

Lifting equipment

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Foreword

The NORSOK standards are developed by the Norwegian petroleum industry to ensure adequate safety, value adding and cost effectiveness for petroleum industry developments and operations. Furthermore, NORSOK standards are, as far as possible, intended to replace oil company specifications and serve as references in the authorities' regulations.

The NORSOK standards are normally based on recognised international standards, adding the provisions deemed necessary to fill the broad needs of the Norwegian petroleum industry. Where relevant, NORSOK standards will be used to provide the Norwegian industry input to the international standardisation process. Subject to development and publication of international standards, the relevant NORSOK standard will be withdrawn.

The NORSOK standards are developed according to the consensus principle generally applicable for most standards work and according to established procedures defined in NORSOK A-001.

The NORSOK standards are prepared and published with support by The Norwegian Oil Industry Association (OLF), The Federation of Norwegian Industry, Norwegian Shipowners' Association and The Petroleum Safety Authority Norway.

NORSOK standards are administered and published by Standards Norway.

Introduction

The main purpose of this NORSOK standard is to contribute to an acceptable level of safety for humans, the environment and property in the petroleum industry by stating technical requirements for the various lifting equipment used.

During development of this NORSOK-standard, due consideration has been made to relevant EU Directives, Norwegian regulations, European Standard and International standard, as well as other rule setting documents which have been found relevant and suitable. It should, however, be noted that this NORSOK standard is neither a harmonised standard, nor contains all the technical and administrative requirements of the applicable regulations and directives, so that it is not sufficient itself for CE-marking of products. The manufacturer needs to comply with the relevant regulations and all applicable requirements regardless of the content of this NORSOK standard.

To a great extent references to standards have been used in this NORSOK standard in order to ensure quality and safety development when standards are revised, but also to avoid that this NORSOK standard is becoming very extensive and comprehensive.

The expert group responsible for this NORSOK standard has agreed that the main safety philosophy and principal requirements shall be based on the essential safety and health requirements stated in relevant EU directives, e.g. the Machinery directive 98/37/EEC. This shall apply regardless of the type of installation or unit where the lifting equipment is installed. However, the administrative requirements, (e.g. CE marking, declaration of conformity, requirements for type approvals, etc.) are not part of this NORSOK standard.

Due consideration is also made to the requirements in the revised Machinery directive 2006/42/EC which will enter into force on 29 December 2009. In addition, the PSA aim of ensuring a high level as regards health, environment and safety in the petroleum activities, has been reflected.

1 Scope

This NORSOK standard states and develops a high technical safety level on lifting equipment for use in the petroleum industry.

This NORSOK standard is valid for lifting equipment on all fixed and floating installations, mobile offshore units, barges and vessels, as well as on land based plants where petroleum activities are performed.

2 Normative and informative references

The following standards include provisions and guidelines which, through reference in this text, constitute provisions and guidelines of this NORSOK standard. Latest issue of the references shall be used unless otherwise agreed. Other recognized standards may be used provided it can be shown that they meet the requirements of the referenced standards.

2.1 Normative references

CEN/TS 13001-3-2,	Cranes - General design - Part 3-2: Limit states and proof of competence of wire ropes in reeving systems
IEC 60034,	Rotating electrical machines
IEC 60204-1,	Safety of machinery Electrical equipment of machines - Part 1: General requirements
IEC 60204-32,	Safety of machinery - Electrical equipment of machines - Part 32: Requirements for hoisting machines
IEC 60529,	Degrees of protection provided by enclosures
NEK IEC 60300-3-11,	Dependability management - Part 3-11: Application guide - Reliability centred maintenance
NEK IEC 60812,	Analysis techniques for system reliability - Procedure for failure mode and effects analysis (FMEA)
NEK IEC 61000-6-4,	Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments
NEK EN IEC 61131-1,	Programmable controllers -- Part 1: General information
NEK IEC 61892 (all parts),	Mobile and fixed offshore units - Electrical installations
NEK EN/TR 61831,	On-line analyser systems - Guide to design and installation
ISO 3864,	Graphical symbols -- Safety colours and safety signs - Part 1: Design principles for safety signs in workplaces and public areas
	Graphical symbols -- Safety colours and safety signs -- Part 2: Design principles for product safety labels
	Graphical symbols -- Safety colours and safety signs -- Part 3: Design principles for graphical symbols for use in safety signs
ISO 6309,	Fire protection -- Safety signs
ISO 9001,	Quality management systems - Requirements
ISO 12482-1,	Cranes -- Condition monitoring -- Part 1: General
ISO 13200,	Cranes -- Safety signs and hazard pictorials General principles
ISO 13849-1,	Safety of machinery -- Safety-related parts of control systems -- Part 1: General principles for design
ISO 12482-1,	Cranes -- Condition monitoring -- Part 1: General
ISO/TR 14121-2,	Safety of machinery -- Risk assessment -- Part 2: Practical guidance and examples of methods
NS-EN 341,	Personal protective equipment against falls from a height - Descender devices
NS-EN 349,	Safety of machinery - Minimum gaps to avoid crushing of parts of the human body
NS-EN 361,	Personal protective equipment against falls from a height - Full body harnesses
NS-EN 364,	Personal protective equipment against falls from a height - Test methods
NS-EN 365,	Personal protective equipment against falls from a height - General requirements for instructions for use and for marking

NS-EN 614-1,	Safety of machinery - Ergonomic design principles - Part 1: Terminology and general principles
NS-EN 614-2,	Safety of machinery - Ergonomic design principles - Part 2: Interactions between the design of machinery and work tasks
NS-EN 795,	Protection against falls from a height - Anchor devices - Requirements and testing
NS-EN 818-1,	Short link chains for lifting purposes - Safety - Part 1: General conditions of acceptance
NS-EN 818-2,	Short link chain for lifting purposes - Safety - Part 2: Medium tolerance chain for chain slings - Grade 8
NS-EN 818-6,	Short link chain for lifting purposes - Safety - Part 6: Chains slings - Specification for information for use and maintenance to be provided by the manufacturer
NS-EN 842,	Safety of machinery - Visual danger signals - General requirements, design and testing
NS-EN 953,	Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards
NS-EN 982,	Safety of machinery - Safety requirements for fluid power systems and their components
NS-EN 983,	Safety of machinery - Safety requirements for fluid power systems and their components – Pneumatics
NS-EN-ISO 898,	Mechanical properties of fasteners made of carbon steel and alloy steel - Part 1: Bolts, screws and studs
NS-EN ISO 9001,	Quality management systems - Requirements (ISO 9001:2000)
NS-EN ISO 11688-1,	Acoustics - Recommended practice for the design of low-noise machinery and equipment - Part 1: Planning (ISO/TR 11688-1:1995)
NS-EN ISO 11688-2,	Acoustics - Recommended practice for the design of low-noise machinery and equipment - Part 2: Introduction to the physics of low-noise design (ISO/TR 11688-2:1998)
NS-EN ISO 12100-1,	Safety of machinery, Basic concepts, general principles for design – Part 1: Basic terminology, methodology
NS-EN ISO 12100-2,	Safety of machinery, Basic concepts, general principles for design – Part 2: Technical Principles
NS-EN ISO 12944,	Paints and varnishes - Corrosion protection of steel structures by protective paint systems - Part 1: General introduction
NS-ISO 14121-1,	Safety of machinery – Risk assessment – Part 1: Principles
NS-EN ISO 13850,	Safety of machinery -- Emergency stop -- Principles for design
NS-EN ISO 13857,	Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs
NS-ISO 2631-1,	Mechanical vibration and shock -- Evaluation of human exposure to whole-body vibration Part 1: General requirements
NS-EN ISO 1421,	Rubber- or plastics-coated fabrics -- Determination of tensile strength and elongation at break
NS-EN 1127-1,	Explosive atmospheres - Explosion prevention and protection – Part 1: Basic concepts and methodology
NS-EN 13586,	Cranes – Access
NS-EN 12644-1,	Cranes – Information for use and testing - Part 1: Instructions
NS-EN 12644-2,	Cranes – Information for use and testing - Part 2: Marking
NS-EN 1037,	Safety of machinery- Prevention of unexpected start-up
NS-EN 13001-1,	Cranes - General design - Part 1: General principles and requirements - (Corrigendum AC: 2006 incorporated)
NS-EN 13001-2,	Cranes - General design - Part 2: Load actions - (Corrigendum AC: 2006 incorporated)
NS-EN 1679-1,	Reciprocating internal combustion engines - Safety - Part 1: Compression ignition engines
NS-EN 1834-1,	Reciprocating internal combustion engines - Safety - Part 1: Compression ignition engines
NS-EN 12198,	Safety of machinery - Assessment and reduction of risks arising from radiation emitted by machinery - Part 2: Radiation emission measurement procedure
NS-EN 13001-2,	Cranes - General design - Part 2: Load actions - (Corrigendum AC: 2006 incorporated)

NS-EN 13135-1,	Cranes - Safety - Design - Requirements for equipment - Part 1: Electrotechnical equipment- (Corrigendum AC: 2006 incorporated)
NS-EN 13135-2,	Cranes - Equipment - Part 2: Non-electrotechnical equipment - (Corrigendum AC: 2005 incorporated)
NS-EN 13557,	Cranes - Controls and control stations
NS-EN 12077-2,	Cranes safety - Requirements for health and safety - Part 2: Limiting and indicating devices
NS-EN 13852-1,	Cranes - Offshore cranes - Part 1: General - purpose offshore cranes - (Corrigendum AC: 2004 incorporated)
NS-EN 12077-2,	Cranes safety - Requirements for health and safety - Part 2: Limiting and indicating devices
NS-EN 982,	Safety of machinery - Safety requirements for fluid power systems and their components - Hydraulics
NS-EN 12385-1,	Steel wire ropes - Safety - Part 1: General requirements
NS-EN 12385-2,	Steel wire ropes - Safety - Part 2: Definitions, designation and classification
NS-EN 12385-4,	Steel wire ropes - Safety - Part 4: Stranded ropes for general lifting applications
NS-EN 13155,	Cranes - Safety - Non-fixed load lifting attachments
NS-EN 13411-3,	Terminations for steel wire ropes - Safety - Part 3: Ferrules and ferrule-securing - (Corrigendum AC:2005 incorporated)
NS-EN 13411-4,	Terminations for steel wire ropes - Safety - Part 4: Metal and resin socketing
NS-EN 13411-5,	Terminations for steel wire ropes - Safety - Part 5: U-bolt wire rope grips
NS-EN 13411-7,	Terminations for steel wire ropes - Safety - Part 7: Symmetric wedge socket
NS-EN 1677-1,	Components for slings - Safety - Part 1: Forged steel components, Grade 8
NS-EN 1677-3,	Components for slings - Safety - Part 3: Forged steel self-locking hooks - Grade 8
NS-EN 1677-4,	Components for slings - Safety - Part 4: Links, Grade 8
NS-EN 12385-3,	Steel wire ropes - Safety - Part 3: Information for use and maintenance
NS-EN 14502-1	Cranes - Equipment for lifting persons - Part 1:Suspended baskets
NEK IEC 61000-6-2,	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
prEN 1497,	Rescue equipment - Rescue harnesses
NORSOK E-001,	Electrical systems (Rev. 3, Dec. 1997)
NORSOK N-003,	Actions and action effects (Edition 2, September 2007)
NORSOK N-004,	Design of steel structures (Rev. 2.October 2004)
NORSOK M-501,	M-501 Surface preparation and protective coating (Rev. 5. June 2004)
NORSOK S-001,	Technical Safety (Rev. 3.January 2000)
NORSOK S-002,	S-002 Working environment (Rev. 4. August 2004)
NORSOK Z-007,	Mechanical completion and commissioning (Rev. 2.december 1999)
NORSOK Z-008,	Petroleum- Criticality analysis for maintenance purposes
NORSOK Z-016,	Regularity management & reliability technology (Rev.1 December 1998)
Directive 97/68/EF,	
2002/88/EF,	
2004/26/EF,	
DNV Rules for certification of lifting appliances 1994,	
NMD Regulation 4.July 2007 No.853,	
US Fed Spec RRC 271,	
IMO Resolution A.760 (18),	
IMO Resolution MSC.82 (70),	
IMO SOLAS LSA Code,	

2.2 Informative references

CEN/TS 13001-3-1,	Cranes- General design-Part 3-1: Limit states and proof of competence of steel structures
CEN/TS 13001-3-2,	Cranes - General design - Part 3-2: Limit states and proof of competence of wire ropes in reeving systems

3 Terms, definitions and abbreviations

3.1.1

3.1.2

3.1.3

3.1.4

3.1.5

3.1.6

3.1.7

3.1.8

3.1.9

3.1.10

heavy lift

load that is more than 10 tonnes and more than half of the SWL of the lifting equipment

3.1.11**inherently safe design**

system that can not cause harm

3.1.12**installation**

facility, plant and other equipment for petroleum activities (excluding ships that transport petroleum in bulk)

NOTE In this NORSOK standard, supply and standby boats are included in the definition of an installation.

Examples of installations include fixed installations, floating production, storage and offshore loading (FPSO) vessels, rigs, barges, crane barges, service vessels etc.

3.1.13**launching and recovery appliances**

lifting appliance for lifesaving equipment

3.1.14**lifesaving equipment**

evacuation equipment and rescue equipment

3.1.15**lifting accessories**

components or equipment used between the lifting appliance and the load or on the load to grip it, but which is not an integrated part of the lifting appliance

NOTE Also cover loose gear.

3.1.16**lifting appliance**

machine or device used for vertical movement of a load, with or without horizontal movement

NOTE Include cranes, hoists, drilling hoisting equipment and launching and recovery appliances for life saving equipment, etc.

3.1.17**lifting equipment**

common term for lifting appliances and lifting accessories

3.1.18**lifting operation**

all administrative and operational activities before, during and after a load is moved and until the lifting equipment is ready for a new load

3.1.19**lifting and stacking truck**

forklift truck and similar mobile motorised work equipment for combined lifting, moving and stacking

3.1.20**may**

verbal form used to indicate a course of action permissible within the limits of this NORSOK standard

3.1.21**offshore container**

transportable unit that can be handled in open sea for repeated transport of load or equipment to/from installations and vessels

NOTE 1 The unit includes equipment for lifting, handling, filling, emptying, cooling and heating etc.

3.1.22**offshore crane**

slewing crane used offshore for lifting operations with relative movements between the crane and the loading area

3.1.23

primary means of launching

main lifeboat launching system, based on gravity free fall or skidding combined with free fall, or lowering by a lifting appliance

3.1.24

rated capacity (R)

maximum load that a lifting appliance is designed to lift under specific conditions

NOTE Rated capacity which corresponds to SWL used by ILO.

3.1.25

redundant component

if the component fails, another component or components continue to perform its purpose or function without affecting the safe operation

3.1.26

reliability

ability of an item to perform a required function under given conditions for a given time interval

3.1.27

reliable component

component which is capable of withstanding all load conditions, disturbances and stresses, with a low probability of failures or malfunctions.

3.1.28

rescue boat

boat equipped with a single lifting suspension for offshore use for rescue of personnel from sea

3.1.29

rescue equipment

rescue boats and personnel baskets

3.1.30

risk

combination of the probability of occurrence of harm and the severity of that harm

3.1.31

safe working load

SWL

maximum working load that the lifting equipment is designed to lift under specific conditions

Note Safe working load corresponds to the term rated capacity (R) used by many standards.

3.1.32

shall

verbal form used to indicate requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted, unless accepted by all involved parties

3.1.33

should

verbal form used to indicate that among several possibilities one is recommended as particularly suitable without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required

3.1.34

significant wave height

average height of the highest third of prevailing waves, typically measured over a period of three hours.

3.1.35**suspended work platform**

mechanically operated work platform that can move freely

NOTE E.g. suspended on rope.

3.1.36**test**

specific operation of lifting equipment, with or without a defined load, in order to determine whether the lifting equipment is suitable for use

3.1.37**test load**

specified load that the lifting equipment shall withstand within the manufacturer's specified limits without resulting in permanent deformation or other defects

NOTE Thereby confirming that the design, materials and manufacture comply with specification and statutory requirements.

3.1.38**working load limit****WLL**

the maximum load that a lifting accessory is designed to lift at a specific configuration

3.2 Abbreviations

ALARP	as low as reasonable practicable
ATEX	Atmosphères Explosibles
CE	Conformité Européenne
EMC	electromagnetic compatibility
EU	European Union
FAT	factory acceptance test
FMECA	failure mode, effects and criticality analysis
FPSO	floating production, storage and offshore loading
HSE	health, safety and environment
HVAC	heat, ventilation and air conditioning
ILO	International Labour Organisation
IMO	International Maritime Organization
MOB	man over board
NMD	Norwegian Maritime Directorate
PSA	Petroleum Safety Authority
RCM	reliability centered maintenance
SWL	safe working load
UHF	ultra high frequency
VHF	very high frequency
WLL	working load limit

4 General safety requirements**4.1 Safety**

Lifting equipment shall be designed, fabricated, tested, installed and maintained in such a way to reduce and minimise risks to humans, the environment and material assets.

All forms of energy including lifting and moving objects, represented or produced by lifting equipment shall be controlled at any time in a safe manner.

The lifting equipment shall be designed such that no single technical failure gives an unacceptable risk.

4.2 Fitness for use

The selection of type and specification of requirements for lifting equipment shall be based on the specific conditions at the workplace, the work itself, and any risk that may arise during the work.

4.3 Reliability and availability

Lifting equipment shall be designed and constructed using well-proven components and safety principles, to ensure reliability by withstanding

- the operating stresses and loadings,
- the environmental influences,
- other relevant influences.

Lifting equipment shall be designed to ensure high availability and a minimum of “down-time” during the design life. In case of conflict between availability and safety, safety shall always prevail.

4.4 Principle of safety integration

The designer shall aim to eliminate any risk of accident throughout the design lifetime of the lifting equipment, including the phases of assembly and dismantling.

In selecting the most appropriate methods, the manufacturer shall apply the following principle of safety integration in the order given:

1. Eliminate and reduce risks as far as possible by design (According to inherently safe design philosophy)
2. Safeguarding and complementary protection measures in relation to risks that cannot be eliminated
3. Inform the users of the residual risks due to any shortcomings of the protection measures adopted, etc.

The basic terminology, methodology and technical principles are given in NS-EN ISO 12100-1 and NS-EN ISO 12100-2.

A documented risk assessment shall be worked out for all lifting appliances. The documentation of risk assessment shall demonstrate that the requirements for performing the risk assessment have been met, and that the results with respect to the acceptance criteria are fulfilled.

The risk assessment principles are given in NS-ISO 14121-1 and ISO/TR 14121-2.

For complex lifting appliances the risk assessment shall be developed using methods on component level, e.g. **FMECA** as described in NEK IEC 60812.

4.5 Inherently safe design

Inherently safe design principles using reliable components shall be applied. Dependent on the result of the risk assessment, fail-safe components or redundant components shall be used.

4.6 Safeguarding and complementary protective measures

Safeguarding and complementary protective measures shall be used to reduce or eliminate risks that can not be avoided or sufficiently limited by design.

4.7 Information for use

Information for use consists of communication links (e.g. text, words, signs, signals, symbols), or diagrams used separately or in a combination to convey information to the user. The information for use shall be an integral part of supply of lifting equipment.

4.8 Strength proportion

The strength elements (structural and mechanical) of lifting equipment shall be designed such that the consequences of accidental overloading or unexpected load conditions which causes break down are known and minimised. This requirement does not apply for lifting accessories and portable units.

For cranes this requirement may be achieved by ensuring that the first element to fail is not the foundation or any other element which is essential for the structural integrity of the entire crane.

4.9 Maintenance

Lifting equipment shall be designed and arranged with means for efficient maintenance which ensures that the safe condition can be maintained for the specified design life.