

Safe use of lifting and transport equipment in onshore petroleum plants

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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 recognized international standards, adding the provisions deemed necessary to fill the broad needs of the Norwegian industry. Where relevant, NORSOK standards will be used to provide the Norwegian industry input into the international standardization 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 Subject to development and publication of international standards, the relevant NORSOK standard will be withdrawn.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 from The Norwegian Oil Industry Association (OLF), The Federation of Norwegian Industry, the Norwegian Shipowners' Association and The Petroleum Safety Authority Norway. NORSOK standards are administered and published by Standards Norway.

Annexes A, B, C, D, E, F, G, H and I are normative. Annexes J, K and L are informative.

NORSOK standards are administered and published by Standards Norway.

Introduction

This NORSOK standard shall help to establish, maintain and further develop a high level of safety and working environment in the planning and execution of lifting and transport operations.

During the preparation of this NORSOK standard, consideration was given to Norwegian regulations, European Standard and International Standard.

The Petroleum Safety Authority Norway (PSA) carries out supervision regarding the regulations given in, or with a basis in, the regulations relating to health, safety and environment. Safety and working environment for petroleum facilities on land are regulated through "Temporary regulations relating to HSE for certain petroleum facilities on land and connected pipeline systems".

For the area of jurisdiction of this regulation, the PSA is the supervisory authority for lifting and transport operations. This includes "Regulations for use of equipment at work" and "Regulations for machinery" issued by The Norwegian Labour Inspection Authority (DAT), and "Regulations for the transport of dangerous goods on roads and railways" issued by the Directorate for Civil Protection and Emergency Planning (DSB) with amendments.

1 Scope

This NORSOK standard embraces the safe use of lifting and transport equipment used in connection with lifting operations in the petroleum activities on land. It does not include the use of personnel lifts and fall protection equipment.

NOTE Examples of lifting equipment covered by this NORSOK standard can be found in Annex J.

2 Normative og informative referanser

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

ISO 4306-1,	<i>Cranes – Vocabulary – Part 1: General</i>
ISO 9926-1,	<i>Cranes – Training of drivers – Part 1: General</i>
ISO 9927-1,	<i>Cranes – Inspections – Part 1: General</i>
ISO 12482-1,	<i>Cranes – Condition monitoring – Part 1: General</i>
ISO 13284,	<i>Fork-lift trucks – Fork-arm extensions and telescopic fork-arms – Technical characteristics and strength requirements</i>
NS-EN 13000,	<i>Cranes – Mobile cranes</i>
NS-EN ISO/IEC 17020,	<i>General criteria for the operation of various types of bodies performing inspection (ISO/IEC 17020:1998)</i>
FOR-2002-07-16-1139,	<i>Regulations for classification, marking etc. of dangerous chemicals</i>
PSA regulation 1595,	<i>Temporary regulations relating to HSE for certain petroleum facilities on land and connected pipeline systems</i>
DAT regulation 608,	<i>Regulations for use of equipment at work</i>
DAT regulation 820,	<i>Regulations for machinery</i>
DSB regulation 1331,	<i>Regulations for the transport of dangerous goods on roads and railways</i>
ADR rules,	<i>European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR)</i>
	<i>See Regulations for the transport of dangerous goods on roads and railways</i>
	Available online at the DSB web-page:
	http://www.dsb.no/Article.asp?ArticleID=2375&Framework=normalt&oppslag=1
DNV Rules for Marine Operations,	<i>Rules for Planning and Execution of Marine Operations, Part 2, Ch.1 Load Transfer Operations</i>
OMHEC Guidance Documents,	See web-page http://www.omhec.org/default.aspx?aid=5
Requirements for certification established by "Coordinating panel for cranes, fork lift trucks and bulk handling machinery"	Available online as a factsheet on the DAT web-page:
	http://www.arbeidstilsynet.no/c26976/faktaside/vis.html?tid=28244

2.2 Informative references

None

3 Terms, definitions and abbreviations

For the purpose of this NORSOK standard the following terms, definitions and abbreviations apply.

3.1 Terms and definitions

3.1.1

plant

facility for processing hydrocarbons, and gas power plants

NOTE Includes all areas and systems that are within the plant area, including building projects.

3.1.2

blind lift

lifting operation where the lifting appliance operator does not have a direct view of the load or landing area

NOTE Use of closed circuit television for monitoring the work area is not considered to be direct view.

3.1.3

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

3.1.4

documented training

training whereby it can be documented that the person who will use the lifting or transport equipment has received practical and theoretical training that provides knowledge about its structure, operation, applications, limitations and scope of use, as well as maintenance and inspection in accordance with the requirements set for safe use and operation stipulated in regulations and instructions for use. See "Regulation for use of equipment at work", § 47 and § 48

3.1.5

simple lifting appliances

lifting appliances constructed and placed so that use is not considered to involve a hazard to life or health. See 6.8

NOTE E.g. overhead cranes, winches, chain hoists, monorail cranes, etc.

3.1.6

principal competent person

person who shall have necessary qualifications within the disciplines and inspection duties to be carried out, and be approved by the certifying authority

NOTE The competence and approval of an *Enterprise of Competence* is tied to the principal competent person. If inspections are carried out by other than the principal competent person, then he/she is responsible for ensuring that the inspector(s) has/have the necessary competence and experience.

3.1.7

dangerous goods

goods that are classified and marked in accordance with the ADR rules

3.1.8

fixed attachment point

pad eyes, winch foundations, movable crane foundations, lifting beams and beams for temporary attachment of beam clamps

3.1.9

pre-use and post-use check

visual and functional assessment of the lifting equipment's technical condition before and after use without disassembly

3.1.10

suspended work platform

mechanically operated work platform that can move freely

NOTE E.g. suspended on rope.

3.1.11

snatch block

lifting equipment consisting of at least one sheave in a frame with an attachment point for rope, wire sling or chain that can be attached to a fixed point or to a movable point on the load.

3.1.12

can

verbal form used for statements of possibility and capability, whether material, physical or casual

3.1.13

elevating work platform

mechanically operated work platform that moves vertically in guides

3.1.14

controller

person in enterprise of competence who has sufficient theoretical knowledge, practical experience and understanding to carry out control of lifting equipment in a satisfactory manner

NOTE See requirements developed by "Coordinating panel for cranes, fork lift trucks and bulk handling machinery". Available as factsheet on the DAT web pages.

3.1.15

crane

lifting appliance whereby the load can be moved horizontally in one or more directions, in addition to the vertical movement

3.1.16

critical lifting operations

operations requiring a work permit and special safety measures

NOTE These operations include, but are not limited to

- lift over critical areas, and process equipment,
- personnel transport with the lifting appliance (unless management has established other approval arrangements),
- coordinated lift where the weight exceeds the maximum lifting capacity of one of the lifting appliances,
- overload testing of a lifting appliance with SWL over 10 tonnes,
- lift of special loads such as structures, etc,
- utilization of more than 75% of the lifting capacity of a mobile crane or truck mounted crane.

3.1.17

critical and special transport operations

transport operations requiring a work permit and special safety measures

NOTE These operations include, but are not limited to

- transport of long or wide objects,
- transport/moving of heavy objects,
- transport of dangerous goods,
- transport of objects that require special safety measures (for instance high or offset centre of gravity, transport over uneven terrain, etc.).

3.1.18

load carrier

all types of containers (except standard ISO containers), gas cylinder racks, wheelbarrows etc. that are equipped with lifting lugs for handling by a crane

NOTE Containers that can only be handled by a fork lift truck (such as ISO containers) are not defined as a load carrier. For description of attachment points on units to be lifted, see 8.2.

3.1.19

lifting and stacking truck

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

3.1.20**lifting components**

parts of the structure of, or used as part of, a lifting gear

NOTE E.g. hooks, shackles, rings, eye bolts, etc.

3.1.21**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

3.1.22**lifting appliance**

combined unit that is used to lift loads, with or without horizontal movement

NOTE Examples of lifting appliances are shown in Annex J.

3.1.23**lifting gear**

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 Examples of lifting gear are shown in Annex J.

3.1.24**lifting equipment**

common term for lifting gear, lifting appliances and lifting components, used together or individually

3.1.25**bulk handling machinery**

motorized machine constructed for lifting or transporting bulk loads such as soil, sand, stone etc.

NOTE Examples of bulk handling machines are shovel loader, road scraper, digger, bulldozer, dump truck and excavator.

3.1.26**material handling plan**

plan for moving load in the plant to ensure a safe and efficient operation

NOTE The material handling plan takes into account, among other things

- the need for type and number of lifting and transport equipment,
- the need for loading and unloading areas,
- preparing for the use of lifting and stacking trucks, trolleys etc.,
- access to areas and workplaces for operation and maintenance.

3.1.27**personnel lifter**

machinery with a work platform or basket constructed and approved in accordance with "Regulations for Machinery" to lift or transport personnel, and which is controlled from the platform or basket

3.1.28**rigger**

person who is competent to assemble, control and issues tags for temporarily assembled lifting appliance

3.1.29**competent control**

control carried out by an enterprise of competence in order to verify that machinery satisfies relevant requirements and is designed, embedded, installed, set up, tested, documented and maintained in such a way that use of the machinery is fully justified

NOTE See Annex H.

3.1.30**declaration of conformity**

document where the producer, or his representative, declares that the marketed machine or safety component is in accordance with laws, regulations and standards

3.1.31**certificate**

form based on ILO's recommendation (issued by the enterprise of competence/competent person) confirming that the lifting equipment meets statutory requirements and is designed, embedded, installed, set up, tested, documented and maintained in such a way that use of the lifting equipment is fully justified.

NOTE The certificate shall state which set of rules the certificate is based on.

3.1.32**enterprise of competence**

entity in the operator companies' organization, or in other companies or institutions, that together have sufficient theoretical knowledge and practical experience to understand calculations for lifting equipment, its design and function, and to carry out necessary examinations and tests in order to issue certificates

NOTE See Annex H.

3.1.33**examiner**

expert within the area of competence who evaluates the examination result from a candidate

3.1.34**certified safety training**

training provided by certified training enterprise in accordance with the requirements in section 49 and section 50 of DAT Regulation no. 608 *Regulations for use of equipment at work*

3.1.35**safe working load****SWL**

maximum load the lifting equipment is certified to withstand under normal use

NOTE 1 For lifting gear with several legs, this is marked for a working angle of 30 degrees.

NOTE 2 SWL is normally used by ILO and shall apply on all floating and other mobile installations and ships that are not covered by EU regulations.

3.1.36**shall**

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

NOTE Verbal form is used in connection with requirements which shall be fulfilled to be in accordance with this NORSOK standard. If other solutions are necessary, this shall be treated as a nonconformance and dealt with as a deviation according to company requirements. The alternative solution, together with any compensating measures, shall provide an equivalent level of safety.

3.1.37**working load limit****WLL**

maximum load that a sling or a lifting component is certified to withstand under normal use and in a given configuration

NOTE For lifting gear with several legs, this is marked for a working angle of 45 degrees.

3.2**Abbreviations**

ADR	European Agreement Concerning the International Carriage of Dangerous Goods by Road
CE	Conformité Européenne (CE marking confirming compliance with the basic requirements in EU directives)
CETOP	European Fluid Power Committee
HAZOP	hazard and operability study

ILO	International Labour Organisation
ISO	International Organisation for Standardization
NDT	non destructive testing
NS-EN	European Standard that is established as a Norwegian Standard
OMHEC	Offshore Mechanical Handling Equipment Committee
OTF	Operational and Technical specialist working group, Cranes and Lifting (Working group within <i>Working together for Safety SfS</i>)
SJA	safe job analysis
SWL	safe working load
WLL	working load limit

4 Safe use of lifting equipment

4.1 General

Clause 4 describes general requirements for a lifting operation and how the persons involved shall carry it out. This description applies to all types of lifting equipment used. Subsequent sections state additional requirements that apply for different types of lifting equipment.

4.2 Overall requirements

All use, maintenance, storage, checks, inspection and examination of lifting equipment shall comply with the applicable regulations, standards, manufacturer's instructions for use and the requirements in this NORSOK standard.

The lifting equipment shall not be used for other purposes than those stated without the consent of the manufacturer and the enterprise of competence.

It is not allowed to operate the lifting equipment with any of the safety devices disconnected, unless the operating instructions allows this.

Lifting equipment shall only be used by personnel who have and can document competence as described in Annex B.

Responsibilities of the company and personnel who are involved in lifting operations are described in Annex A.

Load transfer between ship and quay shall be planned and calculated in accordance with DNV's rules for marine load transfer operations.

4.3 Management

The operational responsible person shall manage all of the activities with lifting appliances within his area of responsibility.

Lifting appliance operator is in charge of the individual lifting operation.

When considered to be safer, a person other than the lifting appliance operator can be designated to be in charge of the lifting operation.

If a signaller is involved in the lifting operation, he shall be responsible for directing the load.

4.4 Risk assessment

All personnel involved shall assess the need for a pre-job talk, SJA or use of other risk analysis methods as described in Annex I.

If, during the execution of a lifting operation, there is a change in operational conditions or in the assumptions on which the risk mapping was based, the operation shall cease and a new risk assessment shall be carried out.

4.5 Planning

Each lifting operation shall be planned in order to ensure safe execution and that all predictable risks are taken into consideration. The planning shall be carried out by personnel who have the relevant competence.

For repeated or routine operations, such planning is only necessary the first time, provided that an operating procedure is in place or documented in another way. Periodic revisions shall be carried out to ensure that no critical factors have changed.

The planning of lifting operations shall, as a minimum, ensure that

- all personnel involved are familiar with the task, i.e. what is to be lifted, weight of the load, what lifting equipment to use, the travel path, and the roles of the persons involved in the lifting operation,
- the shift going off duty shall inform the shift coming on duty about ongoing and planned work that may have a significance for the continuation of the lifting operation (shift going off duty shall also give information about any incidents),
- sufficient personnel are present at all phases of the lifting operation,
- the travel path is clarified and any obstacles are removed before lifting commences,
- barriers are in place to prevent personnel from walking or standing under suspended load,
- method of communication is clarified,
- the lifting operation can be executed safely in relation to simultaneous operations,
- lifting appliances and lifting gear are suitable and will be used in accordance with the manufacturer's instructions for use,
- the landing area can accommodate the load in terms of size and weight,
- cranes are not positioned on culvert, manhole cover or places where the crane can cause damage to equipment under ground,
- use of tag line is considered,
- personnel involved have sufficient competence and knowledge of the regulations and standards that govern the operation that is to be executed,
- work permit is obtained for critical lifting operations.

4.6 Limitations

The lifting appliance operator shall map and take into consideration limitations that can affect the lifting operation, including the capacity of the lifting equipment, weather conditions, landing areas, blind zones and other limitations as a result of the travel path.

In general, the wind limitations of the crane shall be adhered to. The weight, area and shape of the load, and the position of the crane shall be considered when setting wind limitations during the planning/SJA of the lift.

For outdoor lifts, the wind force in the operating area of the crane shall not exceed 15 m/s.

4.7 User check

User of lifting equipment shall check the lifting equipment and make sure that it is in a safe condition before and after use.

The pre-use and post-use checks should include the following:

- visual check of the lifting equipment;
- function test of the equipment in accordance with the manufacturer's recommendations;
- function test of the emergency stop device;
- report any faults or defects to the technical responsible person.

Daily check routines of the lifting equipment can cover this user check requirement.

Lifting appliances shall not be used if safety systems or parts of safety systems are not functioning or have been isolated.

4.8 Communication

At all times there shall be adequate communication between all personnel who are involved in the lifting operation. If radio communication equipment is to be used, then this shall be suitable for the particular lifting

operation and the routines in the plant. The operator of the lifting appliance shall obey any stop signal, even if this comes from other persons on the same radio channel.

Radio check shall be carried out prior to the start of the lifting operation. When directing the load, instructions shall be clear and unambiguous.

The lifting appliance operator can repeat the signaller's instructions (confirmatory communication) to avoid any misunderstandings during lifting operations.

When directing the crane in blind zones, transporting personnel and other lifting operations where radio communication is of prime importance, confirmatory communication shall be used.

In order to help the lifting appliance operator, the desired crane movement can be stated in metres. (For instance in assembly operations)

Where appropriate, a communication method can be chosen whereby the signaller gives a continuous signal to continue the movement. The lifting appliance operator shall stop immediately if he does not receive the signal.

If the radio is blocked or contact is lost, the lifting operation shall be stopped.

The method of communication to be used shall be agreed as part of the pre-job talk or SJA.

Unnecessary use of radios shall be avoided.

If any noise or activity is distracting the lifting appliance operator or other personnel involved in the lifting operation, then the lift shall be stopped.

Unless otherwise agreed, communication shall be in Norwegian. All personnel who are involved shall be competent in the language chosen.

When directing the crane, the following instructions shall be used:

Instruction (Norwegian)	Instruction (English)	Action
Hiv	Pick up	lift the load
Lår	Lower	lower the load
Topp bom	Boom up	raise the boom
Legg bom	Boom down	lower the boom
Sving høyre	Slew right	slew to the right (from crane operator's position)
Sving venstre	Slew left	slew to the left (from crane operator's position)
Stans	Stop	stop the movement immediately
Pent/fint/rolig	Gently/slowly	slow movement
Slakk av	Slack off	release tension in the wire so that the hook can be released
Fri krok	Hook free	lift up released hook
Teleskop ut	Extend boom	extend telescopic boom
Teleskop inn	Retract boom	retract telescopic boom

If communicating by other means than radio, the following shall be considered:

- involved personnel close to each other;
- the influence of noise on the communication;
- visual contact between involved personnel during the whole lifting operation.

If visual signals are used, the hand signals shown in Annex E shall be used.

Lifting appliance operator shall at all times be fully attentive to the operation.

4.9 Safe execution

4.9.1 Fundamental safety requirements

The load and any load carrier shall be properly secured and prepared before the lifting operation commences.

For transport of bulk loose material, a load carrier shall be used that is designed such that material cannot fall out during loading or unloading operations. Liquid products shall be transported in sealed load carriers. For internal transport, load carriers should be used where practical.

Necessary barriers shall be established before the lifting operation starts, to prevent personnel from coming under a hanging load.

Loads shall not be transported over personnel.

Personnel shall not walk under suspended load.

All personnel who are involved in the lifting operation shall ensure that they have an unrestricted escape route in all phases of the operation.

Loads shall be attached to the lifting appliance and handled in such a way that the load remains stable throughout the entire lifting operation, and after being released.

The lifting operation shall cease immediately if safety is jeopardized, when instructions are unclear, or in the event of loss of communication.

Lifting appliance operator shall only obey instructions from the designated signaller, but shall obey the emergency stop signal at all times, regardless of who gives this signal.

Lifting appliance operator shall not leave the operator's cabin or station with load hanging on the hook.

In case of an emergency evacuation, the load shall if possible be made safe before evacuating. For critical lifting operations, the possibility of an evacuation shall be part of the planning and SJA.

If a lifting appliance is used as a suspension point for a snatch block or similar, then the suspension point shall be made safe.

If a block and tackle/chain hoist is used between the hook on the lifting appliance and the load in order to maneuver the load in connection with assembly or disassembly work, care shall be taken to ensure that the block and tackle/chain hoist does not become load bearing when the lifting appliance is in motion.

Operations with lifting appliances shall be stopped when the weight of the load is unknown, or if the load has become stuck, for instance has frozen to the ground. The signaller and slinger shall pay particular attention to the load being free before lifting commences.

To prevent overloading of lifting equipment, when it is used in disassembly operations, it should be checked that the load shown on the load indicator is in accordance with the given or assumed weight of the load.

If the crane has two independent lifting systems, then loose lifting gear should be removed from the hook not in use.

4.9.2 Manning for crane operations

All participants in a lifting operation shall, at all times, know who the signaller is.

During lifting operations, there shall always be two signallers/slingers available in the plant. The operator of the lifting appliance can evaluate if a safe operation can be carried out without the direct involvement of the signaller/slinger. The one who is not involved, shall be in his working clothes and be able to be contacted over radio.

There shall be at least two signallers/slingers directly involved in operations where any of these applies:

- blind lifts;
- narrow landing conditions;
- use of tag line;
- complex lifts like tandem lifts and construction lifts.

The signaller and slinger shall stand in a safe area at all times when the crane and/or lifting wire is moving.

During lifting operations there shall always be at least two persons in the area, in the event it should become necessary to raise an alarm.

If the lifting appliance operator has a good visual overview of the area (not by means of a camera), the signaller can carry out the slinger's duties. In such circumstances, the signaller can, with clearance from the lifting appliance operator, handle/maneuver the load when it is under control, and manually guide the empty hook to and from the load or load carrier.

Participants in lifting operations and their roles can be made known through the wearing of special clothing, such as a reflective vest, hardhat or similar.

4.9.3 Blind lifts

In connection with blind lifts, there shall always be at least two persons (signaller and slinger) who have visual contact with the load and each other, and have radio contact with the lifting appliance operator. Any closed circuit television that monitors the work area is considered to be an aid, and not a replacement for either of these persons.

If a load has to be pushed or pulled into position manually, a signaller shall be present by the load or as close to the load such that he can direct the lifting appliance safely and thereby address the safety of other involved persons.

Where possible, the signaller should place himself in a position where he can give the stop signal manually in the event of radio failure.

4.9.4 Lifting operations through hatches and in shafts

For lifting operations through hatches and in shafts, the requirements for blind lifts apply, see 4.9.3.

Lifting through several levels shall be covered by local procedures, possibly through an SJA. In particular, the risk of the load or load carrier snagging on hatch frames should be assessed.

4.9.5 Use of tag line

Lifting appliance operator shall assess and approve the use of tag line.

The end of the rope shall be secured against fraying, but knots shall not be used at the free end of the rope. Tag line should be used to keep control of a load, not to gain control over a load.

If several tag lines are necessary, personnel who are not slingers can be involved in the operation. SJA shall then be carried out, and the personnel shall have undergone the necessary training related to the use of tag lines.

4.9.6 Transport of scaffolding material and boards

Where practically possible, scaffolding material and boards should be transported in suitable load carriers.

During lifting to and from a lorry, the scaffolding material and planks should be transported in load carriers.

When moving scaffolding material and boards whereby load carrier cannot be used, nylon ratchet straps shall be used to prevent slipping. The slings shall be wrapped round twice and choked around the load. The slings should be choked in the same direction.

4.9.7 Radioactive sources, trace elements and explosives

Radioactive sources, trace elements and explosives shall be placed and handled in accordance with the material safety data sheets, marking on the load carrier and local procedures. See the ADR rules.

Receiving of containers for radioactive sources, trace elements or explosives shall be dealt with by the designated person in the plant.

4.9.8 Tandem lifts

Tandem lifts should be avoided, but when they are required they shall be calculated and SJA shall be carried out.

Tandem lifts always demand good planning and supervision of the work. The operational responsible person must therefore make sure that all predictable risks are taken into account in advance, amongst others, determination of weight and centre of gravity
For tandem lifts, the allowable load is limited to 75% of the load diagram for the crane. Consideration shall be given to the shape of the load, and influence from wind during the lift.

Enterprise of competence shall be involved in tandem lifts where the total load may exceed the lifting capacity of one of the lifting appliances being used. See Annex L.

4.10 Equipment owned by contractors

The company is responsible for ensuring that a contractor, who becomes involved in lifting and transport operations, is aware of and abides by the requirements in this NORSOK standard.

The company shall ensure that there is sufficient competence in the organization to carry out quality assurance of the contractor's equipment, competence and execution of lifting and transport operations.

Documentation for competent control of equipment owned by a contractor shall be available in a satisfactory manner at the place of use, either in an electronic system or on paper.

The responsibility of the company can be taken care of by regular verifications and inspections of the contractors lifting and transport equipment and lifting and transport operations in the plant.

4.11 Completion and evaluation

Any undesirable incidents taking place during the lifting operation shall be reported.

After the operation is completed, the persons involved shall assess whether experience transfer or improvements to operational procedures are necessary.

After the lifting operation is completed, any barriers shall be removed and the area tidied.

5 Additional requirements for the lifting of personnel

5.1 General

Machines used for lifting personnel shall be designed and approved according to "Regulations for Machinery".

For all planned use of personnel lifting, using equipment approved for the purpose, a general procedure for use of the equipment shall be available, or a SJA shall be performed for the particular operation.

If the use of a lifting appliance not approved for this use is considered to be the safest alternative, then the rules for exceptional lifts in "Regulations for use of equipment at work" shall be applied as a minimum. The safety evaluation shall be documented. Competent control of the equipment shall have been carried out no more than a month before the actual lift. This applies until 1. January 2010.

5.2 General requirements

An ongoing assessment shall take place to determine whether routine work can be carried out more safely through establishing permanent access or by identifying other methods of performing the work tasks. This assessment shall be implemented in consultation with the safety delegate service and the operational responsible person.

All lifting of personnel with lifting appliance shall be voluntarily.

During operations involving the lifting of personnel over the sea, life-vest shall be worn, and rescue stand-by shall be established.

The operator of the lifting appliance shall assess whether the operational conditions (weather, visibility, movement) permit a safe execution of the operation.

Personnel lifts shall be carried out within the wind limitations of the lifting appliance. The maximum wind speed for lifts outdoors is 10 m/s. The area shall be well lit, and weather conditions must allow work from a work basket.

When lifting personnel, other lifting and transport operations close by or over the work area for the personnel lift shall be avoided.

A minimum of two persons shall always be involved in personnel lifts. The person in the basket shall have radio communication available, and procedure for evacuation shall be established.

The area under the work platform shall be cordoned off.

Fall protection equipment shall be used when working from a work basket. Tools and equipment shall be secured against falling down.

Before the personnel lifting appliance is used, all escape methods shall be described and given a function test. Everyone involved shall be aware of all the methods available and have been given training in how to operate these.

5.3 Suspended work platform and elevating work platform

Requirements with respect to competence, use and control of suspended work platforms and elevation work platforms are based on "Regulations for use of equipment at work".

The suspension points for suspended work platforms and elevating work platforms are subject to certification by the Enterprise of Competence.

Necessary considerations shall be given to weather conditions when using suspended work platforms and elevating work platforms.

6 Additional requirements for different lifting appliances

6.1 Mobile crane

The local rules for use of vehicles in the plant shall apply.

When changing location, the mobile crane shall be made safe and correctly configured for travelling. See also chapter 9.

Mobile cranes shall only be used for lifting. Pulling or pushing a load is not allowed.

If the mobile crane is to be fitted with special equipment such as vacuum lifter, magnet yoke or grab, then the operator of the mobile crane shall have documented competence for operating this equipment.

Positioning of the mobile crane shall be in accordance with the manufacturer's instructions and the local routines in the plant.

Mobile lifting appliances shall not be placed on drainage channels, manhole covers or unstable ground such as infill edges etc.

The outrigger feet of a mobile crane shall during lifting be placed on pads suitable for the condition of the ground and the lift to be carried out.

Only the crane driver can allow access to the mobile crane. If entered by other personnel, the crane shall be secured against unintentional use.

A wind anemometer should be fitted to the boom tip.

When risk of lightning, the mobile crane operations shall be stopped.

When re-reeving a mobile crane, the procedures for working aloft shall apply.

Mobile cranes produced after September 2004 shall be equipped with safety systems as defined in NS-EN 13000. However, the requirements in NS-EN 13000 for external sound and light alarms in the case of overload shall apply to all mobile cranes.

6.2 Tower crane

Before placing a tower crane near or in a process plant in operation, a risk assessment shall be carried out with respect to assembly, use and dismantling.

Before use the crane shall be evaluated with respect to the fire and gas philosophy of the plant.

A work description shall be available before assembly and dismantling takes place.

The foundation and assembly shall be carried out according to the manufacturer's instructions, and a certificate shall be issued by the Enterprise of Competence.

A tower crane shall have an external earth connection.

Relevant personnel safety equipment shall be used during work on the crane construction, and the workers shall have training in its use.

Safe access shall be provided for operation and maintenance. For access to operator cabins higher than 25 m above ground, a lift shall as a rule be provided.

During thunder and lightning the tower crane operations shall be stopped.

If several cranes operate in the same area, (either at the same or different heights) where the boom radiuses overlap, then operational procedures shall be established. Limiting zones should be considered.

The slewing function on tower cranes shall free-wheel when the crane is not in use or in limiting wind conditions.

If moving along rail tracks the operator should have full view of the travel path and be sure it is free from obstacles. If a full free view is not possible, then the operator of the lifting appliance shall use a signaller with radio communication on the ground.

Tandem lifts using a tower crane and a ship-mounted crane is not allowed.

If the tower crane is to be fitted with special equipment such as vacuum lifter, magnet yoke or grab, then the operator of the mobile crane shall have documented competence for operating this equipment.

The Civil Aviation Authority of Norway shall be notified of tower cranes positioned closer than 5 km to an airport. Marking of the crane may be necessary, depending on the position and height. Cranes taller than 60 m shall have marking lights fitted to the top.

When leaving the crane, the main switch shall be off and locked. Cranes travelling along rails shall be secured to the rails with clamps.

During transport of self-erecting tower cranes, the slewing function shall be secured mechanically before transport.

6.3 Portal and jib cranes

During thunder and lightning the operation of outdoor portal or jib cranes shall be stopped.

If travelling along rail tracks the operator should have full view of the travel path and be sure it is free from obstacles. If a full free view is not possible, then the operator of the lifting appliance shall use a signaller with radio communication on the ground. This can be the slinger or signaller.

If the crane is to be fitted with special equipment such as vacuum lifter, magnet yoke or grab, then the operator of the crane shall have documented competence for operating this equipment.

6.4 Overhead crane

If the overhead crane is located in an area with a good overview, and there is no blind lifts involved, the lifting appliance operator can carry out the lifting operation alone by taking care of the slinger and signaller's tasks.

Operator of an overhead crane that is radio controlled shall have visual contact with the crane and load. If this is not possible, the guidelines in 4.9.3 shall be followed.

The operator panel for the crane shall be kept in a fixed storage space when not in use. This shall be lockable if the crane is not lockable by other means.

Overhead cranes with radio control shall have unmistakable marking to show which controller belongs to which crane. This is particularly important where there are several cranes in the same building.

If a spare radio control panel exists, then this shall be locked away and not easily available to the lifting appliance operator. This is to prevent two control panels being used simultaneously.

If there are more than one crane on the same railway or more than one hoist trolley on one crane, then a functioning collision protection shall be installed.

Overhead cranes with more than one control systems shall have a device to ensure that only one system can be active at any time.

It shall be possible to evacuate overhead cranes with a fitted operator position/cabin anywhere in the operational area.

If several cranes operate on the same railway, each one shall have a main electrical switch. The cranes may have a common electrical supply switch.

For tandem lifts (option switch A+B) with two hoist trolleys on the same crane, all relevant safety functions shall have effect on all hoists.

If the overhead crane is to be fitted with special equipment such as vacuum lifter, magnet yoke or grab, then the operator of the crane shall have documented competence for operating this equipment.

6.5 Lorry mounted crane

The local rules for use of vehicles in the plant shall apply.

The outrigger feet of the lorry mounted crane shall not be placed on drainage channels, manhole covers or unstable ground such as infill edges etc.

Positioning of the lorry mounted crane shall be in accordance with the manufacturer's instructions and the local routines in the plant.

The outrigger feet of the lorry mounted crane shall during lifting be placed on pads that are larger than the feet and be suitable for the condition of the ground and the lift to be carried out.

Movement of the lorry shall only take place with the lorry crane in the secured transport position.

If the lorry mounted crane is located in an area with a good overview, and there is no blind lift involved, the lifting appliance operator can carry out the lifting operation alone by taking care of the slinger and signaller's tasks.

Operator of a lorry mounted crane, signaller/slinger and other personnel shall stay well clear from the load when it is lifted or lowered.

Removeable lorry mounted cranes shall be correctly locked to the vehicle.

Lorry mounted cranes shall be stable throughout the range of slewing.

Lorry mounted cranes shall only be used for lifting. Pulling or pushing a load is not permitted.

6.6 Cargo winch (tugger)

When using a cargo winch, a safety area shall be cordoned off to prevent damage if the wire rope should break. During use the operator of the winch shall ensure that the wire rope is spooling correctly, so that there is no danger of the rope bunching up and causing the load to fall.

Winch operator shall never use his hands to guide the wire rope onto the drum while it is in motion.

For requirements to blind lifts, see 4.9.3. Regarding use of snatch block, see 7.11.

6.7 Lifting and stacking truck

When using a lifting and stacking truck, appropriate consideration shall be given to slippery floors, narrow loading areas and the emission of exhaust gases indoors.

Load accessories for trucks shall be suitable for the vehicle, and be certified as lifting equipment. Fork extensions shall be in accordance with ISO 13284.

Regarding using lifting and stacking trucks for transport, see clause 9.

6.8 Simple lifting appliance

The operational responsible person shall assess whether a lifting appliance can be classified as simple. The assessment shall focus on

- special requirements to competence,
- use of several signallers,
- lifting in blind zones,
- operation in critical area,
- simultaneous operations,
- SWL and lifting height.
- operation in an area with pressurized equipment,
- construction work,
- personnel transport,
- loading and unloading of vehicles,
- work areas with personnel movements,
- is the lifting appliance manually operated?

If the simple lifting appliance is located in an area with a good overview, and there is no blind lift involved, the lifting appliance operator can carry out the lifting operation alone by taking care of the slinger's and signaller's tasks.

6.9 Bulk handling machine and tractor

Bulk handling machines and tractors used in connection with lifting operations, and with lifting gear and lifting appliances fitted, shall comply with the general requirements in chapter 4.

7 Additional requirements for different types of lifting gear

7.1 General

Use and daily check of lifting gear shall be in accordance with the manufacturer's instructions for use, and requirements in this NORSOK standard with annexes. In addition, relevant parts of recognized training material used by certified training enterprises can be referred to.

7.2 Storage of loose lifting equipment

All installations shall have dedicated area(s) where loose lifting equipment not in use shall be stored. Loose lifting equipment shall be protected against the weather and other harmful conditions during storage.

Sizeable lifting gear such as lifting beams, pendants, internal load carriers and similar shall as far as practically possible, be protected against harmful conditions during storage.

An updated index should be kept of the issue and return of lifting equipment used in connection with setting up of temporary lifting appliances as described in this NORSOK standard.

The user shall inspect loose lifting equipment for the correct marking, possible overload, wear and damage, before and after use. The user is responsible for returning loose lifting equipment to the storage area after use.

Defective and damaged loose lifting equipment shall be marked and set aside at a designated place clearly identified for this purpose.

7.3 Slings

The load shall be attached to the hook by means of slings or other suitable lifting gear. Protective material shall be placed between the slings and any sharp edges, and a check shall be carried out to ensure that the bend diameter complies with the manufacturer's instructions for use.

If several slings are used in the same eye or hook they shall not lay on top of each other.

When slings or chains are used, consideration shall be given to the number of legs, the angle and other factors that alter the capacity of the sling.

The sling shall be wrapped twice around the object to be lifted, if possible. The sling shall be tensioned with care, and not jerked.

7.4 Chain

Certified short link chain shall be used.

Particular care and attention must be exercised during the before-use check when using connectors. Be particularly aware of corrosion and seized joint. Connectors shall be lubricated.

7.5 Shackles

If shackle without rotating bolt is used in lifting arrangement, the bolt shall be properly secured to withstand any rotating forces transferred to the shackle bolt.

In permanently placed lifting arrangements and for all lifts of personnel, only shackles with double locking shall be used, e.g. nut plus split pin or screwed connection with split pin.

For simple lifts with shackles, simpler locking pins may be used as part of the double locking, such as clips. If hair pins/split pins are to be used, the safety shall be given special consideration in each instance.

A threaded bolt may be used if the danger of rotation being transferred to the bolt of the shackle is small.

Shackles without rotating bolt should not be used in permanently installed lifting arrangement due to the danger of transferring rotating forces to the shackle bolt.

Shackles where the bolt is only locked with a split pin are not allowed (bolt not threaded).

7.6 Eye bolts and eye nuts

Eye bolts and eye nuts shall always be screwed in to the point where the entire collar is in contact with the surface.

Pre-use check shall include a check of the threads in the material in which the eyebolt will be mounted, and that the thread dimension and type are the same.

The thickness of the material where the eye bolt is mounted, shall as a minimum be the same as the bolt diameter.

The use shall be in accordance with the manufacturer's instructions.

Eye bolts of material grade 80 should preferably be used.

Eye bolts should be removed after use, and the female thread preserved.

7.7 Wire rope clamps

Wire rope clamps shall be of a type with two gripping surfaces. U-bolt clamps shall not be used on lifting equipment.

When using wire rope clamps, the minimum breaking load of the wire rope shall be reduced in accordance with manufacturer's instructions for use, and the correct number of clamps shall be used.

Wire rope clamps shall be fastened using the correct torque

7.8 Beam clamps and trolleys

If trolleys are used, end stops shall be installed on the beams.

Beam clamps shall be installed as described in the manufacturer's instructions for use, and not be subjected to load beyond the stated load angles.

7.9 Turnbuckles

If turnbuckles are used in the lifting arrangement, they shall be certified and approved for lifting.

7.10 Lifting nipples and lifting caps

Lifting nipples and lifting caps shall be certified and approved for lifting.

Before use, a check shall always be carried out to ensure that the thread section on the pipe and on the lifting nipple or lifting cap are undamaged, that the lifting equipment is correctly installed, and that the thread dimension and type are the same.

When moving a load with lifting nipple or lifting cap, the area below the travel path shall be cordoned off.

7.11 Single and multi-sheave block

When securing a snatch block to the load bearing structure, the operator shall ensure that all split pins, locking and safety pins are in place and in good condition.

The rigger shall ensure that the load bearing structure is strong enough to withstand the resultant force (load plus wire tension and any friction forces) and that the snatch block is correctly positioned such that the wire rope does not rub against the side plates.

For complex arrangements, which involves several sheave blocks, an enterprise of competence should verify the correct set-up and calculations of resultant forces.

7.12 Load carriers

Before use, the slinger shall check that the load carrier and attached lifting set are suitable and that the load is satisfactorily secured.

The check shall ensure that

- load carrier has been controlled and approved,
- all load is secured in such a way that it cannot move around,
- load does not stick out over the sides of the load carrier,
- multi-leg sling on open load carriers, tanks, special containers and modules are secured against snagging the load etc. Net or canvas can be used as covering, or the legs of the slings can be secured with cable ties,
- all load is positioned such that it is easy and safe for the receiver to handle the material when unloading the load carrier,
- equipment is always placed on pallets when loading containers,
- pallets or timber are always used on the floor of the basket,
- load is supported as necessary when using pallets etc.,
- safety net is used to prevent load from falling out of load carriers with doors,
- heavy and/or unstable items are secured by means of tensioning arrangement,
- there are no loose parts on the load that could fall off during the lift,
- there are no loose items that could fall down in the forklift pockets,
- multi-leg chain slings are not crossed when attached to load,
- dangerous goods is marked with the correct hazard sticker on all four sides in accordance with the DAT Regulation no. 1139.

All load carriers shall be placed such that the slings can be hooked on from ground level. It is not allowed to climb onto the top of the load carrier to hook on the sling.

Stacking of load carriers by use of crane is not allowed. Load carriers that have been designed to be stacked, may be stacked, with a maximum of three in a stack, and the hooking/unhooking shall be possible to be carried out from ground level.

Other loads shall not be placed on top of load carriers.

Extreme caution shall be taken when opening doors on load carriers in case there are loose objects that could fall out.

Load in load carriers shall not be lifted when personnel are in the load carrier.

When placing load in load carrier, the load shall be set down on pallets/timber and secured. The weight shall be distributed as evenly as possible in the load carrier. Heavy loads should be placed at the bottom of containers.

Lifting set for offshore containers (sling assembly and shackles) should not be removed except for inspection and maintenance, or if a container shall be installed for a longer period in a plant.

7.13 Load carriers for gas cylinders

Gas cylinders shall be transported with protection cap fitted and in a load carrier designed and approved for the purpose.

7.14 Big bags

Big bags for repeated use shall be documented as lifting gear.

Big bags for single use shall have a type certificate in accordance with a recognized standard.

"Single use" means transport from the manufacturer via the supplier to the plant.

Big bags for single use shall be destroyed after use.

Before use check shall be carried out.

7.15 Claws, clamps, vacuum lifters and magnet yokes

The manufacturer's instructions shall be followed.

The working area shall be cordoned off, and free of personnel.

When establishing the barrier, be aware of the possibility that some of the load may slide off and be a danger in an extended area.

7.16 Wire pulling tackle

Lifting and pulling shall not be done at the same time.

The wire rope shall not be pulled further in than to leave minimum 15 cm at the free end.

8 Permanent attachment points and temporarily assembled lifting appliances

8.1 Permanent attachment points for lifting appliance

Before a permanent attachment point (typically lifting pad, lifting beam or tube encased in concrete) for a lifting appliance is used for the first time, an enterprise of competence shall issue a certificate that it is ready for use. Any restrictions on use of permanent attachment points shall be specified in the certificate and be legible on/near the attachment point, or be made known to the user in another way.

Sideways loads are not allowed unless specified in the certificate.

Documentation for concrete casting/grouting shall be provided. The installation instructions from the producer shall be followed.

Visual inspection, non destructive inspection /testing and test loads shall be the basis for approval of attachment points.

All permanent attachment points for load shall be dimensioned, tested and clearly marked with SWL and identification number.

Lifting equipment that is used on a permanent attachment point, and which is not in regular use, should be removed after use.

Where the environment is suitable for storing the equipment and the equipment does not otherwise represent a hazard, it can nevertheless hang on the permanent attachment point over a longer period.

Pre-use and post-use check of the attachment point shall always be carried out. Load test or periodic control is not required unless the enterprise of competence has made this a requirement.

If misalignment occurs in the attachment point or there is suspicion of cracks or corrosion, then a NDT inspector or competent person should be called to evaluate.

8.2 Lifting points on lifted component

Use of a lifting point incorporated into a component which is designed to lift only the weight of the component itself, shall be described in the manufacturer's instructions for use or documented in another way. There is no requirement for certification or control of such lifting points by enterprise of competence.

Pre-use and post-use check of such lifting points shall be carried out.

The lifting point shall be permanently attached to the component (welded or cast). If it is possible to unfasten the lifting point, then it is considered to be lifting gear, and shall be controlled and certified every 12 months.

8.3 Attachment point for pulling

Strength of attachment points for pulling shall be documented. There is no requirement for certification or control of attachment points for pulling.

When carrying out pulling operations, relevant parts of this NORSOK standard should be the basis for the operation, see in particular 4.3 and 4.4.

Pre-use and post-use control of attachment points for pulling shall be carried out.

8.4 Attachment points built with scaffolding material

Using scaffolding material to construct an attachment point is dependent on the material being approved by the supplier as attachment point for lifting appliances. Construction of an attachment point with scaffolding material (trestle) shall be carried out by a competent scaffolder in accordance with the supplier's instructions.

Trestles shall be clearly marked with "*Trestle for lifting/Løftebukk*" and maximum SWL, date of approval and signature of the competent person.

8.5 Loader arms, movable gangways etc.

Unless loader arms, movable gangways etc. are used to lift loads or personnel, they are defined as machines, and shall be designed, documented and maintained in accordance with "Regulations for Machinery".

8.6 Temporarily set-up lifting appliance

Use of lifting appliances attached to temporary attachment points should be limited. If there is a repeated need to lift components in connection with maintenance etc., a permanent attachment point should be installed for the lifting appliance.

Plate clamps may be used as a temporary attachment point only if the manufacturer's instruction for use of the clamp allows this.

It should be attempted to use lockable flange clamps, where possible.

Clamps shall be removed after completion of the lifting operation.

The following applies for use of temporarily assembled lifting appliances:

Table 1 – Requirements for temporarily assembled lifting appliances

	Permanent attachment point for lifting appliance	Temporary attachment point for lifting appliance	
		Loads less than or equal to 2 tonnes	Loads greater than 2 tonnes
Description	Installation or reassembly of equipment where confirmation has been given by enterprise of competence that the attachment point is ready for use.	Rigging from temporary attachment point where confirmation has not been given by enterprise of competence that the attachment point is ready for use.	Rigging where calculation competence is required for approving temporary attachment point or for calculating forces on lifting appliance or lifting gear.
Execution:	See 8.1.	Rigger assesses whether temporary attachment point is strong enough. Forces on the lifting gear can be determined based on lift technical tables. In order to help the user, tables stating capacities for different profile types can be prepared. If calculation competence is considered necessary, proceed as for loads greater than 2 tonnes.	If necessary, perform calculations in order to document the strength of the temporary attachment point. Qualified person shall for each and every case verify the set-up, including instructions for use or operation procedure.
Competence for approval:	Attachment point: enterprise of competence Assembly: Documented training in accordance with training plan no. O-1.1 and O-2.2	Documented training in accordance with training plan no. O-3.2	Enterprise of competence
Competence for user:	See table B.1.		
Documentation	Confirmation from enterprise of competence that the attachment point is ready for use.	The responsible rigger tags the temporary lifting appliance confirming that the equipment is ready for use. The tag shall state - area/module, - weight of load to be lifted, - description of what components the appliance consists of, - total lifting capacity, - limitations of use, - date and rigger's signature. If rigger is present throughout the work operation, i.e. rigging up, use and rigging down, and this is a continuous operation, there is no tag requirement. If the rigger leaves the workplace, the equipment shall be tagged with "Not approved for use".	Enterprise of competence, as described in Annex H, issues certificate or other user documentation that confirms that the temporary lifting appliance can be used.

9 Requirements for transport operations

9.1 General requirements

The local rules for use of vehicles in the plant shall apply, in addition to this NORSOK standard.

Work permit shall be available for critical and special transport operations.

When moving mobile cranes, the block, hook, outrigger legs and slewing function shall be secured to avoid swinging and oscillation. Transporting a load suspended from the hook is not allowed. If special circumstances makes this necessary, and the crane is constructed to handle it, then a SJA shall be carried out.

For each plant there shall be documentation to show the limiting loads for quays and transport roads. See Annex C.

When moving cranes with a long boom, a person shall proceed in front of the crane to warn about the approaching crane, and to signal stop to the driver, if necessary.

9.2 Transport in the plant

The Road Traffic Act applies to all plants, in addition to the Driving Permit for the plant.

Maximum axle load specified for each plant shall be adhered to.

Overloading a vehicle is prohibited.

All vehicles shall be maintained, satisfy national technical requirements, and without defects.

9.3 Securing of loads

Loads shall be secured so that they do not fall off during transport, or in any other way become a danger to personnel or equipment.

Gas cylinders shall have protective caps fitted during transport.

Loads shall be transported on carriers constructed for the purpose

9.4 Width of load and vehicle

For normal transport of width up to 2,6 m there are no restrictions.

Use a rotating beacon for width up to 3 m. This also applies if the load exceeds 50 % of the width of the road.

For widths over 3 m, prepare a work description for the planned route, with description of the vehicle and load, and relevant critical parts of the route.

Carry out SJA.

Use a rotating beacon and accompanying vehicle.

Protruding edges or parts shall be highlighted with marking signs.

9.5 Length of vehicle and load

No restrictions apply for normal transport of lengths up to 2 m over registered length of the vehicle.

For transport where the load protrudes more than 2 m past the maximum length of the vehicle, a work description shall be prepared for the planned route, with a description of the route, size of vehicle, load and any critical parts of the route.

Carry out SJA.

Use a rotating beacon and place personnel behind the transport to keep an eye on the movement of the vehicle in sharp turns.

9.6 Transport of chemicals

Tanks with chemicals shall be handled and placed in accordance with transport documentation and local procedures.

Before transport/lifting it shall be checked that there are caps on drain points, there is no external spillage on the load carrier and that the tank otherwise is properly prepared.

Chemicals and gases that would cause danger if they were in contact with each other, shall be transported in separate load carriers.

9.7 Completion and evaluation

Any abnormalities or irregularities that have happened during the transport operation shall be reported.

After completing the transport operation, the involved parties shall evaluate if experience transfer or improvement of the operational procedures is necessary.

Annex A (Normative) Roles and responsibility

Personnel shall be designated in order to address the roles described below. The designation of the responsible persons does not exempt the plant manager, owner of the lifting equipment or the responsible company from legal liability. The roles can be filled by personnel who also have other duties, and the personnel do not need to be employed in the responsible company.

The responsible persons shall have adequate training and experience in accordance with the requirements in Annex B.

The company	Shall • implement this NORSOK standard and ensure that plant specific governing documentation is adhered to, • have internal competence to set requirements in the discipline area in accordance with statutory requirements, • have at its disposition adequate and qualified enterprise of competence, • have at its disposition adequate and qualified operational and technical support, • carry out verifications in the discipline area.
Plant manager	Shall • ensure that plant specific governing documentation is adhered to, • ensure compliance with this NORSOK standard and that all statutory requirements are obeyed, • designate technical and operational responsible persons for all lifting appliances and lifting operations on the installation. The responsibility shall be linked to job position(s) in the plant, • establish, implement and maintain installation-specific governing documents, • ensure that the responsible persons have the proper authority, • designate a person responsible for ensuring that external lifting equipment that is used in the plant is in accordance with regulations.
Technical responsible person	Shall • address the technical condition of lifting equipment, • ensure that the necessary maintenance programme is established, implemented, completed and maintained in accordance with the manufacturer's instructions and experiences with this type of equipment, see Annex G regarding maintenance, • ensure that the necessary competent control is carried out and followed up in accordance with Annex H, • ensure that the necessary documentation for lifting equipment is available in accordance with Annex E, • assess the need for, and recommend replacement and modifications of lifting equipment in consultation with users.

Operational responsible person	Shall • ensure that the lifting and transport operations are executed with sufficient and qualified personnel, • when necessary, ensure that someone other than the operator of the lifting or transport appliance is in charge of the operation, • ensure overall planning and execution of lifting and transport operations in different areas and assess the safety in connection with simultaneous operations and tandem lifts, • exercise overall operational management of the lifting and transport operations, • ensure sufficient information exchange between shifts, • ensure that the requirements in this NORSOK standard regarding storage of loose lifting equipment are adhered to, • assess whether a lifting appliance can be classified as a “simple lifting appliance”, • appoint mentor, and ensure approval of these.
Lifting appliance operator	Shall • be in charge of and ensure the safety of each and every lift, • plan or take part in the planning of each lifting operation, see 4.5, • conduct a pre-job talk with involved personnel, • ensure that the lifting appliance and lifting gear are in good condition for their purpose and in accordance with the manufacturer's instructions for use, specifications and instructions, • ensure that the lifting appliance is maintained in accordance with the maintenance programme, • carry out first line maintenance, or ensure that first line maintenance is carried out, in accordance with the maintenance programme, • carry out pre-use check of the lifting appliance, • ensure necessary cordoning off and necessary announcement of ongoing lifting operations, • ensure that necessary communication is established between all personnel involved in the operation, • coordinate the lifting operation in relation to other ongoing activities, • operate the lifting appliance and lifting gear correctly in accordance with the manufacturer's instructions for use, this NORSOK standard and the company's governing documents, • operate the equipment in accordance with the capacities and limitations that apply for the lifting appliance and gear, • abide instructions and signals from signaller, and obey stop signal no matter who gives it, • stop a lifting operation if there is doubt about safety. The operation shall not recommence before safety is addressed and re-established, • not participate in lifting operations if he feels physically or mentally unwell, • not participate in other tasks that can distract him during the operation of the lifting appliance, • carry out post-use check of the lifting appliance, • report faults/defects, • report any undesirable events, • maintain the competence by regular use of the equipment.

Signaller	Shall • participate in the planning of each lifting operation, • clear the travel path and ensure necessary barriers to keep personnel who are not involved in the lifting operation outside the exposed area. In plants onshore the signaller does this in cooperation with the operator of the lifting appliance, • ensure that the slinger and other personnel is in a safe area when lifting and lowering load, • maintain visual or radio contact with the lifting appliance operator and with the slinger at the beginning and end of the lift, • give the start signal and direct the safe movement of the lifting appliance and hook load in accordance with this NORSOK standard, • communicate in accordance with requirements in this NORSOK standard, • inform all persons involved in the lifting operation about the identity of the new signaller when changing over. New signaller shall confirm that he is taking over responsibility, • function as slinger as necessary, in situations where this is allowed according to this NORSOK standard.
Slinger	Shall • participate in the planning of each lifting operation, • select and use lifting gear in accordance with the manufacturer's instructions for use and this NORSOK standard, • carry out pre-use and post-use check of the lifting gear, • ensure that load and load carrier are properly prepared and secured before the lifting operation commences, • hook on and unhook slings to and from the load, and to and from the crane hook or lifting gear, • notify the signaller when the load is ready for lifting, and when the hook is released after the load has been landed, • function as signaller as necessary, in situations where this is allowed according to this NORSOK standard.
Mentor	Shall • be responsible for instruction and training in accordance with the relevant training plan or training programme, • assess at all times the type of tasks the trainee can perform without assistance, and monitor the performance of these tasks, • be responsible for operating the equipment in the period when new lifting appliance operators are under training, • confirm that the training has been implemented in a satisfactory way, and verify that the trainee has achieved a level of competence in accordance with the relevant training plan or training programme.
Examiner	Shall evaluate and approve new operators of lifting appliances in accordance with the additional requirements established by "Coordinating panel for cranes, fork lift trucks and bulk handling machinery".
Rigger	Shall • approve and issue a tag for temporary lifting appliances with SWL below 2 tonnes in accordance with the procedure for temporarily set-up lifting appliances. If several persons participate in setting up a temporary lifting appliance, a responsible rigger shall be designated, • lead and ensure safety in lifting operations with temporary lifting appliances, • ensure certification from enterprise of competence for lifting operations over 2 tonnes.

Annex B (Normative) Training requirements

B.1 General

The manager for the plant shall ensure that all personnel who are involved in lifting operations, or with maintenance of the lifting equipment, are able, competent and adequately trained to carry out the tasks and address the areas of responsibility. Competence requirements for the different roles and recognised training standards are described in this Annex.

Training of lifting appliance operators can take place within the company or under the direction of an external training enterprise. The training shall be in accordance with training plans published in factsheets on the web-pages of "The Norwegian Labour Inspection Authority". In addition reference is made to training plans made available on the web-pages of the Standards Organization of Norway, [Petroleum R - Lifting equipment](#)

Previous syllabus established by the Norwegian Ministry of Education and Research can be used where recent training plans are not available. The syllabus shall be in accordance with the requirements in ISO 9926-1.

Personnel under training shall only be assigned tasks that are appropriate for their competence at the time, as assessed by the mentor and operational responsible person.

The responsible company, normally the operator or company responsible for construction of a plant, is responsible for verifying that personnel with non-Norwegian certificates of competence satisfy the competence requirements stated in this NORSOK standard.

Table B.1 - Competence requirements

Roles	Competence requirements
Manager for the plant	Knowledge of statutory requirements, this NORSOK standard and plan specific governing documents for lifting operations.
Technical responsible person	Knowledge of applicable technical requirements to lifting appliances, including relevant requirements in "Regulations for machinery" and "Regulations for use of equipment at work" with associated technical standards. Knowledge of enterprise of competence and necessary documentation as described in statutory requirements, this NORSOK standard and installation-specific governing documents. Knowledge of maintenance programmes and maintenance systems used for the lifting appliances. Knowledge of maintenance, repair and replacement of lifting equipment. Relevant technical background.
Operational responsible person	Knowledge of statutory requirements, this NORSOK standard and installation-specific governing documents for lifting operations. Operational knowledge and experience to be able to manage and guide personnel who are involved in lifting operations. Knowledge of methods to ensure that the lifting operations are executed in accordance with statutory requirements, operational standards and installation-specific governing

Roles	Competence requirements
	documents. Knowledge of dangers connected with lifting operations and use of risk mapping as described in this NORSOK standard
Lifting appliance operator	Documented training in accordance with Table B.2. Knowledge of statutory requirements, this NORSOK standard and installation-specific governing documents. From 1.1.2012 the requirement of competence for operator of main cranes (type G1, G2, G3) will be Craftsman certificate as skilled cranesman.
Mentor	Knowledge of statutory requirements, this NORSOK standard and installation-specific governing documents for lifting operations. Mentors for lifting appliances shall have at least one year's practical experience, and mentor training is desirable. The ability to pass on knowledge, guide personnel and assess level of competence. Mentors shall be approved and registered by a national recognized register.
Examiner	Examiner for lifting appliances shall have minimum 5 years experience or be approved instructor on the relevant lifting appliance. Authorized examiner shall be registered in industry register.
Signaller	Documented training in accordance with training plan module O-1.1 (F-2702) or module 2.3. Knowledge of statutory requirements, this NORSOK standard and installation-specific governing documents.
Slinger	Documented training in accordance with training plan modules O-1.1/ (F-2702) /module 2.3. Knowledge of statutory requirements, this NORSOK standard and installation-specific governing documents.
Rigger	Documented training in accordance with training module no. O-3.2. Knowledge of statutory requirements, this NORSOK standard and installation-specific governing documents.
Maintenance personnel	Be in possession of relevant trade certificates related to the specialist skill areas in which the personnel shall operate, as well as training in accordance with any special instructions the manufacturer of the equipment may have issued. The syllabus for trade certificates shall be established by the Norwegian Ministry of Education and Research. Additional training in hydraulics for personnel who shall carry out maintenance on hydraulic machinery. The training should follow a curriculum that is in accordance with guidelines and requirements prepared by CETOP, minimum CETOP competence level 2. The curriculum should also be approved by the hydraulics industry in Norway (Hydraulics and Pneumatics Association. http://www.hpf.no/fakta.html).
Enterprise of competence	An enterprise certified by a certifying authority designated by The Norwegian Labour Inspection Authority (DAT). The enterprise shall be certified by a certifying authority in accordance with requirements in "Regulations for use of equipment at work", § 58, and requirements based on NS-EN 45004 (the standard is replaced by NS-EN ISO 17020) issued by "Coordinating panel for cranes, fork lift trucks and bulk handling machinery". Enterprise of competence controllers shall be employed by the enterprise of competence and have documented competence for the relevant control groups. See "Additional requirements for enterprise of competence" issued by "Coordinating panel for cranes, fork lift trucks and bulk handling machinery".

B.2 Training of lifting appliance operators, instructors and controllers

The requirements for the training of lifting appliance operators, instructors and controllers are considered fulfilled when the training is implemented in accordance with Table B.2, Table B.3 and Table B.4.

All training that is implemented after this NORSOK standard was published shall be in accordance with training plans where these have been prepared. Previous training in accordance with syllabus as stated in the tables will remain valid.

Training in accordance with training plans and training modules shall be documented through certificates of competence issued by a national and recognized register. The operator companies and the registers are responsible for checking the quality of the training that is carried out by the various training institutions.

Table B.2 – Recognized training standards – Lifting appliance operator

User of	Certificate of competence category	Syllabus ^a	Training module ^a	Lifting appliance - specific training	S/D
Slinging		F-2702 (T/P)	Module 2.3/O-1.1 (T/P)		S
Rigging arrangement	Rigger		Module O 2.2 (T/P) and Module O 3.2 (P)		D
Mobile crane ^b	G1	F-2685 (T/P) F-2686 (T + BI)	Module 2.4 (T) Module 3.4 (GP) Module 4.4 (P)	X	S
Tower crane ^b	G2	F-2695 (T/P) F-2696 (T + BI)	Module 2.5 (T) Module 3.5 (GP) Module 4.5 (P)	X	S
Portal crane and jib crane ^b	G 3	F-2690 (T/P) F-2691 (T + BI)	Module 2.6 (T) Module 3.6 (GP) Module 4.6 (P)		S
Gantry crane and overhead crane	G4	F-2693 (T/P) F-2694 (T + BI)	Module 2.7 (T) Module 3.7 (GP) Module 4.7 (P)	X	S
Lorry mounted crane with capacity > 2 tm (tonnes x meter)	G8	F-2707 (T) F-2706 (P)	Module 2.8 (T) Module 3.8 (GP) Module 4.8 (P)	X	S
Lorry mounted crane with capacity < 2 tm (tonnes x meter)		F-2702 (T/P)	Module 2.3/O-1.1 (T/P)		D
Personnel lifts, scissor lifts etc.		F-2699 (T/P)		X	D
Cargo winch	One of the following: G1, G4, G5, G8 and G20	F-2685, F-2693, F-2689, F-2706, F-3089		X	S
Fixed crane with swing or telescopic boom	One of the following: G1, G5, G8, G20 to be used until new plan is established	F-2685, F-2693, F-2689, F-2706, F-3089		X	S
Simple lifting appliances	O-2.2 or one of the following: G1, G4, G5, G8 and G20		O-2.2		D
Lifting and stacking truck	Truck driver certificate		Module 2.2 (T) Module 3.2 (GP) Module 4.2 (P) Driving license class B	X	S

User of	Certificate of competence category	Syllabus ^a	Training module ^a	Lifting appliance - specific training	S/D
Battery powered pallet truck	Requirements to competence, use and control of suspended work platforms are based on DAT Regulation no. 608			X	D
Suspended work platform	Requirements to competence, use and control of suspended work platforms are based on DAT Regulation no. 608				D
Temporarily assembled lifting appliance	O-2.2 or one of the following: G1, G4, G5, G8, G20	F-2685, F-2693, F-2689, F-2706, F-3089	O-2.2		D
Bulk handling machinery	M1 – M6, M20		Module 2.1(T) Module 3.1 (GP) Module 4.2 (P)		S
Explanation: S = certified safety training D = documented training T = theoretical training GP = basic practical course P = practical course and on the job training ^a training modules are available as factsheets on the web pages of The Norwegian Labour Inspection Authority, while syllabus is available on the web pages of The Standardization Organization in Norway, Petroleum R - Lifting equipment ^b From 1.1.2012 the requirement will be Craftsman Certificate as skilled tradesman.					

As syllabus for training of instructors, national syllabuses and any standardized test agreed amongst the three partners in the work society (employers, workers and authorities), shall be used

Until these are available, the training modules in Table B.3 shall be used. Requirements for training, exams etc. are described in documents issued by "Coordinating panel for cranes, fork lift trucks and bulk handling machinery". The documents are available as factsheets on the web pages of "The Norwegian Labour Inspection Authority":

- Additional criteria for training, § 50
- Guidelines for conducting theoretical and practical tests

Be aware that it is the principal competent person that approves the instructors in the training institution. These certified courses only document that the candidate has passed a course that ensures a recognized level of competence.

Table B.3 – Recognized training modules - Instructors

Appliance type	Certificate of competence category	Syllabus ^a	Training module ^a	S/D
Slinging	G 11	Basic Instructor Course (T/P)	Module I-G00 Module I-G11	S* ^b
Mobile crane	G 1	F-2687 (T/P)	Module I-G00 Module I-G11 Module I-G01 (T/P)	S* ^b
Tower crane	G 2	F-2697 (T/P)	Module I-G00 Module I-G11 Module I-G02 (T/P)	S* ^b
Portal crane and jib crane	G 3	F-2689 (T/P)	Module I-G00 Module I-G11 Module G03 (T/P)	S* ^b
Gantry crane and overhead crane	G 4	F-2700 (T/P)	Module I-G00 Module I-G11 Module I-G04 (T/P)	S* ^b
Lorry mounted crane with capacity > 2 tm (tonnes x meter)	G 8	F-2708 (T/P)	Module I-G00 Module I-G11 Module I-G08 (T/P)	S* ^b

Explanation:

S* = certified safety training. The training institution shall be certified as training institution for operators of work equipment within the relevant equipment group, until the certification is valid for training of instructors ^b

D = documented training

T = theoretical part

P = practical part

^a Training module/syllabus are available on the web pages of The Standardization Organization in Norway, [Petroleum R - Lifting equipment](#)

The documents are examples of suitable training modules. The information is provided to help the users of this NORSOK standard, and shall not be considered as a recommendation from Standardization Organization in Norway to use these training modules. Equivalent training modules can be used if they provide the same or higher level of competence.

^b OTF will in cooperation with relevant partners in The Norwegian Labour Inspection Authority (DAT), establish mandate for certifying institutions for certification of training institutions for instructor and controllers.

As syllabus for training of controllers, national syllabuses and any standardized test agreed amongst the three partners in the work society, shall be used

Until these are available, the training modules in Table B.4 shall be used. Requirements for training, exams etc. are described in documents issued by "Coordinating panel for cranes, fork lift trucks and bulk handling machinery". The documents are available as factsheets on the web pages of "The Norwegian Labour Inspection Authority":

- Additional criteria for training, § 50
- Guidelines for conducting theoretical and practical tests

Be aware that it is the principal competent person that approves the controllers of the enterprise of competence. These certified courses only document that the candidate has passed a course that ensures a recognized level of competence. See "Additional requirements for enterprise of competence", § 58, issued by "Coordinating panel for cranes, fork lift trucks and bulk handling machinery".

Table B.4 - Recognized training modules - Controllers

Appliance type	Certificate of competence category	Syllabus ^a	Training Module ^a	S/D
General part		F-2037	Module K-G00	D
Mobile crane	G 1	F-2037 F-2038 (T) F-2039 (P)	Module K-G00 Module K-G01-1 (T) Module K-G01-2 (P)	S* ^b
Tower crane	G 2	F-2037 F-2040 (T) F-2041 (P)	Module K-G00 Module K-G02-1 (T) Module K-G02-2 (P)	S* ^b
Portal crane and jib crane	G 3	F-2037 F-3044 (T) F-3045 (P)	Module K-G00 Module K-G03-1 (T) Module K-G03-2 (P)	S* ^b
Gantry crane and overhead crane	G 4	F-2037 F-2042 (T) F-2043 (P)	Module K-G00 Module K-G04-1 (T) Module K-G04-2 (P)	S* ^b
Electrical hoists and winches	G 7	F-2037 F-3018 (T) F-3019 (P)	Module K-G00 Module K-G07-1 (T) Module K-G07-2 (P)	S* ^b
Lorry mounted cranes with capacity > 2 tm (tonnes x meter)	G 8	F-2037 F-2044 (T) F-2045 (P)	Module K-G00 Module K-G08-1 (T) Module K-G08-2 (P)	S* ^b
Chain hoists	G 10	F-3020 (T/P)	Module K-G10 (T/P)	S* ^b
Lifting gear	G 11	F-2046 (T/P)	Module K-G11 (T/P)	S* ^b
Truck	TX	As an alternative, the MGF <i>Syllabus for training of controllers for competent control of fork lift trucks</i> may be used.	Module K-T00 Module K-TX-1 (T) Module K-TX-2 (P)	S* ^b
Personløfter	PX		Module K-P00 Module K-PX-1 (T) Module K-PX-2 (P)	S* ^b
Bulk handling machines	MX		Module K-M00 Module K-MX-1 (T) Module K-MX-2 (P)	S* ^b
Explanation: S* = certified safety training. The training institution shall as a minimum be certified as training institution for operators of work				

Appliance type	Certificate of competence category	Syllabus ^a	Training Module ^a	S/D
equipment within the relevant equipment group, and have competence equivalent to principal competent person for the relevant control group S2, until the certification is valid for training of controllers^b D = documented training T = theoretical part P = practical part ^a Training module/syllabus/teaching plans are available on the web pages of The Standardization Organization in Norway, Petroleum R - Lifting equipment The documents are examples of suitable training modules. The information is provided to help the users of this NORSOK standard, and shall not be considered as a recommendation from Standardization Organization in Norway to use these training modules. Equivalent training modules can be used if they provide the same or higher level of competence. ^b OTF will in cooperation with relevant partners in The Norwegian Labour Inspection Authority (DAT), establish mandate for certifying institutions for certification of training institutions for instructor and controllers.				

B.3 Other lifting appliances

Lifting appliances for which there are no recognised syllabus or training plans available, shall only be operated by personnel with documented training in accordance with the training plan developed by the company. The plan shall be based on the manufacturer's recommendations, the company's own experiences and official syllabus or training plans for the most similar types of crane.

B.4 Simple lifting appliances

Table B.2 differentiates between simple lifting appliances and other lifting appliances for certain types of crane. For classification, see 3.1.4 and 6.8.

B.5 Certified and documented training

Certified training enterprise shall be responsible for all training in according with syllabus and training modules, see requirements in "Regulations for use of equipment at work" and requirements issued by "Coordinating panel for cranes, fork lift trucks and bulk handling machinery". Other training shall be documented.

B.6 Lifting appliance – specific training

The specific training shall include as a minimum

- relevant requirements in this NORSOK standard,
- plant specific governing documents for lifting operations,
- planning, organising and execution of relevant operations,
- communication,
- technical structure, e.g. hydraulics, control system etc.,
- safety functions such as overload system, emergency stop, limit switches, alarms etc.,
- load chart,
- instructions for use, crane manual and other technical documentation,
- emergency procedure,
- operational limitations,
- assembly of tools and extra equipment, including slinging methods etc.,
- pre-use and post-use check,
- routines for, and content of, first line maintenance,
- routines for maintenance and control,
- operation of the appliance.

A program shall be established that describes the content, duration and verification of the training.

The training shall be carried out with mentor, and documented such that both the trainee and mentor confirm that the training has been completed in a satisfactory manner.

B.7 Mentor arrangement

Training of new operators shall follow relevant syllabus/training plans and the mentor (instructor) shall fulfill any additional requirements in these.

Mentor shall be responsible for lifting appliance operation in the training period.

When the trainee operates the lifting appliance, he shall be under the supervision of the mentor the entire time.

During training in the operation of the lifting appliance, the mentor shall be with the trainee until the mentor considers it safe to supervise operations from a distance. The mentor shall have radio contact with, and supervision of, his trainee the entire time.

B.8 New personnel in the plant

The company shall ensure that new personnel in the plant, who will take part in lifting operations, has knowledge of this NORSOK standard and plant specific governing documentation.

B.9 Maintenance of competence

All competence that is required in accordance with this annex shall be maintained. The following areas should receive particular focus in refresher training:

- applicable regulations and standards;
- internal governing documents;
- emergency procedures;
- correcting of undesirable behaviour.

Maintenance of competence can be done internally in the company or through an external training enterprise.

Maintenance of competence shall be documented.

B.10 Verification of competence

All training and maintenance of competence shall be verified.

The verifications of accomplished competence can include direct observation, practical tasks, answering written and oral questions, simulation or a combination of these methods.

If there is a requirement for an examiner, this person shall not have been involved in the training of the candidate.

Annex C

(Normative)

Requirements to local procedures

Each plant shall establish one local addendum to this NORSOK standard that describes local requirements and procedures in accordance with this Annex. The addendum shall as a minimum include

- which lifting appliances in the plant are defined as simple, see 6.8,
- any requirements for competence for operators of special lifting appliances which is not described in Table B.2,
- who has the role of operational responsible and technical responsible for lifting equipment (tied to position),
- references to plant documentation showing load limits for road systems, quays, underground systems and approved storage areas for lifting appliances and transport equipment.

Further, the local addendum may contain description of

- material handling plan,
- lifting over pressurised area, dangerous goods etc.,
- placement and handling of different types of load, chemicals, radioactive sources, trace elements, explosives etc.,
- access to dangerous goods in the event of need to move it as a result of an emergency situation, e.g. fire,
- simultaneous operations,
- special lifting operations,
- heavy lifts and tandem lifts,
- necessary cordoning off areas on the travel path,
- communication equipment and use of correct channel,
- maintenance, inspection and control of lifting equipment and lifting gear,
- lifting operations related emergency situations,
- storage and follow-up of loose lifting equipment,
- plan for bad weather,
- lifting of personnel.

Annex D

(Normative)

Transport in the plant

D.1 General

All persons involved in transport and lifting operations shall be familiar with the roles they shall fill and the responsibility they shall assume. The individual shall act in a way that enables the other links in the chain to perform their duties safely.

In general, the following applies to all persons involved:

- transport of dangerous goods shall be in accordance with the ADR rules, and the competence of the participants shall be in accordance with the ADR rules;
- heavy transport shall be checked against the plan of the road transport system;
- receiving of containers for radioactive sources and trace elements shall be dealt with by designated responsible person in the plant or by supplier or contractor.

D.2 Requisitioner

Requisitioner shall specify that the equipment shall be delivered in a suitable load carrier.

Prior to heavy or special lifts, the requisitioner shall contact the operational responsible person in the plant. Operational limitations and other special conditions related to the lift shall be clarified.

Any delivery of loads shall take into account the ability of the plant to empty load carriers in a safe manner.

Only chemicals that are authorized for use in the relevant plant shall be ordered.

D.3 Supplier

Focus should be given to packing the load in such a way as to optimize the utilization of the load carrier. Load carriers shall, to the extent possible, be appropriate for the dimensions and weight of the load. Load shall if relevant be secured with sea fastenings.

Supplier or subcontractor shall issue a special consignment note for radioactive sources or trace elements. When necessary, the supplier shall supply instructions for safe slinging and lifting of the load.

Annex E

(Normative)

Documentation and marking

E.1 Requirements to user documentation

All lifting equipment produced after 1.1.1995, shall be accompanied by a declaration of conformance and shall have CE marking in accordance with "Regulations for machinery".

All lifting equipment shall be accompanied by instructions for use in accordance with requirements in "Regulations for Machinery" and certificate(s) from the enterprise of competence.

Temporarily assembled lifting appliances shall have documentation in accordance with requirements in 8.6.

An instruction for use shall be available for each lifting appliance in the plant. This shall contain information of use, maintenance, assembly, disassembly and transport. Reference is made to requirements for content in "Regulations for Machinery". All lifting appliances shall have an up to date maintenance log.

E.2 Control register

Inspections, examinations, repairs and modifications shall be entered in a control register or on a control card. An electronic system that provides a similar overview can be used. The information shall be kept as long as the equipment is in use and be readily available. See also 4.10.

E.3 Marking and labeling

Lifting equipment shall be marked in accordance with "Regulations for Machinery" and other standards and regulations that apply for the relevant lifting appliance or lifting gear.

Where appropriate, the lifting appliance can be labeled with the instructions for use of the appliance.

The standards and regulations can include

- competence requirements to the user,
- technical responsible person for the lifting appliance,
- user control,
- operational limitations,
- instructions for safe use,
- any emergency procedures.

The sign with maximum capacity (WLL/SWL) shall be readable from the operator level.

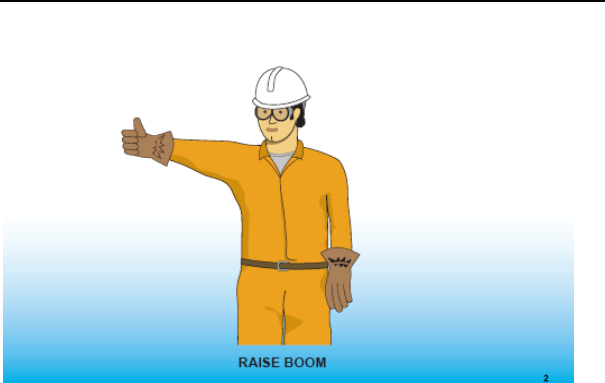
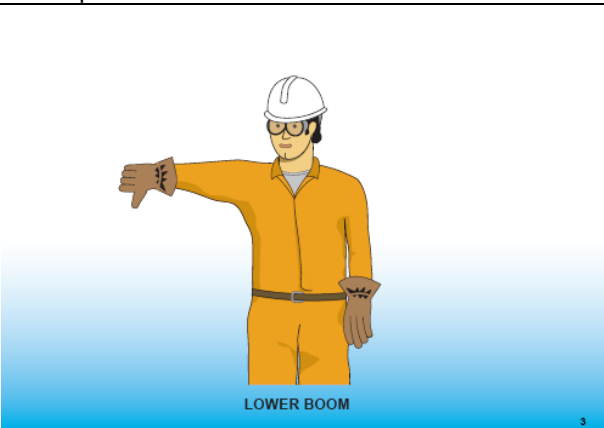
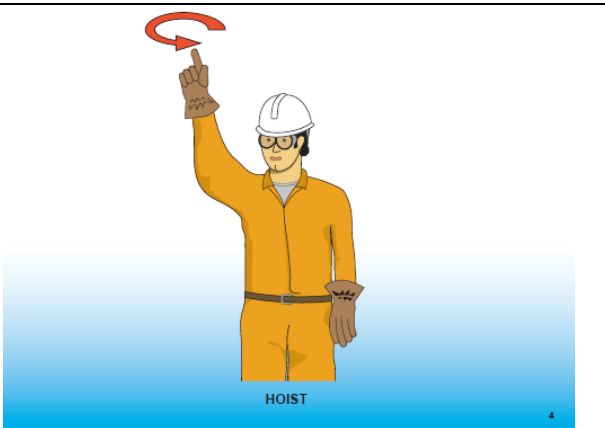
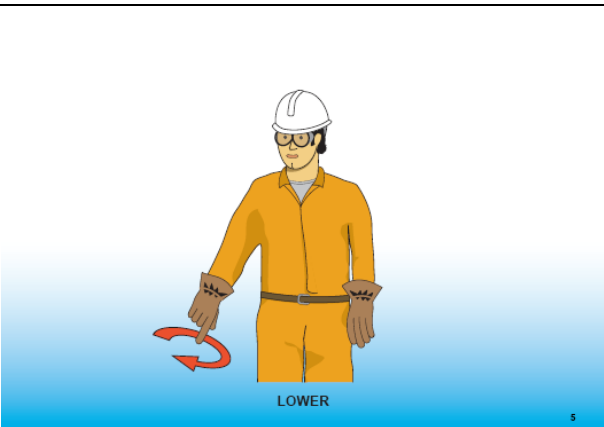
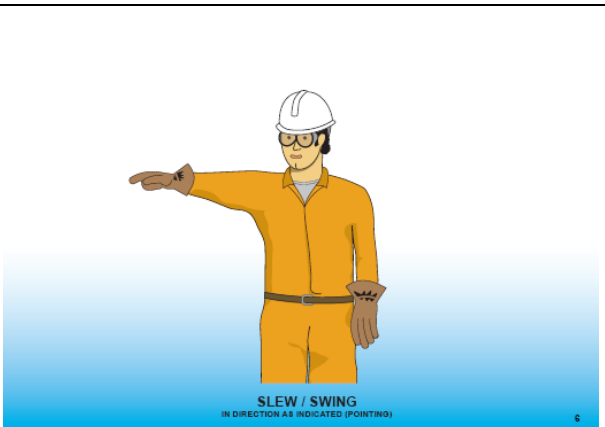
Lifting appliances approved for transport of personnel shall have marking to indicate this (type approval).

The marking shall be legible for the lifetime of the product.

All lifting equipment shall have traceability marking.

Annex F (Normative) Hand signals

For direction of lifting operations standardized hand signals for the North Sea countries shall be used. See OHMEC Guidance documents.

 START OPERATION 1	 RAISE BOOM 2
 LOWER BOOM 3	 HOIST 4
 LOWER 5	 SLEW / SWING IN DIRECTION AS INDICATED (POINTING) 6

Start operation

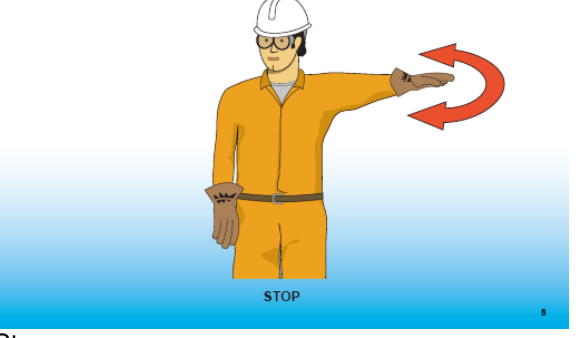
Raise boom

Lower boom

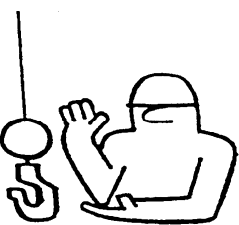
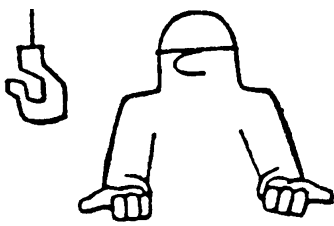
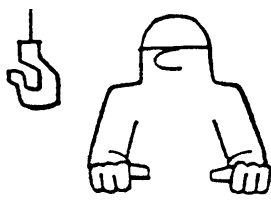
Hoist

Lower

Slew/swing in direction as indicated (pointing)

 Slew/swing in direction as indicated	 Stop
 End of operation	 Emergency stop

In addition the following national hand signals shall be used.

Use main block 	Use whip line 
Extend telescopic boom 	Retract telescopic boom 
The operator of the appliance did not register the signal. 	

Annex G (Normative) Maintenance

Maintenance is a combination of all technical, administrative and managerial measures taken throughout the equipment's lifespan with the aim of re-establishing the condition of the equipment whereby it can perform the intended functions. Maintenance can include preventive activities, monitoring, inspection, testing, repair, replacement, cleaning and tidying.

The maintenance shall be in accordance with the manufacturer's instructions. The maintenance programme shall focus on preventing failure in components that would result in a high risk of hazardous situations. Consideration shall also be given to the company's experiences, as well as standards for safe use of lifting appliances referred to in this NORSOK standard.

The maintenance shall be developed and improved continuously based on experiences made during the operation and maintenance of the equipment. The maintenance shall be documented. The documentation shall be available and may be electronic or on paper, and shall as a minimum contain the following information:

- identification of the equipment that is maintained;
- description of the work carried out;
- recording of registered readings in accordance with the manufacturer's instructions;
- date of execution and the name of personnel.

Where appropriate, the lifting appliance operator can perform first-line maintenance on the lifting appliance he operates. This contributes to greater knowledge about, and ownership in, the lifting appliance

Before carrying out maintenance on lifting appliances, a 'Do not operate' or similar warning sign shall be placed by the controls, which should preferably be locked out. The lifting appliance shall not be operated before the warning sign has been removed by the person responsible for the maintenance activity

Before the lifting appliance is put into operation, the person responsible for the maintenance activity shall ensure that testing is carried out in accordance with the manufacturer's instructions for use, and that all safety systems are set for normal operations.

After the maintenance has been carried out, and before the lifting appliance is used, the lifting appliance operator shall perform a user check and ensure that the functions have been returned to normal operational status. If the scope of the maintenance is limited, it is sufficient to control the functions related to the maintenance carried out.

After maintenance has been carried out on crane boom, the lifting appliance operator shall check the boom visually before it is raised. In particular, he shall check for loose parts, that the wire rope is laying correctly in the sheaves and that wire locks are correctly installed.

Before controls carried out by enterprise of competence and sizeable maintenance activities on complex lifting appliances a pre-job talk shall be held by the personnel involved. If, in connection with these activities, testing is to be carried out beyond what is described in the programme, an SJA should be carried out.

The general responsibility that the lifting appliance operator has for the crane operation, also applies in connection with maintenance activities and controls carried out by enterprise of competence. If safety is called into question, the lifting appliance operator shall halt the operation.

Organization, duties and scope of enterprise of competence are described in Annex H.

Annex H

(Normative)

Enterprise of competence

H.1 Enterprise of competence

Enterprise of competence shall verify the lifting equipment's technical safety and thereby act as an extra safety barrier.

The company shall quality assure the organization and work performance of the enterprise of competence that the company uses.

Enterprise of competence shall be organized and certified in accordance with "Regulations for use of equipment at work" and requirements issued by "Coordinating panel for cranes, fork lift trucks and bulk handling machinery".

Enterprise of competence shall be sufficiently independent such that the appraisal of the equipment is not influenced by other factors. In this respect, reference is made to NS-EN ISO/IEC 17020 (Previously NS-EN 45004), which describes general requirements to bodies that carry out A, B or C inspections.

In connection with competent control, competent personnel connected to the enterprise of competence can function test a lifting appliance without having the certificate of competence for operating the appliance.

The company shall describe how it complies with the requirements for the enterprise of competence. The description shall as a minimum contain

- responsibility and roles,
- organization,
- any use of an external enterprise of competence,
- independence.

H.2 Initial control

Prior to initial use, after each set-up of a lifting appliance at a new workplace (not valid for mobile cranes), and in connection with modifications resulting in a new set-up, the lifting appliance shall be controlled by an enterprise of competence. The purpose of the control is to verify compliance with statutory requirements, safe set-up, safe functioning and necessary documentation (Instructions for use, declaration of conformance, certificates etc.). This control supplements the testing carried out by the manufacturer at the fabrication site.

For temporarily assembled lifting appliance, the requirement to initial control by enterprise of competence is considered fulfilled upon implementation of the procedure described in 8.6.

H.3 Periodic control

Lifting appliances and lifting gear shall be controlled periodically by enterprise of competence. As a general rule, periodic control shall be carried out every twelve months, but no later than in the same month one year after the previous control.

Periodic control shall be carried out before taking back into use a lifting appliance that has been out of use for more than six months.

A procedure shall be prepared describing competent control for each type of lifting appliance and lifting gear.

The periodic control shall comply with the manufacturer's instructions for use and shall as a minimum include

- control of documentation, certificates etc.,
- review of report from enterprise of competence, maintenance and equipment history from latest control period,
- use of lifting appliance in relation to design lifespan and assess the need for initiating lifespan analysis,
- condition control (including marking),

- function testing,
- reporting and signing for completed control.

H.4 Extraordinary control

Enterprise of competence shall perform extraordinary control of lifting appliances and lifting gear

- following exposure to, or there is suspicion of, overloading or damage,
- following significant repairs or modifications,
- upon change in owner of lifting appliances,
- when more frequent controls are required as a result of the environment in which the lifting equipment is placed.
- when the equipment requires extra condition monitoring to in relation to expected lifespan

The scope of the extraordinary control depends on the situation and the reason for the control. Enterprise of competence determines the scope of the control in consultation with the manufacturer and technical responsible person.

Extraordinary control is also condition monitoring in relation to lifespan.

Factors that trigger this type of control may be:

FACTOR	Comments
a. Statutory interval	Marine 5-yearly
b. Enterprise of competence	Routines (for instance 4 years or 5 years)
c. Producers instructions	See instructions for use
d. As in ISO 12482–1	When periodic control (see ISO 9927-1) shows significant deterioration of the condition of the crane.
e. As in ISO 12482–1	When an increasing number of failures are registered (can be indicated through maintenance costs).
f. As ISO 12482–1, Appendix A	This is only relevant for series produced hoists, where the load is directly suspended from the hoist, see ISO 4306–1. Definitions § 4.7.
Maximum number of years after production before condition control shall be carried out	
a. Tower cranes	10 years
b. Mobile cranes	10 years
c. Lorry mounted cranes	10 years
d. Other types of lifting appliances	20 years

The condition control shall include all parts of the lifting appliance that by failing may influence safe operation. The following main groups should be included:	Comments
a. Load bearing parts	Acceptance criteria for wearing parts and methods for analysis (measurements) NDE. The manufacturer shall list controls etc. in the control book.
b. Mechanical system	
c. Hydraulic system	
d. Pneumatic system	
e. Electrical system	
f. Safety system	

H.5 Assembly control

Before a lifting appliance is taken into use in a new location, the assembly/installation and control of safe operation shall be carried out in accordance with the manufacturer's specification

The control shall be carried out when

- the lifting appliance is reassembled in a new position, except when the lifting appliance is constructed to allow a limited disassembly for transport between several positions/or changes in assembly which are in accordance with the manufacturers specifications, e.g. mobile cranes,
- safe use of the lifting appliance is dependent on assembly conditions, for instance solid foundations, railway tracks, tie-down points.

H.6 Safety assessment

A safety assessment shall be carried out on lifting appliances and lifting gear that show an increasing frequency of failure, cause serious incidents, are at a risk of fatigue fracture, or create other reasonable doubt about safety through continued use.

Depending on the need, the safety assessment can include causal analysis, lifespan analysis, gap analysis against current requirements, classification and establishment of barriers, operational risk analysis, consideration of amended application, working environment study etc.

The safety assessment shall be carried out by enterprise of competence or others that have documented competence in the relevant equipment.

H.7 Documentation following control

Documentation following control carried out by enterprise of competence and any safety assessments shall be available in the plant/lifting appliance. Initial control shall be documented in the form of certificate and control book, control card or similar for recording subsequent controls. The documentation can be available in electronic format.

The certificate shall include, as a minimum

- identification number which traces the certificate to the lifting equipment,
- product information, test load and allowable working load,
- references to regulations and standards,
- description of control scope, including references to other certificates etc.,
- operational limitations,
- signature of enterprise of competence.

After periodic or extraordinary control has been carried out, enterprise of competence shall issue a report that clearly states

- the controlled lifting equipment (identification number/description of the assembled lifting appliance),
- reference to control programmes used,
- faults and defects revealed,
- consequences for continued use of the lifting appliance,
- corrective measures, both technical and operational,
- deadline for fixing faults,
- name of person carrying out the control,
- date of control.

Enterprise of competence should use the codes given in Table H.1 to grade faults and defects revealed during the control.

Table H.1 - Grading of faults and defects

Code	Designation	Status	Consequence with regard to use	Action
NC	NON-CONFORMITY	Minimum requirements to safety level are not fulfilled. The code indicates an assessment whereby the overall technical condition of the equipment in terms of design, assembly, set-up and maintenance do not satisfy the statutory requirements.	Stop use immediately, completely or partially for certain operations.	Repair, operational restrictions or apply for deviation.
RC	RECOMMENDATION	Specific requirements are not fulfilled.	Use can continue with special caution provided that measures are implemented.	Measures and/or repair. Rectification of a directive shall begin immediately and be completed within the stated deadline. If the deadline cannot be kept, a new deadline shall be approved by enterprise of competence.
MO	MEMORANDUM	Specified requirements are fulfilled, but the condition can develop negatively.	No immediate consequences.	Special monitoring and repair/measures if or when necessary.
C	COMMENTS	General comments, repairs completed or other factors that are highlighted.	None.	Any actions depend on what the comments refer to.
OK	No comments.	Only used when other codes are not stated	None.	None.

Repair means complete restoration to original condition. *Measure* is a temporary or permanent alternative to repair, e.g. operational restriction, other technical solution, precautionary measures, etc.

For transportable lifting appliances and lifting gear, the periodic control shall be documented through signing the control card, certificate, control system and marking the equipment with the year's colour.

The marking shall be clearly visible and permanent. For marking, a suitable adhesive label stating the control month can be used.

The following colours shall be used:

Year:	Colour:
2007	Green
2008	Blue
2009	Red
2010	Yellow
a.s.o.	a.s.o.

White indicates that the equipment shall not be used.

H.8 Follow-up of directives from enterprise of competence

The technical responsible person is responsible for ensuring that faults and defects reported by enterprise of competence are followed up.

Annex I (Normative) Risk mapping

I.1 Purpose

In order to achieve safe lifting operations, it is necessary that all involved parties are aware of and can reduce the hazards inherent in the operation. In this respect, different types of risk mapping can be used, depending on the complexity of the operations to be performed.

The purpose of risk mapping is to try to identify all potential hazards under all imaginable conditions and initiate measures to reduce or eliminate these.

The different methods of risk mapping (see I.3) can be used for all types of lifting operations. This mapping is particularly relevant

- if available procedures and work descriptions are inadequate,
- if the operation involves new and unpredictable risk elements,
- if it is proposed to alter equipment, develop new equipment, or assess the interaction between new solutions and the equipment already in operation,
- when ensuring that the equipment used is suitable for the purpose, and that the equipment is used correctly,
- when there is an increasing fault frequency or increased risk during certain operations.

With all risk mapping, it is particularly important to involve personnel with operational experience.

I.2 Identification of risk elements

Risk elements means all factors that directly or indirectly can influence the risk of fatality or injury, damage to the environment, or material damage or losses.

Identifying risk elements is important. If the risk elements are not identified, there will be no possibility of systematically eliminating or reducing them.

A successful identification of risk elements is based on

- knowledge of procedures, systems, equipment and components,
- knowledge of activities and operations,
- knowledge of accidents,
- knowledge of undesirable events and near-miss accidents,
- systematics and analysis methods,
- knowledge of slinging of various types of load.

I.3 Methods

In order to ensure that risk mapping is carried out systematically, different methods have been developed, including:

Pre-job talk

A pre-job talk is a non-documented review before a concrete work task or operation. Everyone who is directly involved in the operation shall participate.

Checklists can be used in this connection. Participants in a pre-job talk should always consider the need for a SJA.

Safe job analysis (SJA)

A SJA is a systematic and documented review of all risk elements before a concrete work task or operation, such that measures can be initiated in order to eliminate or control the identified risk elements during the preparations for, and execution of, the work task or operation.

Hazard and operability study (HAZOP) by a competence group

HAZOP by a competence group is a systematic and documented review by means of predefined keywords, and is implemented by personnel with special competence within the relevant specialist areas.

For lifting operations, obvious group members can be the lifting appliance operator, slinger, signaller, technical and operational responsible persons, equipment suppliers, vessel crew, etc.

The group shall be headed by a person with sufficient competence to carry out this type of risk mapping.

Annex J

(Informative)

Examples of lifting equipment

Lifting appliances covered by this NORSOK standard (examples)

Cranes - all types	Crane girders
Cargo winch (tugger)	Hoist trolleys
Hoists – all types	
Hydraulic work basket	Beam clamps (used as attachments for temporarily set-up lifting appliance))
Elevating platforms	Personnel winches

Lifting gear covered by this NORSOK standard (examples)

Lifting beams	Shackles
Blocks	Slings - fibre/chain/wire rope
Load and service containers	Slings – single/multi-leg
Baskets	Snatch blocks
Work baskets	Single/multi-sheave blocks for wire and rope
Waste containers	Swivels
Eye bolts/Eye nuts	Rings
Beam clamps	Turnbuckles
Hooks	Web belts
Wedge sockets	Links
	Pendants

Examples of detachable lifting equipment

Typical examples of detachable lifting equipment for which European standards have been prepared:

Clamps
Grabs
Rotators
Grab buckets
Vacuum elevators
Lifting magnets
C-hooks
Lifting forks
Lifting beams

Annex K (Informative) Human factors

K.1 General

Analysis shows that a significant part of accidents with lifting operations are due to human factors. This can be a weakness in the organization of the operation, wrong operation of the equipment, not adherence to procedure, insufficient procedure, insufficient maintenance or insufficient securing of the area where the lifting operation is carried out.

When management gives priority to improving working environment, competence and attitudes of executors of lifting operations, then this can improve the safety of lifting operations.

The most important factors for lifting operations are within the following areas:

- safety culture/work environment;
- people;
- facilities/equipment;
- management system.

K.2 Safety culture/work environment

Good safety culture within lifting operations is characterized by

- respect for colleagues and current procedures,
- execution in accordance with prevailing procedures,
- enthusiasm for improving procedures and attitudes,
- reaction over contravention of procedures that take care of safety.

The fact that a job is well planned and supervised cannot compensate for an executor's lacking competence and poor attitudes.

Attitudes can be altered by management's and colleague's example and regular training/refreshers and improvement of competence.

Repeated routine lifts may reduce a crane driver's attention on the lifting operation. To ensure that safety is not reduced, it should be considered to change operator more often or accept more frequent breaks during the lifting operation.

If personnel involved in lifting operations are not fit for the job, or seem to be a safety risk because of psychological imbalance, tiredness or other circumstances, then they should be removed from the work, or alternatively be given other tasks.

To avoid misunderstanding in communications between the participants of a lifting operation, the language and meaning of signals shall always be agreed before the lifting operation starts.

K.3 People

It shall be ensured that all involved in a lifting operation know what is to be done, how it is to be done, and know the dangers involved in the operation. It is therefore important that the personnel know why plans and procedures are as they are, and that they are given the opportunity to study and understand these and thereby gain an ownership to them.

This can be achieved by involving experienced operators in the development of the procedures, and by giving everyone involved in lifting operations the opportunity to comment. It is usually the ones involved in the lifting operation that get hurt when the accident happens.

Experienced operators should be used for training of colleagues in the correct execution of a lifting operation in accordance with procedures, in the daily work (as mentors), in safety meetings, on courses or simulator

training. Simulator training is an effective tool to train for execution in accordance with procedures and to train how to handle dangerous situations that may occur during a lifting operation.

Procedures, standards and "best practice" should be readily available for the user, for instance as small booklets, plastic cards or alternatively in easily accessible computers with printing facility.

K.4 Equipment

Lifting and landing areas should be free of obstacles and easy to escape from for the involved in the lifting operation. The area shall be cordoned off to prevent personnel not concerned with the lift to enter the area. Safety will be improved if the operator of the lifting appliance has good visibility of the lifting and landing area.

The lifting equipment shall be designed in such a way that it does not inflict a health risk or tiredness to the operator. The following elements shall be considered:

- ergonomics – (comfort, visibility, maneuvering panel, etc.);
- noise and vibration protection;
- weather protection (wind, temperature, rain, snow, etc.);
- easy access and escape.

The equipment shall in addition be designed such that an unintentional movement of the operator can not cause a dangerous situation. For instance functions for freeing the load, emergency stop etc. shall be protected against unintentional activation.

K.5 Management system

The attitudes of employees are affected by the working environment. It is therefor important that management is serious about safety in lifting operations. Management shall ensure that the plant has a safe working system and a good safety culture for lifting operations.

This can be achieved if the following elements are taken care of:

- use only certified, maintained and controlled lifting equipment which is suitable for the lifting operation;
- load is suitable for lifting;
- suitable procedures, standards, "best practice documents", regulations for lifting are available and known by all involved parties;
- lifting plans and risk assessments are available and known to all involved parties;
- enough personnel with the correct competence and positive attitudes to safe working are given enough time to execute the lifting operation in a safe manner;
- all involved parties know their role and responsibility and it is accepted the any of the involved can stop the operation if the risk alters from what was considered in the risk assessment;
- a system is available for recording unwanted occurrences/accidents and to improve safety of lifting operations.

To take care of this, management shall appoint personnel to be responsible for the technical condition of the equipment (technical responsible), and personnel to be responsible for safe lifting operations in the plant (operational responsible).

Annex L (Informative) Tandem lift

L.1 General

When planning a plant with cranes it may be pertinent to plan for using two cranes to lift the heaviest lifts, instead of building a larger crane that can lift these loads on its own.

Often developments have led to loads of a size that were not envisaged when the plant was planned. In such cases a solution to the problem may be to use two cranes in tandem instead of resorting to a more costly solution to the problem.

In "Regulations for use of equipment at work", § 46, section 5, the only comment about tandem lifts is: "If a load has to be lifted simultaneously by two or more units of work equipment for lifting, and the load is not guided, then routines to ensure that the operator coordinates the work in a secure manner shall be established and used".

When carrying out tandem lifts, two cranes with the same capacity should be used, and a block with sheave and hook, see Figure L.1.

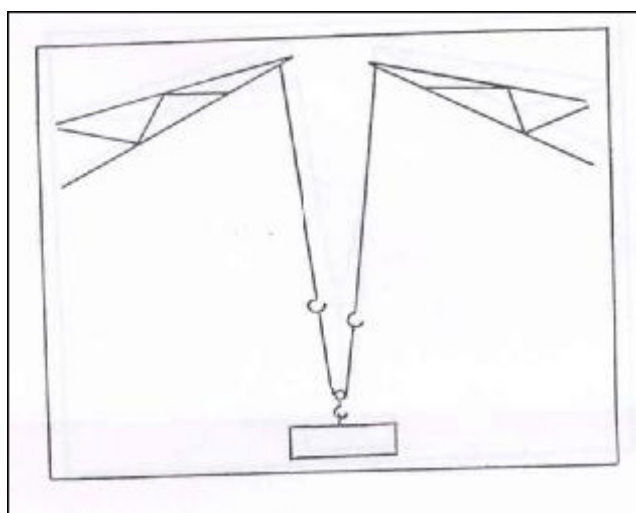


Figure L.1 – Two cranes with equal capacity

In special cases the person responsible for the cranes may allow two cranes of unequal capacity to be used in a tandem lift. In such cases "Spanish tackle" should be used, see Figure L.2.

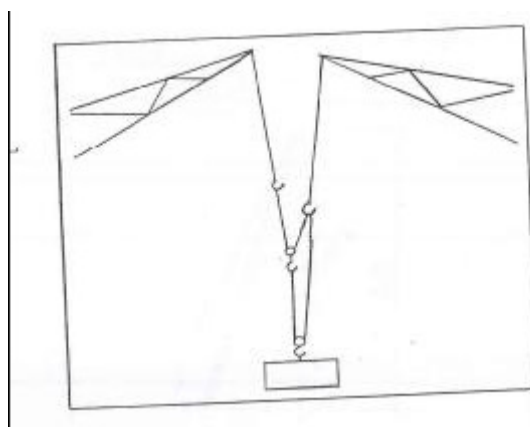


Figure L.2 – Two cranes with unequal capacity

During tandem lifts, it should be ensured that the top sheave of the two cranes preferably are not further apart than 3 m, and the cranes must be positioned so that the sideways pull is as small as possible (preferably less than 5 degrees from vertical).

Special personnel shall be instructed about the conditions, and one of them shall be used as controller during the tandem lift. For cranes with equal capacity, the allowed total weight is about 75 % of the sum of the capacities of the two cranes.

L.2 Additional loads during tandem lifts

When the wire rope of the crane is not vertical, there will be additional strain. There will be an increased tension in the lifting wire, and there will be a force trying to overturn the crane. This is particularly relevant for the stability of cranes with outriggers, especially when they have a great height.

On the crane in Figure L.3, the overturning moment from the load increases with 30 % compared to when the wire is vertical.

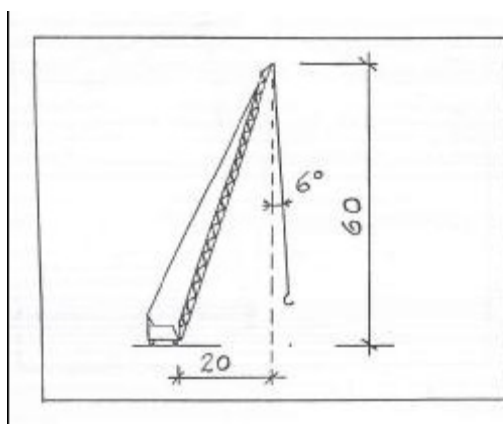


Figure L.3 – Non-vertical lifting wire

During tandem lift the lifting wires will hang slightly off vertical. The angle will be smaller, the longer the distance from block to top sheave, see Figure L.4. It is therefore an advantage to lift the load as little as possible when using tandem lifts.

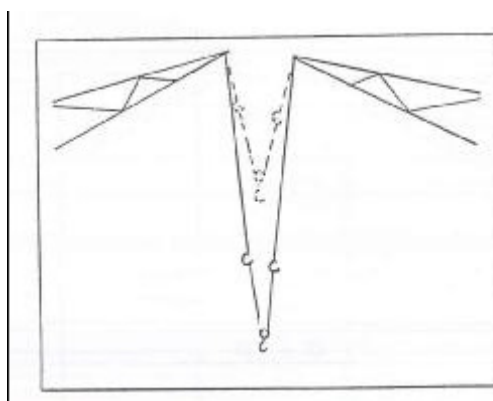


Figure L.4 – Non-vertical lifting wire during tandem lift

If two cranes are hooked independently to the load being lifted (see Figure L.5), the distribution of the load will be dependent on the position of the centre of gravity.

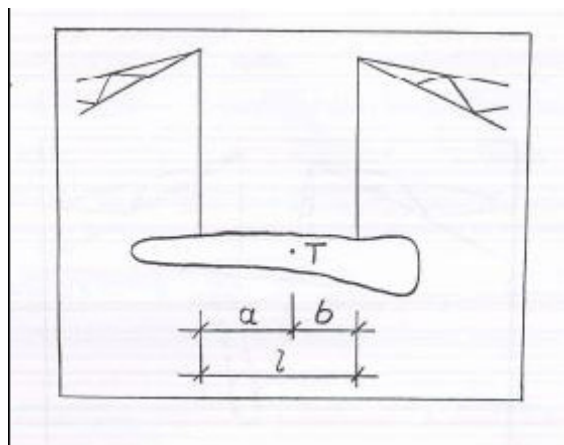


Figure L.5 – Two cranes independently hooked to the load

A wrong assessment of the position of the centre of gravity can give considerable deviation from the calculated distribution of the loads, and the error will increase significantly when the distance between the hooks is reduced.

A deviation will also occur if the hooks are lifted with different speeds, both because the wire ropes will be hanging on a slant, and because the centre of gravity will move in relation to the hooks, see Figure L.6. In the extreme case, one crane may take the whole load on its own. If this happens during lowering, it will not help that the cranes are protected by overload switches, as one crane can be given the entire load by the other crane.

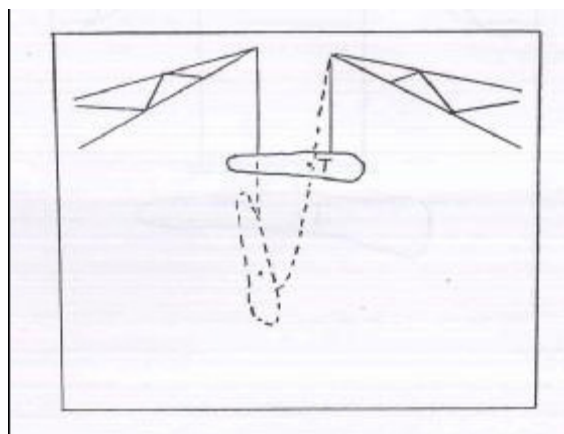


Figure L.6 – Lifting with unequal speed

L.3 Yokes

By using lifting yokes (see Figure L.7) a more reliable load distribution is achieved. It is as safe as using a block with sheave and hook (see Figure L.1), and in addition it is easier to achieve vertical wires to reduce any overturning moment.

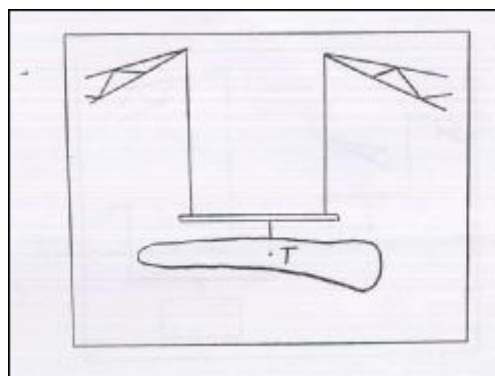


Figure L.7 – Use of yoke

Usually only two cranes are used for tandem lifts, but it does happen that up to four cranes work together, see Figure L.8.

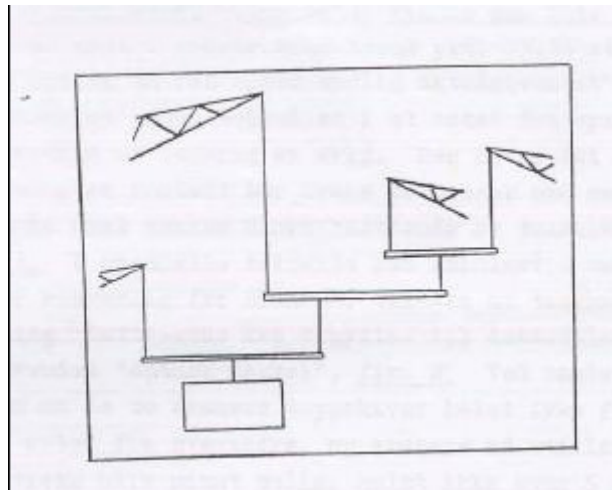


Figure L.8 – Four cranes working together

L.4 Recommended loading

The Norwegian Labour Inspection Authority has no binding rules for how much the cranes can be loaded during tandem lifts, but because of the many uncertainties a reduction should be made on the maximum allowed load.

The following reductions are recommended as minimum values with the assumption that the person responsible will make further reductions when conditions make this necessary:

- a) tandem lifting shall usually not be used where two cranes have the hook fastened at the same point;
- b) when using two cranes of unequal capacity and block with sheave and hook as shown in Figure L.1, minimum 15 % reduction of ordinary SWL;
- c) when using two cranes of unequal capacity and “Spanish tackle” – 15 % reduction of the smaller value of:
 - 1) 33 % of the crane fastened to the end of the tackle rope,
 - 2) 67 % of the crane fastened to the block of the tackle.
- d) when fastening directly to the object to be lifted, it is assumed that the weight and position of the centre of gravity is determined with the best accuracy possible. Maximum allowed capacity for cranes with outriggers shall be reduced by at least 25 %. The same reduction applies to both maximum load and maximum moment,
- e) for the same arrangement as in d), but using overhead cranes, use a reduction of at least 15 %;
- f) for use of cranes with outriggers and yokes, the minimum reduction is 10 %;
- g) for use of overhead cranes and yokes, the minimum reduction is 5 %.

For all cranes with synchronized movements there is no reduction

L.5 Planing and management

A tandem lift will always put great demands on both planning and management of the work. It is therefore assumed that the manager responsible makes sure all necessary investigations are carried out beforehand with determination of weights and if necessary the centre of gravity.

As important is to make sure the lift is conducted under the supervision of an experienced person who the whole time has direct contact with the crane drivers, for instance by radio. Only experienced crane drivers must be used with a thorough knowledge of the equipment to be operated.

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