

OFFSHORE CRANE OPERATOR COURSE



Course Aim

- To provide the delegate with necessary knowledge and skills to operate an offshore crane in safe manner, in line with LOLER/PUWER/API guidelines and industry best practices.
- To enhance awareness of risks associated with lifting and hoisting operation, roles and responsibilities and local governance regulation.

Roles & Responsibilities

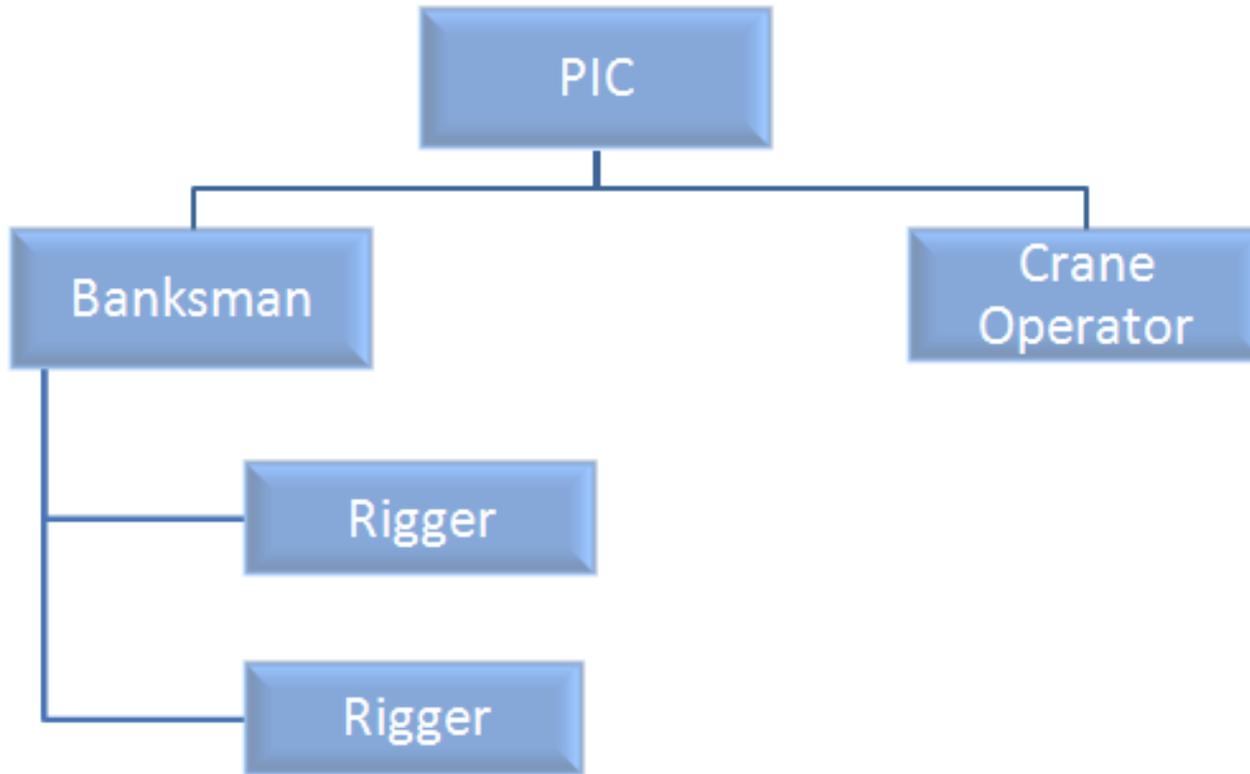
Crane Operator Shall:-

- Carry out first line inspection and maintenance of the crane.
- Ensure the crane pre-use inspection is carried out prior to commencing a lifting operation.
- Report any fault or damage that may affect the safe operation of the crane.
- Ensure a crane operation is carried out within the approved lift plan.
- Ensure that the load is directly under the hook.
- Be conversant of the crane load rating chart, crane Safe Load Indicator (SLI) selection and understand the limitation of crane.
- Maintain and update the crane log book.
- Be familiar with and understand the specific crane control functions through crane familiarization and crane operation manual.

Roles & Responsibilities – cont.

- Ensure safe and smooth crane operation throughout the lifting operation.
- Never leave the crane control cabin while the load is still suspended.
- Never allow any override in the crane safety system and unauthorised meddling of crane SLI device throughout the lifting operation.
- Ensure agreed communication method is established with Banksman.
- Ensure multiple part lines are not twisted around each other throughout the lifting operation.
- Maintain good housekeeping in the crane engine room and operating control cabin at all time.
- Suspend the lifting operation immediately when situation arises where safety of the personnel, equipment or plant may be jeopardized, poor visibility and/or inclement weather.

Reporting Structure



Crane Types



**Lattice Boom
King Post Crane**



**Lattice Boom
Fixed "A" Frame Mast
Crane**

Crane Types



Knuckle Boom Crane



**Hydraulic Folding
Boom Crane**



**Hydraulic Telescopic
Boom Crane**

Crane Types



Boxed Boom Crane



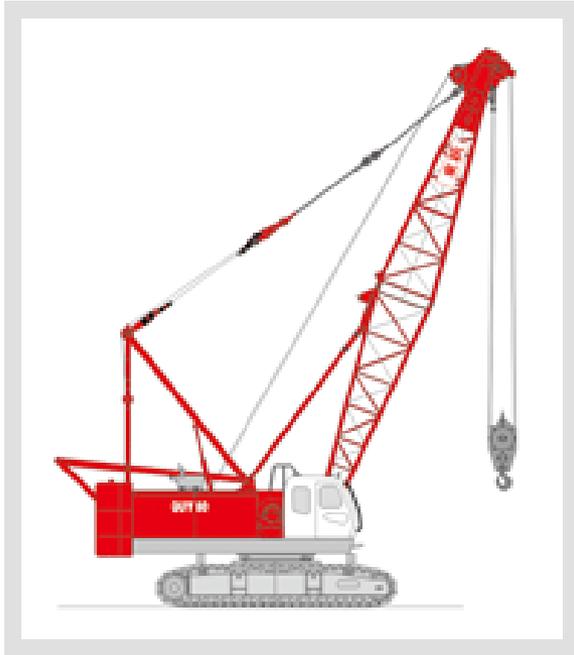
Counterweight Live Mast Crane

Crane Stability

Stability of a mounted crane depends solely on the strength of the connection between the crane and the platform. This may be the swing joint (slew ring) or the crane itself.

Therefore the load that a crane can lift is usually based upon the structural strength of the crane and its components.

Crawler Crane



Crawler Crane

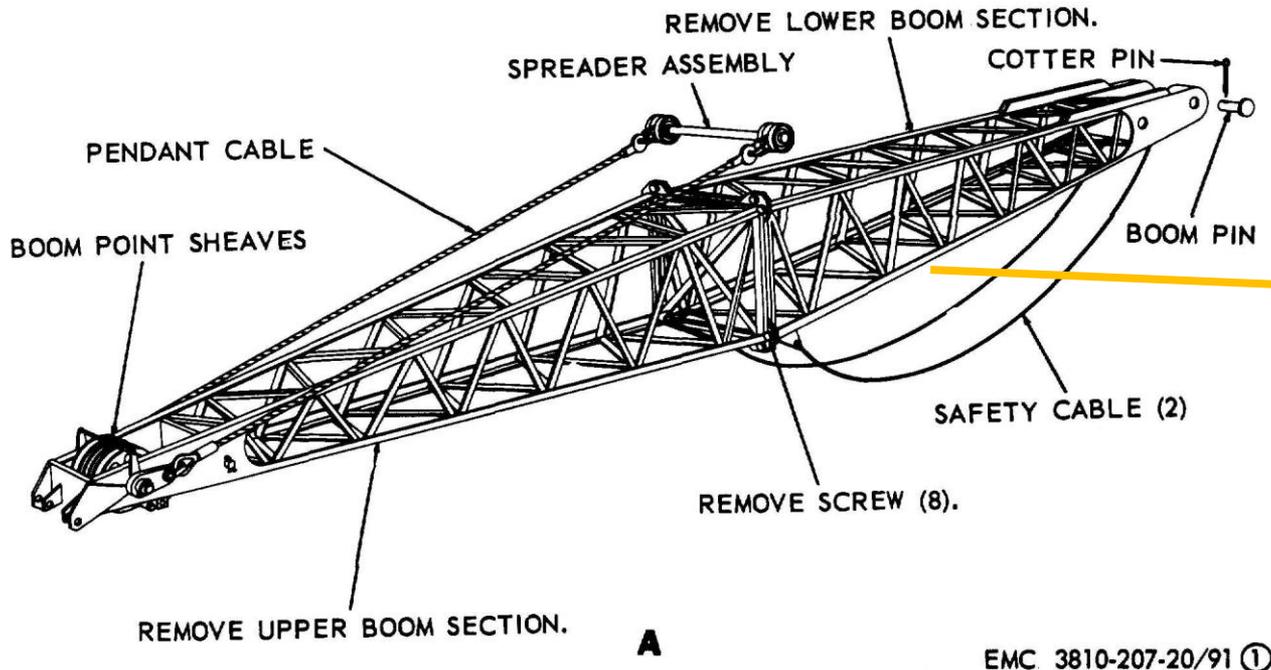


Hydraulic Crawler Crane



Telescopic crawler crane

Boom Structure



Lattice Boom

Consists of a steel web-like framework that is capable of lifting and supporting heavy load.

Boom Structure



Box Boom

Enclosed and rigid boom structure control through hydraulic ram.

'A' - Frame Mast Assembly

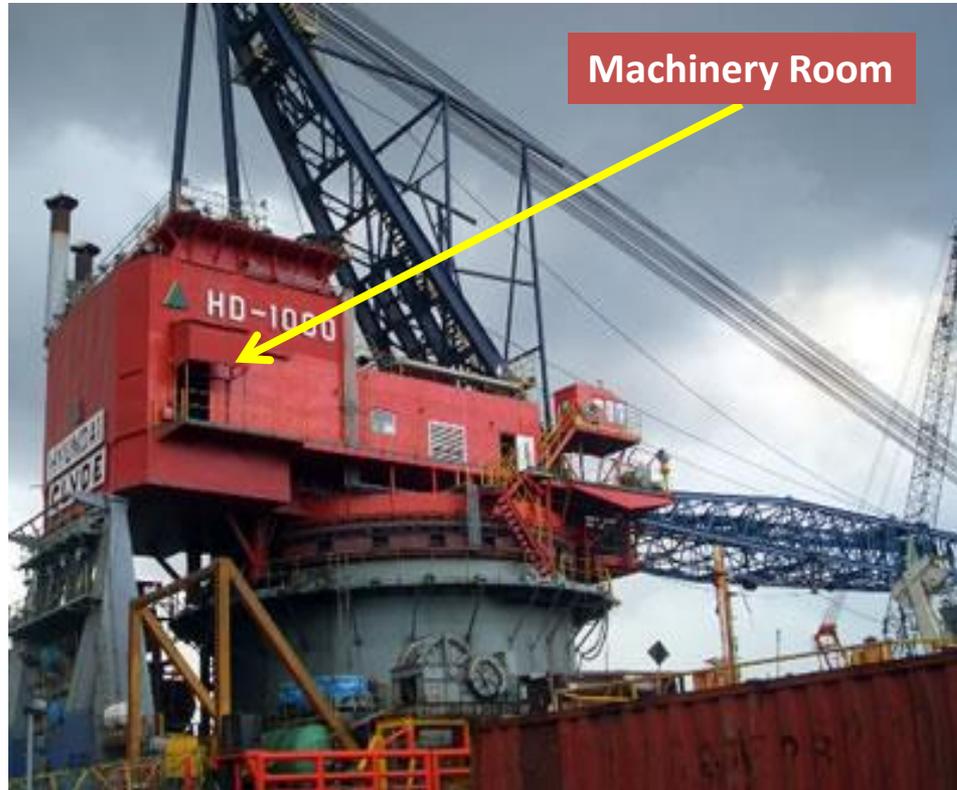
A Frame Mast



Bridle Sheaves
Assembly

"A" Frame Mast consist of sheaves assembly that provide multi part reeving ability to boom bridle sheaves for luffing control .

Machinery Room



Machinery room consists of all machineries such as winches, brakes, gears, motors, hoist and derrick drums and power pack etc.

Control Lever

There are 3 basic types of offshore crane control lever as per API Spec 2C.

- Basic Single Axis (4 – Lever) Control Arrangement
- Basic Dual Axis (2 – Lever) – (Option 1)
- Basic Dual Axis (2 – Lever) – (Option 2)



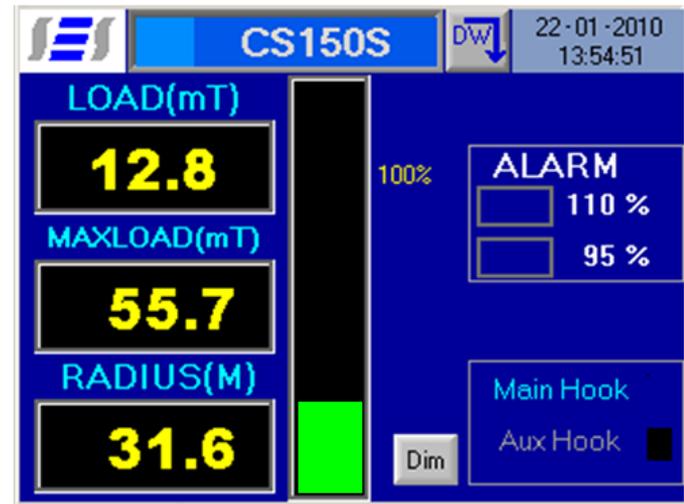
Control Lever

All primary motions (hoist, luff, swing) must automatically stop when controls are set free. Swing motions are exempt from this requirement when "free swing" is specified. This is the default provision for most suppliers. The intention is for the boom to freely move from side to side as the supply boat drifts, preventing potentially damaging side-load to the boom. This can cause a problem (of booms drifting to the side) on ships that tilt or on non-level platforms.



Safe Load Indicator

UK's Lifting Operations & Lifting Equipment Regulations (LOLER) 1998 regulation 4 clearly states: 'Where there is a significant risk of overturning and/or overloading arising from the use of the equipment, it should be provided where appropriate with equipment or devices such as safe load indicators (SLI) and rated capacity limiters. Such devices provide audible and/or visual warning when the safe lifting limits are being approached.'



Safe Load Indicator (SLI) is also known as Rated Capacity Indicator (RCI)

Safe Load Indicator



Robway RCI 4000IS

Visual Warning Lights

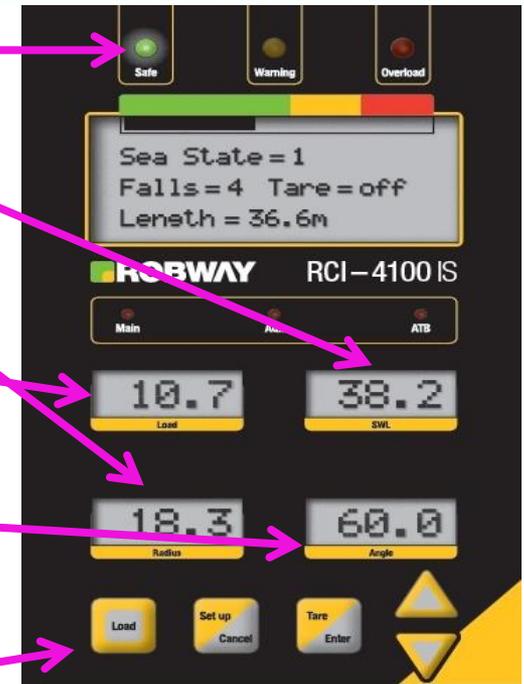
Maximum SWL

Actual Radius

Actual Load

Actual Angle

Winch Select



Robway RCI 4100IS

Most of platform pedestal cranes are fitted with Robway RCI system as shown above

Safe Load Indicator

Other than the most commonly use Robway 4000Is & 4100IS SLI, there are also few other type of SLI being installed in some SMEP offshore location as shown below:-

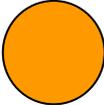
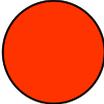


Mipeg 2000



LSI GS550 Wireless

Safe Load Indicator

-  **AMBER** if **reached** 95% of crane SWL.
-  **RED** if reached 100% of crane SWL.

The red light should be accompanied by an audible signal, generally a buzzer, bell or horn.



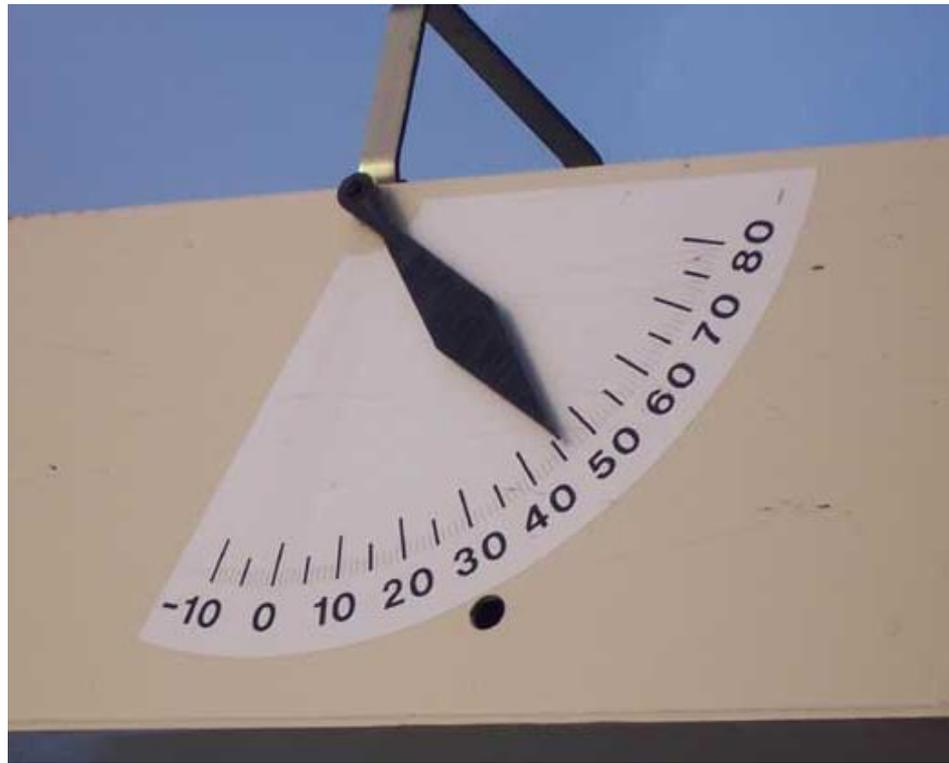
Safe Load Indicator

It is the Crane Operator's responsibility to familiar with type of Safe Load Indicator fitted to his machine.

A Crane Operator must also required to know how to select the particular duties chart, sea state and hoist for the required crane operating configuration.

It is the Crane Operator's responsibility to avoid meddling with Safe Load Indication device or switch to override mode during lifting operation.

Angle Indicator



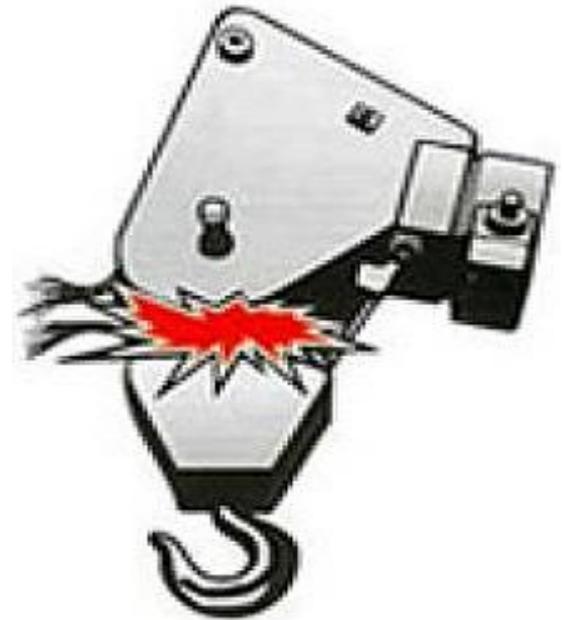
The mechanical angle indicator usually fitted at the boom to allow Crane Operator to view the boom angle as the back up device in case SLI accuracy is in doubt.

Anti-Two-Block Device

Anti two block device is a mandatory safety device to prevent the crane hook block and sheave block come into contact accidentally.

If a crane in two blocking without notice, hoist rope will continue to pull the hook block upward and crush onto the sheaves block, resulted huge damaged to the crane.

Likewise, the hoist rope will be damaged or parted through the excessive force exerted.



Anti-Two-Block Device

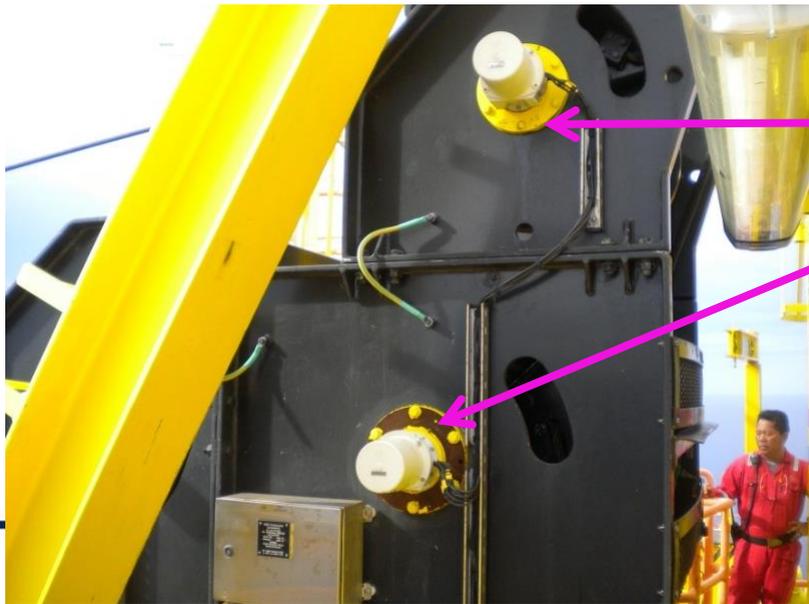
It is the Crane Operator responsibility and duties to carry out the anti-two-block function test each day during pre-use inspection to ensure it is working properly.



Anti-Two-Block Device

Some crane equipped with rotary gear cam type limit switch, and the physical anti-two-block (ATB) bob weight is not required. That is because the rotary limit switch take measure from number of hoist drum rotation instead of mechanical contact.

If the rotary limit switch activated, a electrical signal will be sent to cut off the hoist up motion.



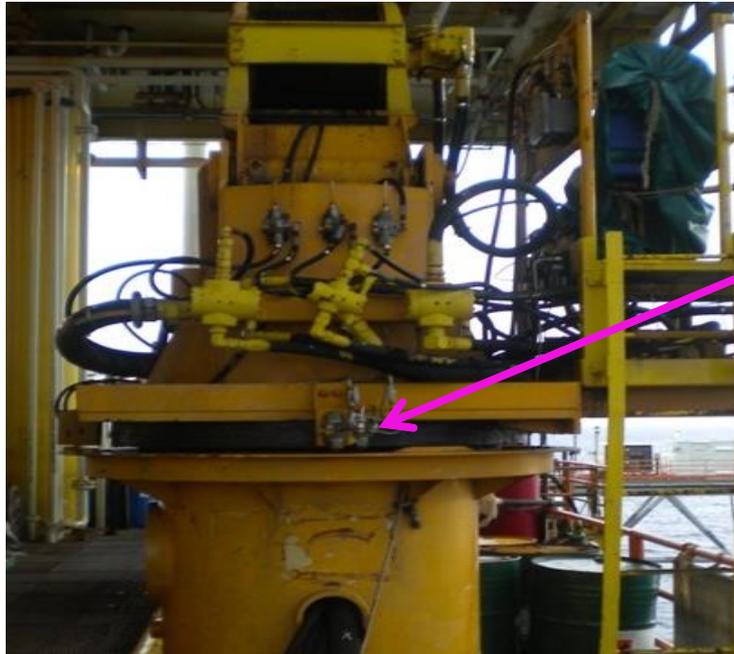
Geared Cam
Rotary Limit
Switch



Limit Switch

Slew limit Switch

Slew limit switch is fitted to limit the crane slew due to proximity obstruction or over a sensitive area.



Slew Limit Switch

Limit Switch

Boom Up Stopper

A boom up stopper act as a limiting device to prevent Crane Operator from over boom the crane. The boom stopper is either configured in mechanical valve or in electrical limit switch will stop the boom up motion upon activated.

It is the Crane Operator responsible not to overly boom up the crane exceeded it limit.



Gross Overload Protection

A gross overload protection device is a system fitted to an offshore crane intended to protect the crane from damage in situation where hook is entangled with supply boat, which subject the crane to an unbounded gross overload outside the limit of any operational design condition.

The gross overload protection system can be either automatic or manual activated, and must be operational in all reeving configurations and operational hook radius.



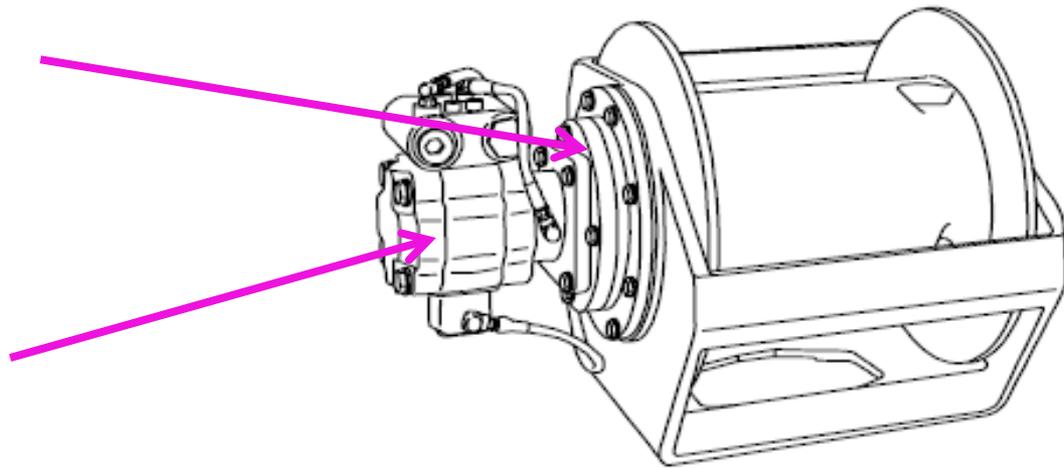
Manual Gross Overload Protection Device

Winch Brakes

A non-personnel lift enable hoist winch normally fitted with hydraulic static friction disc brake system. The static friction disc brake must be able to hold the drum from rotation when the control lever is in neutral position or power shut down.

**Static Friction
Disc brake**

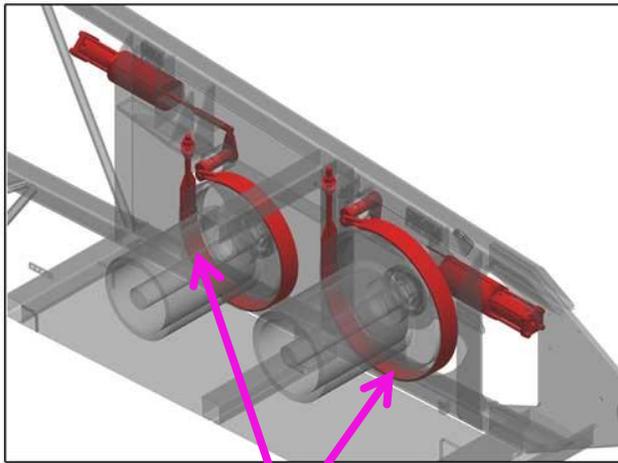
**Hydraulic
Motor**



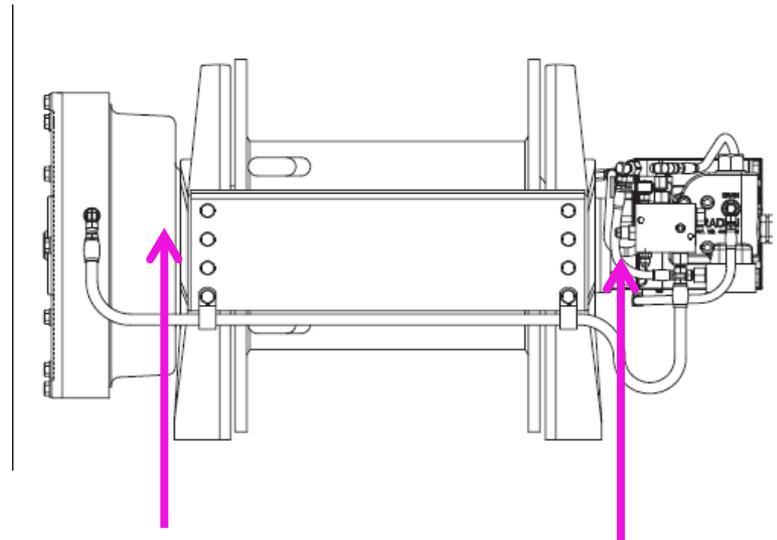
Braden PD Series Hydraulic Winch

Winch Brakes

A personnel lift enable hoist winch must be fitted with dual braking system - static friction disc brake and auxiliary brake or band brake for the safe operation of personnel transfer.



Secondary Band Brake



**Auxiliary
Brake**

**Static Frictional
Disc Brake**

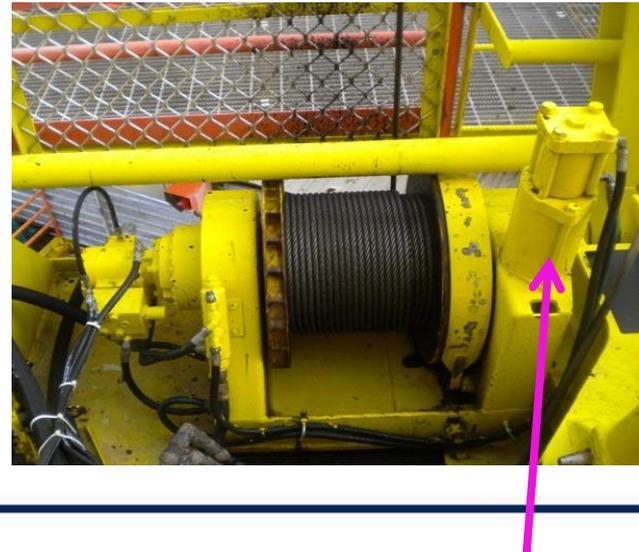
Boom Holding Device

It is the requirement in API Spec 2C, a secondary holding mechanism shall be provided for boom support regardless of the type of drive.

Boom (luff) winches have a secondary dog (ratchet & pawl) to catch should the brakes slip. Hydraulic rams have a secondary lock valve to catch if a hose should burst.



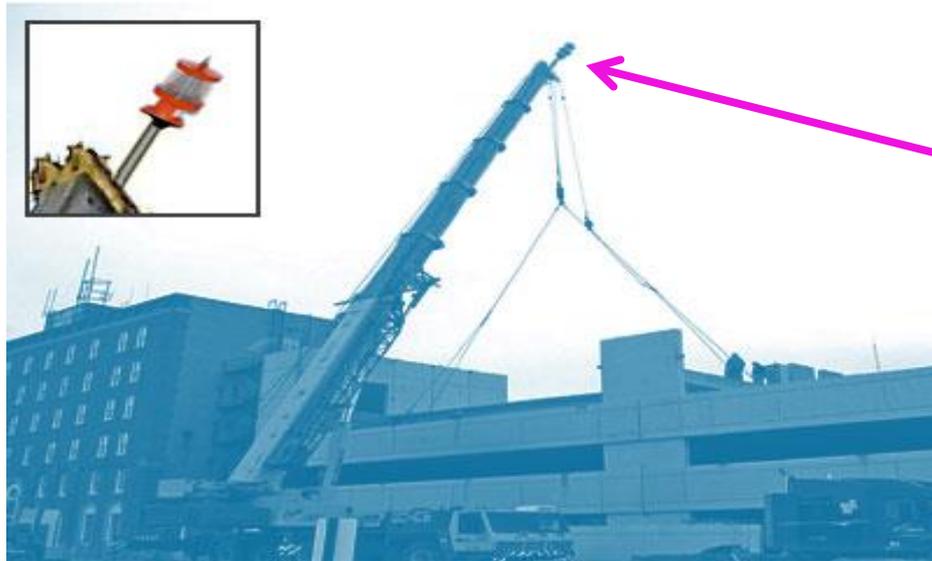
Ratchet & Pawl



Auxiliary Brake

Aviation Light

Aviation warning lights are lights that are placed on any tall structure – normally at boom tip. Their purpose is to prevent collisions between aircraft and structures during the night.



Aviation Light



Emergency Load Lowering

Emergency load lowering is the safety device that allow load to be lowering safely in the event of crane power lost and the load is left suspended.

The emergency load lowering device is either a hydraulic bleed-off needle valve, or manual hydraulic pump.

Emergency load lowering device is mandatory for personnel lift hoist. Crane Operator must be trained to know how to operate the device.

Emergency Stop Push Button

An emergency stop push button shall be fitted in the crane cabin and power pack for emergency crane shut down.

It is the Crane Operator responsible to check the emergency stop push button during the daily pre-use inspection.



Emergency Stop Push Button

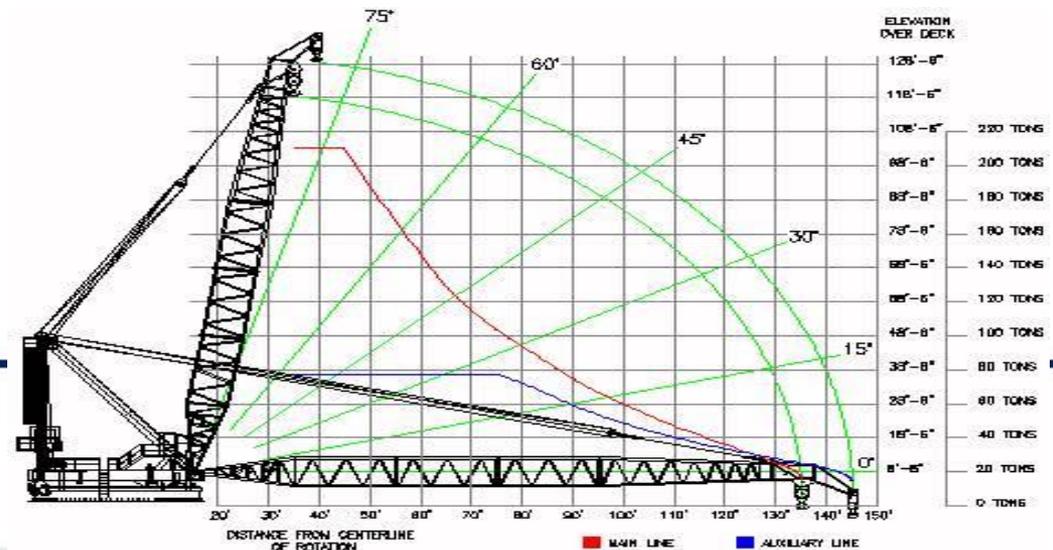


Load Charts

Crane load chart contained critical information of the crane lifting capacity at various boom length configuration and working radius. There are some differences in between the onshore and offshore crane load charts.

For onshore crane, load charts are based on **75%** of the crane tipping load.

For offshore crane, load charts are based on **75%** of the structural strength for static load rating, and **50%** for dynamic load rating.



Load Charts

Offshore Crane Load Chart

A **static** load rating is also known as **on-board** load rating. An on-board load rating restricted to only deck-to-deck lift on the fixed/floating platforms or vessels, the deck-to-deck lifts will have relatively low dynamic amplification on the crane structural load bearing components.

An **dynamic** load rating is also known as **off-board** load rating. As the name imply, an off-board load rating covered any out board lifts of the fixed/floating platforms or vessels such as to and fro platform and supply vessel, and vessel to vessel. the off-board lifts will have relatively high dynamic amplification on the crane structural load bearing components.

Load Charts

**Main Hoist
On-Board
Rating**

7.5/10K LOAD CHART S/N : 1571
TAG NO.: B-7300
27.4m BOOM – MAIN HOIST 2 FALLS /
AUX. HOIST 1 FALL

BOOM ANGLE (DEGREES)	RADIUS (METRES)	MAIN HOIST SWL (IN TONNES)		
		ONBOARD DF=1.33	OFFBOARD DF=2.0	OFFBOARD SWH=3.5m
83.2	5.4	20.0	20.0	15.0
81.9	6.0	20.0	20.0	15.0
77.6	8.0	20.0	20.0	15.0
73.3	10.0	20.0	20.0	15.0
68.9	12.0	20.0	20.0	15.0
64.3	14.0	20.0	20.0	15.0
62.0	15.0	20.0	20.0	15.0
57.1	17.0	20.0	20.0	13.8
52.0	19.0	20.0	17.0	12.1
46.4	21.0	20.0	15.0	10.7
40.3	23.0	20.0	13.9	9.7
33.3	25.0	20.0	12.7	9.0
24.4	27.0	20.0	11.2	8.0

AUX. HOIST 5.0T @ ALL RADII (MIN 6.6m TO MAX. 29.2m RADIUS)
AUX. HOIST : PERSONNEL LIFT 1.5T @ ALL RADII

**Main Hoist
Off-Board Rating**

**Example of
Offshore Crane
Load Chart**

**Auxiliary Hoist
Rating**

**Personnel Lift
Rating**

Load Charts

DF = 1.33 known as dynamic factor of 1.33 have been considered in the load chart, In other words, the crane SWL is at 75% of the structural strength.

Example of Offshore Crane Load Chart

7.5/10K LOAD CHART S/N : 1571
TAG NO.: B-7300
27.4m BOOM – MAIN HOIST 2 FALLS / AUX. HOIST 1 FALL

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73.3	10.0	20.0	20.0	15.0
68.9	12.0	20.0	20.0	15.0
64.3	14.0	20.0	20.0	15.0
62.0	15.0	20.0	20.0	15.0
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33.3	25.0	20.0	12.7	9.0
24.4	27.0	20.0	11.2	8.0

AUX. HOIST 5.0T @ ALL RADII (MIN 6.6m TO MAX. 29.2m RADIUS)
AUX. HOIST : PERSONNEL LIFT 1.5T @ ALL RADII

DF = 2.0 known as dynamic factor of 2.0 have been considered in the load chart, In other words, the crane SWL is at 50% of the structural strength. Normally the maximum allowable sea wave height for DF=2.0 shall not exceed 2.5m.

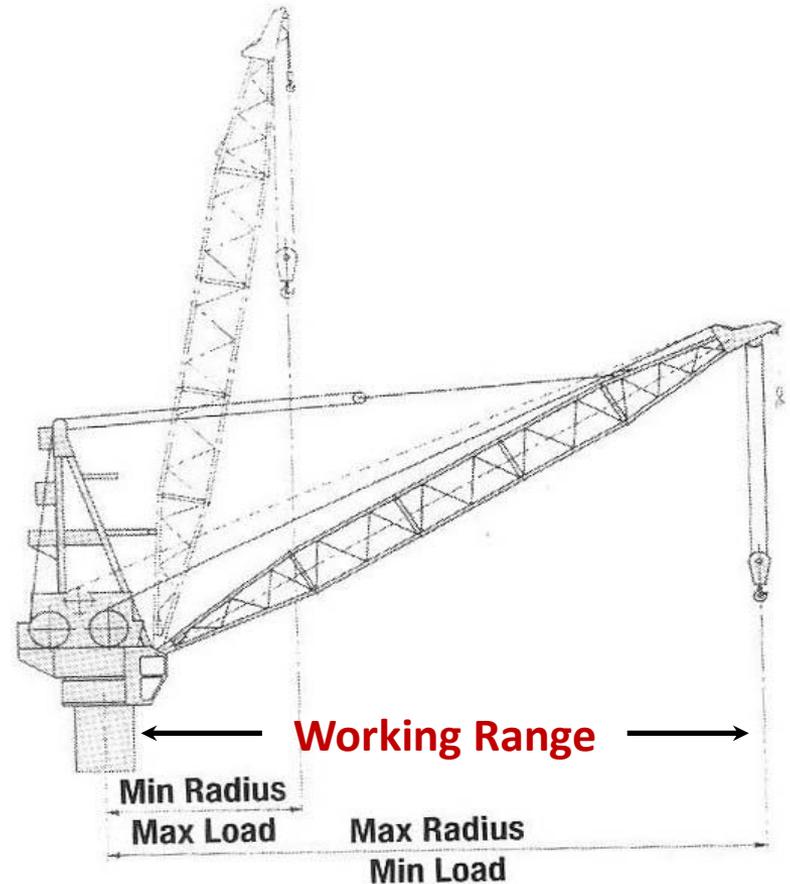
In some cases, dynamic factor (DF) is substitute by sea significant wave height (SWH) in order to limit the maximum allowable wave height condition.

Crane Operating Radius

A boom crane will have a **minimum** radius, and a **maximum** radius.

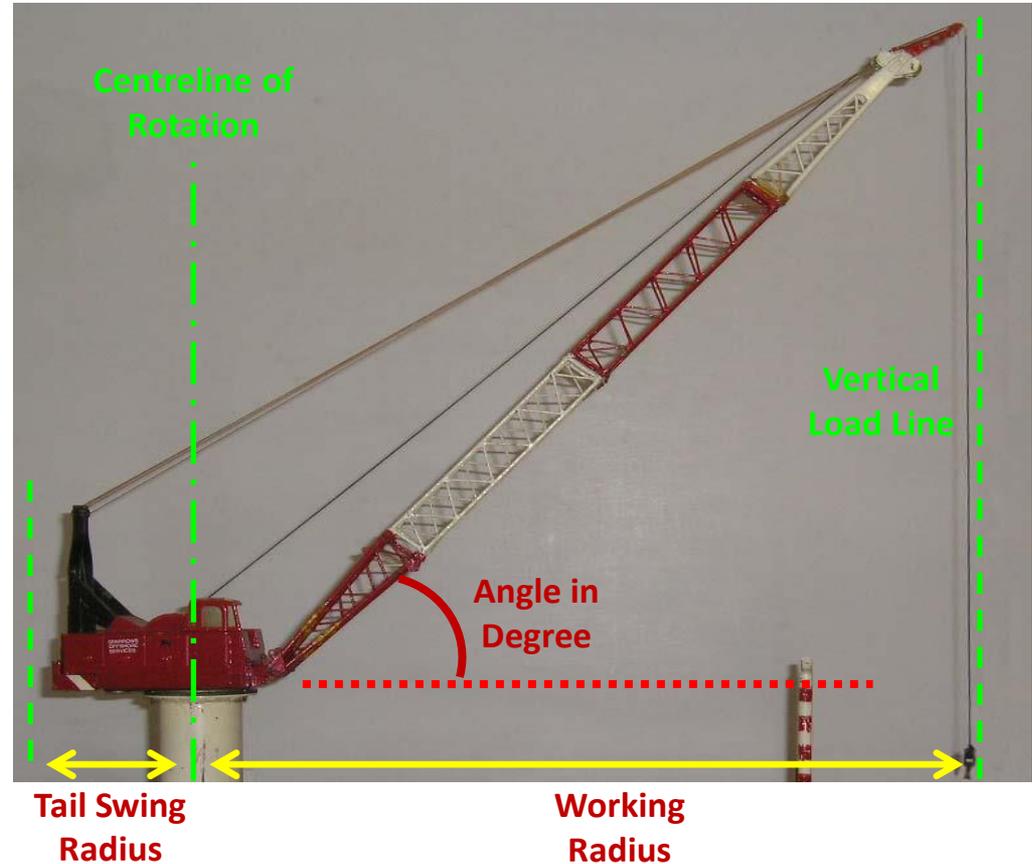
The minimum and maximum crane operating radius varies from crane to crane depend upon the boom length configuration.

Working range of crane is from minimum to maximum radius.



Crane Boom Angle

Crane boom angle is the angle of the boom from horizontal, this information provide additional cross reference to with regard to crane load chart.



Crane Parts Line

Crane parts line refer to the number of wire rope line or falls that reeve over a hook block. For normal duty offshore crane, an auxiliary hook block usually come with single part line as to achieved the required hoist speed for light load.

A main block usually come with multi parts in order to achieve the required lifting capacity for heavier load. Hoist speed will be much slower as the number of parts line increase.



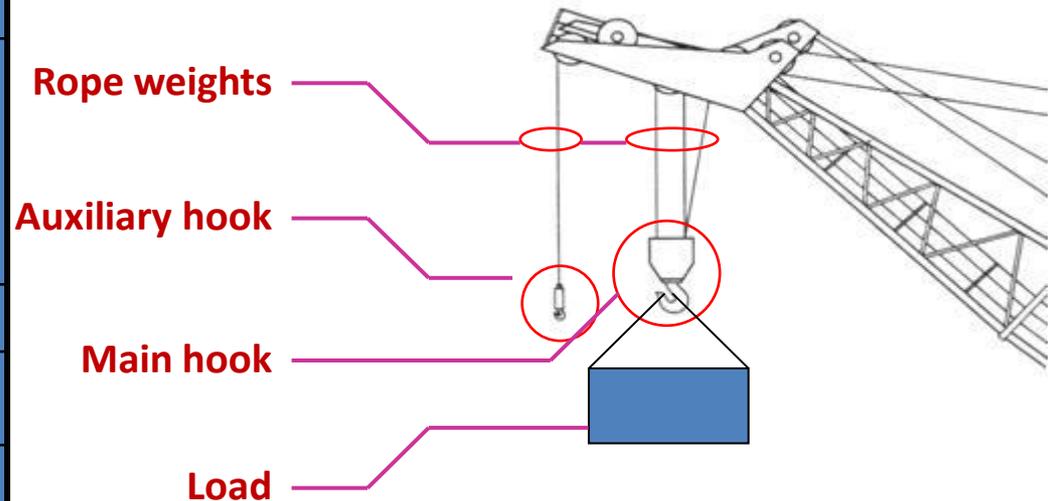
Crane Capacity & Utilization

Example 1:

To stay within 80% of the crane capacity utilization, what is the maximum allowable crane working radius to lift a 10 Te load from offshore supply boat using a platform crane, sea wave height is approximately 3.2m, wind speed is within allowable limit.

Given that hook blocks and rigging weight is approximately 500 kg.

ITEM	WEIGHT
HOOK BLOCKS	500kg
ROPE WEIGHT	
RIGGING ACCESSORIES	
LOAD	10000kg
10% CONTINGENCY	1000kg
TOTAL WEIGHT	11500kg



Crane Capacity & Utilization

7.5/10K LOAD CHART S/N : 1571
TAG NO.: B-7300
27.4m BOOM – MAIN HOIST 2 FALLS /
AUX. HOIST 1 FALL

BOOM ANGLE (DEGREES)	MAIN HOIST SWL (IN TONNES)			
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33.3	25.0	20.0	12.7	9.0
24.4	27.0	20.0	11.2	8.0

AUX. HOIST 5.0T @ ALL RADII (MIN 6.6m TO MAX. 29.2m RADIUS)
AUX. HOIST : PERSONNEL LIFT 1.5T @ ALL RADII

Answer:

At 15 Meters working radius the crane capacity utilization is approximately 77%

ITEM	WEIGHT
HOOK BLOCKS	500kg
ROPE WEIGHT	
RIGGING ACCESSORIES	
LOAD	10000kg
10% CONTINGENCY	1000kg
TOTAL WEIGHT	11500kg

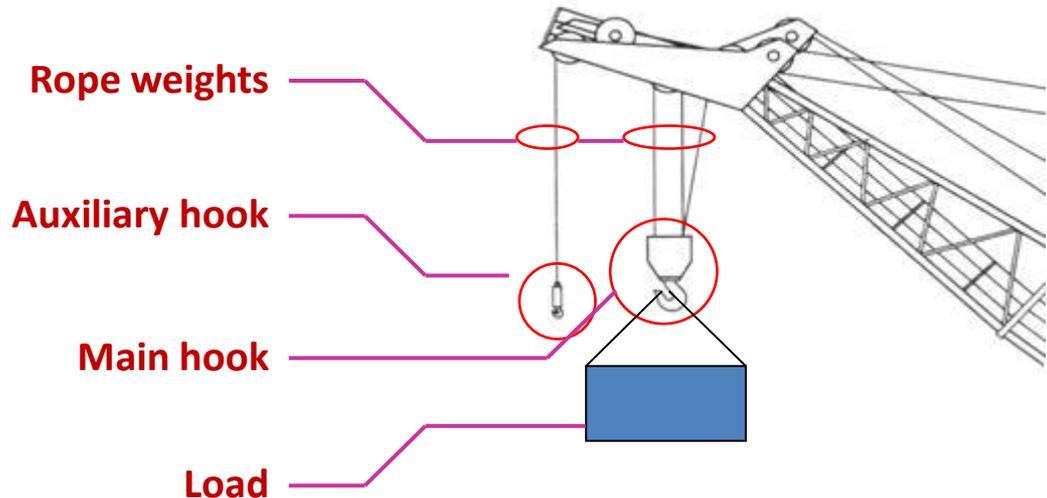
Crane Capacity & Utilization

Example 2:

Given the same load chart, in order to stay within 80% of the crane capacity utilization, what is the maximum allowable crane working radius to remove a 10 Te load from the platform and place it on the platform lay down area, consider wind speed is within allowable limit.

Given that hook blocks and rigging weight is approximately 500 kg.

ITEM	WEIGHT
HOOK BLOCKS	500kg
ROPE WEIGHT	
RIGGING ACCESSORIES	
LOAD	10000kg
10% CONTINGENCY	1000kg
TOTAL WEIGHT	11500kg



Crane Capacity & Utilization

7.5/10K LOAD CHART S/N : 1571
TAG NO.: B-7300
27.4m BOOM – MAIN HOIST 2 FALLS /
AUX. HOIST 1 FALL

BOOM ANGLE (DEGREES)	MAIN HOIST SWL (IN TONNES)			
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33.3	25.0	20.0	12.7	9.0
24.4	27.0	20.0	11.2	8.0

AUX. HOIST 5.0T @ ALL RADII (MIN 6.6m TO MAX. 29.2m RADIUS)
AUX. HOIST : PERSONNEL LIFT 1.5T @ ALL RADII

Answer:

At 27Meters working radius the crane capacity utilization is approximately 57%

ITEM	WEIGHT
HOOK BLOCKS	500kg
ROPE WEIGHT	
RIGGING ACCESSORIES	
LOAD	10000kg
10% CONTINGENCY	1000kg
TOTAL WEIGHT	11500kg

Capacity utilization = Total Weight ÷ SWL x 100%

Crane Pre-Use Inspection

The pre-use inspection shall be performed prior to the first crane use of the day, prior to or during each change in operator, and then as deems necessary during the day for extended operations.

Pre-use inspection performed by a crane operator may include but not be limited to the following area:-

- | | |
|---|--|
| <input type="checkbox"/> Machinery Room | <input type="checkbox"/> Crane Structural |
| <input type="checkbox"/> Hoist System & Wire Ropes | <input type="checkbox"/> Electrical Connection |
| <input type="checkbox"/> Slew Bearing & Bolts | <input type="checkbox"/> Functional Checks |
| <input type="checkbox"/> Hook Blocks | <input type="checkbox"/> Report of Anomalies |
| <input type="checkbox"/> Sheaves | |
| <input type="checkbox"/> Pendants & Bridle Assembly | |

Machinery Room Inspection

Items to be visual inspect of the crane machinery room should covered at least the following:-

- ✓ Check all fluid level of prime mover (hydraulic, diesel, engine oil and coolant).
- ✓ Check for hydraulic oil leakage and damaged hydraulic hoses and valves.
- ✓ Check for other leaked and damaged (pneumatic and non-mechanical system).
- ✓ Check for loose connections.

Hoist System & Wire Rope Inspection

Items to be visual inspect of the crane hoist system and wire rope should covered at least the following:-

- ✓ Check for any loose mounting bolts and connections.
- ✓ Check hoist system lubrication level through side glass or dipstick.
- ✓ Check for any hydraulic hoses damaged and leaked.
- ✓ Check wire rope spooling.
- ✓ Check wire rope for any kinked, break wires, cuts etc.
- ✓ Check for worn or damaged wire rope termination.
- ✓ Check wire rope lubrication.



Slew Bearing & Bolts Inspection

Items to be visual inspect of the slew bearing and slew bolts should covered at least the following:-

- ✓ Check for any loose or missing slew bolts.
- ✓ Check for worn gears.
- ✓ Check for slew bearing lubrication.



Hook Blocks Inspection

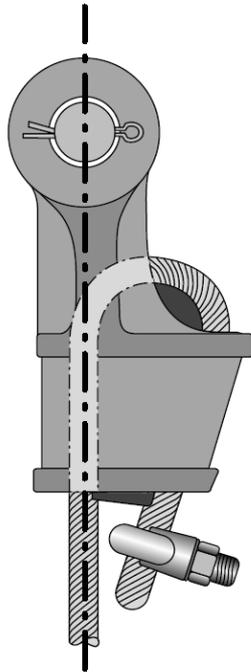
Items to be visual inspect of the hook blocks & terminations should covered at least the following:-

- ✓ Check for damaged hook latch, wedge & socket, sheave and swivel.
- ✓ Check for any loose bolts.
- ✓ Check for worn and damaged hook jaw.
- ✓ Check for hook block lubrication.

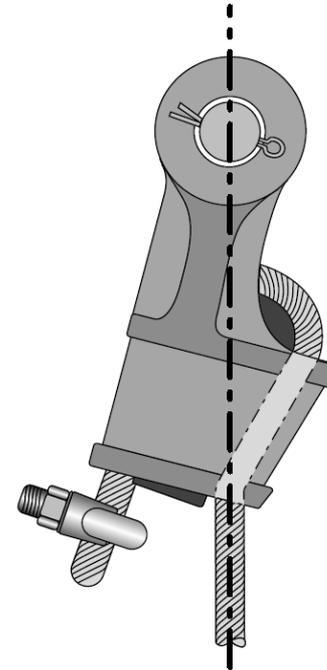


Termination Inspection

Ensure the socket and wedge termination is properly installed.



Correct Installation.

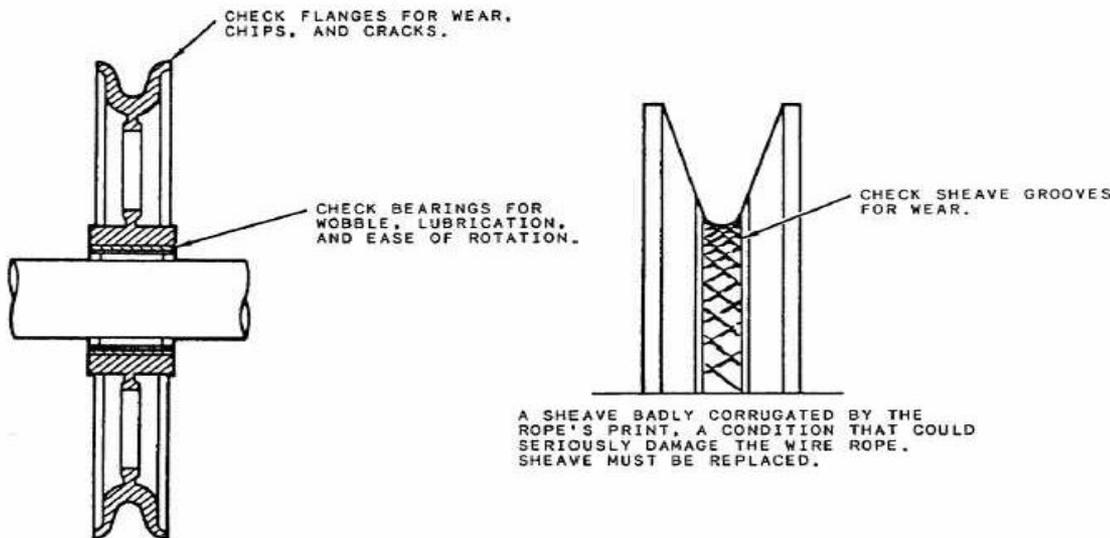


Incorrect Installation.

Sheaves Inspection

Items to be visual inspect of the sheaves should covered at least the following:-

- ✓ Check for loose sheaves and worn sheaves groove.
- ✓ Check for sheaves lubrication and bearing.



Pendant & Bridle Assembly Inspection

Items to be visual inspect of the pendant and bridle assembly should covered at least the following:-

- ✓ Check for pendant broken wires and damaged termination.
- ✓ Check for any worn bridle sheaves.



Broken Pendant



Bridle Sheave Assembly

Crane Structures Inspection

Items to be visual inspect of the crane structures should covered at least the following:-

- ✓ Check for damaged or rusty boom structure.
- ✓ Check for damaged or rusty crane structure.
- ✓ Check for any damaged cat walks, ladders, handrail, grating.
- ✓ Check for loose bolts.



Broken Boom Lacing

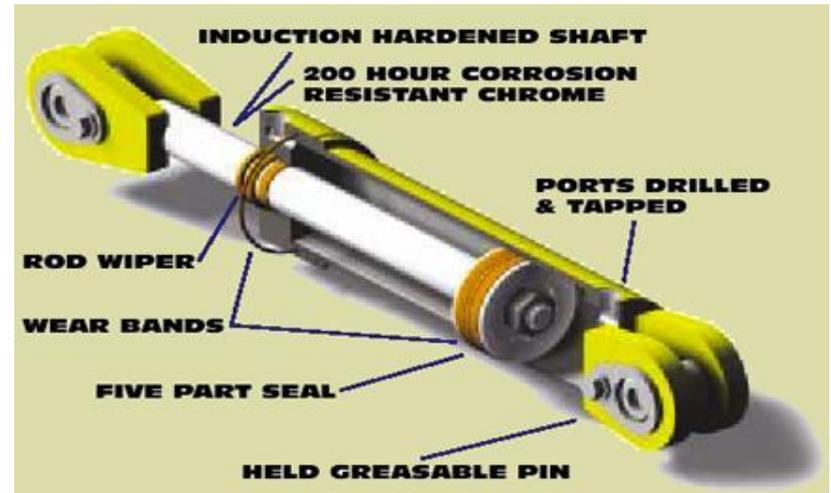


Damage Structure

Hydraulic Cylinder Inspection

Items to be visual inspect of the crane hydraulic cylinder should covered at least the following:-

- ✓ Check for damaged or leaked cylinder seal.
- ✓ Check for any corrosion on the cylinder rod.
- ✓ Check for any loose mounting.



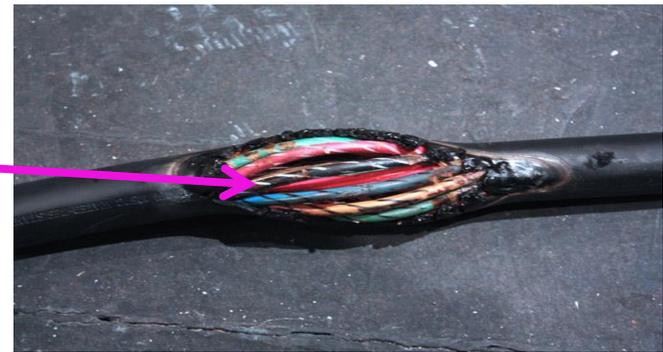
Electrical Connection Inspection

Items to be visual inspect of the crane electrical connection should covered at least the following:-

- ✓ Check for broken and damaged termination/connection.
- ✓ Check for any sign of burned cables
- ✓ Check for any wires exposure from the main cable.
- ✓ Check for any loose and unsecured cables.

If found burned cable, shut of the main supply and inform supervisor.

Beware of Electrocutation



Functional Checks

Upon completed of visual inspection, Crane Operator may start the crane and proceed for functional checks

- ✓ Check for any abnormal sound.
- ✓ Check for gauges, switches, emergency stop, horn operation.
- ✓ Check for anti-two-block and slew limit switches operation.
- ✓ Check for safe load indication setting and accuracy.
- ✓ Check lighting and other safety device, warning system operation.
- ✓ Check hoist brake for operation.



Report Anomalies

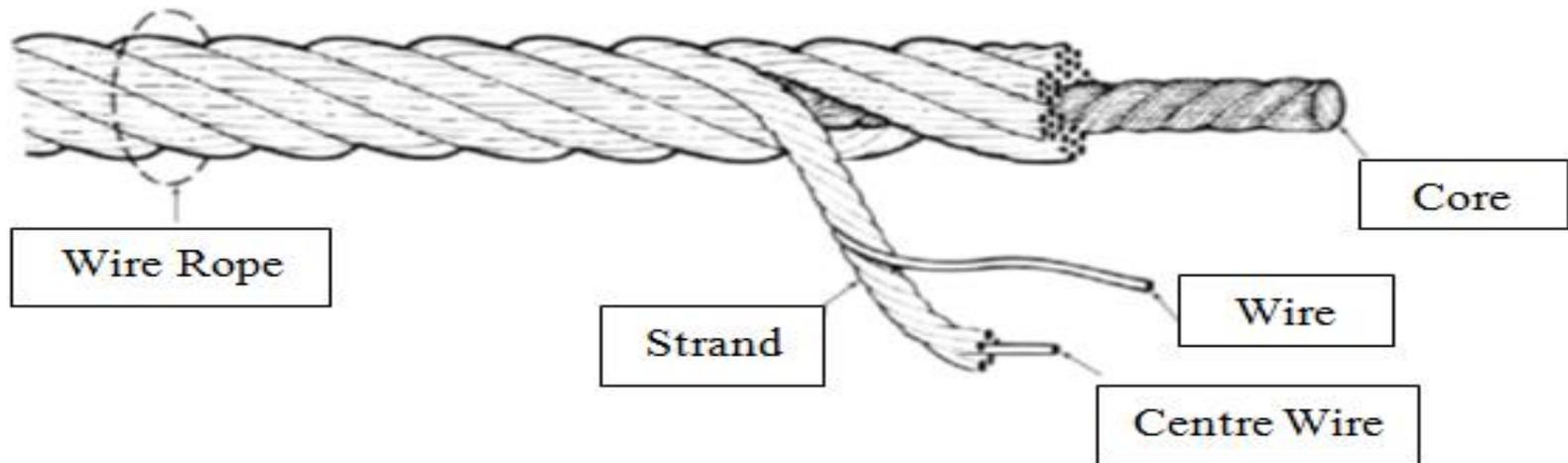
All anomalies found during pre-use inspection or during lifting operation must be reported to the supervisor and recorded in the crane log book.

It is the Crane Operator responsibility to maintain the crane log book and report any anomalies.



Wire Rope - Terminology

The number of wires in a strand and the number of strands in a rope are known as the 'construction' of the rope. There are variety of wire rope construction that give special characteristics such as flexibility, rotation resistant, crush resistant, etc.



Wire Rope - Terminology

Regular Lay

The wires in the strands are laid one way and the strands in the rope laid in the opposite direction. Regular lay rope is completely stable, easy to handle and have greater resistance to crushing than a Lang lay rope

Right Regular Lay RRL



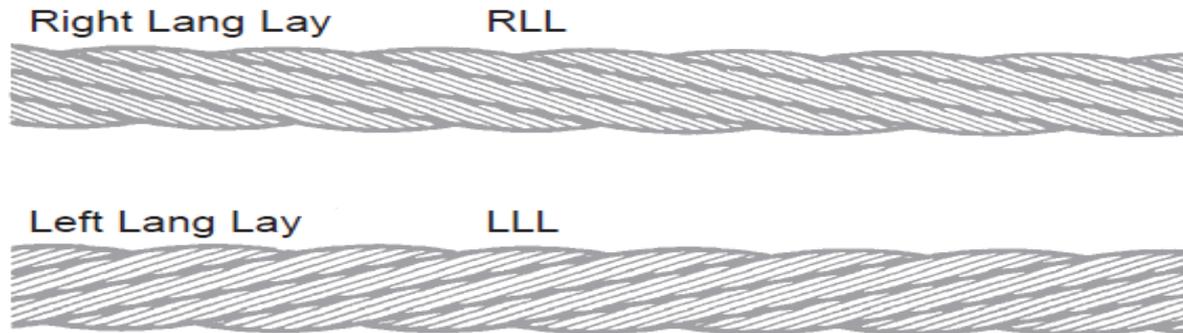
Left Regular Lay LRL



Wire Rope - Terminology

Lang's Lay

The wires in the strands and strands in the rope are laid in the same direction. Lang lay rope has better bending fatigue, wear resistance and more surface area of wire per lay length than Regular lay rope. It is less likely to exhibit crown and/or valley breaks due to fatigue or wear. However, it is much more rotational than Regular lay and sensitive to twist within a system.

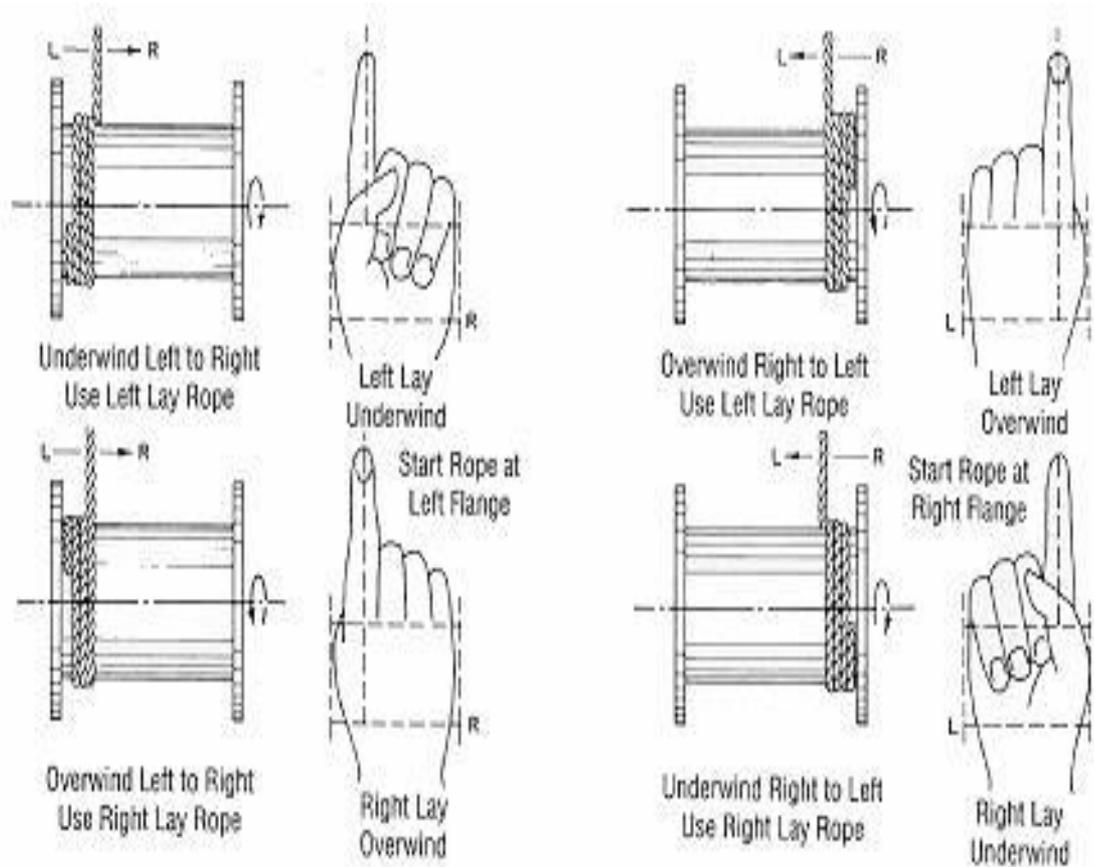


Wire Rope - Terminology

Right Hand Rule

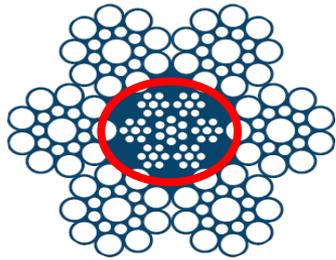
With plain barrel drums, it is difficult to achieve satisfactory multi-layer coiling beyond three layers.

The direction of coiling of the rope on the drum is important, particularly when using plain barrel drums, and should be related to the direction of lay of the rope in order to induce loose coiling.

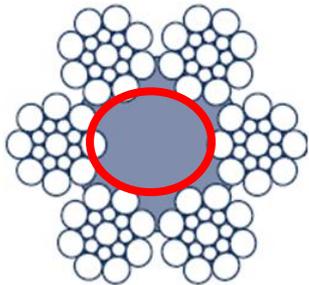


Wire Rope Core

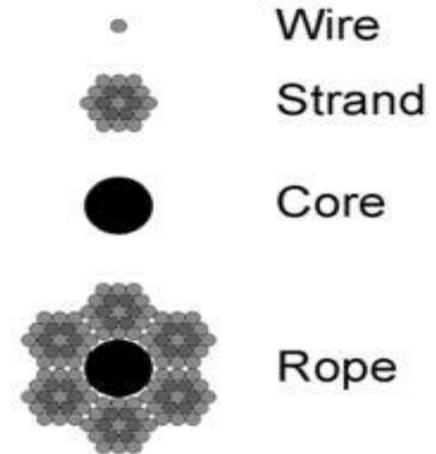
Fibre Core construction is much more elastic under load, as such it has a greater energy absorption capability but is even less crush resistant than Steel Core .



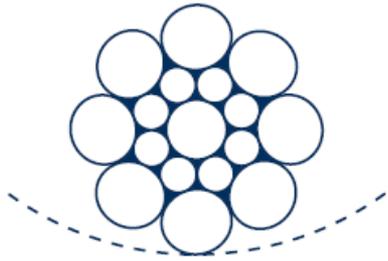
6 x 36 Independent Wire Rope Core (IWRC)



6 x 36 Fiber Core (FC)

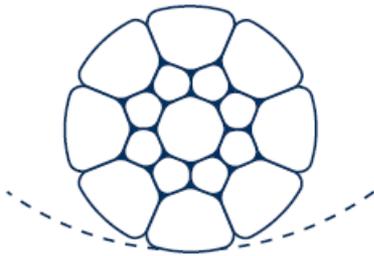


Wire Rope Construction



**Non-Dyform Rope
(Standard Rope)**

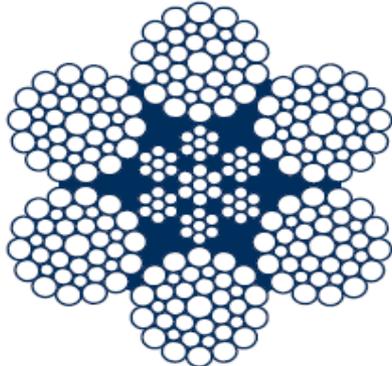
Non-Dyform wire rope on adjacent drum laps can cause point contact to the sheave and accelerated wear.



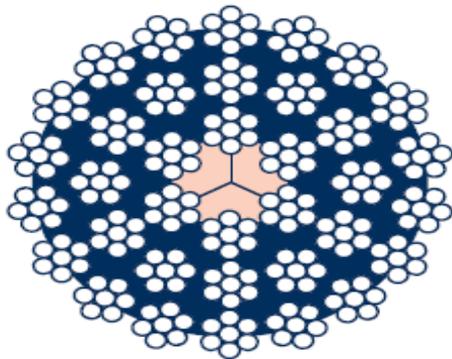
Dyform Rope

The smooth surface of Dyform rope creates better contact to the sheaves and leads to longer life span.

Wire Rope Construction



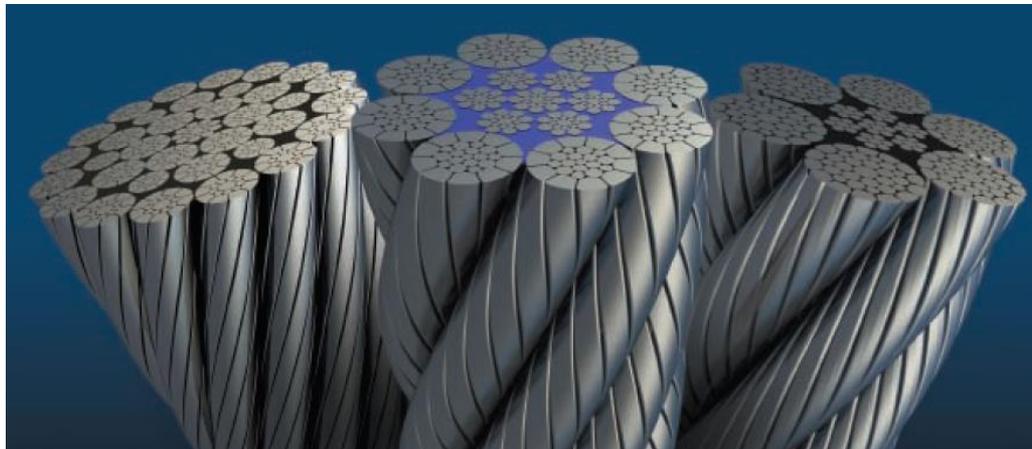
Rotation Rope – Any external load creates a moment which tries to untwist the rope and to rotate the load.



Low Rotation Rope - Comprising a central multi-wire strand, an intermediate layer of multi-wire strands closed in one operation around the central strand, and a covering layer of multi-wire strands closed around the intermediate layer. Each intermediate and covering layer of strands has a direction of lay opposite to that of the other layer of strands.

Type of Hoist & Boom Rope

- **Low Rotation Resistant Rope** - Either main or auxiliary hoist, recommended for high lifting operations, and reduced of rope sheave wear.
- **Rotation Rope** – Boom hoist rope, recommended for multi layer coiling, and have better crush resistant.



Wire Rope Maintenance

Offshore crane hoist ropes must be properly maintained and lubricated due to saline corrosive environment.

Initial factory lubrication will not last, therefore regular wire rope lubrication must be carry out during quarterly preventive maintenance.

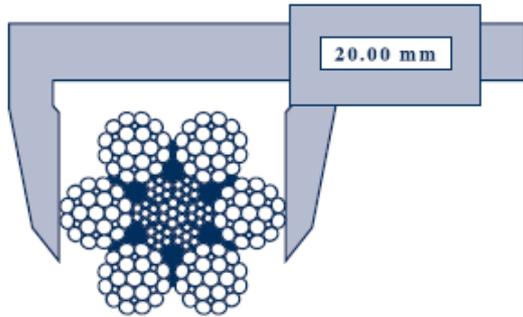
Bright wire ropes are susceptible to corrosion, rope lubrication must be carry out as soon as new rope replaced.

Galvanized wire ropes are more corrosion resistant than bright wire rope as it was zinc coated and it also serve as lubrication. Therefore minimum maintenance is required compared to bright wire ropes.

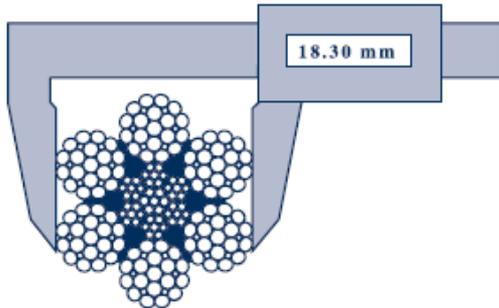


Inspection of Wire Ropes

For correct measurement, take at least 3 measurement over a lay length



Correct Method



Incorrect Method

Inspection of Wire Ropes

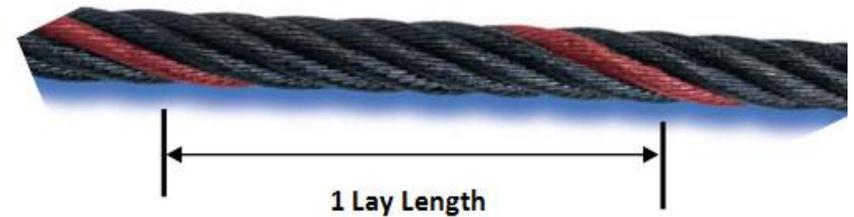
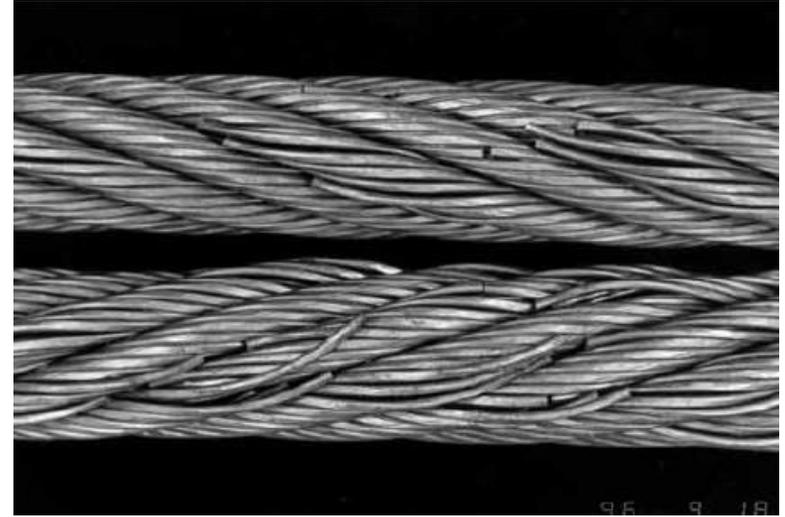
Visual inspection should include verification of the following rejection criteria:

- ✓ Broken wires
- ✓ Kink, Corrosion, Abrasion, Deformation
- ✓ Increase of lay length and accompany reduction in diameter
- ✓ Heat damage
- ✓ Bird Caged
- ✓ Protrusion of wire core
- ✓ Less than 5 full turns of rope is remained on the drum in any operating condition.

Rejection Criteria of Wire Ropes

Check the Following Wire Rope:-

- ✓ Boom Hoist
- ✓ Main and Auxiliary Hoist
- ✓ Boom Pendant



Rejection Criteria of Wire Ropes

Boom hoist (rotation rope):-

- ✓ 6 randomly distributed broken wire in 1 lay length.
- ✓ 3 broken wires in 1 strand in 1 lay length.

Main and auxiliary hoist (low rotation rope):-

- ✓ 4 randomly distributed broken wires in 1 lay length / 30 rope diameters.
- ✓ 2 broken wires in 1 strand in 1 lay length / 6 rope diameters.

Boom Pendants:-

- ✓ 3 broken wires in 1 lay length.
- ✓ 2 broken wires at the end connection.
- ✓ 2 or more valley breaks are found in 1 lay length.

Any wear resulting in the outer wires of more than 1/3 of the original diameter

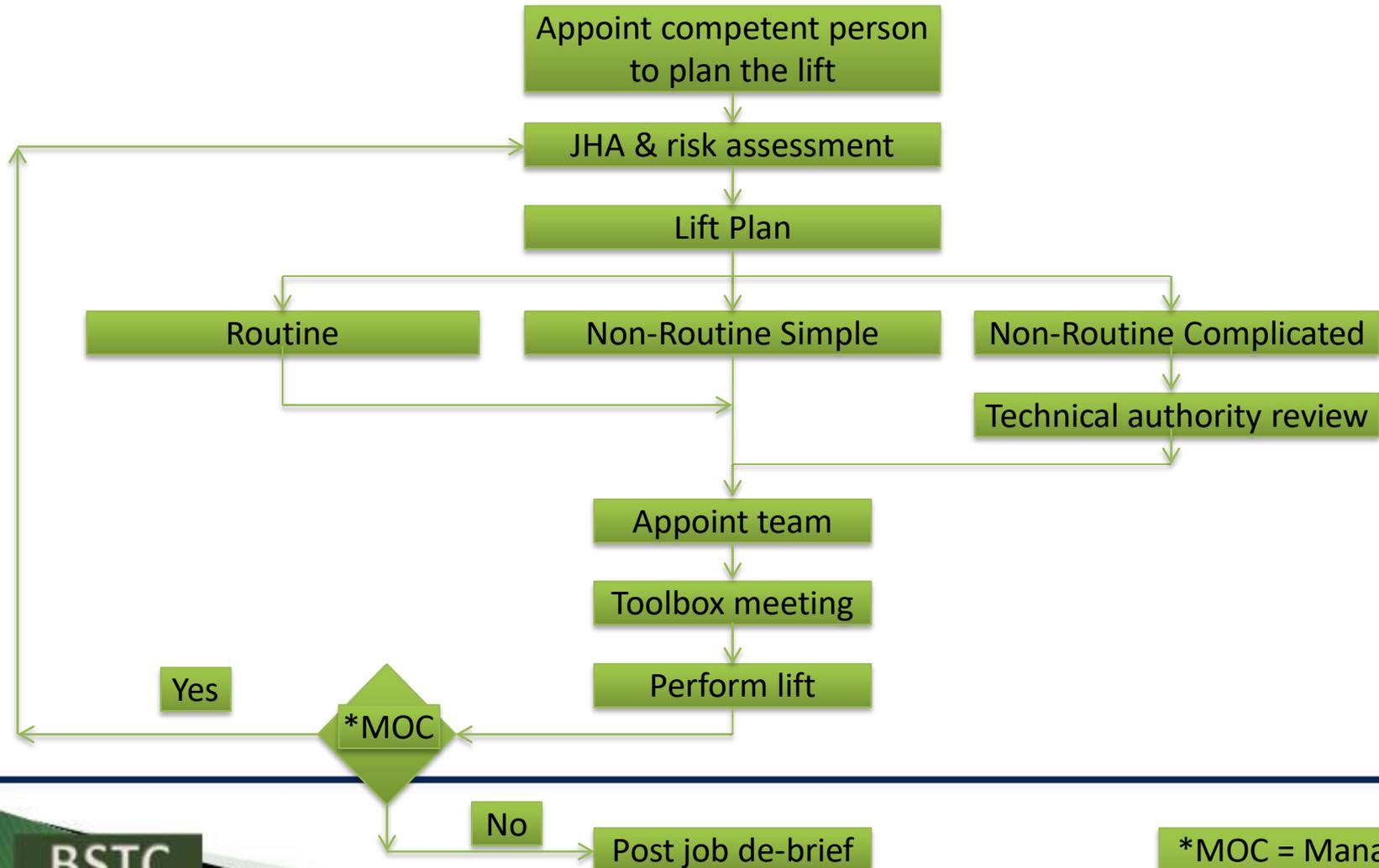
Lift Plan

A lift plan is a written document of a planned lifting activity, it must be prepared by a competent person who have the required level of competency to plan and supervise the specific lifting operation.

A lift plan shall includes at least the following information:-

- ✓ Lift categorization & Lift Description,
- ✓ Crane data and configuration,
- ✓ Load data,
- ✓ Minimum allowable environmental limits,
- ✓ Communication method,
- ✓ Lifting tackles required,
- ✓ Checklist,
- ✓ Sketch/drawings.

Lift Planning – Flow Chart



Toolbox Meeting

Toolbox meeting shall be held prior to lifting operation, this will involve the Person in Charge (PIC), Crane Operator, Banksman and Rigger. Similarly, the boat Master shall brief his crew.

A toolbox meeting shall discuss and review the **Job Hazards Analysis (JHA)**, **Risk Assessment** and **Lift Plan** to ensure that everyone clearly understands his/her responsibilities and agree with the methods and control measures to be deployed.

A toolbox meeting shall be conducted by the Person in Charge (PIC).

Toolbox Meeting

Short Discussion 10 – 15 minutes

- ✓ Daily Activities
- ✓ Lift Plan
- ✓ JHA & Risk Assessment
- ✓ Roles & Responsibilities
- ✓ 10 questions for a Safe Lift



10 Questions for Safe Lift

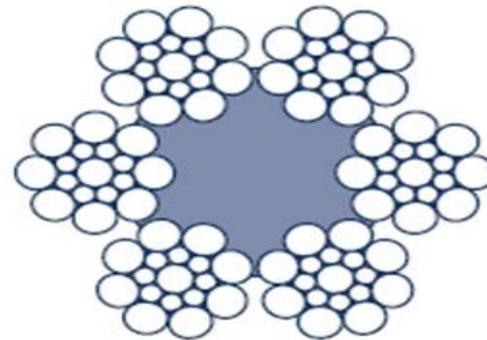
1. Are you aware of and fully conversant with the lifting and hoisting procedures applicable to the lift?
2. Everyone involved with this lifting operation attended the toolbox talk?
3. Has pre use inspection of the lifting equipment been carried out?
4. Are all the safety devices working ?
5. Do you know who is the person in charge of the lift?
6. Is everyone competent and aware of his or her task?
7. Is there a current Lift Plan and JSA, which manages risk?
8. Do you know the environment limits for the lift?
9. Is the area controlled and everyone is clear if the load swings or falls?
10. Are signaling methods and communication agreed and clear to you?

Personal Protective Equipment

OSHA requires the use of personal protective equipment (PPE) to reduce employee exposure to hazards when engineering and administrative controls are not feasible or effective in reducing these exposures to acceptable levels

The following are the minimum PPE's mandatory at site:-

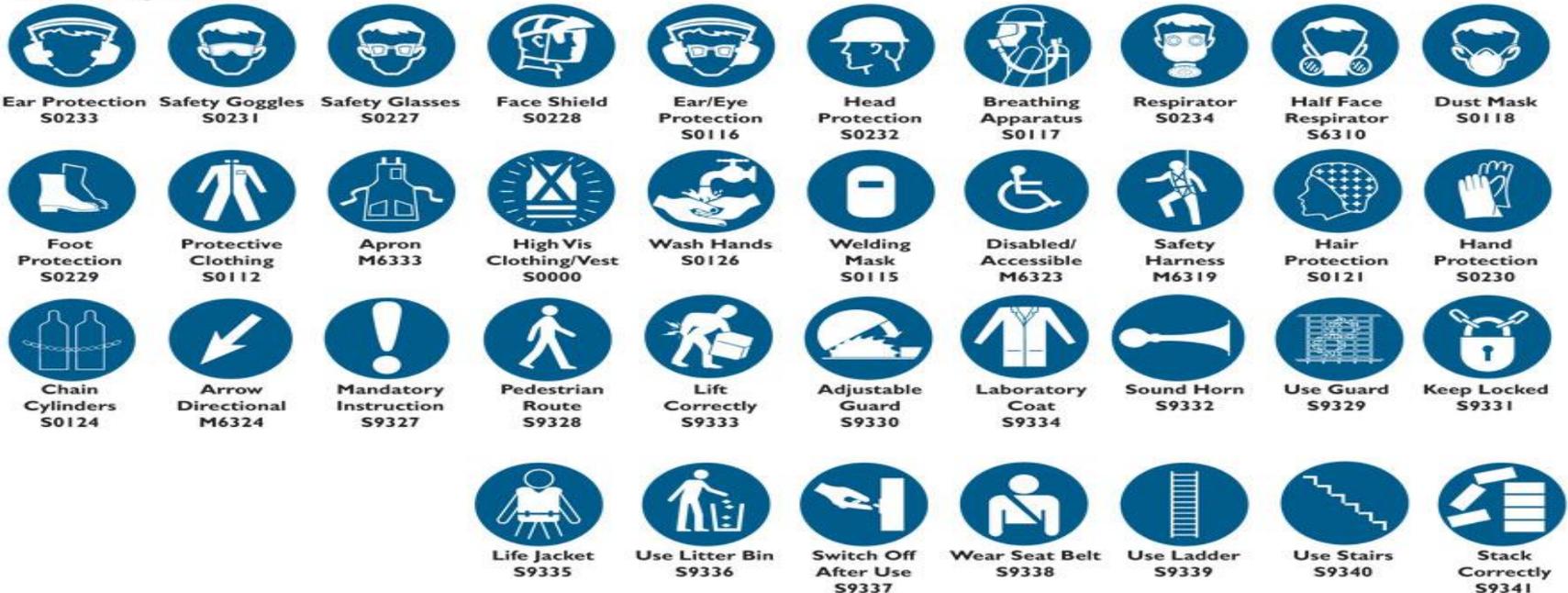
- ✓ Safety Helmet
- ✓ Safety Spectacle
- ✓ Gloves
- ✓ Safety Boots
- ✓ Coverall
- ✓ Ear Plugs/Ear Muffles



Personal Protective Equipment

Depending on the inherent nature of tasks, other PPE's may be a mandatory requirement. Always consult your supervisor if you are in doubt.

Mandatory Pictos



Pre-use Inspection

Always ensure the equipment pre-use inspection have been carry out on a daily basis or prior to lifting operation.



Loose Lifting Tackles Color Code

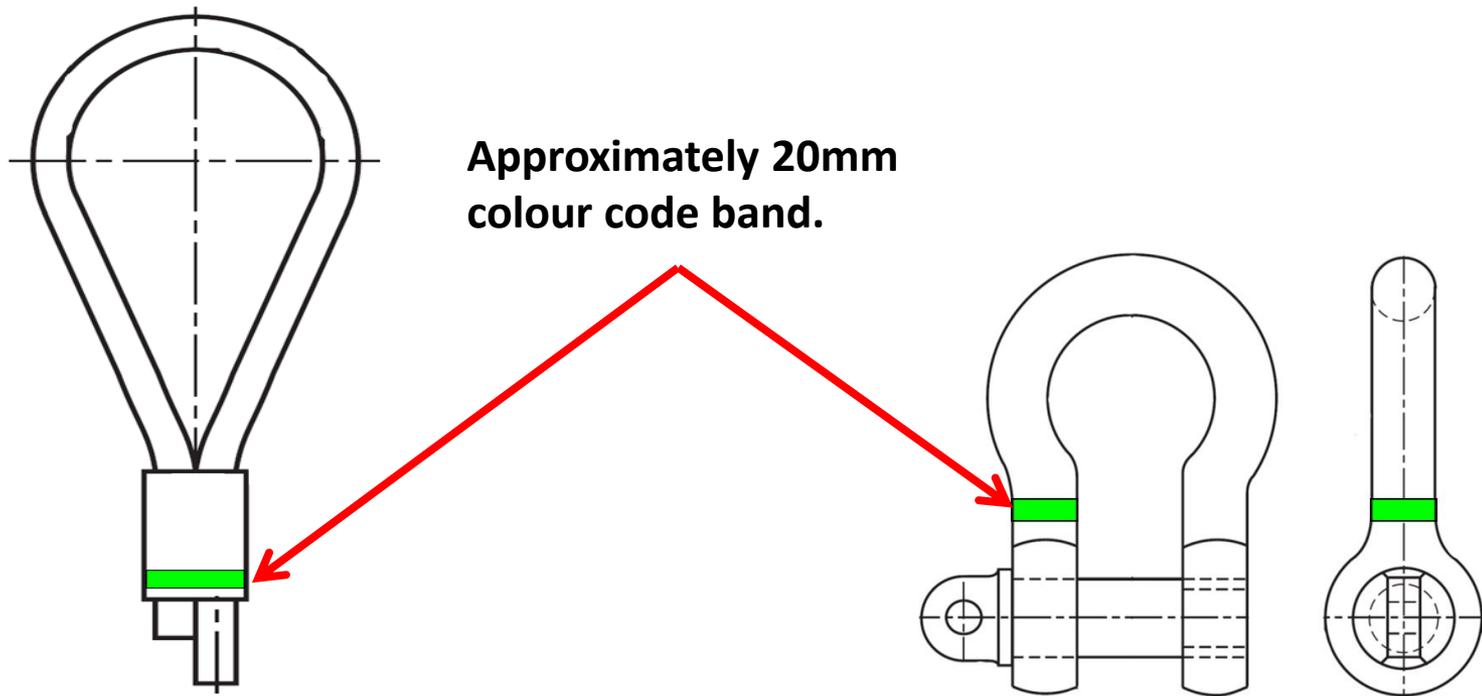
Ensure all loose lifting tackles such as shackles, slings, chain blocks, beam clamps etc is colour coded according to company's colour code calendar.

Regardless of colour code validity, pre-use inspection is still require to be carry out prior to lifting operation.

Year											
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
WHITE			YELLOW			GREEN			BLUE		

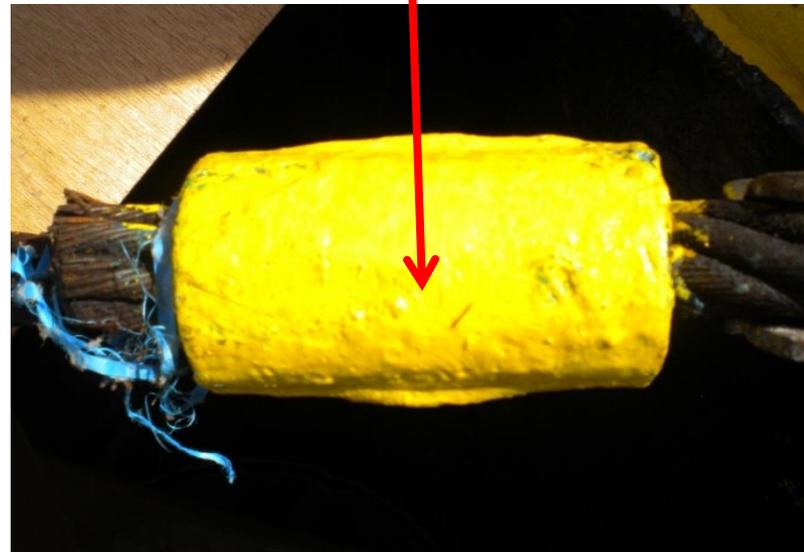
Loose Lifting Tackles Color Code

Ensure all loose lifting tackles is colour coded with approximately 20mm colour code band.



Loose Lifting Tackles Color Code

Can you see the crack line if the loose lifting equipment is fully colour coded with paint?



Environment Limitation

Ensure the environmental limitations is within the permitted range. Always remain alert to the changing condition, seek advise from the supervisor if in doubt.

Change of environmental condition may included:-

- ✓ Change of sea significant wave height
- ✓ Change of wind speed
- ✓ Change of weather condition – rain, storm, lightning.



Communication

Establish and agreed the method of communication used throughout the lifting and hoisting operation.

The method of communication may be either by:-

- ✓ Hand signals
- ✓ 2-ways radio communication

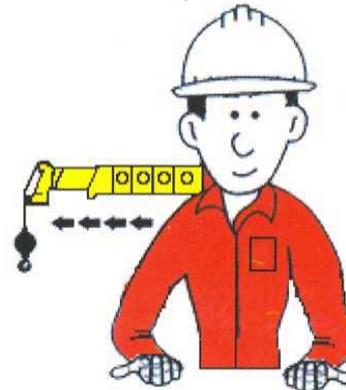
Hand Signals



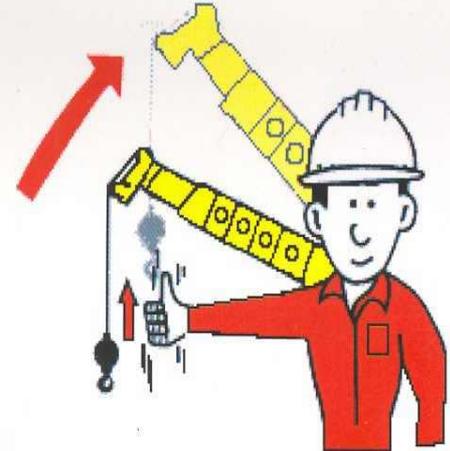
HOIST LOAD
NAIKKAN ANGKATAN



LOWER LOAD
TURUNKAN ANGKATAN



EXTEND BOOM
MEMANJANG BOOM



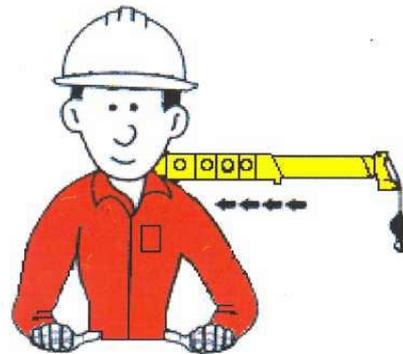
LUFF BOOM UP
TINGGIKAN BOOM



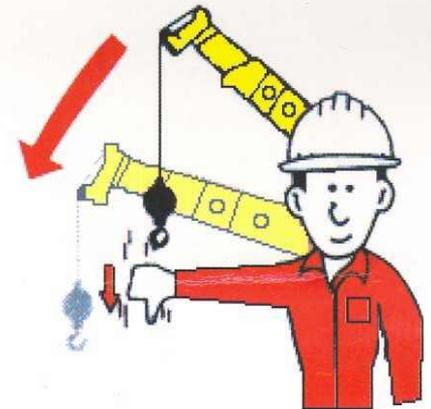
HOIST LOAD SLOWLY
NAIKKAN ANGKATAN PERLAHAN-LAHAN



LOWER LOAD SLOWLY
TURUNKAN MUATAN PERLAHAN-LAHAN



RETRACT BOOM
MENARIK BOOM



LUFF BOOM DOWN
TURUNKAN BOOM

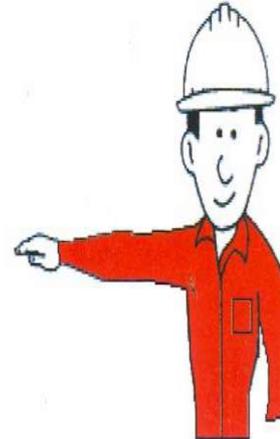
Hand Signals



LUFF BOOM UP – LOWER LOAD
TINGGIKAN BOOM TURUNKAN ANGKATAN



USE MAIN HOIST
GUNA PENAikkan UTAMA



SLEW LOAD IN DIRECTION FINGER POINTS
PUSING KEARAH YANG DI-TUNJUK OLEH JARI



EMERGENCY STOP
BERHENTI KECEMASAN



LUFF BOOM DOWN – HOIST LOAD UP
TURUNKAN BOOM NAIKKAN ANGKATAN



USE WHIP HOIST
GUNA PENAikkan KEDUA

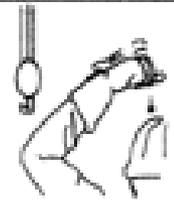
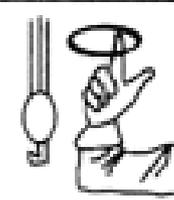
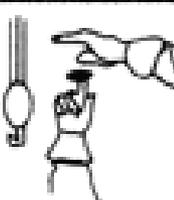
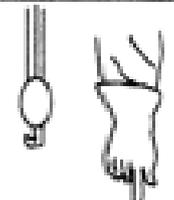
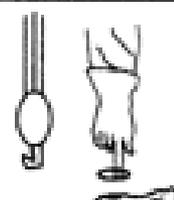


DOG EVERYTHING
BERHENTI SEMUA



STOP
BERHENTI

Hand Signals

 <p>Main Hoist</p>	 <p>Auxiliary Hoist</p>	 <p>Hoist Load</p>	 <p>Hoist Load Slowly</p>	 <p>Stop</p>
 <p>Raise Boom</p>	 <p>Raise Boom & Lower Load</p>	 <p>Lower Load</p>	 <p>Lower Load Slowly</p>	 <p>Emergency Stop</p>
 <p>Lower Boom</p>	 <p>Lower Boom & Raise Load</p>	 <p>Swing Boom</p>	 <p>Swing Boom Slowly</p>	 <p>Travel (mobile eqpt)</p>
 <p>Retract Boom 2 hands</p>	 <p>Retract Boom 1 hand</p>	 <p>Extend Boom 2 hands</p>	 <p>Extend Boom 1 hand</p>	 <p>Dog Everything</p>

Voice Command

- ❑ Controlling of lifting operation through 2-ways communication radio (walkie-talkie) voice command have been commonly adopted in the lifting industry.
- ❑ A Banksman shall establish and agreed with Crane Operator on the type of voice command used through 2-way communication radio during the lifting operation.
- ❑ Take note some of the key area in following when establish of voice command:-
 - ✓ The language used
 - ✓ The agreed command
 - ✓ Acknowledge the received of command
 - ✓ Emergency response



Voice Command Etiquette

Following are the examples of voice command etiquette through walkie-talkie:-

- ✓ Always test the radio channel to ensure other parties is able to hear from you.
- ✓ Always allow other parties to finish the sentence before press on the talk button.
- ✓ Ensure command given is load and clear.
- ✓ Do not use long sentence, keep the command short.
- ✓ Do not use vulgar languages.
- ✓ Do not congest the radio channel unnecessary.
- ✓ Repeat the command if there is no response.



Blind Lift

Blind lift is the lifting operation of which a crane operator do not have direct view of the lifted load, and rely only to the banksman to direct the crane movements.

It is mandatory to establish a 2-ways radio communication between the banksman and crane operator during blind lift.

The Banksman at the load shall have a complete overview of the activity:-

CAUTION: WHEN CARRYING OUT BLIND LIFT, THE USE OF MORE THAN TWO BANKSMEN MAY RESULT IN SIGNAL TIME DELAY.

Common Personnel Lift Offshore



**FROG – A Semi
Enclosed Basket**



**Billy Pugh X-
904 Series**



ESVAGT – Rigid Basket

Trial Lift – Personnel Carrier

- A trial lift with the unoccupied personnel transfer carrier shall be undertaken at the start of each day the personnel carrier will be used.
- After the trial lift and just prior to hoisting the personnel, the carrier and rigging shall be hoisted a few centimeters and inspected by the PIC.



Frog – Semi Enclosed Basket



ESVAGT - Rigid Basket

Post-use Inspection & Crane Logbook

Upon completed of any lifting operation, Crane Operator's are responsible to perform a visual post-use walk around inspection and update the crane logbook.



Suspended Load

Falling of the crane suspended loads can be catastrophic. It is compulsory no one is allow to stand, walk and work under the crane suspended load.



Falling Object

Ensure all loose objects is properly secured or removed before commencement of any lifting operation. The falling object may be a light weigh, however depend on the height of fall, the objects may gain it acceleration due to gravity and resulted in great impact

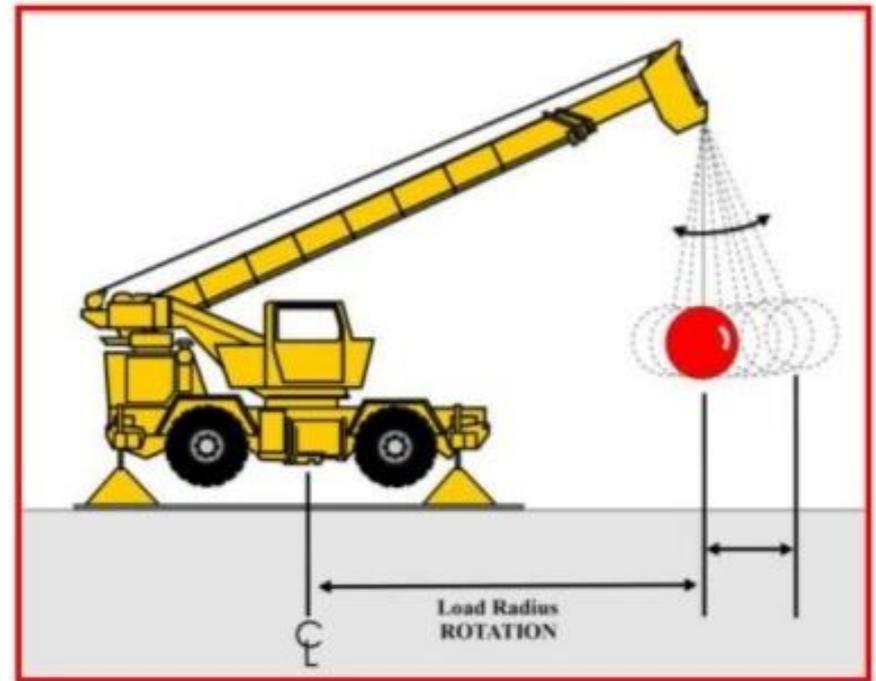


Load Swing

Swing load can be dangerous if it is not properly controlled. Always keep a safe distance from a swinging load as there is always a possibility to be crushed by the swinging load due to poor weather condition, man made error and equipment failure.

Changes in Load Radius

(Load Swing)



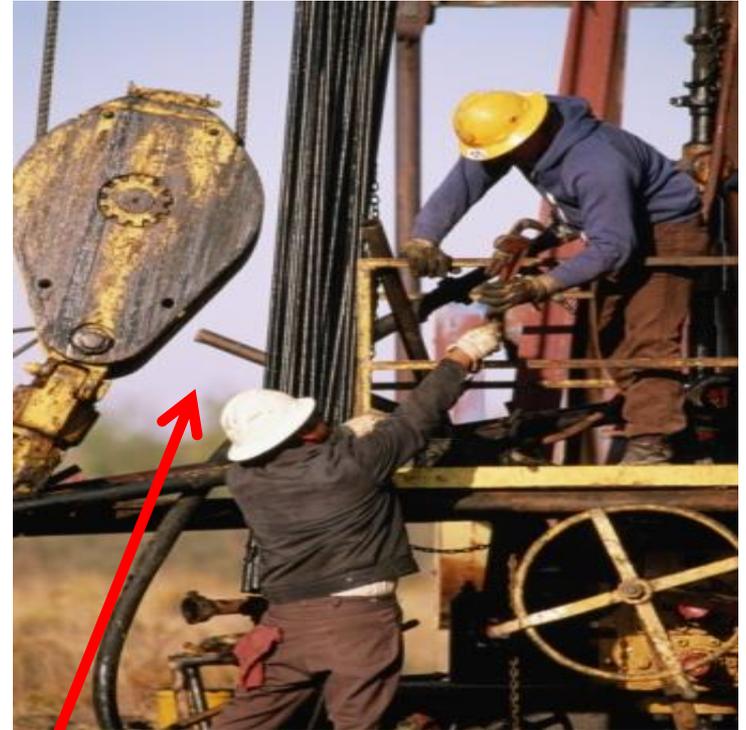
Pinch Points

A pinch point is any point at which it is possible for a person or part of a person's body to be caught between the moving and stationary parts of a machine or substance.

Always be alert when handling of lifting equipments, or dealing with offshore cargo vessel handling activities.

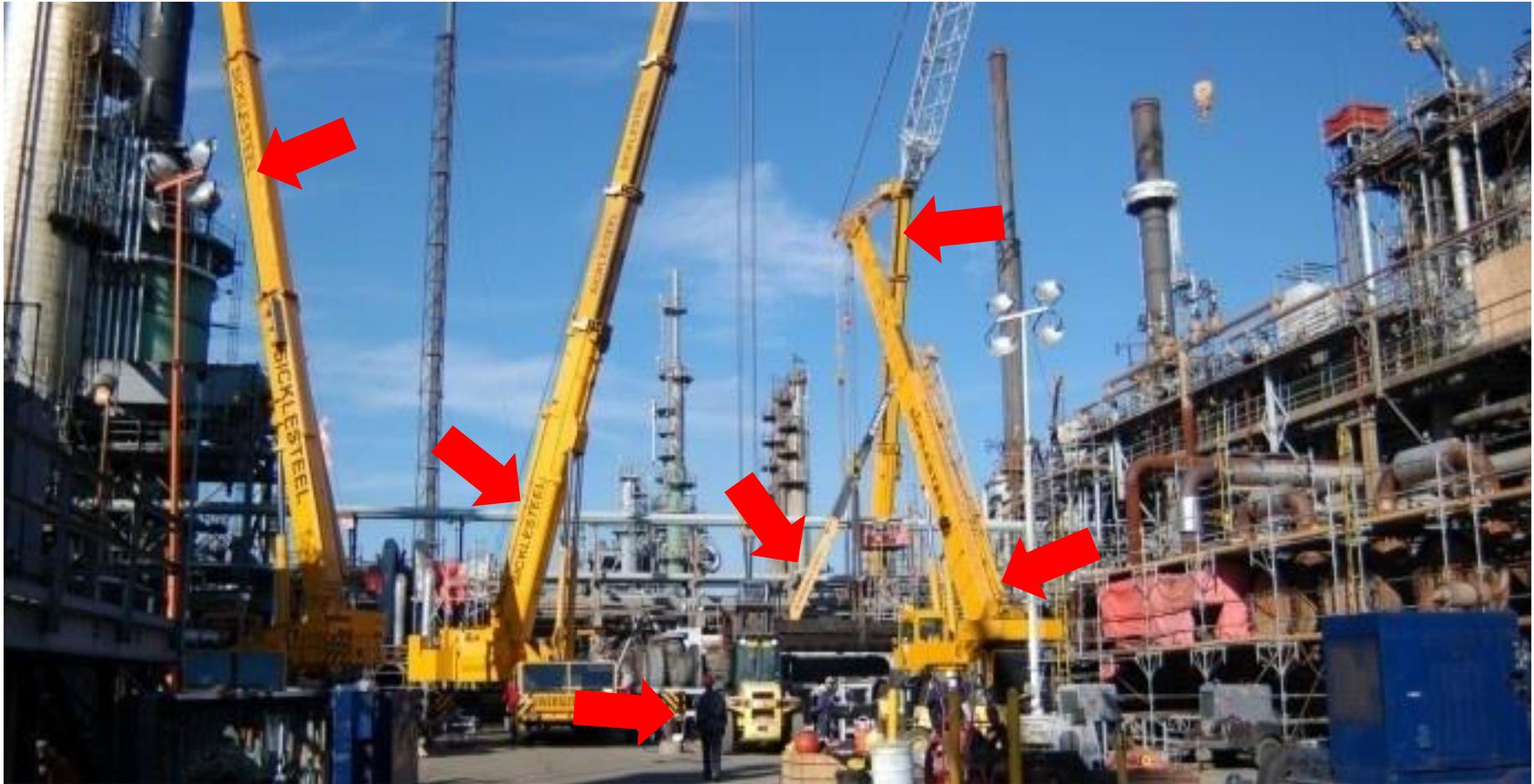


Pinch Points



Ensure personnel are not in between two object

Conflicting Activities



Environment Factors



Wind Speed



Wave Height

Environment Factors



Darkness / Poor lighting



Noise

Environment Factors



Rain & Low Visibility



Ground Condition

Dynamic Loads

All lifts are exposed to dynamic effects due to variation in hoist speeds, crane and vessel motions, cargo barge movements, object movement etc.



Dynamic Loads

Dynamic Amplification Factor (DAF) should be taken into account for all offshore lifts. Table below may be considered as minimum factors for lifts in air, provided the lifting operation will not take place under adverse weather conditions.

Static Load	DAF Onshore	DAF Offshore
0 – 100 Te	1.10	1.30
100 – 1000 Te	1.05	1.2
1000 – 2500 Te	1.05	1.15
> 2500 Te	1.05	1.10

Note: Dynamic Hook Load = DAF (Rigging Weight + Load Weight)

Dynamic Loads

All offshore crane built to meet API Spec 2C has build-in dynamic coefficient of 1.33, in other word, the crane load chart is based on 75% of the structural strength.

However, it is important to avoid utilized the maximum crane load chart limit, always maintain some safety margin in account of dynamic amplification factor offshore.

As a general guideline, do not exceed 80% of the crane load chart limit.

Human Error

Statistic shown than over 90% of crane and lifting accidents are due to human error, there are number of things that are known to contribute to human error as follow:-

- ✓ Inadequate training, guidance and experience.
- ✓ Inadequate facilities and information.
- ✓ Personnel mental & physical distraction.
- ✓ Repetitive, routine and boring task.
- ✓ Dangerous and difficult task.
- ✓ Others.



Gross Overload Condition

Gross overload condition refer to situation when the offshore crane hook entangled with supply boat that resulted serious damaged to the crane. Although some cranes are fitted with manual gross overload protector, the consequences is however catastrophic .

All Riggers & Banksman shall ensure the cranes hook is properly guided and clear of any obstruction.

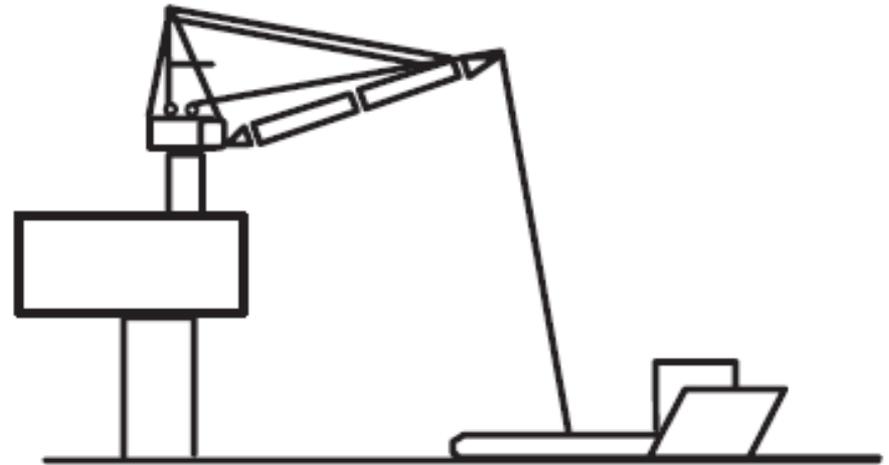


Gross Overload Condition

Gross overload condition can be catastrophic especially when hook entangled with supply boat as shown below:-



a) Vertical motion, hook tangled



b) Horizontal motion, hook tangled

Gross Overload Condition - Accident

“That never happened to me, are you sure??”

Picture below shown an offshore crane slew bearing bolts was tear off due to hook entangled with supply boat.

Before the Incident



After the Incident



*Operator escaped from the cabin just before the crane fall into the sea.
Think about the consequences...*

Warning & Alert

Where necessary, Crane Operator sound horn or use the crane public announcement system to alert or warn the personnel at vicinity of lifting zone.

