ABC Guide to Dropped Object Prevention

VOL. 1

Worksite Hazard Management for DROPS

Contents

Introduction

Dropped objects have accounted for the great majority of potential and actual fatalities in Wells operations over the last two years. In the first half of 2009, we experienced a potentially fatal incident involving a dropped object every four days. This situation cannot continue.

We intend to address this challenge with determination and rigour and have therefore initiated a global campaign built on the foundations of our new Prevention of Dropped Objects Manual (EP 2009-9039).

This ABC Guide to Dropped Object Prevention is part of this campaign and includes the mandatory requirements for the worksite as set out in the Prevention of Dropped Objects Manual. It also provides guidelines to facilitate compliance with the Worksite Hazard Management requirements.

I believe that by following the guidance of this handbook at all times and at all locations we shall make significant progress in the elimination of dropped objects. Through this increased focus and the support of everyone who works on our sites, this will save lives.

Peter Sharpe
Executive Vice President Wells
October 2009

Mandatory Requirements

There are four principles each with a number of Mandatory Requirements as set out in the Prevention of Dropped Objects Manual. They are designed to prevent harm to personnel and damage to equipment from dropped objects in the execution of Shell's drilling, completion and well intervention activities.

The four principles are:

1. **Contractors providing equipment and personnel on Shell well sites shall have a Dropped Object Prevention Scheme (DROPS) in place.**

2. **A systematic DROPS inspection programme shall be in place.**

3. **Worksite Hazard management for DROPS shall be in place.**

4. **Audits to check for compliance with DROPS shall be in place.**

The Mandatory Requirements for each principle are listed on the following pages.

Principle 1: Contractors providing equipment and personnel on Shell well sites shall have a DROPS that meets, as a minimum, the following requirements.

1.1 All contracts for the provision of drilling, completion and well intervention services shall comply with the requirements of the Prevention of Dropped Objects Manual (EP 2009-9039), EP Manage Logistics – Lifting and Hoisting HSE (EP 2005-0264), the Shell Group Lifting and Hoisting and Working at Height manuals, and compliance shall be verified prior to contract commencement.

1.2 The personnel roles and responsibilities, required competencies, training and operational interfaces shall be documented and communicated.

1.3 A worksite DROPS Lead shall be appointed for each worksite and be accountable for the implementation of these DROPS Mandatory Requirements.

Principle 2: A systematic DROPS inspection programme shall be in place that meets, as a minimum, the following requirements.

2.1 All equipment and loads shall be inspected prior to transportation, for secure retention or removal of loose objects not intended for transportation to the operations site or return to logistics base.

2.2 Routine DROPS inspections shall be performed weekly and on rig-up of other well intervention equipment. These inspections shall be verified, once a month, with a follow-up inspection by the contractor's representative or Shell site representative.

2.3 An independent dropped object survey of the permanent installation structure (fixed derrick type rigs) shall be performed prior to all rig start-ups and every two years thereafter.

2.4 A documented procedure for pre-mast raising, post-mast raising and pre-mast lowering inspections shall be in place and strictly followed.

2.5 Dropped object inspections shall be performed following jarring of stuck pipe, activities causing excessive vibrations or severe storms.

Principle 3: Worksite hazard management of DROPS shall be in place that meets, as a minimum, the following requirements.

3.1 The workplace checklist – handling tubulars shall be used and applied for tubular handling operations.

3.2 Forklifts used for tubular handling shall be fitted with a pipe clamp to prevent pipes inadvertently rolling off the forklift.

3.3 Equipment that is not an integral part of the structure on which it is mounted shall have a suitable secondary method of retention to the structure.
The correct installation and secondary retention of all permanent equipment in the inventories shall be shown in a picture book that is available on site.
The equipment condition shall be visually inspected against the requirement in the picture book during routine DROPS inspections.
Appropriately rated secondary retention lines shall be installed as a minimum underneath all winch, tong hanging and other load bearing lines in such a manner as to catch the line in the event it 'jumps' the sheave or one of the components of the sheave rigging system fails. The safety line shall be secured to an independent point and not to the same suspension point as the sheave itself. Ideally, the safety line will also be secured integrally through the sheave cheek plates. The safety line shall not interfere with the effective operation of the sheave mechanism.

3.4 A Management of Change procedure shall be followed prior to mounting fixtures to existing structures, or installing new equipment at height, and shall include engineering design review and approval at appropriate level in the Asset owner's organisation.

3.5 Inventories shall be in place for all equipment in the derrick, substructure and moonpool. The inventories shall be updated with location and precise details of all new or modified equipment, including equipment from third party contractors, even if it is only installed on a temporary basis.

3.6 A maintenance management system shall record all permanent equipment at height (as noted in the derrick inventory) and its maintenance requirements and frequency. Maintenance activities (including, e.g. visual and NDT inspections) shall be performed in accordance with the system requirements.

3.7 A derrick temporary equipment register shall be in place, and contain all equipment temporarily installed or used at height. Temporary equipment shall include hand tools used by persons in the derrick and any third party equipment.

3.8 All hand tools, to be used at height, shall be tethered to prevent them from dropping. This requirement shall be clearly stated in the relevant written procedures and the Job Safety Analysis (JSA).

3.9 A complete register of lifting equipment (as per EP 2005-0264) shall be available to record data on all lifting equipment and its certification status, including ID number, SWL and date into service. The register shall include items such as slings, shackles, pad eyes, trolley beams, hoists, tuggers, manlifts, manriders, harnesses, lifting subs, forklifts, lifting attachments or devices.

3.10 All personnel lifting operations shall be authorised by the Site Manager as referenced in EP 2005-0264-SP-01 and the Shell Group Lifting and Hoisting Manual.

3.11 Incident reporting of all dropped objects shall be recorded in Fountain Incident Management noting the potential as determined from the DROPS calculator.

3.12 All rig locations and C&WI locations shall indicate No-Go Zones and Red Zones. All persons on location shall be made aware of these zones.

- No-Go Zones in which there is a high potential risk for dropped objects. These areas shall be controlled with a permit to work and be physically marked off at all times with rigid or chained barriers.
- Red Zones in which there is a medium potential risk for dropped objects. A designated person in charge (PIC) shall be accountable for permitting personnel to enter the Red Zone. Step back safety zones adjacent to the Red Zone shall be clear and shall have fixed gates across designated access points to Red Zones to provide additional control and increase awareness.

Principle 4: Audits to check for compliance with this manual shall be in place that meets, as a minimum, the following requirements.

4.1 Local Area Compliance audits (Level 2) shall be performed every two years and Contractor/ Facility audits (Level 3) shall be performed annually against the requirements of this manual.

4.2 C&WI operations shall be audited on completion of rig-up for non-routine operations and on an annual basis for routine operations.

Forbidden equipment and practices

Numerous incidents have occurred as a result of misuse of equipment, lack of maintenance or misplaced creativity by individuals trying to get the job done. To avoid such incidents, the following high risk items are forbidden.

- Uncertified lifting equipment including 'home made' lifting devices.
- Surface drill pipe filters.
- Use of hammers with wooden handles at height.
- Bolts secured with a double nut arrangement.
- Use of welding rods/wire/tie wraps instead of properly engineered split pins or safety pins.
- Use of hooks on any part of the rigging on winch lines and stabbing board.
- Slings wrapped around derrick/mast beams.
- Unsecured water bottles, grease tubes/guns.
- Drifting stands in the derrick without a formally documented procedure and JSA detailing how the No-Go or Red Zones will be controlled.

Note: This list does not represent a fully comprehensive list of forbidden practices.

DROPS focal points

DROPS focal points have been assigned to assist with the roll-out of the campaign in all areas and will be given the full commitment and support of Shell management and their contractors.

The DROPS focal points are:

Area	Name	Contact
VP Wells HSE	Gordon Graham	+31 70 447 7251 gordon.graham@shell.com
New Ventures+	Bob Baister	+31 70 447 4497 bob.baister@shell.com
Deepwater	Ricky Guttenberg	+1 504 728 7177 r.guttenberg@shell.com
Brazil	John Cook	+55 21 3984 7418 j.f.cook@shell.com
Americas	Michael Corcoran	+1 504 728 4789 michael.corcoran@shell.com
Asia	Rik De Bruijn	+60 85 45 20 65 rik.debruijn@shell.com
Africa	Ronald Leichsenring	+234 1 27 65698 ronald.leichsenring@shell.com
Europe	Stacey Murphy	+44 1224 883454 stacey.murphy@shell.com
Oman	Scott Murray	+968 24675630 scott.sd.murray@pdo.co.om

DROPS wellsite leads, will be assigned with the implementation of the mandatory requirements on site.

More information and updates to the above can be found on the DROPS website: http://sww.shell.com/ep/technology/wells_function/hsse/DROPS.html

DROPS calculator

The DROPS calculator shown in Figure 1 provides a common benchmark in the classification of the potential consequences of a dropped object. It plots the mass of a dropped object against the distance it falls to determine its possible consequences.

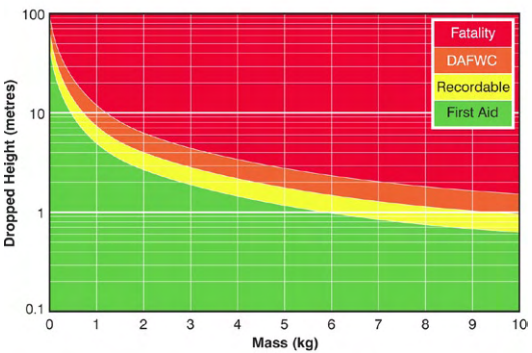


Figure 1: Drops Calculator

The Drops calculator is available at: https://sww-knowledge-epe.shell.com/teamsiep/livelink.exe/open/43594494 as well as on Drops forum website http://www.dropsworkpack.com/downloads_news.htm.

The DROPS calculator has been developed on the basis of kinetic energy calculations and is to be used as a guide, in combination with the Shell RAM matrix. The calculator does not take account of the shape of the dropped object, e.g. sharp objects, which can potentially increase the consequences should the object strike a person.

Tubular handling

Dropped tubulars are the largest single category of dropped objects.

DROPS MANDATORY REQUIREMENTS

3.1 The workplace checklist, 'Handling Tubulars' shall be used and applied for tubular handling operations.

3.2 Forklifts used for tubular handling shall be fitted with a pipe clamp to prevent pipes inadvertently rolling off the forklift.

Workplace checklist – Handling Tubulars

1. The checklist is intended for use on drilling rigs and hoists, for rigfloor activities such as tripping and moving pipe.
2. Observe the drill crew from a safe location. You may also need to discuss some of the questions with them.
3. The expected performance standard is that all questions which apply can be ticked 'yes'.

Workplace checklist

Location: ..... Date: .... /.... /.....

Aspects of tubular handling observed: Yes or No	
Pre-job team talk	☐
Drillfloor layout and equipment	☐
Tubular handling task – details	☐
Question: Yes, No or N/A	
Pre-job team talk	
Evidence that the talk was well-prepared?	☐
Translations provided if required?	☐
Linked to documented procedures for the task, and a risk assessment?	☐
Full team present and contributing?	☐
Clearly defined responsibilities?	☐
No more than one 'Green Hand' or Relief in team?	☐
If so, 'buddy' for that person agreed?	☐
Discussion of relevant Life-Saving Rules?	☐
Reinforcement of obligation to 'STOP the job' if deemed/perceived to be unsafe?	☐
Team talk suitably recorded? (subject(s) discussed and those present).	☐
Drillfloor	
Driller has clear sight of working area?	☐
Where applicable, hands-free communication system functional and tested between driller and roughnecks and driller and derrickman (monkeyboard)?	☐
Correct bails, elevators, slips rigged up? All elevators and lifting subs shall be inspected (checked), **and independently double checked** prior to handling tubulars, for correct size, latch function, latch springs, hinge pins, elevator shoulder and sub thread type?	☐
All other equipment needed is readily available?	☐
All equipment not needed is stored, leaving a clear work area?	☐
All tong pinch points clearly marked as hazardous?	☐

All tong hand-holds clearly marked and soft grips fitted were suitable?	☐
Any temporary equipment tested before the task begins?	☐
Checklist(s) used for these tests?	☐
Tubular handling task (by observation, for ..... minutes)	
Clear line of sight between driller, floormen, derrickman?	☐
Correct pipe handling by floormen? (palms, not fingers, crossed hands). No hands/fingers inside pin at any time?	☐
Two people for stabbing operations? Stabbing guide used?	☐
Buddy demonstrating and coaching Green Hand or Relief?	☐
Physical barriers in place and effective?	☐
Slipping hazards suitably minimised?	☐
Rope used for tailing in pipe?	☐
Drillfloor tailing: rope double-wrapped and properly knotted?	☐
V-door tailing: rope live end double wrapped through shackle?	☐
Flush-mounted slips?	☐
All pipe fingers down before derrickman leaves his position?	☐
Protectors, drifts, etc. returned to deck/ground level safely or stored safely on rig floor.	☐
When crane is used: tubulars tailed in are slung double wrapped with load balanced? Tag lines installed and of sufficient length? Dedicated banksman? Radio comms available and tested with Crane operator, banksman and rigfloor?	☐
Tubular handling teamwork	
Jobs rotate for long tasks?	☐
Team members observed watching out for each other?	☐
'Time Out' called?	☐

Called by: ..... Reason: .....

Feedback and debriefing session?	☐

Location: ..... Time taken: ..... mins.

Check completed by: Position:

....

Forklift clamp

All forklift trucks used for handling tubulars should have a clamp fitted that holds the tubulars firmly in place when they are being moved. Some examples are shown in Figures 2 and 3. Approved design is required.

Figure 2: Forklift truck handling tubulars with a clamp

Figure 3: Close up of the forklift truck clamp

Derrick Temporary Equipment

DROPS MANDATORY REQUIREMENT

3.7 A derrick temporary equipment register shall be in place, and contain all equipment temporarily installed or used at height. Temporary equipment shall include hand tools used by persons in the derrick and any third party equipment.

Derrick temporary equipment register example

Temporary equipment includes all hand tools taken into the derrick. Temporary equipment, such as wire line sheaves, coiled tubing equipment and casing handling equipment, which has to be rigged up in the derrick shall be subjected to the same degree of scrutiny as the fixed derrick equipment. All lifting points, shackles, safety slings and lifting slings shall be visually inspected as a minimum by the driller.

All third party equipment shall be inspected by the drilling contractor, prior to installation of the equipment in the derrick.

The senior service company representative shall confirm that the equipment has been inspected for defects (e.g. damage during shipping) since its arrival onboard.

The derrick temporary equipment register shall be completed for all temporary equipment to ensure that all items are accounted for and have been removed from the derrick after the completion of any task. A derrick temporary equipment checklist (see below) should be completed prior to installation of equipment in derrick.

Derrick temporary equipment register

The following register is to be filled out and updated by the driller. When this register is completed, it is to be kept on file for a period of six months.

Type of equipment	Person responsible	Equipment is up in derrick (date/time)	Equipment removed from derrick (date/time)	Equipment permanently installed	Driller's signature

Derrick temporary equipment checklist example

Item	Task	Checked
1	Current certification for all lifting equipment used to install temporary equipment in the derrick (i.e. slings, shackles, snatch blocks and lifting points) is available on the rig and has been checked by the relevant supervisor, including valid certification for the temporary equipment itself (if applicable).	
2	Safe working load, colour code and identification number is clearly visible on all lifting equipment to be used for this task.	

Item	Task	Checked
3	All securing methods to be used for temporary equipment comply with the Asset owner's requirements and guidelines.	
4	Appropriate rigging equipment as specified in the Asset owners (e.g. drilling contractor) specifications is to be used to anchor temporary equipment in the derrick, e.g. a sling wrapped around derrick steel work is not acceptable, a beam clamp/pad eye shall be used.	
5	Temporary equipment rigging and securing arrangement has been discussed with a qualified person.	
6	Temporary equipment rig-up will be checked for balance as close as possible to the rig floor prior to hoisting into the derrick.	
7	Pad eye or structure from which the temporary equipment is suspended is adequate for the maximum possible load and has valid certification.	
8	Proposed location of temporary equipment in the derrick has been assessed by the Asset owner to check for potential clashes with derrick travelling equipment, e.g. top drive, racking arms, winch wires, etc.).	
9	If applicable, the senior third party representative has given written verification that his equipment has been inspected for defects (e.g. damage during transportation) prior to use.	
10	Derrick temporary equipment register has been completed detailing number, location and type of all temporary equipment in the derrick. Ensure register is updated as soon as equipment is removed from the derrick.	

Supervisor's signature	Name	Date

Lifting and hoisting

This section contains information on the Shell lifting and hoisting Mandatory Requirements, a template for a lift plan and the ten questions for a safe lift checklist.

DROPS MANDATORY REQUIREMENTS

3.9 A complete register of lifting equipment (as per EP 2005-0264) shall be available to record data on all lifting equipment and its certification status, including ID number, SWL and date into service. The register shall include items such as slings, shackles, pad eyes, trolley beams, hoists, tuggers, manlifts, manriders, harnesses, lifting subs, forklifts, lifting attachments or devices.

3.10 All personnel lifting operations shall be authorised by the Site Manager as referenced in EP 2005-0264-SP-01 and the Shell Group Lifting and Hoisting Manual.

Shell mandatory – lifting and hoisting

http://sww.shell.com/hse/group_hse_standards/control_framework/personal_safety/control_framework_personalsafety_v1.html

Confirm that you can answer 'yes' to the "10 Questions for a Safe Lift" before all lifting and hoisting operations.	
1. Is everyone aware of and do they fully understand the lifting and hoisting procedures applicable to the lift?	
2. Has everyone attended the toolbox talk?	
3. Has a pre-use inspection of the lifting equipment been carried out and are the lifting accessories tagged or marked with: • safe working load? • a unique identification number? • a valid certification date?	
4. Are all safety devices working?	
5. Does everyone know the person-in-charge of the lift?	
6. Is everyone competent and aware of his or her tasks?	
7. Is there a current lift plan and Job Safety Analysis and does everybody understand the job and precautions?	
8. Does everyone know the environmental limits, e.g. maximum permissible wind speed for the lift?	
9. Is the lift area controlled and is everyone out of the way if the load falls or swings?	
10. Are signalling methods and communication agreed and clear to you?	

Lift plan example

Location:	Area:
.....	.....
Permit number:	Risk assessment number:
.....	.....
Lifting plan number:	Technical review:
.....	.....

Description of lifting operation:

.....

.....

Is sketch of lifting operation enclosed?

☐ Yes ☐ Routine ☐ Non-routine

Weight load:

..... ☐ Estimated ☐ Assessed

Lifting equipment and accessories to be used (specify type, SWL): colour code

.....

.....

All Lifting operations require the following to be considered but this list is not exhaustive:

- ☐ Weight, size, shape and centre of gravity of load.
- ☐ Method of slinging/attaching/detaching load.
- ☐ Availability of approved lifting points on load.
- ☐ Pre-use equipment checks by operator.
- ☐ Proximity hazards, obstructions, path of load.
- ☐ Lifting over live equipment.
- ☐ Conflicting tasks in area.
- ☐ Working under suspended loads.
- ☐ Overturning/load integrity/need for tag lines.
- ☐ Environmental conditions including weather.
- ☐ Experience, competence and training personnel.
- ☐ Number of personnel required for task.
- ☐ Communication requirements.
- ☐ Only certified and colour coded equipment to be used.

Method(s) of communication to be used:

☐ Radio ☐ Verbal ☐ Hand signals

Steps taken to eliminate danger to personnel involved and others, including barriers where appropriate:

.....

.....

Planned by:

Name:	Signature:	Date:
.....		
.....	.....	...../...../.....

Approved by person in charge (PIC):

Name:	Signature:	Date:
.....		
.....	.....	...../...../.....

Reviewed by: (the competent person conducting the lift must carry out the review of the lifting plan)

Name:	Signature:	Date:
.....		
.....	.....	...../...../.....

Task Details: (Use continuation sheet if required)

No.	Task Details	Individual responsible
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

No-Go and Red Zones

DROPS MANDATORY REQUIREMENT

3.12 All Shell wells locations shall indicate No-Go Zones and Red Zones. All persons on location shall be made aware of these zones.

- No-Go Zones are those in which there is a high potential risk for dropped objects. These areas shall be controlled with a permit to work and be physically marked off at all times with rigid or chained barriers.
- Red Zones are those in which there is a medium potential risk for dropped objects. A designated person in charge (PIC) shall be accountable for permitting personnel to enter the Red Zone. Step back safety zones adjacent to the Red Zone shall be clear and shall have fixed gates across designated access points to Red Zones to provide additional control and increase awareness.

Some No-Go and Red Zones will change during different phases of an operation. Changes to the No-Go zones shall be managed via the Permit To Work System.

Floormen move in and out of the Red Zone depending on the operation. It is important to define the Red Zone for each location/rig. 'Safer' areas shall be clearly defined using Step Back Safety Zones – areas where floormen will step back to during movement of the blocks.

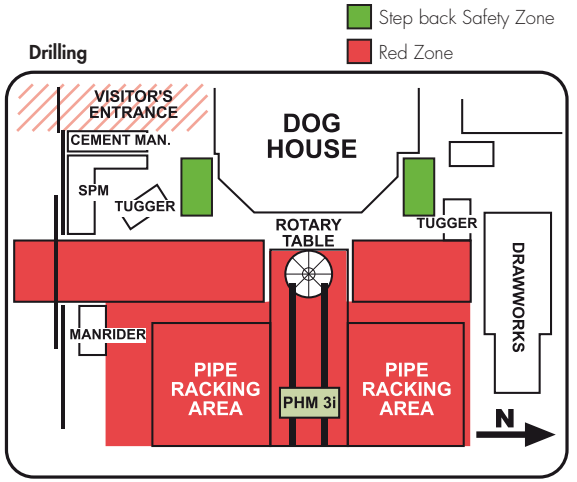


Figure 4: Example Red Zone changes according to operations

It is not intended to define the rig floor as a No-Go Zone hence Red Zone classification. In some areas, the catwalk area is defined as No-Go during tripping and a work permit is required. This has proven to be a control which has saved peoples lives, particularly when dealing with automated or semi-automated equipment. HAZID sweeps of the Facility should be done with help of suitably skilled staff

Example Red Zone protocol

A Red Zone protocol such as the following should be in place on all drill sites.

- All personnel should check the boards at the drill floor entrance for current Red Zone status before visiting the drill floor.
- Permission to enter a Red Zone must be given by the driller or his delegate before personnel do so.
- Liaise with the driller or delegate immediately on entering the drill floor.
- Everyone should communicate their requirements clearly.

Reliable securing

This section of the handbook applies to equipment that is going to be procured and to equipment that is already in use on many installations.

It covers all the equipment, components and circumstances, e.g. corrosion, that have the potential to cause or become a dropped object and what should be done to prevent this.

DROPS MANDATORY REQUIREMENTS

3.3 Equipment that is not an integral part of the structure on which it is mounted shall have a suitable secondary method of retention to the structure. The correct installation and secondary retention of all permanent equipment in the inventories shall be shown in a picture book that is available on site. The equipment condition shall be visually inspected against the requirement in the picture book during routine DROPS inspections. Appropriately rated secondary retention lines shall be installed as a minimum underneath all winch, tong hanging and other load bearing lines in such a manner as to catch the line in the event it 'jumps' the sheave or one of the components of the sheave rigging system fails. The safety line shall be secured to an

independent point and not to the same suspension point as the sheave itself. Ideally, the safety line will also be secured integrally through the sheave cheek plates. The safety line shall not interfere with the effective operation of the sheave mechanism.

3.10 All hand tools, to be used at height, shall be tethered to prevent them from dropping. This requirement shall be clearly stated in the relevant written procedures and the Job Safety Analysis (JSA).

Shell wishes to acknowledge Statoil, SFS and the Drops Forum for the base material for this section. This section is intended as guidance to assist in meeting the Shell Mandatory Requirements, as defined in the manual EP 2009-9039 and noted elsewhere in this ABC Guide.

The use of 'Must' in this section should be interpreted as a requirement to meet the Best Practice.

Galvanic corrosion

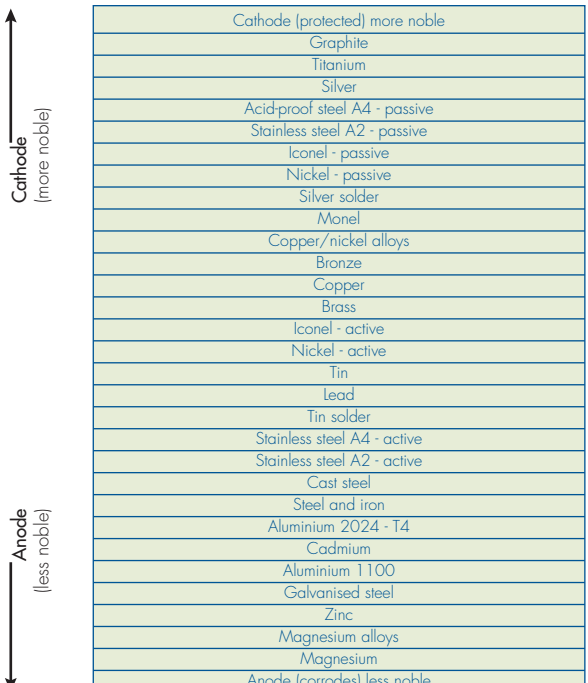


Figure 5: Nobility of various metals

Galvanic corrosion occurs when two dissimilar metals with different voltage potentials are in contact with each other in the presence of an electrolyte (damp film or seawater/ fresh water). When this happens, the less noble metal becomes the anode and the more noble metal the cathode (see Figure 5).

If a steel screw is fixed into a copper plate, the screw will be the anode since copper is the nobler metal (Figure 6). The screw will rust rapidly as the difference in potential is great.

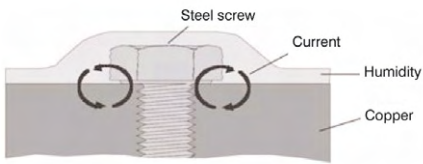


Figure 6: Steel screw on a copper plate

If the same steel screw is fixed into a less noble plate, e.g. a zinc plate, the screw will be the cathode and will not rust (Figure 7). The zinc plate will corrode, as it is less noble than the screw.

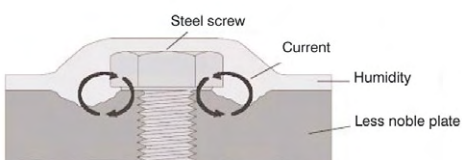


Figure 7: Steel screw on a zinc plate

For these reasons, it is important that all securing devices are of the stainless steel type. This applies to cotter pins, safety pins, securing wire and locking wire for threading through nuts and bolts, etc.

Bolted connections

At present, bolts are being produced to 85 different industrial standards and the requirements for bolted connections (Figure 8) vary for the different sectors depending on the given design, operational and maintenance requirements.

Achieving a stable bolted connection will, therefore, require a qualified evaluation of the following factors.

- Load design.
- Choice of materials with a view to mechanical properties and corrosion resistance.
- Use of lubricant where appropriate.
- Pre-tensioning and use of the correct torque equipment.
- Need for locking bolts to secure against loss of torque/ pre-tension.

Eighty-five per cent of all damage to bolts is due to fatigue. This is primarily a result of:

- dynamic load with inadequate pre-tensioning
- overload resulting in reduced pre-tensioning.

Figure 8: Bolted connections

Special bolts

Bondura Bolt
www.boltnorge.no

Bondura has a construction that can take up movement and ovality by using expanding tapered sleeves at both ends of the bolt. There are several variants of the bolt, both straight-through versions to other that are fitted from one side. Standard screws are tightened to press in the cones. The bolt is fixed directly to the machine or equipment with locking screws. This prevents the bolt from loosening, falling out or rotating in the bolt hole. Bondura bolts must be fitted and maintained in accordance with the manufacturer's specifications. Bondura is certified in compliance with API 8C and F.E.M. regulations.

Areas of use:
For example, as a replacement for clevis bolts in top drives and hinge bolts on dollies, pipe handling equipment and cranes.

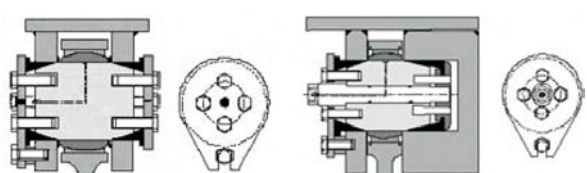


Figure 9: Bondura bolt 6.6 *Bondura bolt 6.1*

Superbolt/Supernut
www.superbolt.com

Superbolt/Supernut are constructed such that standard nuts are replaced by 'stretch nuts' with integrated jackbolts and washers. Use can be very beneficial in terms of HSE because only hand tools are needed for fitting and dismantling. Rigging of heavy torque equipment and use of sledgehammers during installation and disassembly is avoided. An additional benefit is that time is saved during the operations. Bolts must be fitted and maintained in accordance with the manufacturer's specifications. Both Superbolt and Supernut are available in a special corrosion resistant offshore version.

Areas of use:
Almost unlimited; available in both inch and millimetre dimensions and diameters from M20 to M160.

Figure 10: Superbolt

Bolted Connections

Dual nuts are forbidden for locking of bolted connections. The following methods are recommended for locking bolted connections.

Nord-Lock Bolt Securing System
www.nordlock.com

When correctly installed, the Nord-Lock Bolt securing system provides a guaranteed secure bolted connection. Locking is achieved by means of two washers that ensure the clamping force is maintained in the bolted connection. Nord-Lock has DnV (Det Norske Veritas) type approval.

Areas of use:
Particularly suitable for connections exposed to vibrations, e.g. grating, loudspeakers, cable trays, ladders, guide rails, etc. But it has an almost unlimited range of applications.

Figure 11: Nord-Lock bolt securing system

Spiral Lock
www.spiralock.com

Spiral Lock is an all-metal lock nut/bolt and has a specially designed threaded profile that locks when tightened and distributes the tension over the whole length of the thread. This provides better load distribution, which helps to improve the locking of the bolt connection.

Areas of use:
Almost unlimited, frequently used for critical bolt connections.

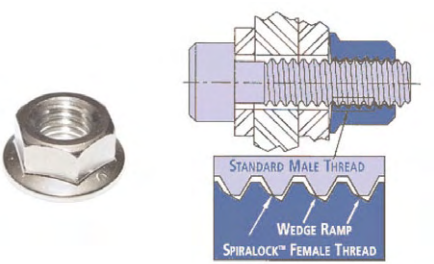


Figure 12: Spiral Lock

Castle nut with cotter pin

Adopted from the aviation industry, Castle nuts provide a visual and reliable method for locking bolted connections. The nut has radial slots and is locked by noncorrosive cotter pins that are inserted through a hole in the bolt.

Areas of use:

Unlimited, but frequently used for critical bolt connections.

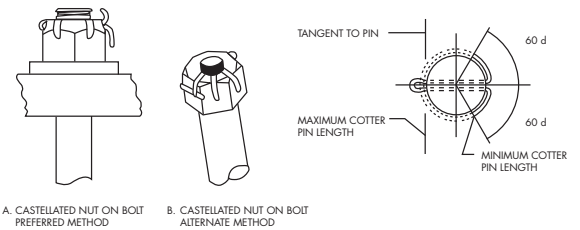


Figure 13: Correct installation of cotter pins in bolts

Nyloc lock nut

Nyloc lock nuts are extensively used throughout the industry. Nyloc lock nuts should only be used once. Standard Din 985 Nyloc nuts have a temperature rating from -70 °C to +120 °C.

Areas of use:

This type of nut is recognised for locking in connections where a certain degree of lost pre-tension can be accepted.

Figure 14: Nylock lock nut

Figure 15: All-metal lock nut

Figure 16: All-metal lock nut

All-metal lock nuts

All-metal lock nuts can be used on all bolt dimensions. The nut locks by the threaded section or top of the nut deforms/splits, or through the nut having a toothed ring under the collar. This provides greater friction between the bolt/underlay and nut, providing a secure connection. There are many varieties and suppliers on the market.

Areas of use:

These nuts have an almost unlimited area of use.

Tab washer/tab plate DIN 93/463

Tab washers can be used on all dimensions and in any place designed for the use of tab washers. There are several types with different areas of use for locking either nuts or bolts. It is important to use the right type for each purpose.

Areas of use:

Typically in use on machinery where it is important to prevent the bolt from rotating.

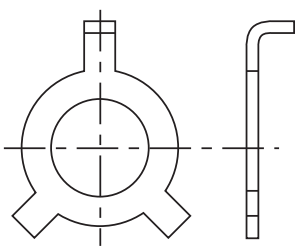


Figure 17: Tab washer

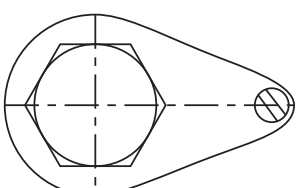


Figure 18: Tab plate

Lock-wiring

Lock-wiring of bolts is a locking method adopted from the aviation industry. In brief, the method involves threading a special stainless wire through a hole in the bolt head, twisted and locked to the next bolt or structure, thus preventing the bolt to rotate and loosen. The wire can be used to lock a maximum of three bolts in a row, as shown in the illustration. (For info on the size of the hole in the bolt head, see ISO7378).

Areas of use:

Used extensively for locking external bolted connections on drilling and pipe-handling equipment. Often used where there are no through-bolts and/ or there is *a need for easy visual control of the locking.*

Figure 19: Lock-wiring of bolts

Securing pins/safety pins

Within the industry various types of inappropriate securing pins are used. These are unsafe because they can easily be knocked out, for example; spring type split pin.

Best practice

- NB! Securing pins of the type shown in the pictures must never be used in lifting appliances.
- Securing pins shall provide secondary retention.
- Securing pins shall be of the proper size and quality.
- Securing pins shall be secured by wire (where this is
- appropriate) to prevent drop.
- It is a requirement that securing pins as described above are inspected regularly and replaced when required.

Areas of use:

Scaffolding bolts, security bolts on removable railings, claw couplings and securing brackets on gas cylinder racks, etc.

Figure 20: Securing pins/safety pins

Correct use of cotter pins

The industry has experienced problems with the correct use of cotter pins and the choice of materials.

Best practice

- Cotter pins must be bent to prevent them from being knocked out.
  - Where there is a danger of personnel exposed, the cotter pin must be bent as shown in the illustration.
- When hoisting persons and loads, always use four part shackles.
- Linchpins, spring type split pins or any other type of safety pins that can be knocked out must not be used for lifting operations.
- Cotter pins should be made of stainless steel.
- It is a requirement that cotter pins as described above are inspected regularly and replaced when required.

Figure 21: Cotter pin in a shackle bolt

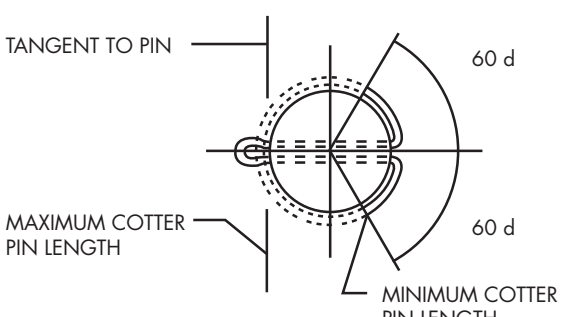


Figure 22: Correct installation of cotter pins in bolts

Securing devices (wires, chains and couplings)

Wherever possible, equipment installed at height shall have integrated secondary retention. If not possible, or where equipment is exposed to the risk of collision, the equipment must be equipped with secondary retention securely attached to the structure.

Best practice

- Securing devices must be dimensioned in accordance with the equipment supplier's calculations. The quality of materials used must be consistent throughout the entire assembly.
- Only acid-proof securing wire (AISI 316, type 7x19 IWRC) shall be used. Wires must be locked with double press locks (for example Talurit locks). The locks must be made of copper and the minimum distance between the locks must be approximately equal to the length of a fully crimped lock.
- All connectors/snap hooks must be made of acid proof steel (AISI 316) and be equipped with locks. Snap hooks attached to shackles should have eyelets.
- Chain must be made of acid-proof (AISI 316) or galvanised steel.
- Shackles for use with securing devices should have rotating bolt with nut and cotter pin, marked with WLL/SWL and traceability, at least in the form of batch marking.
- The chain or securing wire must be as short as possible to minimise the potential fall energy.
- Securing devices must be installed, maintained and inspected in accordance with the instructions provided in the user manual or maintenance instructions.

Figure 23: Securing devices (wires, chains and couplings)

Securing of personnel

When working at height, for which anti-fall equipment as shown in Figure 24 is mandatory, the necessary expertise is required to ensure safe working conditions.

Best practice

- Anyone using personal protective equipment against falls from heights must have documented training. The training must also cover rescue methods.
- The necessary rescue equipment must always be available at the work place.
- The equipment must have approval markings (e.g. CE) and comply with an accepted standard.
- The equipment must be checked at least every six months by a competent person.
- The control or validity date must be shown on the equipment.
- The choice of equipment must be made after evaluating the geometry of the work place.

For more information refer to the Shell Manual for Working at Heights http://sww.shell.com/hse/group_hse_standards/control_framework/personal_safety/control_framework_personalsafety_v1.html

Figure 24: Anti-fall equipment

Derrick evacuation equipment

- Equipment must be protected from wear and harsh environment.
- Equipment should be stored in cabinet/locker to protected it from UV radiation and weather.
- The riding belt or harness must be attached to the evacuation block or to the guide line where appropriate.
- Evacuation block, guide line, attachment point, couplings and shackles are defined as evacuation equipment/anti-falling devices and must be checked, certified and marked accordingly.
- Anchor points for suspension must be able to support at least 10kN.
- The equipment must be checked at least every 12 months by a competent person and shall be marked with the next inspection date.
- Safe access to and use of the equipment must be ensured.

Figure 25: Evacuation equipment (example only)

Securing of tools at height

Securing of tools at height (<5kg)
There is a significant potential of dropped objects when using tools at height.

Best practice
- Use of tools at height must be risk-assessed.
- Wires and connectors must be used between the tools, belt or bag.
- Swivels with set screws should not be used.
- Weak link shall be installed between the bagbelt and safety wire.
- A tool bag with internal loops should be used when various tools are deployed at height.
- Wrist straps must not be used because of potential personal injury.
- If an attachment point other than the belt or bag is required, use an appropriate part of the surrounding structure, preferably above the work level.
- In limited areas, for example the derrick, flare boom and cranes, tools used at height must be logged out and in to ensure that nothing is left behind.
- All tools at height to be registered (e.g. in derrick log book).

Figure 26: Weaklink

Figure 28: Safety wires and connectors

Figure 29: Internal securing loops

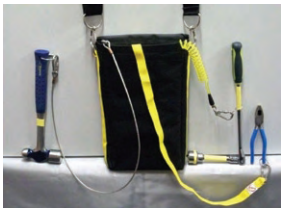


Figure 27: Tethered tools

Figure 30: Securing tools

Securing tools at height (5-25kg)
Methods for securing heavy tools and hand-held machinery for use at height have not been adequately defined. In view of the major potential for serious damage if such tools or machinery are dropped, it is important to have clear guidelines.

Best practice
- All use of heavy tools and hand-held machinery at height must be risk-assessed.
- All heavy tools and hand-held machinery used at height must be secured against drop both when in use and while being transported.
- Securing devices must be dimensioned in accordance with verifiable calculations and documented drop tests (see the section on securing devices).
- Securing points for tools and machinery must be in place above the work site and the securing device must be as taut as possible.
- In limited areas, for example the derrick, flare boom and cranes, tools used at height must be logged out and in to ensure that nothing is left behind.

Figure 31: Tools secured against falling

Securing of other portable equipment at height
Several reported dropped object incidents are related to radios, pagers and gas detectors.

Best practice

- All portable equipment used at height must be secured against being dropped.
- Carrying pouches must always be used for radios and any other portable equipment that don't have certified securing points.
  - Locks on the pouches must have a double securing mechanism to prevent unintentional opening.
- Belt clips which allow equipment to become detached when turned 180° should not be used.
- Belts with snap fasteners are not recommended for securing of equipment at height.

Figure 32: Example radio holder

Figure 33: Portable equipment secured to the body

Figure 34: Portable equipment secured to the body

Tool cabinets for work at height

Tool cabinets/lockers for work at height have now been installed at many Facilities. Unfortunately, a number of irregularities have been observed regarding securing, control and registration of tools.

Best practice

- Each cabinet/locker shall be equipped with a list of contents and be kept locked.
- A designated person must be responsible for the cabinet to ensure that all tools taken from and returned to the cabinet are logged.
- The contents of the tool cabinet for work at height and its accompanying log book must be checked at the end of every shift.
- All tools must be adequately equipped for securing at height and must have documented attachment points.
- In addition to the necessary tools, cabinets should be equipped with a sufficient number of:
  - correctly dimensioned safety wires with approved swage locks;
  - connectors/snap hooks with locking;
  - tool bags with internal fastening devices;
  - special belts for fastening of tools and bag;
  - weak links for fastening between the harness/belt and safety wire.

Figure 35: Tool cabinet

Securing of permanently attached equipment

Piping and equipment feedthroughs
Significant shortcoming in piping and equipment feedthrough and missing hole covering are found throughout the industry.

Best practice
- All piping and equipment feedthroughs in decks and grating must have a toe board and must be covered to the greatest extent possible.
- Canvas or a cladding material can be used. This is especially important in areas where there is equipment requiring periodic maintenance. Done properly and preferably permanently, it will be an efficient measure against dropped objects.

Figure 36: Example of piping and equipment feedthroughs

Railings
Major defects in railings have been observed in the industry, and particularly in collapsible, movable and aluminium railings.

Best practice
- Railing must be 1100mm high as a minimum and have integrated toe boards that are at least 100mm high
- Railing must have a functional design for the area it is intended to secure, e.g. wire mesh must be installed as required (locked areas).
- Railings shall not have deformations or cracks that affects the functionality or strength.
- It must always be possible to insert movable railings into the fastenings and insert a securing through-bolt.
- The safety bolt must be adequately locked using a securing pin, snap hook (with eyelet) or a cotter pin (see also the section on securing pins).
- Both the safety bolt and locking must be secured in the immediate vicinity of the attachment.
- All connections between elements in the railing must be secured with through-bolt and lock nut.
- Use of setscrews are not recommended in permanent railings.
- Railings and attachment points for collapsible and movable railings must be inspected on a regular basis to maintain adequate securing and functionality.

Toe boards

Shortage of and incorrectly installed toe boards are observed throughout the industry. Commonly, the gap between the toe board and deck are exceeding requirements.

Best practice

- Decks, gangways and platforms must have toe boards with a minimum height of 100mm.
- On stairways, every step must have a toe board with a minimum height of 50mm.
- All landings in stairways must have toe boards with a minimum height of 100mm.
- The gap between the deck or grating and toe board must not exceed 10mm.

Figure 37: Toe boards

Grating

At present there are a number of different ways of fastening grating to underlying structures or frames. As a result of vibrations and defective locking of fastening, there are incidents of loose grating and loose or missing fastening clips.

Best practice

- Grating must be adequately fixed to underlying structures to prevent loosening due to vibrations or loads.
- Grating should be secured against major sideways displacement in all directions.
- Through-bolts or threaded connections with locknut, are recommended for securing to structure.
- Openings in the grating must not exceed 20mm where personnel may traffic the area below, and should otherwise not exceed 35mm.

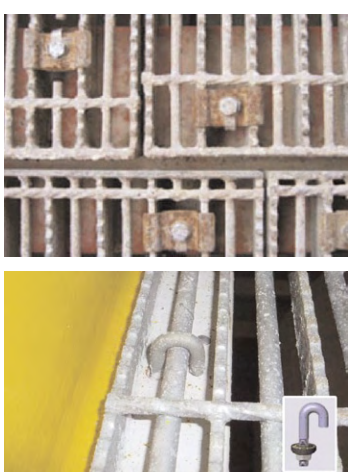


Figure 38: Different types of grating fastenings

Swing gates

On many swing gates, the hinges are fitted without the required material quality or design strength to serve the intended function. Many older gates also lack integrated toe boards.

Best practice

- Gates must be of the same strength as the surrounding railings.
- Gates must be secured in order to prevent disengaging.
- Gates must open/swing inwards to the platform or deck.
- Gates must be designed to automatically return to and remain in closed position.
- On floating rigs/installations it is recommended to fit a latch to secured the gate in closed position.
- Toe boards must be integrated in gates.
- Wherever possible, the hinges should be an integral part of the gate.
- Swing gates must be inspected and maintained on a regular basis to ensure adequate function.

Figure 39: Example swing gate

Floodlights
Floodlights are rarely adequately secured against dynamic drop caused by hits from moving equipment.

Best practice
- Floodlights must be positioned to prevent being hit by equipment/loads.
- If there is a potential of the floodlights being hit by mobile equipment/loads, they should be protected with reinforced cages.
- Floodlights must be equipped with two independent barriers. The attachment points should be integrated, for example with eye bolts threaded into the floodlight housing.
- Strength of attachment points and securing devices, related to the relevant fall energies must be evaluated.
- Fastening devices for securing of equipment to bracket or structure should be fitted with secondary retention.
- Hatches for replacement of light bulbs must be hinged or secured with wire to the floodlight housing/frame.
- For new installations or for installing securing devices on existing equipment, a user manual maintenance instructions should be available. The instructions should also cover securing devices.

Figure 40: Floodlight

Light fittings

There have been several serious incidents where both the cover and the casing of light fittings have dropped.

Best practice

- Lighting fixtures must be positioned to prevent being hit by mobile equipment/loads.
- Lighting fixtures and brackets should be fitted with secondary retention.
- Safety wires attachment points should be integrated in both ends of the fixture.
- Battery packs must be fitted with secondary retention.
- Above walkways and other trafficked areas fixtures with power cable in from one side only, requires that the opposite end is secured with a safety wire.
- The cover should have hinges that can be fitted on either side.
- The component rail should be hinged and must allow for adequate securing in the closed position.
- Strength of attachment points and securing devices, related to the relevant fall energies must be evaluated.
- For new installations or when installing securing devices on existing fixtures, user manuals/maintenance instructions should be available. The instructions must also cover securing devices.

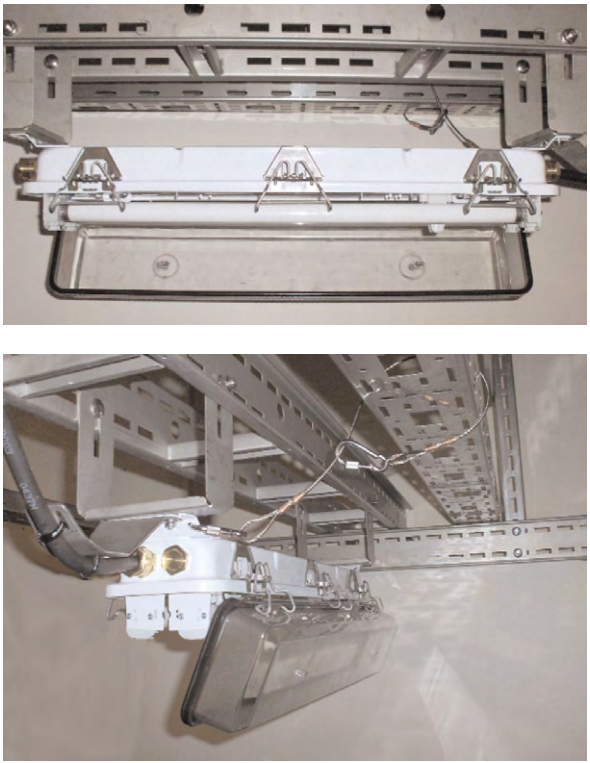


Figure 41: Example light fittings

Navigation lights

Best practice

- The bolts used to attach navigation lights to brackets and structures should be equipped with secondary retention.
- Attachment brackets must have holes for attachment of safety wires.
- Cover for electrical connections must be hinged or secured with wire.
- Strength of attachment points and securing devices, related to the relevant fall energies must be evaluated.
- Navigation lights with sliding grooves for bolt attachment to the structure, are not recommended.
- For new installations or when installing securing devices on existing equipment, a user manual/maintenance instructions should be available. The instructions must also cover securing devices.

Figure 42: Navigation light

CCTV cameras

Within the industry, it is identified that CCTV cameras have been inadequately secured.

Best practice (integrated solution)

- CCTV camera location must be evaluated to prevent risk of being hit by moving equipment/loads.
- In areas where there is crane activity, cameras should be shielded by protective cages.
- The camera casing must be fastened to the bracket and structure with adequate locking of attachment bolts.
- The attachment point for securing devices should form an integrated part of the camera casing and bracket.
- Strength of attachment points and securing devices, related to the relevant fall energies must be evaluated.
- For new installation or when installing securing devices on existing equipment, a user manual/maintenance instructions should be available. The instructions should also cover securing devices.

Figure 43: CCTV camera

Crane boom cameras

Within the industry there have been several incidents where a crane camera has been struck during lifting operations.

Best practice

- Crane boom cameras must have two independent barriers.
- Bolts used for attaching the crane boom camera to brackets and structures should be fitted with secondary retention.
- Attachment points for the safety wire should be integrated as part of the camera casing. Alternatively, special clamps can be fitted round the camera casing.
- The safety wire must run from the camera casing through the camera bracket and then through the attachment bracket before being attached securely to the structure of the crane boom.
- Strength of attachment points and securing devices, related to the relevant fall energies must be evaluated.
- For new installations or when installing securing devices on existing equipment, a user manual/maintenance instructions should be available. The instructions should also cover securing devices.

Figure 44: Crane boom camera

Loudspeakers

Best practice

- Loudspeakers location must be evaluated to prevent risk of being hit by moving equipment/loads.
- If there is a risk of being hit by mobile equipment/loads, loudspeakers must either be protected by reinforced braces or equipped with a safety wire.
- Bolts used to fasten loudspeakers to brackets and the structure should be fitted with secondary retention, as an alternative a safety wire can be attached between bracket and structure.
- Strength of attachment points and securing devices, related to the relevant fall energies must be evaluated.
- For new installations or when installing securing devices on existing equipment, a user manual/maintenance instructions must be available.
- The instructions should also cover securing devices.

Figure 45: Loudspeakers

Junction boxes and cabinets installed at height

Within the industry, it is revealed incorrect positioning of junction boxes and cabinets, defective suspension fastening and inadequate securing of hatches, doors and covers.

Best practice

- Junction boxes and cabinets must be located where they do not obstruct passageways, evacuation routes or moving equipment.
- The type and design of attachment and safety devices must be in accordance with calculated loads and known potential external stress factors.
- Fastening devices for securing of equipment to bracket or structure shall be fitted with secondary retention.
- Where there is danger of the equipment being struck by moving equipment/loads, it must be protected by a reinforced cage or be fitted with a safety wire.
- Covers must be secured by fasteners that are secured and locked to prevent loosening, and must be secured with wire or chain.
- Strength of attachment points and securing devices, related to the relevant fall energies must be evaluated.
- As a minimum, the manufacturer's instructions for installation and maintenance (user manual) must be complied with.

Figure 46: Junction box and cabinet

Cable trays and cable ladders

Best practice

- Only approved bolt connections shall be used for fastening and couplings.
- Cable fixing clamps with screw connections are used for safe and functional securing of instrument cables.
- When attaching the cable support system to a structure, the risk of galvanic corrosion must be assessed and insulation considered where appropriate.
- The user manual and instructions for use must also provide guidelines for correct installation, both in the joints and the attachment.
- In addition, the user manual/instructions for use must provide guidelines for necessary maintenance/ retightening and inspection of both electro-steel and bolt and screw connections.

Figure 47: Cable tray

Wind walls

Within the industry, many damaged and loose plates have been revealed in wind walls. This is due both to faulty installation and to external factors (collisions with mobile equipment and harsh environment).

Best practice

- Wind wall panels must be fastened to a separate support/structure and never to the main structure.
- Wind wall panels must always be reinforced using horizontal steel beams in accordance with the design loads.
- Areas that are exposed to collision risk must have stronger corner mountings secured by through-bolts and lock nuts.
- The preferred attachment solution is through-bolts with washers and lock nuts.
- The user manual/instructions must also provide guidelines for correct installation of both joints and attachment points.
- Guidelines must be available on essential maintenance and inspection of wind wall panels and their attachment points.

Signs
Sign installation methods have in many cases been found inadequate.

Best practice
- Signs, brackets and frames for signs must always be securely attached and the frames should be of metal.
- Where the underlying material permits, sign frames should be attached using through-bolts with lock nuts.
- Fasteners used for attachment to brackets and structures should be fitted with secondary retention.
- Identification tags that are painted or glued are recommended for identification of piping systems. On hot surfaces, identification tags should be attached with plastic-coated steel bands.

Figure 48: Example of signs

Valve handles and valve wheels installed at height

Many cases have occurred where valve wheels and valve handles for manual valves are not adequately secured.

Best practice

- Valve wheels and handles must be fitted with secondary retention.
- Where possible, nuts and cotter pins should be used in the valve stem on stationary valve handles and wheels (Nordlock and Nyloc nuts can also be used where appropriate).
  - On large handles and wheels, bolts and lock nuts should be used instead of cotter pins.
- When mobile handles or wheels are used, they should be secured.
  - When not in use, handles and wheels should be stored in a suitable and safe location.
- If Seeger rings are used for locking/securing, frequent inspections/maintenance should be carried out to check for corrosion and/or mechanical damage.
- On wheels that are secured by a set screw only, replace the set screw with a through-bolt and lock nut.
- Safety wire with a lockable snap hook may be an alternative if the securing methods mentioned above cannot be used.

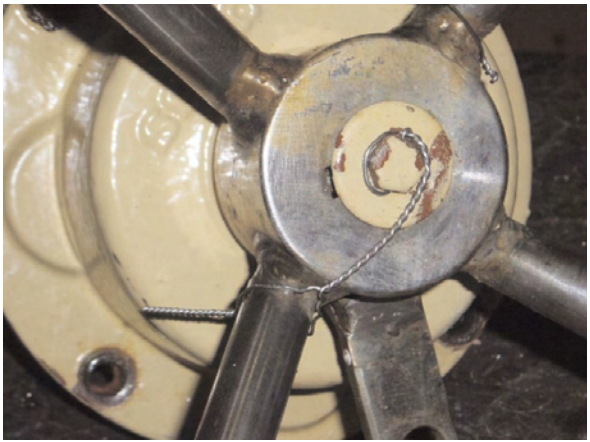


Figure 49: Example valve wheels and handles

Locks on insulation cladding

There have been many instances within the industry where pieces of insulation cladding have dropped from heights due to vibrations, corrosion or strong winds.

Best practice

- Insulation cladding must be securely fastened to prevent locks from loosening unintentionally.
- The locks should be secured with secondary retention, either by using a bolt and lock nut or by inserting a stainless cotter pin through the securing holes in the locks or similar.
- Maintenance routines must include inspection of the cladding to ensure that it is in good condition.

Figure 50: Example locks on insulation cladding

Snatch blocks

Best practice

- Blocks must have two barriers both in the suspension and the shaft.
- A maintenance programme must be established in accordance with the user manual, including requirement for inspection every twelve months of blocks, shackles and lifting lugs by a competent person.
  - Blocks must be dismantled at the request of the competent person or in accordance with the manufacturer's recommendations or, in any case, at least every fifth year.
- Snatch blocks and suspension shackles should preferably be marked with coloured tie wraps using the designated colour code of the year.

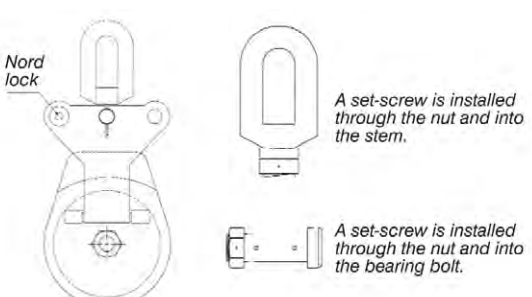


Figure 51: Snatch block

Umbilical roller sheaves (Banana sheaves)
As a result of inadequate securing of rollers in umbilical roller sheaves, there have been several serious incidents.

Best practice

- An umbilical roller sheave must have maintenance programme and be subjected to testing and inspection every twelve months in accordance with the manufacturer's instructions.
- Rollers must be secured with two independent barriers, for example, through-bolts with lock nuts or cotter pins.
- An umbilical roller sheave must be used exclusively for the purpose for which it was delivered, i.e. it is not permitted to use it for suspending wires.
- The umbilical must be installed on deck and the support rollers reinstalled and secured.
- A user manual and maintenance instructions for the equipment must be available The instructions must cover installation, inspection and maintenance. Instruction must also include securing devices.
- Sheaves and suspension devices should preferably be marked with coloured tie wraps using the designated colour code of the year.

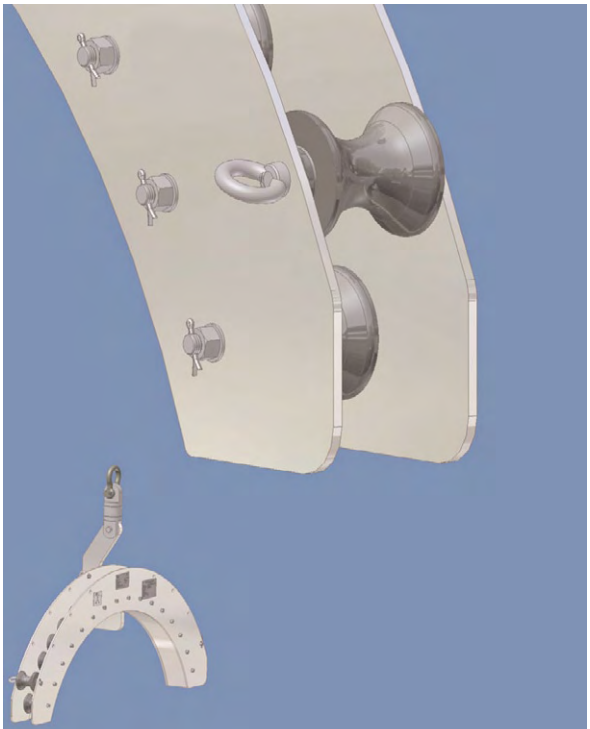


Figure 52: Umbilical roller sheaves

Loop hoses
Faulty installation or inadequate maintenance of loop hoses, and especially high-pressure hoses, is a potential safety risk.

Best practice
- The equipment manufacturer's instructions for installation and technical description must be followed.
- Clamps must be attached and securely fastened where the hose is marked with; 'Attach safety clamp here'.
- Safety chains must be as short as possible and installed as close to the vertical as possible, to prevent fall energy and pendulum effect.
- Securing devices for hoses must be designed to support the maximum loads generated by a burst hose. The design basis must be documented.
- The required resistance to wear and tear, chemicals, heat and UV radiation must also be documented
- The securing system for hoses must be certified and traceable.
- The securing devices must be checked and marked in accordance with the norm for lifting appliances.
- In addition to correct instructions for installation, the user manual/maintenance instructions should contain guidelines for necessary maintenance and inspection of the hose securing system.

Figure 53: Example loop hose

Load carrier Units (LcU)

Several serious incidents related to the use and dispatch of load carriers have been revealed.

Best practice

- Chain slings must have the necessary certification, be intact and without twists. Shackles must be equipped with nuts and cotter pins (i.e. four part).
- LCUs must have the necessary identification and certified lifting lugs.
- Lifting lugs, doors, hinges and locks must not be deformed or damaged.
- Permitted loads in containers and baskets must be well distributed and adequately secured by stamping, use of lashing and nets (baskets). Lashing must not come in contact with sharp edges. Padding should be used where appropriate. Heavy objects must be placed at the bottom.
- On LCUs with attached equipment such as pumps, tanks, winches, etc., check and ensure that no equipment protrudes from the frame.
- Tanks must have secured and sealed manholes/valves. All attached equipment (grids, covers, plates, etc.) must be adequately secured. The permitted load must not be exceeded.
  - It must be ensured that there are no loose objects in the forklift pockets or on top of the LCUs or in loads.
  - Check of equipment must be documented by a signature before transport to or from a location.

Figure 54: Forklift pockets and roof

Figure 55: Forklift pockets, frame, tank and tank top

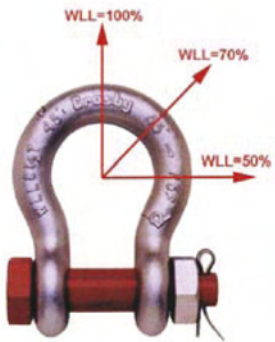
Figure 56: Forklift pockets, frame and tank top

Correct use of shackles

Best practice

- Shackles must be certified, and approved, i.e. be marked with the designated colour code of the year (preferably by using coloured tie wraps).
- Shackles must be equipped with two barriers: nut and cotter pin.
- Shackles must only be used for their intended purpose and manner.
- The user must be familiar with the applicable limitations and guidelines for use.
- Shackles are designed to support the load at the bottom of the hollow torus and evenly across the shackle bolt.
- If shackles are exposed to loads in other places, this must be taken into account during use as it will reduce capacity.
- Point loads on the shackle bolt should be kept to a minimum as it will reduce capacity.
- On shackles with a capacity of more than 8.5 t, or have large openings, the reduction factor shown at the bottom of the figure may be used to prevent deformation of the shackle bolt.

Load direction on a shackle



Load on shackle bolt:
WLL x factor = Lifting capacity

Illustration for shackles > WLL 8.5 t. on small shackles, the load must be distributed across the whole bolt. example: if a load of WLL 10.5 t is distributed across only 40 per cent of the shackle bolt's length, WLL is reduced to 10.5 x 0.8 = 8.4 t.

Figure 57: Safe use of shackles - limitations

Correct use of eye bolts/eye nuts

Best practice

- Eye bolts/eye nuts must be certified, and approved, i.e. be marked with the designated colour code of the year (preferably by using coloured tie wraps).
- Eye bolts/nuts must only be used for their intended purpose and manner.
- The user must be familiar with the applicable limitations and guidelines for use.
- Eye bolts/nuts for use on and offshore shall be at least grade 80.
- Grade 80 eye bolts/nuts are labelled with the permitted load in the least advantageous direction, i.e. 90 degrees on the fastening bolt.
- Eye bolts/nuts must be adequately tightened prior to use.
- Manufacturer installed eye bolts/nuts are normally appropriate for use during installation/removal of the units they are installed on, e.g. gear boxes, pumps, motors and valves.
- Eye bolts/nuts must be removed after use, and the threads in the equipment on which they have been used must be preserved by for example; grease and a plastic plug.

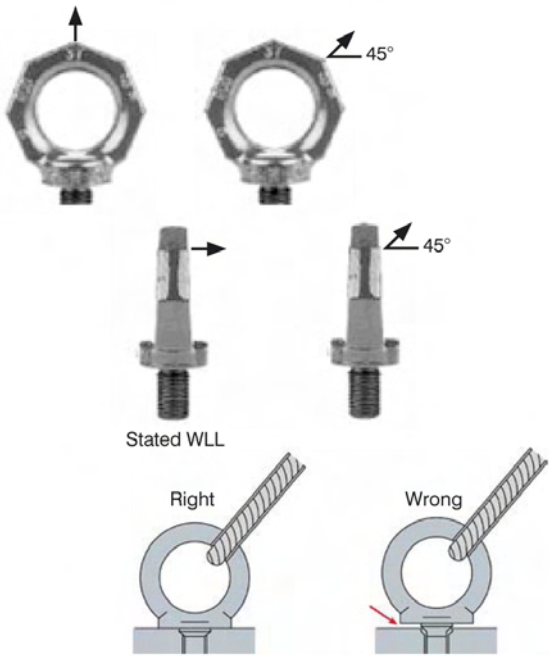


Figure 58: Figure showing correctly and incorrectly installed eye bolts. Note: only grade 80 (or better) eye bolts shall be used offshore.

Racks and storage

The design of racks for storage of material and equipment is often not appropriate to ensure safe storage.

Best practice

- Ensure that temporary storage in modules is permitted in a controlled manner with respect to type of goods, duration, storage area and house keeping.
- Storage must not obstruct accessibility or evacuation of the module.
- Ensure that the stored materials do not obstruct access to emergency equipment.
- Storage racks and storage areas must be designed to ensure that equipment cannot accidentally drop to lower levels.
- The heaviest equipment should be stored lowest.
- On mobile units, temporary storage space/racks must be fastened and shelves shall be equipped with baffle plates.
- Storage racks should be appropriately secured to avoid toppling/collapse e.g. due to top heavy loading.

Figure 59: Example temporary storage rack

Temporary/permanent storage of gas cylinders
Gas cylinders temporarily stored are often poorly secured with rope or cargo straps.

Best practice
- Storing of gas cylinders must not obstruct passage.
- Gas cylinders must be stored and secured safely.
- Storing of gas cylinders must be risk assessed.
- Temporarily stored gas cylinders must be secured with a chain.
- Permanent storage racks must be equipped with securing brackets/chains.

Figure 60: Storage rack with bolted cylinder brackets

Figure 61: Temporary storage of cylinders secured with chain

Unnecessary equipment at height

Obsolete equipment is often found at height. This equipment is often excluded from established inspection and maintenance procedures, and introduces a considerable risk potential.

Best practice

- It is required on regular basis to evaluate what equipment is required or should be removed.
- The assessment should establish whether equipment should be relocated to reduce the risk of collision with mobile equipment.
- Inspection and maintenance procedures should be revised regularly, to ensure inspection and maintenance of all equipment installed at height.
- Final checks must be carried out consistently to ensure that no equipment materials are forgotten at height.

For more examples visit the Shell DROPS website:

http://sww.shell.com/ep/technology/wells_function/hsse/DROPS.html

Figure 62: Examples of unnecessary equipment found at height

Securing of parts, equipment and material during work at height

The potential for dropped objects during repair and installation work at height is severe and is reflected in a significant proportion of reported incidents.

Best practice

- All repair and maintenance work at height must be risk assessed.
- All parts, equipment and material used at height must be secured against drop.
- Small parts must be stored in suitable storage containers or similar.
- In limited areas, for example the derrick, flare boom and cranes, tools used at height must be logged out and in to ensure that nothing is left behind.
- When the work is complete, a final check must be carried out, to ensure that no material or equipment have been left at height.

See also page 50 for more information on tools at height and page 20 for temporary equipment register.

Post inspection/final check of the work site

Always keep your work site tidy.

Best practice

- Tools, equipment and material must be secured in a safe location, at the end of each shift.
- When the work is finished, a final check and inventory count must be carried out to ensure that no tools, equipment or material are not left behind at height.
- The work site must be left in a tidy and clean state, and all tools, equipment and material must be returned to their designated storage place.

Observation technique

In order to identify potential Dropped Objects, it is important to be trained in observation techniques or similar. The training must include methods for reliable securing of equipment.

Best practice

- Allow ample time.
- Limit size of the area.
- Concentrate on a small number of categories and inspect in a structured way to maintain an overview
- Limit the number of personnel in each area, to keep an overview.
- Any findings not in conformity with the established standard or checklist are photographed, given an accurate description and site reference.
- Inspection, identification and categorisation of findings are the first steps in minimising the potential for dropped objects.
- Follow-up and correction of findings are decisive factors in preventing dropped objects.

Additional reference: www.dropsworkpack.com

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