power is supplied from an external source off the crane); and shall not overload the supply cables, if electrically driven.

If the crane does not have enough power for full speed to all motions at maximum load simultaneously, it shall be possible to reduce the speeds either automatically or manually according to rules of priority clearly stated in the operating manual(s).

The installed power shall not be less than the highest of the required power for:

- 1) full hoisting speed and 50 % luffing speed, or
- 2) full hoisting speed and 50 % slewing speed.

Hoisting motions shall always have first priority, but no other motion shall stop fully if operated simultaneously.

5.3.4 Slewing drives

The slewing drive system shall primarily be designed to hold at least 1,3 times the static design slewing torque, caused by effects of wind, crane base inclination and sidelead effects. If the holding capacity is less than this, the crane shall be equipped with a slew torque indicating device giving continuous information of the actual slew moment to the crane operator.

The system shall consist of a minimum of two drive units.

NOTE A single drive unit is acceptable provided failure of the drive unit and its control system will not cause uncontrolled movement of the crane.

The slewing brakes shall conform to Annex I.

5.3.5 Slewing bearings

Slewing bearings shall conform to Annex E and Annex H.

5.3.6 Slewing bearing fasteners

The attachment of the slewing bearing, including the fasteners, shall be in accordance with the requirements of the slewing bearing manufacturer. These requirements shall be stated in the information for use, ref. 7.1.

The fasteners attaching the fixed ring to the pedestal structure shall be equally spaced over the 360° mounting circumference of the bearing.

For the connection between revolving ring and crane, unequal fastener spacings may be used if the integrity of the bolted connection can be verified by structural analysis including fatigue calculations or empirical data from prototype testing. Unequal supporting stiffness of the slewing bearing is to be taken into consideration as applicable.

The distance between the centres of two fasteners shall not exceed $6d$, where d is the nominal diameter of the bolt.

The mating surface shall be steel to steel without surface levelling compound. The flatness of the mating surfaces shall be within the tolerances specified by the slewing bearing manufacturer.

Slewing ring fasteners shall conform to Annex E and Annex H.

5.3.7 Winches and brakes

For all operations, the distance between the top of the outer layer of the wire rope on the drum and the outer edge of the drum flanges shall be at least 2,5 times the diameter of the wire rope, except in cases where guards are fitted to prevent over spilling of the wire rope.

Brakes shall be in accordance with Annex I.

In addition to the normal working brake, luffing winches shall be equipped with a mechanically and operationally independent back-up brake, with separate control circuits.

5.3.8 Wire rope termination

Wire rope termination shall be one of the following three types only and shall conform to EN 13135:2013 and the following:

- a) wedge socket in accordance with EN 13411-6:2004+A1:2008 or EN 13411-7:2006+A1:2008;
- b) metal or resin poured socket in accordance with EN 13411-4:2011;
- c) ferrule secured-eyes (with thimble only) in accordance with EN 13411-3:2004+A1:2008.

On a running single line where hooking/snatching could occur, the rope shall be terminated as shown in EN 13411-3:2004+A1:2008 or similar. Wire rope with annealed end shall not be used with conical ferrule as shown in EN 13411-3:2004+A1:2008.

Fixed load lifting attachments such as wire rope terminations, shackles, swivels, hooks and similar components shall be designed and equipped to minimise the risk of unintended entanglement.

NOTE This requirement can be met by a "slim and rounded" geometry, avoiding sharp edges/protruding (extended) parts or installing additional protection such as plastic cones on wire rope terminations.

All wire rope terminations, including those at the hook, boom head, integral shackle, etc., which are exposed to motions or impacts shall have double means of locking in order to avoid inadvertent loosening and detachment during operation.

Where nuts, bolts, screws, etc. are used for fixing the wire ropes, the prescribed torque shall be durably and clearly marked in the immediate vicinity, and / or stated in the information for use.

5.3.9 Wire rope fastening to the drum

Wire rope fastening to the drum shall conform to EN 13135:2013, except for the following:

The wire rope anchorage shall be designed for a minimum breaking out force equal to the minimum breaking load of the rope minus the amount of the friction effect from remaining wire rope.

There shall be a minimum of 3 turns of wire rope left on the winch drum with the hook and the boom at their most adverse position including trim and heel, offlead and sidelead, see Annex M, design excursion envelope B.

In case the hoist drum wire rope length capacity is not enough to maintain the design excursion envelope C see Annex M, the wire rope anchorage shall be designed for a breaking out force not leading to a significant damage of the crane.

5.3.10 Wire ropes

Wire ropes shall conform to EN 12385-1:2002+A1:2008, EN 12385-2:2002+A1:2008, EN 12385-3:2004+A1:2008 and EN 12385-4:2002+A1:2008.

Uncoated or bright surface finish shall not be used, unless documented maintenance procedures are provided to ensure that the corrosion protection is guaranteed throughout the specified lifetime.

Calculation of wire ropes shall be performed in accordance with Annex G. The required safety factor shall be calculated for each particular crane reeving configuration and based on the maximum R_0 for each configuration. The same safety factor shall be used for both hoisting and luffing for each configuration. Where R_0 is radius dependent, the maximum value of R_0 applies.

The required minimum wire rope breaking force shall be determined by the maximum static and dynamic rope pull multiplied by the static and dynamic safety factors given in Annex G.

The maximum static rope pull shall be determined from dead weight (including the hook block and wire rope) and the actual hook load without dynamic coefficient, wind, offlead/sidelead, trim/heel or other secondary factors. Rope reeving efficiency reduction according to CEN/TS 13001-3-2:2008 shall be added for running rigging.

The maximum dynamic rope pull shall be determined from dead weight (including the hook block and wire rope) and the actual hook load including dynamic coefficient, wind, offlead/sidelead and trim/heel. Rope reeving efficiency reduction according to CEN/TS 13001-3-2:2008 shall be added for running rigging.

The efficiency of the applicable wire rope termination shall be documented by test certificate/ report covering the actual wire rope type being used. If the efficiency of the end termination is below 80 %, the loss shall be compensated for up to minimum 80 % efficiency.

5.3.11 Blocks and hooks

Hooks shall conform to CEN/TS 13001-3-5:2010.

Hook shank and collar or nut retaining systems, including threads, shall be designed, material selected and manufactured such that the effects of the offshore corrosive environment and offshore crane usage shall not lead to unacceptable erosion or corrosion of the retaining system within a stipulated inspection interval.

The crane shall be designed so as to prevent structural damage to the crane or crane boom from hook blocks impact while the hook blocks are in their parked position.

Means shall be provided such that a hook block impact will not lead to a possible dropped object, see 5.7.4.

Any hook blocks not in use shall not cause damage to the crane or interfere with hooks or blocks that are in use.

Safety latches shall be provided on all hooks.

Safety latches which have spring loaded closing mechanism only, shall have means to prevent accidental opening.

Blocks and hooks shall be designed in accordance with ergonomic principles of EN 614-1:2006+A1:2009. Handles shall be provided on hook blocks to enable safe handling.

5.3.12 Hydraulic cylinders

Hydraulic cylinders used as primary components shall be designed based on the maximum pressures and dynamic forces acting in-service and out of service.

Where hydraulic cylinders are used for luffing, folding or telescoping, they shall be fitted with a device, which will hold the boom in position in the event of loss of hydraulics pressure to the cylinder or hose/pipe burst. This device shall be directly connected to the cylinder, i.e. no intermediate piping or hoses in between. Automatic overriding of this device in order to reduce oscillations etc. is not permitted. The load holding device is regarded as a brake and shall be in accordance with Annex I.

5.3.13 Constant tension systems/motion compensators/shock absorbers

Where active or passive constant tension systems, motion compensators, shock absorbers or similar systems are installed, the following requirements apply:

- activation of any system with any particular load shall not lead to a hazardous situation;
- no single failure shall lead to a hazardous situation;
- any failure/fault shall give an alarm at the control station.

5.3.14 Mode and rigging selector

Cranes with variable modes and rigging, requiring manual input of variables to the control system, shall be equipped with a mode and rigging selector which displays the valid setting and request a confirmation by the operator as part of every start up and change of manual input of variables. Modification of input variables shall be done by authorised personnel only.

5.4 Drive systems

5.4.1 Electromagnetic compatibility

Electric and electronic equipment, apparatus and systems, and their assemblies and wiring up shall conform to EN 61000-6-2:2005, EN 61000-6-4:2007 or relevant product specific EMC standards.

5.4.2 Pneumatic systems

Pneumatic systems shall conform to EN 13135:2013 and EN ISO 4414:2010.

Pneumatic elements and components shall only be located in a controlled environment.

NOTE 1 A controlled environment is for example an enclosed space where the humidity and salt content in the atmosphere is controlled by air filters and dryers.

NOTE 2 For the use in explosive atmosphere and further information, see Annex O.

5.4.3 Hydraulic systems

Hydraulic systems shall conform to EN 13135:2013 and EN ISO 4413:2010.

For vented reservoirs, air breathers shall be provided and arranged to ensure the filtered air entering the reservoir is to a cleanliness level compatible with the system requirements, taking into account the environmental conditions in which the system is installed.

NOTE For the use in explosive atmosphere and further information, see Annex O.

5.4.4 Electrical systems

Electrical systems shall conform to EN 13135:2013. For operational temperatures below 0 °C and above 45 °C special precautions shall be taken.

Local thermal effects, such as the thermal influence of flares, etc., shall be taken into account when selecting components of the electrical system.

NOTE For the use in explosive atmosphere and further information, see Annex O.

5.5 Control station, machinery house etc

5.5.1 General

The control station shall include all controls, instruments, indicators, signals, load charts and alarms that are necessary for safe operation of the crane. In addition, the control station shall conform to EN 13557:2003+A2:2008.

NOTE For the use in explosive atmosphere and further information, see Annex O.

5.5.2 Control cabin

A cabin shall be provided in order to contain the control station and a working environment for the crane operator. The cabin shall comply with the specific requirements stated below and conform to ISO 8566-1:2010 and EN 13557:2003+A2:2008. If there is any conflict between the standards, then EN 13557:2003+A2:2008 shall take precedence.

- a) it shall be weatherproof to withstand an offshore marine environment;
- b) the front, roof and floor (if any) windows shall be provided with window wipers and washing systems that are suitable for operation in a marine environment and provide sufficient coverage for the intended view without impairing the operator's position;
- c) it shall be provided with external access and to allow for safe wind-shield wiper exchange and window cleaning;
- d) it shall have an ergonomic design in accordance with EN 614-1:2006+A1:2009;
- e) means for heating, cooling and supply of fresh air shall be provided;
- f) air inlets shall be located in areas not contaminated by exhaust outlets, dust, fuel- or oil vapours.

Where the full view of the loading area from the control station is restricted, a real time CCTV shall be provided, consisting of one or more camera's, preferably in the boom tip, to enable the operator from a second angle to survey the crane motions, lifting accessories, load motions, loading areas, etc.

Cameras for monitoring of the load shall be fitted with a zoom in-out function for all load lifting heights. The monitor shall be a separate unit from the rated capacity display unit, located in a way that facilitates easy viewing from the operator's position, without obstructing the normal view.

5.5.3 Windows

Windows shall be provided to give aerial vision of the load and the operation area of the crane at any position of the load from minimum to maximum radius. The minimum view angles from the operator position shall be as follows:

- a) side view: $\pm 100^\circ$, with operator movement while seated;
- b) vertical plane: the operator shall be able to see the load and boom in all their positions;

- c) any equipment, instrumentation or window protection shall be arranged as to provide the least view restriction.

Windows shall be anti-reflection treated laminated glass.

As a minimum the cabin roof including windows shall be able to withstand the impact of a steel ball weighing 7 kg, falling from a height of 2 m, without plastic deformations exceeding 50 mm impact depth.

The front window shall extend down to the floor and ensure the operator's free view of the operational area.

Floor windows, if any, shall be protected by a grating, which shall be arranged not to obstruct a free view of the operational area.

5.5.4 Crane operator's seat

Where provided, the crane operator's seat shall be of an ergonomic design with a padded seat and adjustable arm support. The seat shall be fully adjustable, i.e. height, forwards/backwards and backrest angle. Arm supports shall be easy to adjust.

An additional seat shall be provided (can be folded type) for an instructor, trainee or maintenance personnel.

5.5.5 Cabin interior

The cabin shall be provided with means of defrosting and demisting the windows.

The cabin shall have the means to provide a comfortable working environment for the crane operator. The system shall be able to keep an adjustable inside temperature within the range of 15 °C to 25 °C for all ambient air temperatures, for which the crane has been designed.

Where pressurised hoses, pipes and cables are located in the cabin they shall be protected against mechanical damage, and such that personnel are protected from the effects of hose rupture, leakages, etc.

5.5.6 Cabin instrumentation

The instrumentation shall be located in accordance with EN 13557:2003+A2:2008 and Annex F.

The cabin shall be provided with fire and smoke alarms connected to detectors in the machinery house and other areas of the crane where there is such a risk.

5.5.7 Communications

Communication equipment shall be provided to enable the crane operator to communicate with the platform and the supply vessels and other units involved in the lifting operations. The crane operator shall be able to operate the radio communication system without moving his hands from the main control levers.

5.5.8 Machinery house and other enclosed spaces

Each individual accessible space and pedestal shall have a proper means of access, air quality and air supply.

5.5.9 Lighting

The following lighting shall be provided;

- All enclosed areas for operation and maintenance, such as the cabin and the machinery house shall have lighting to ensure safe operation and maintenance.

- Access to operator position(s), and access of Type 1 according to EN 13586:2004+A1:2008, including the area where maintenance is to be performed, shall have adequate lighting. Lighting along boom walkway can be omitted.
- The emergency escape and access routes, from operator positions shall be equipped with emergency lighting.

The boom shall have floodlights installed for illumination of the load.

Obstruction lights shall be installed in accordance with regulations and requirements applicable for the area of operation.

5.6 Noise reduction

5.6.1 Noise reduction at source by design

The technical information given in EN ISO 11688-1:2009 shall be used as means to design of low-noise machinery. EN ISO 11688-2:2000 also gives useful information concerning noise generation.

The A-weighted emission sound pressure level at the operator position at the control station, measured according to Annex N, shall be as low as possible and at least less than 80 dB.

5.6.2 Noise reduction by information

Recommendations for further noise reduction during use shall be given in the instructions for use, see Clause 7.

5.7 Access, guards etc

5.7.1 Access

Means of access for operation and/or maintenance shall conform to EN 13586:2004+A1:2008.

Every control station shall have at least one exit onto a fixed means of access/egress.

An alternative means of access/egress shall be provided when the fixed means of access/egress cannot be reached from all working positions of the control station or of the crane.

In addition to the main access route to the crane drivers cabin an alternative means of escape shall be provided to allow evacuation from the cabin in case the main access route cannot be used (e.g. fire in spaces adjacent to the cabin).

5.7.2 Guards

The crane shall incorporate guards in accordance with EN 953:1997+A1:2009. Where possible, the guards shall be fixed.

5.7.3 Hazardous substances

Systems and enclosures containing oil or other substances hazardous to humans or the environment shall be designed and constructed such that a potential spillage into the open environment is minimised or can be contained.

5.7.4 Dropped objects

Non-welded components and equipment attached to the crane structure shall be assessed for the risk of unintended detachment and a “dropped object” hazard.