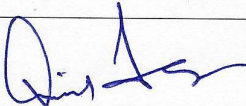



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HZL Standards

“Lifting & Shifting of Equipment & Material” Standard

	Issued by	Approved by
Name	Chairman, Corporate SRP Sub-Committee	Chairman, Corporate Safety Council
Sign.		
Date	27/01/2023	

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1	20 July 2019	Addition of lifting tools and tackle Section 6, Section 7 and color coding Section 8	Vivek Yadav	Rajinder Ahuja
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3	25 Dec 2022	Requirement of VSS 7 version 1 amended.	Vivek Yadav	Vinod Jangid

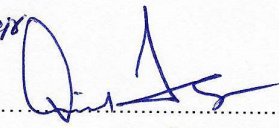
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DOCUMENT ISSUE

The "Lifting and Shifting of equipment and material" Standard is issued by the Corporate Safety Council on behalf of Hindustan Zinc Limited management and forms a part of the HZL Integrated Management System.

Name: *Vinod Jangir*
Signed: 
Date: *27/01/2023*

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Acknowledgement The management acknowledges the contributions of the following individuals for being a part of the Zone / location workgroup and for their assistance in preparing this standard on “Lifting and Shifting of equipment and material”.

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1. SCOPE AND FIELD OF APPLICATION

Heavy Lifting of materials like equipment and structural steel is a critical job to execute which require utmost safety. The activity depends on various aspects including the skill of operator, skill of foreman, Rigging activities and performance and maintenance of lifting equipment. For all such heavy lifts mobile cranes, are engaged in all the locations of Hindustan Zinc Limited. This standard establishes provisions for qualifying operators of all types of mobile cranes and boom trucks used within Hindustan Zinc Ltd., and also for inspecting, maintaining, and operating this equipment for operational safety. This standard also establishes the parameters for qualifying the rigging tools.

All plant and project sites where Hindustan Zinc Limited, - has management control, must comply with their local regulations in addition to requirements of this standard.

2. REFERENCES

- Corporate Policy
- HZL HSE Policy
- HZL Safety Principles
- Corporate Standards
- Vedanta Mobile Crane and Lifting Safety
- VSS
- Standard for working at height
- Standard for General electrical safety
- Standard on LOTO
- Vedanta Guidelines for HIRA and JSA
- Standard on Work Permit
- Standard on Vehicle and Driving
- Standard on Scaffolding
- Standard on Confined Space
- Factories Act (1948) and Rules (including State rules)
- Mines Act and Rules (MMR)
- ASME B30.2
- ASME 30.16
- ASME 30.26
- ASME 30.10
- IS 3828.2005
- IS 2361.2002 Bull Dog Grip
- IS 7846: General Characteristics of Lifting hooks.
- Rajasthan Factory Rules.

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3. MANAGEMENT RESPONSIBILITIES

Line management has the responsibility to implement this standard. Each Unit Implementation Committee (UIC) should identify a crane champion to assist line management in implementing the mandatory requirements of this standard.

3.1. Concerned Engineer (Lift Plan Designer and Lift Plan Approver)

- Check suitability of mobile crane before lifting.
- Ensure use of tested lifting tool-tackles of appropriate capacity (sling / synthetic belt / D-shackle etc.)
- Ensure tool box talk of all movements & rigging operations.
- Ensure operating locations are far enough away from shoring, excavations, trenches, buried utilities, foundations, etc. to eliminate the risk of collapse.
- Recording and documenting of daily and preventive checks.
- Development and approval of lift plan before lifting.

3.2. Crane Champion

- Ensure mobile crane are annually tested by competent person as specified by factory inspector of state.
- PM & proactive maintenance of all cranes for smooth & safe operation and to ensure that record is maintained.
- Assist for critical lifts in plant.
- Periodical refresher training to rigger, signal man, lift plan maker and approver.

3.3. Rigging foreman/ signal man & riggers

- Will follow procedure to use mobile crane best rigging practice for safe operation of crane.
- He will use only lifting tools which are tested & of appropriate capacity.
- Signal man will identify himself by wearing specific jacket.
- Not to use cell phone during operation.
- Inspect lifting tools and tackle prior to use.

3.4. Contractor's Supervisor

- Comply with procedures and information provided in training.
- Daily checklist compliance report to crane champion.

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4. DEFINITIONS

- **Anti-two-blocking device:** A device that, when activated, disengages all crane functions whose movement can cause two-blocking. It prevents main block/auxiliary block from touching the boom tip sheaves.
- **Auxiliary hoist:** supplemental hoisting unit usually of lower load rating and higher speed than the main hoist.
- **Abnormal operating conditions:** environmental conditions that are unfavorable, harmful, or detrimental to the operation of a crane, such as excessively high or low ambient temperatures, exposure to adverse weather, corrosive fumes, dust-laden or moisture-laden atmospheres and hazardous locations.
- **Brake:** a device, other than a motor, used for retarding or stopping motion by friction or power means.
- **Crane Champion:** One who has relevant experience in mobile crane operations and is capable of identifying existing and predictable deficiencies in mobile cranes and boom trucks. He is nominated by SRP Chairman and appointed by Apex Chairman of Zone.
- **Critical Lift Group:** A group of experts (UIC Champion) in the plant to support the Zone Crane Champion, for planning critical lifts or when needed.
- **Competent person:** One who, is authorized by Chief Inspector of Factories (for Inspection & Testing of Tools & Tackles) and can verify compliance with the provisions of local / country standards.
- **Counter Weight:** A counterweight is a weight that, by exerting an opposite force, provides balance and stability of a mechanical system. Its purpose is to make lifting the load more efficient, which saves energy and is less taxing on the lifting machine.
- **Dual or Tandem Lift:** Tandem lift involving the simultaneous use of two or more cranes or hoists to lift a large load. A lift in which the centre of gravity of the load can change during the lift.
- **Emergency operations:** Operations that include fire, power line contact, loss of stability, or control malfunction.
- **Health-care professional:** Any licensed/registered/certified health-care provider working within his or her license/registration/certification and providing medical services to employees. This includes physicians, physician assistants, nurse practitioners, and registered nurses.
- **Hoist:** a machinery unit that is used for lifting or lowering a freely suspended (unguided) load.
- **Lift Plan Maker/Designer:** One who has relevant experience in mobile crane operations and is capable of identifying existing and predictable deficiencies in mobile cranes and boom trucks. He has completed the stage 1 training on the standard as per Vedanta approved methodology. He can prepare and design lift plan for lifts.
- **Lift Plan Approver:** All qualified engineer who have completed both stage 1 and stage 2 training on the L&S standard. They are appointed to review and approve lift plan for the lift by Apex Chairman.
- **Mobile crane:** A crane that is self-propelled. This includes crawler cranes, wheel-mounted cranes, and any variations thereof.
- **Main hoist:** the primary hoist mechanism provided for lifting and lowering the rated load.

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- **Out Rigger:** The foot of the crane which take complete weight of the machine and the load.
- **Out Rigger Pads:** Is a mat that is fabricated to distribute the load of the outriggers. These mats are strong enough to support the crane and the hoisting material's weight. As a general guideline, outrigger pad size should be at least three times the size of the outrigger foot itself for proper weight distribution.
- **Periodic inspection:** Detailed safety and maintenance inspection performed by a Competent Person to verify compliance with the provisions of local/country standards.
- **SWL:** safe working load as per OEM recommendation max load crane can handle.
- **Safe Load Indicator:** A device in a mobile or portable cranes that indicates boom length, radius and load weight. And also alerts the operator when lift exceeds the safe operating range of machinery.
- **Switch, emergency stop:** a manually actuated switch to disconnect power independently of the regular operating controls.
- **Switch, limit:** a device that is actuated by the motion of a part of a power-driven machine or equipment to alter or disconnect the electric, hydraulic, or pneumatic circuit associated with the machine or equipment.
- **Side Pull:** The Component of the hoist pull action horizontally when the hoist lines are not operated vertically.
- **Safety Latch/ Hook Latch:** A latch provided to bridge the throat opening on the hook to prevent the release of load.
- **Two-blocking:** the condition in which the lower load block or hook assembly comes in contact with the upper load block or boom point sheave assembly.
- **Tagline:** Is a piece of rope that is attached to the load to help directed while it being hoisted. They must be non-conductive.
- **Walkie Talkie:** A walkie talkie is a small portable radio, which can be used talk and hear message through so that we can communicate.

5. MOBILE CRANES

5.1. Inspection

There are different levels of crane inspections used on sites. The site should be aware that in addition to the requirements and advisory guidance covered below, local legislations may impose additional mandatory inspection requirements beyond those specified here. There must be a documented process that ensures all critical components are inspected and in place prior to a crane being commissioned and put into service and for recertification if the crane configuration is changed, for example, the attachment or removal of a boom section.

Inspection - Prior to use on sites

Mobile cranes shall be inspected by a qualified person(s) prior to use on sites. A checklist shall be used to document the inspection. For verification of the fitness of equipment as per local/ state regulations, a competent person is to be engaged.

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Competent person should be independent of the company, agency or contractor supplying the equipment. If a mobile crane is removed from a site and then returned, it shall be re-inspected by a qualified/ competent person(s) before it is used again on the site. Altered mobile cranes shall be re-inspected by a prior-to-use inspection. The prior-to-use inspection to be done by a crane champion or a competent person shall be decided by the Zone crane champion based on the alteration done.

Inspection - Frequent (daily and monthly)

Before beginning the work in each shift or in-case of change in operator/initiator/issuer, mobile crane operators shall inspect all controls and safety devices as per the daily checklist which will be documented and records shall be maintained. At least once each month, an Engineer in-charge shall inspect all mobile cranes following the same inspection methodology used in the prior-to-use inspection. Unit crane champion will also verify the daily checklist for its compliance and ensuring healthiness of the crane. The technical support during inspection shall be taken from Zone champion.

Inspection - Periodic

Mobile crane equipment shall receive periodic inspection by a competent person at least annually. This competent person should be from an independent agency. For company-owned mobile cranes (including Operations supporting equipment) - the annual inspection records shall be available on site. For equipment owned, leased, or rented by a contractor, the previous periodic inspection record shall be reviewed prior to use. NDT Checks (UT/MPT as per applicability and feasibility) should be done for all lifting Hooks, anchorage pins hook shanks and other load bearing part atleast once in year.

Load testing of crane to be done in particular configuration (wherever mentioned in crane load chart given by OEM). Load testing to be done considering 100% of capacity as per load chart in particular configuration.

SLI to be validated and calibrated if required annually by OEM or competent authorities/Person.

All mobile crane operated hydraulically must have hydraulic oil testing done once in 6 months. Hydraulic oil replacement of crane will be done on basis of oil report or as per guidelines of OEM.

Inspection - Cranes not in regular use

Cranes that remain on site and are idle for more than one month shall receive a prior-to-use inspection (see Section 5.1.1) by a qualified person / Unit Crane Champion before being returned to service. Cranes that are idle for more than six months shall receive a periodic inspection (see Section 5.1.3) by a Zone Crane Champion / Competent Person before being returned to service.

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5.2. Maintenance, repairs and modifications

All maintenance and repairs shall be in accordance with manufacturer's recommendations. Modifications affecting capacity or safe operation shall have the manufacturer's written approval and the crane shall be inspected by a competent person. Records of maintenance, repairs, and modifications shall be maintained.

Mobile Crane hired across HZL for duration more than 6 months, must have maintenance schedule supplied by the vendor in accordance with manufacture's recommendation.

All maintenance required to be carried out on crane must be done by trained and authorized technician by OEM. All major maintenance on crane to be done OEM technician or in presence of OEM engineer. Scheduled maintenance required to be carried out on crane as per manufacturer recommendation must be carried out in vendors works or service station. No maintenance on mobile crane can be done in plant premises. In case where crane cannot be taken out of plant premises in case of breakdown, maintenance on crane be done only after approval of Unit Head. Operators and assistant are not allowed to carry out any maintenance on mobile crane.

5.3. Mobile Crane Operation & Lift Planning

The Following shall apply to all personnel involved in mobile crane operations. Each operation must be classified into 2 types of lift; Critical lift and Normal /Routine Lift. All lifting operation must be recorded in lift register. Each lifts to have documented lifting plan to address the associated hazards and mitigation measures.

Classification of lift to be done as critical if any of the points are satisfied.

- 1) Load Exceeds 50% of Crane Load Chart Value. No lifting beyond 90% capacity loading.
- 2) Blind Lifts
- 3) Lifts over Live Tracks, Utility Lines, Live Power Lines
- 4) Tandem Lifts
- 5) Erection with Tailing Operation
- 6) Lifts involving personnel/ Man cages.

At initial stage of planning process; lift plan maker shall classify each lift into critical or routine/ normal lift. Once lift plan is prepared same shall be reviewed and approved by Lift Plan Approver.

Crane drivers and rigging crews involved in critical lifts must have input into the lifting plan and be consulted prior to finalization of the plan. No interpolation / extrapolation of load chart is allowed to arrive at intermediate loads not specified in load chart.

The lifting plan must include lift data, equipment data, rigging data, lift computation.

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proximity to power lines and process areas, buildings, structures and local hazard and its control.

Crane with a safe working load beyond 15T shall be fitted with rated load indicator, also known as Automatic safe load indicator which conforms to BS 7262 or an equivalent international standard.

Cranes should be equipped with an anti-two-block device that includes audible or visual alarms.

Line of fire should be well defined & barricaded against any trespasser.

The operator shall not leave the crane controls while a load is suspended.

There must be a documented and approved method for communication between the crane driver and those assisting with the lift. Only standard hand signals and walky talky to be used as means of communication.

No crane shall be moved (“marched”) with a load suspended unless it is specifically designed to do so. Any “pick and carry” operations must undergo an assessment of the dynamics of the load and crane during the planned travel to control any risks.

Outriggers should rest on impact pads of thrice the area of outrigger foot. For crawler cranes impact pad provided by OEM should be used.

All mobile cranes should be placed on ground properly leveled & compacted. Plumb accuracy should be 1degree i.e., +/- 0.5 degree from vertical axis.

No lift should be done if wind velocity is more than 32 km/hr (or as specified by OEM of crane).

Dry run to be ensured and mandatory before lift. (No lifting to be done beyond 90% capacity loading).

Hired crane should not be older than 10 years as per OEM Year of manufacture.

Procedure for Exceptional circumstances:

- 1) Any lift in night is to be avoided. In case unavoidable circumstances, approval to be taken from UH.
- 2) Illumination to be ensured minimum of 100 Lux.
- 3) Lift to be carried out in presence of Area IC, HOD.
- 4) Any Critical lift to be communicated to rescue team, crane champion and unit head before start of lift.

5.4. Crane Hiring Criteria

S. No	Documents required	Source
1	Registration no. of crane / RC	TO be provided by Vendor
2	Insurance of crane	TO be provided by Vendor

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3	Fitness Certificate	TO be provided by Vendor
4	Model	TO be provided by Vendor
5	Make	TO be provided by Vendor
6	Type of crane	TO be provided by Vendor
7	Year of manufacture from crane	shall not be more than 10 years. To be provided by Vendor and validated by manufacturer (if required)
8	Serial No of crane	TO be provided by Vendor
9	Anemometers availability (compulsory for boom length 40 mtr and above)	TO be provided by Vendor
10	SLI validation /calibration certificates.	TO be provided by Vendor
11	NDT (MPT and UT) testing of load bearing parts of crane (especially hook, hook shank, anchorage pins)	TO be provided by Vendor
12	Manufacturer of lifting wire rope being used in crane	TO be provided by Vendor
13	Original wire rope certificate from OEM	TO be provided by Vendor
14	Qualification and experience of Operator & OEM training Certificate	TO be provided by Vendor
15	Any incident with Crane/Lift History	TO be provided by Vendor
16	Major maintenance on crane	TO be provided by Vendor
17	Hydraulic oil report.	TO be provided by Vendor.

5.5. Mobile Crane Operator qualifications

Mobile crane operators shall be minimum 10th class Pass and have a minimum of 05 years' experience with at least 1-year experience in operating similar crane. He shall successfully complete a testing program that meets mandatory country and/or site requirements. Operator must be trained by OEM or Vedanta approved agency. The

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testing program should preferably consist of both a written test and an operating test demonstrating proficiency in handling the specific type of crane. Normal and emergency operations, load/capacity chart use, and crane signals shall be covered by the testing. He should possess heavy vehicle driving license. Mobile crane operators shall pass a medical examination given by a health-care professional once every 06 months if Age above 45 years, annually if Age below 45 years. Medical examination must include vision test and color blindness test along with site specific medical test. Site management may elect to specify a more frequent medical examination.

5.6. HOISTING EQUIPMENT

Sheaves

Sheave grooves shall be free from surface defects which could cause rope damage. The cross-sectional radius at the bottom of the groove should be such as to form a close-fitting saddle for the size of rope used. The sides of the groove shall be tapered outward and rounded at the rim to facilitate entrance of the rope into the groove. Flange rims shall run true about the axis of rotation.

Sheaves carrying ropes, which can be momentarily unloaded, shall be provided with close-fitting guards, or other devices, to guide the rope back into the groove when the load is reapplied.

The sheaves in the bottom block shall be equipped with close-fitting guards that will minimize the possibility of ropes becoming fouled when the block is lying on the ground with the ropes loose.

All running sheaves shall be equipped with means for lubrication. Permanently lubricated, sealed, or shielded bearings shall be acceptable.

Drums

Rope drums shall be grooved, except when the crane is provided by the manufacturer for a special application. This requirement does not preclude the use of multiple layer spooling. The grooves shall be free from surface defects that could cause rope damage. The cross-sectional radius at the bottom of the groove should be such as to form a close-fitting saddle for the size of rope used.

Ropes

The hoisting ropes shall be of a recommended construction for crane service. The total load (rated load plus weight of load block) divided by the number of parts of line shall not exceed 20% of the minimum breaking strength of the rope.

Socketing shall be done in a manner recommended by the rope or fitting manufacturer or a qualified person.

Rope shall be secured to the drum as follows:

No less than three wraps of rope shall remain on the drum at each anchorage of the hoisting drum when the hook is in its extreme low position unless a lower-limit device is

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provided, in which case no less than one wrap shall remain.

The rope end shall be anchored by a clamp attached to the drum, or by a socket arrangement specified by the crane or rope manufacturer. The rope clamps shall be tightened evenly to the manufacturer's recommended torque.

Eye splices shall be made in recommended manner. Rope thimbles should be used in the eye.

Wire rope clips shall be drop-forged steel of the single-saddle (U-bolt) or double-saddle type. Malleable cast iron clips shall not be used. For spacing, number of clips, and torque values, refer to the clip manufacturer's recommendation. Wire rope clips attached with U-bolts shall have the U-bolt over the dead end of the rope and live rope resting in the clip saddle. Clips shall be tightened evenly to the recommended torque. After the initial load is applied to the rope, the clip nuts shall be retightened to the recommended torque to compensate for any decrease in rope diameter caused by the load. Rope clip nuts should be retightened periodically to compensate for any further decrease in rope diameter during usage.

Swaged or compressed fittings shall be applied as recommended by the rope, crane, or fitting manufacturer or qualified person.

Wherever exposed to ambient temperatures at the rope in excess of 180°F (82°C), rope having an independent wire-rope or wire-strand core, or other temperature damage-resistant core, shall be used.

Replacement rope shall be the same size, grade, and construction as the original rope furnished by the crane manufacturer,

Equalizers

If a load is supported by more than one part of rope, the tension in the parts shall be equalized.

Hooks

Hooks shall meet the manufacturer's recommendations and shall not be overloaded. If hooks are of the swiveling type, they should rotate freely. Latch-equipped hooks shall be used unless the application makes the use of the latch impractical or unnecessary. When required, a latch or mousing shall be provided to bridge the throat opening of the hook for the purpose of retaining slings, chains, or other similar parts, under slack conditions (see ASME B30.10).

5.7. Rope Inspection & Replacement

(a) Frequent Inspection

- All ropes should be visually inspected by the operator at the start of each shift. These visual observations should be concerned with discovering gross damage, such as listed below, that may be a hazard.

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- distortion of the rope, such as kinking, crushing, unstranding, birdcaging, main strand displacement, or core protrusion
- general corrosion
- broken or cut strands
- When such damage is discovered, the rope shall be removed from service as per detailed inspection, mentioned in periodic inspection.

(b) Periodic Inspection

- The inspection frequency shall be determined by a qualified person and shall be based on such factors as expected rope life, as determined by experience on the particular installation or similar installations; severity of environment; percentage of capacity lifts; frequency rates of operation; and exposure to shock loads. Inspections need not be at equal calendar intervals and should be more frequent as the rope approaches the end of its useful life.
- Periodic inspections shall be performed by a designated person. This inspection shall cover the entire length of rope. The individual outer wires in the strands of the rope shall be visible to this person during the inspection. Any deterioration resulting in appreciable loss of original strength, such as the following, shall be noted and determination shall be made as to whether further use of the rope would constitute a hazard:
 - distortion of the rope, such as kinking, crushing, unstranding, birdcaging, main strand displacement, or core protrusion
 - reduction of rope diameter below nominal diameter due to loss of core support, internal or external corrosion, or wear of outside wires
 - severely corroded or broken wires at end connections
 - severely corroded, cracked, bent, worn, or improperly applied end connections
- Special care should be taken when inspecting sections of rapid deterioration, such as the following:
 - sections in contact with saddles, equalizer sheaves, or other sheaves where rope travel is limited
 - sections of the rope at or near terminal ends where corroded or broken wires may protrude
 - sections subject to reverse bends
 - sections of rope that are normally hidden during visual inspection, such as parts passing over sheaves
 - In order to establish data as a basis of judging the proper time for replacement, a continuing inspection
 - record should be maintained. This record should cover points of deterioration listed.

Rope Replacement

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- No precise rules can be given for determination of the exact time for rope replacement, since many variable factors are involved. Once a rope reaches anyone of the specified removal criteria, the rope shall be replaced.
- Removal criteria for rope replacement shall be as follows:
- in running ropes, twelve randomly distributed broken wires in one lay or four broken wires in one strand in one lay,
- in rotation-resistant ropes, two randomly distributed broken wires in six rope diameters or four randomly distributed broken wires in thirty rope diameters
- one outer wire broken at the contact point with the core of the rope, which has worked its way out of the rope structure and protrudes or loops out from the rope structure
- wear of one-third the original diameter of outside individual wires
- kinking, crushing, bird-caging, or any other damage resulting in distortion of the rope structure
- evidence of heat damage from any cause
- reductions from nominal diameter greater than those listed below

Rope Diameter	Maximum Allowable Reduction from Nominal Diameter
Up to ~6 in. (8 mm)	1/64 in. (0.4 mm)
Over 5/16 in. to 1/2 in. (13 mm)	1/32 in. (0.8 mm)
Over 1/2 in. to 3/4 in. (19 mm)	3/64 in. (1.2 mm)
Over 3/4 in to 1 in (29 mm)	1/16 in. (1.6 mm)
Over 1 in. to 1-1/2 in. (38 mm)	3/32 in. (2.4 mm)

- Broken wire removal criteria cited in standard apply to wire rope operating on steel sheaves and drums The user shall contact the sheave, drum, or crane manufacturer, for broken wire removal criteria for wire ropes operating on sheaves and drums made of material other than steel.
- Attention shall be given to end connections. Upon development of two broken wires adjacent to a socketed end connection, the rope should be re-socketed or replaced. Re-socketing shall not be attempted if the resulting rope length will be insufficient for proper operation.
- Replacement rope and connections shall have a strength rating at least equal to the rating of the original rope and connections specified by the hoist manufacturer.
- Any deviation from the original size, grade, or construction of the rope shall be specified by a rope manufacturer, the crane or hoist manufacturer.

Rope Maintenance

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- Rope should be stored to prevent damage or deterioration.
- Rope shall be unreeled or uncoiled in a manner to avoid inducing a twist in or kinking of the rope.
- Before cutting rope, means shall be used to prevent unlaying of the strands.
- During installation, care should be observed to avoid dragging the rope in dirt or around objects that will scrape, nick, crush, or induce sharp bends.
- Rope should be maintained in a well-lubricated condition. Lubricant applied as part of a maintenance program shall be compatible with the original lubricant.

5.8. Hook Inspection

Hooks shall be removed from service if damage such as the following is visible and shall only be returned to service when approved by a competent person. Any sort of welding or hot work is strictly prohibited.

- excessive pitting or corrosion
- cracks, nicks, or gouges
- wear — any wear exceeding 10% (or as recommended by the manufacturer) of the original section dimension of the hook or its load pin
- deformation — any visibly apparent bend or twist from the plane of the unbent hook
- throat opening — any distortion causing an increase in throat opening of 5% not to exceed 1/4 in. (6 mm) (or as recommended by the manufacturer)
- thread wear, damage, or corrosion
- evidence of excessive heat exposure or unauthorized welding

6. LIFTING HARDWARE

Line management has the responsibility to implement this standard. Each Unit Implementation Committee (UIC) should identify a Overhead crane champion to assist line management in implementing the mandatory requirements of this standard.

6.1 Shackles

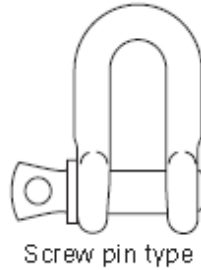
6.1.1. Types

- Body types covered are anchor, chain, and synthetic sling (see Fig. 1).
- Pin types covered are screw pin and bolt-type (see Fig. 1).
- Shackles other than those detailed in this chapter shall be used only in accordance with recommendations of the shackle manufacturer or a qualified person

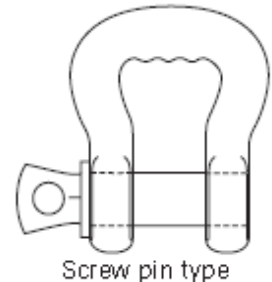
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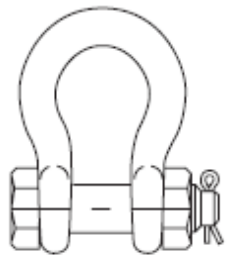
Screw pin type



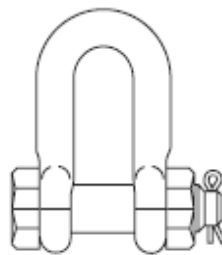
Screw pin type



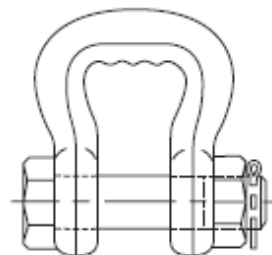
Screw pin type



Bolt type
Anchor Shackles



Bolt type
Chain Shackles



Bolt type
Synthetic Sling Shackles

Fig. 1 Shackle Types

6.1.2. Shackle Identification

Each new shackle shall have forged, cast, or die stamped markings by the manufacturer to show name or trademark of manufacture, rated load and size.

6.1.3. Removal Criteria

Shackles shall be removed from service if damage such as the following is visible and shall only be re- turned to service when approved by a competent person:

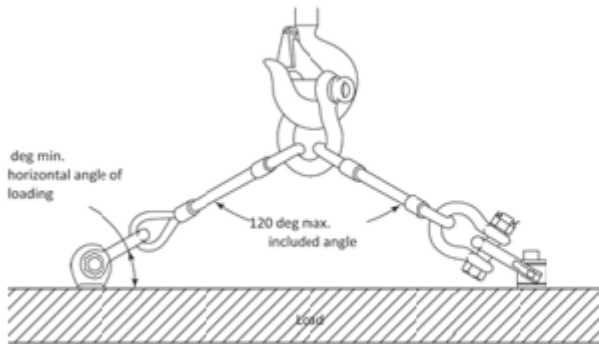
- Missing or illegible manufacturer name or trade mark or rated load.
- indications of heat damage including weld spat- ter or arc strikes
- excessive pitting or corrosion.
- bent, twisted, distorted, stretched, elongated, cracked, or broken load-bearing components.
- excessive nicks or gouges
- 10% reduction of the original or catalogue dimension at any point around the body or pin
- incomplete pin engagement
- excessive thread damage
- evidence of unauthorized welding

6.1.4. Rigging Practices

- Multiple slings in the body of a shackle shall not exceed 120 deg included angle.(Fig 2)
- The screw pin shall be fully engaged, with the shoulder in contact with the shackle body (see Fig. 3).

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- If a shackle is designed for a cotter pin, it shall be used and maintained in good working condition. No alterations or modifications is allowed.
- Contact with sharp edges that could damage the shackle should be avoided.
- Shock loading should be avoided.
- The load applied to the shackle should be centered in the bow of the shackle to prevent side loading of the shackle
- Multiple sling legs should not be applied to the shackle pin. If the shackle is to be side loaded, the rated load shall be reduced according to the recommendations of the manufacturer (see Fig.4).
- The screw pin shackle shall not be rigged in a manner that would cause the pin to unscrew.
- For long-term installations, bolt type shackles should be used; if screw pin type shackles are used, the pin shall be secured from rotation or loosening.
- Shackles should not to be dragged on an abrasive surface.
- When a shackle is used in a choker hitch, the pin shall be connected to the choking eye of the sling.



Horizontal Angle Deg	Stress Multiplier
90	1.0
60	1.155
45	1.414
30	2.000

Fig 2 : Angle of loading

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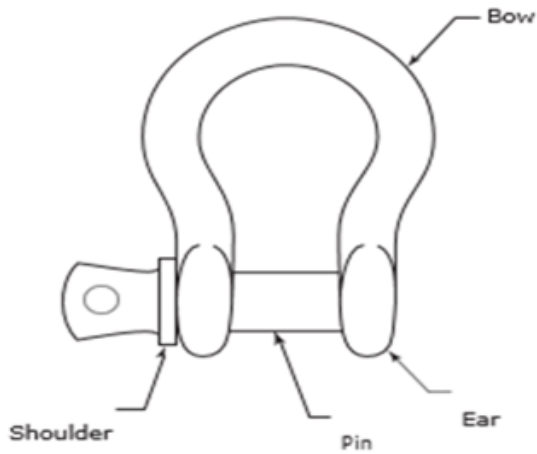
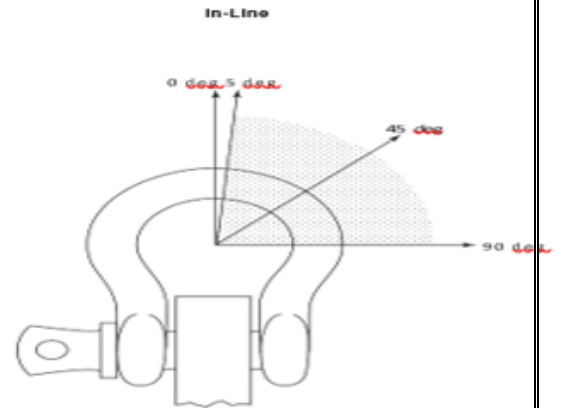


Fig 3: Typical shackle component



Side Angle Loading Deg	% load reduction
In-line to 5 deg	None
6 deg to 45 deg	30%
45 to 90 deg	50%
Over 90	Not recommended.

Fig 4: Side Loading

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6.2 Turnbuckles, Eye bolts, Eye-Nuts and Swivel hoist rings

6.2.1. Types

- Turnbuckles, including open and pipe body types with hook, eye, or jaw end fittings (see Fig. 5).

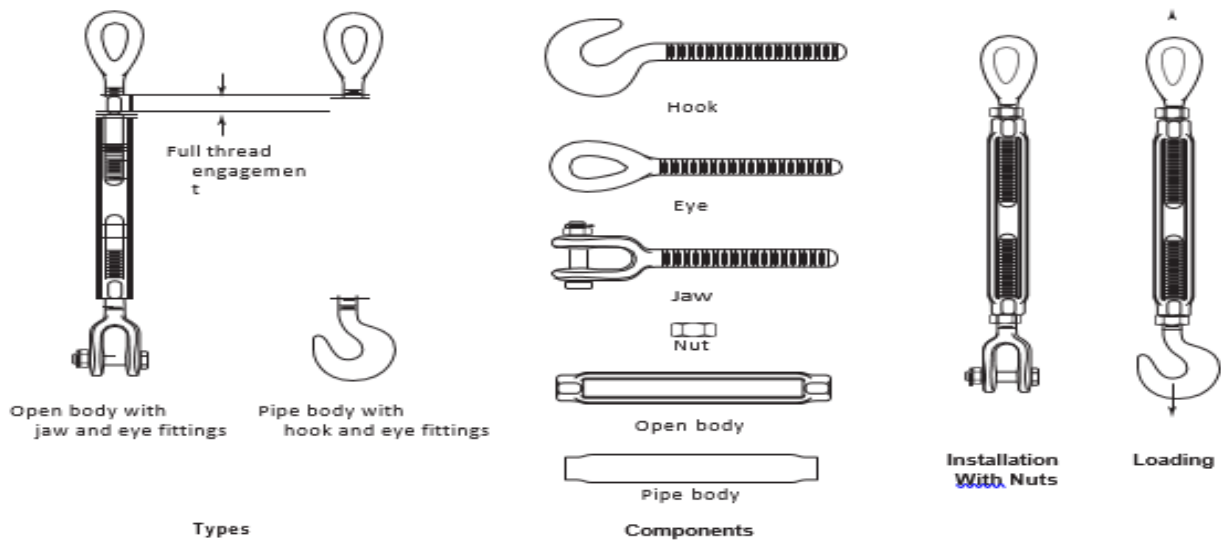


Fig. 5 Turnbuckles

- Eyebolts including shoulder nut, non-shoulder nut, non-shoulder machinery and shoulder type machinery types (Fig 6).

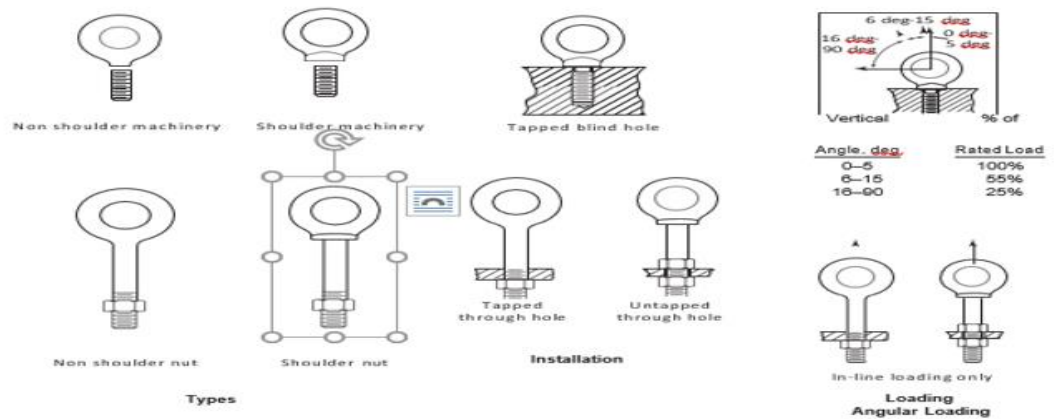


Fig 6: Eye-Bolt

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- Swivel hoist rings (Fig. 7).

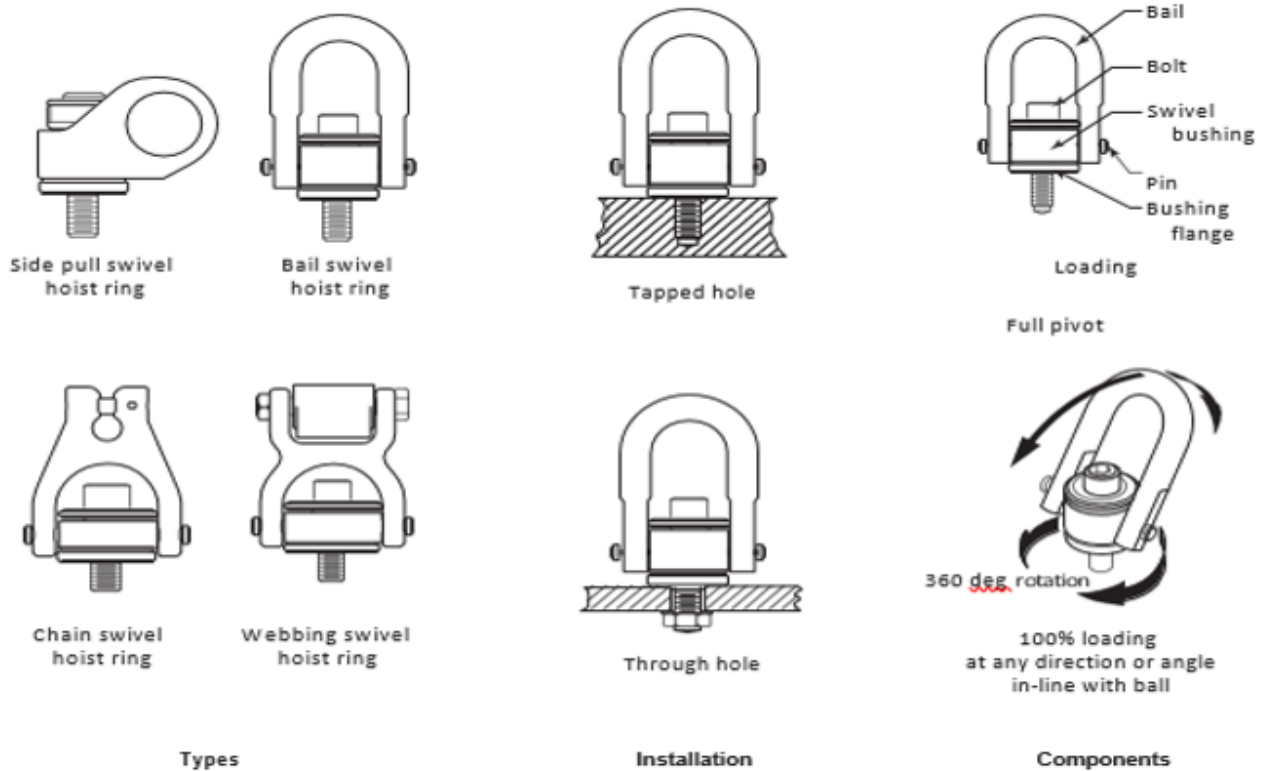


Fig 7: Swivel Hoist Rings

6.2.2. IDENTIFICATION

- Each turnbuckle, eyebolt, and eye nut shall be marked to show name or trademark of manufacturer, size or rated load and grade for alloy eyebolts.
- Each swivel hoist ring shall be marked to show name or trademark of manufacturer, rated load and torque value

6.2.3. Removal Criteria

Adjustable hardware shall be removed from service if damage such as the following is present and shall only be returned to service when approved by a qualified person:

- missing or illegible identification
- indications of heat damage including weld spatter or arc strikes
- excessive pitting or corrosion
- bent, twisted, distorted, stretched, elongated, cracked, or broken load-bearing components
- excessive nicks or gouges

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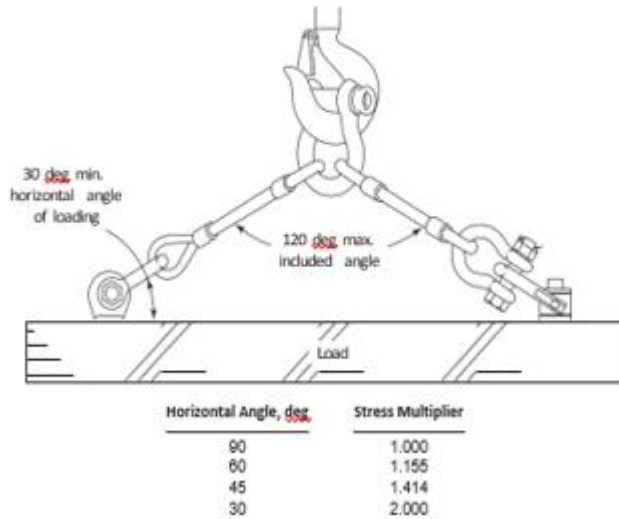
- a 10% reduction of the original or catalogue dimension at any point
- excessive thread damage or wear
- evidence of unauthorized welding or modification
- for swivel hoist rings, lack of the ability to freely rotate or pivot

6.2.4. Rigging Practices

- Turnbuckle end fitting threads shall be fully engaged in the body threads.
- NOTE: Pipe bodies conceal the length of thread engagement. Verify full engagement before loading (see Fig. 5).
- Components, including pins, bolts, nuts, or cotter pins used with jaw ends, shall be in good working condition prior to use. No alterations or modifications is allowed.
- If locking nuts (see Fig. 5) are used they shall be compatible with the threads of the turnbuckle end.
- Contact with obstructions that could damage or bend the turnbuckle should be avoided.
- The load applied to the turnbuckle should be in line and in tension.
- Turnbuckles should not be side loaded.
- Turnbuckles should be rigged or secured to prevent unscrewing during the lift.
- For long-term installations, turnbuckles shall be secured to prevent unscrewing.
- Turnbuckles should not be dragged on an abrasive surface.
- Turnbuckles should be adjusted with a properly sized wrench, used on the wrench flats of the turnbuckle body.

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Fig 8: Angle of loading (Adjustable Hardware)



- Eyebolts should be tightened or otherwise secured against rotation during the lift.
- When used in a tapped blind hole, the effective thread length shall be at least 1.5 times the diameter of the bolt for engagement in steel (see Fig. 6). For other thread engagements or engagement in other materials, contact the eyebolt manufacturer or a qualified person
- When used in a tapped through-hole of less than one diameter thickness, a nut shall be used under the load and shall be fully engaged and tightened securely against the load (see Fig. 6).
- When used in an untapped through-hole the nut under the load shall be fully engaged. If the eyebolt is not shouldered to the load, a second nut on top of the load should be used where possible (see Fig. 6).
- Eyebolts not shouldered to the load shall only be used for in-line loads (see Fig. 6).
- Only shoulder eyebolts shall be used for angular lifting. When used for angular lifting, the shoulder shall be flush and securely tightened against the load. The working load limit (WLL) must be reduced as shown in Fig. 6.
- When using shoulder eyebolts for angular lifts, the plane of the eye shall be aligned with the direction of loading. Flat washers may be used under the shoulder to position the plane of the eye (see Fig. 6).
- Eyebolts shall be in good working condition prior to use. No Alterations or modifications is allowed.
- Eye nuts should be secured against rotation during the lift.

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- The threads of the eye nut shall be fully engaged.
- Eye nuts shall only be used for in-line loads.
- The plane of the eye may be positioned with a flat washer(s) or lock nut.
- Swivel hoist ring components shall be in good working condition prior to use. No Alterations or modifications is allowed.
- When used in a threaded-hole, the effective thread length shall be 1.5 times the diameter of the bolt for steel. For other thread engagements or engagement in other materials, contact the swivel hoist ring manufacturer or a qualified person.
- When used in a through-hole application, a nut and washer shall be used. The washer and nut shall be in accordance with the swivel hoist ring manufacturer's recommendations. The nut shall be fully engaged.
- The bushing flange shall fully contact the load surface.
- Spacers or washers shall not be used between the bushing flange and the mounting surface of the load being lifted.
- The swivel hoist ring shall be tightened to the torque specifications of the manufacturer.
- The swivel hoist ring shall be free to rotate and pivot without interference during lifting.
- The load applied to the swivel hoist ring shall be centered in the bail to prevent side loading.
- Any attached lifting component shall be narrower than the inside width of the bail to avoid spreading.
- Components shall be in good working condition prior to use. No Alterations or modifications is allowed.
- Ensure that the swivel hoist ring WLL meets or exceeds the anticipated angular rigging tension (see Fig. 8).
- Shock loading should be avoided.

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6.3 Wire Rope Clips and Wedge Socket.

6.3.1. Types

- Wire rope clip types covered are U-bolt and double saddle (see Fig. 9).
- Wedge sockets (see Fig. 10).
- Saddles shall be forged steel.

6.3.2. IDENTIFICATION

- Each new wire rope clip saddle shall have forged or die stamped markings by the manufacturer to show, name or trademark of manufacturer, size.
- Each new wedge socket body and wedge shall have forged, cast, or die stamped marking by the manufacturer to show name or trademark of manufacturer, size, model, if required to match wedge to body.

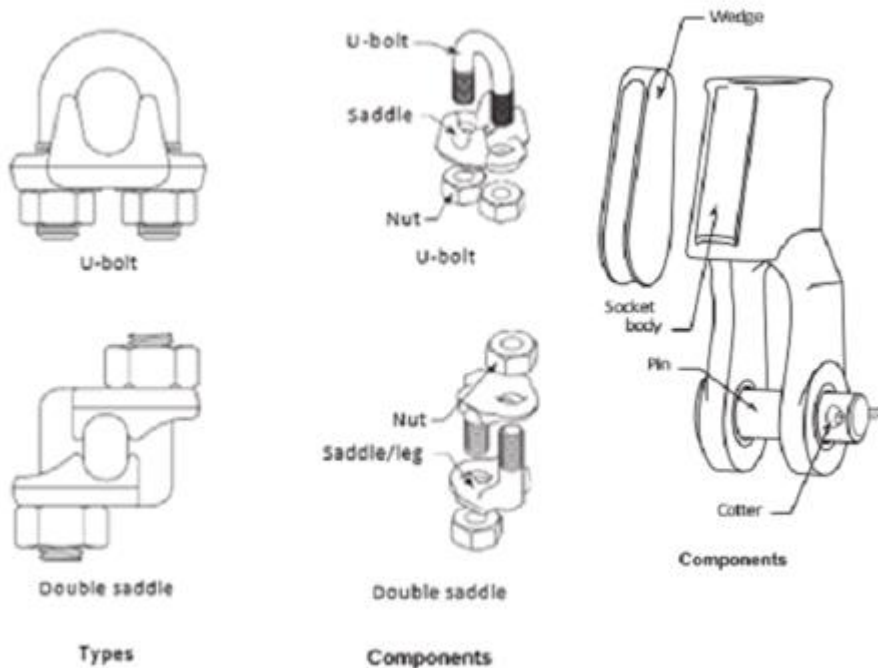


Fig 9

Fig 10

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6.3.3. Removal Criteria

Compression hardware shall be removed from service if conditions such as the following are visible and shall only be returned to service when approved by a competent person:

- missing or illegible identification.
- indications of heat damage including weld spatter or arc strikes.
- excessive pitting or corrosion.
- bent, twisted, distorted, stretched, elongated, cracked, or broken components
- excessive nicks or gouges.
- **10% reduction of the original or catalogue dimension at any point.**
- evidence of unauthorized welding.
- insufficient number of wire rope clips () improperly tightened wire rope clips.
- indications of damaged wire rope (l) indications of wire rope slippage.
- improper assembly or other conditions, including visible damage, that cause doubt as to continued use.

6.3.4. Rigging Practices

- Wire rope clips and wedge socket should not be in contact with the load or any obstruction during the lift.
- Shock loading, and side pull should be avoided.
- Rigging tools and tackles using wire rope clips or wedge socket should not be dragged on an abrasive surface.
- The use of wire rope clips to fabricate slings is prohibited.

6.3.5. Assembly – Wire Rope Clips

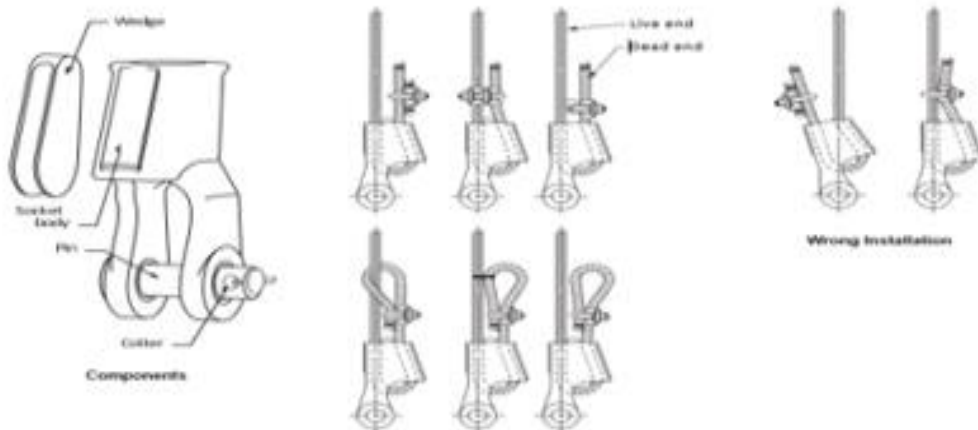
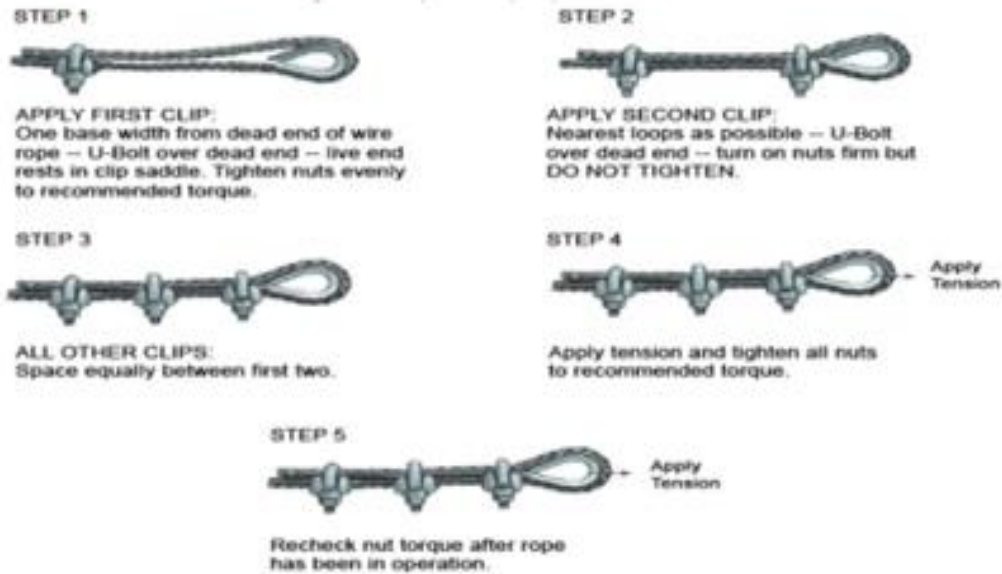
- Before installing a wire rope clip on plastic coated or plastic impregnated wire rope, consult the wire rope clip manufacturer, wire rope manufacturer, or a competent person.
- For U-bolt clips used to create end terminations, the saddle shall be placed on the live end of the wire rope, with the U-bolt on the dead end side (see Fig. 11).
- At least the minimum number of clips as recommended by the manufacturer or as mentioned below in table.
- The spacing between wire rope clip should be as recommended by the manufacturer or a qualified person.
- The wire rope clip shall be tightened to the torque recommended by the manufacturer.
- After assembly, the connection shall be loaded to at least the expected working load.
- After unloading wire rope clips shall then be re-tightened to the torque recommended by the manufacturer or a qualified person.

S.No	Diameter of wire rope in mm	Min No. of grip
1	Upto and including 20 mm	3
2	Over 20 and up to and including 32mm	4

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3	Over 32 and up to and including 38 mm	5
4	For 41mm	6

Fig 11: Assembly of wire clip and wedge socket



Assembly of Wedge Socket

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6.3.6. Assembly – Wedge Sockets

- The wedge socket shall be assembled as recommended by the manufacturer or a qualified person.
- Before installing a wedge socket on plastic coated or plastic impregnated wire rope, consult the wedge socket manufacturer, wire rope manufacturer, or a qualified person.
- The live end of the wire rope in the wedge socket cavity shall be in alignment with the socket's pin (see Fig. 11).
- The assembler shall match the proper wedge with the socket for the wire rope to be installed.
- **NOTE: Wedges shall not be interchanged between different manufacturers' sockets or models.**
- The length of the dead end tail of the wire rope shall be as required by the manufacturer or a competent person.
- The dead end tail of the wire rope extending beyond the wedge socket shall be secured in a manner recommended by the wedge socket manufacturer or a competent person (see Fig. 11).
- The dead end of the wire rope shall not be secured to the live end of the wire rope such that it restricts the movement of the live end (see Fig. 11).
- After assembly, the connection shall be loaded to fully seat the wedge before use.

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6.4 Rigging Block

6.3.1. Types

- (a) Types include tackle, utility, rolling, and snatch blocks (see Fig. 12).
- (b) Load fittings on rigging blocks may include hooks, eyes, swivels, yokes, bails, shackles, and pins (see Fig. 13).

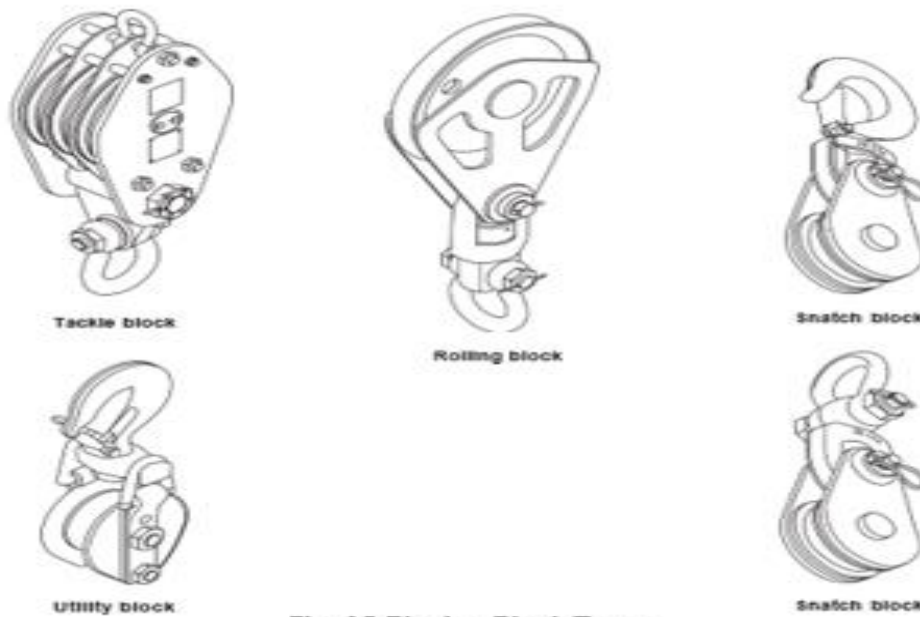


Fig. 12 Rigging Block Type

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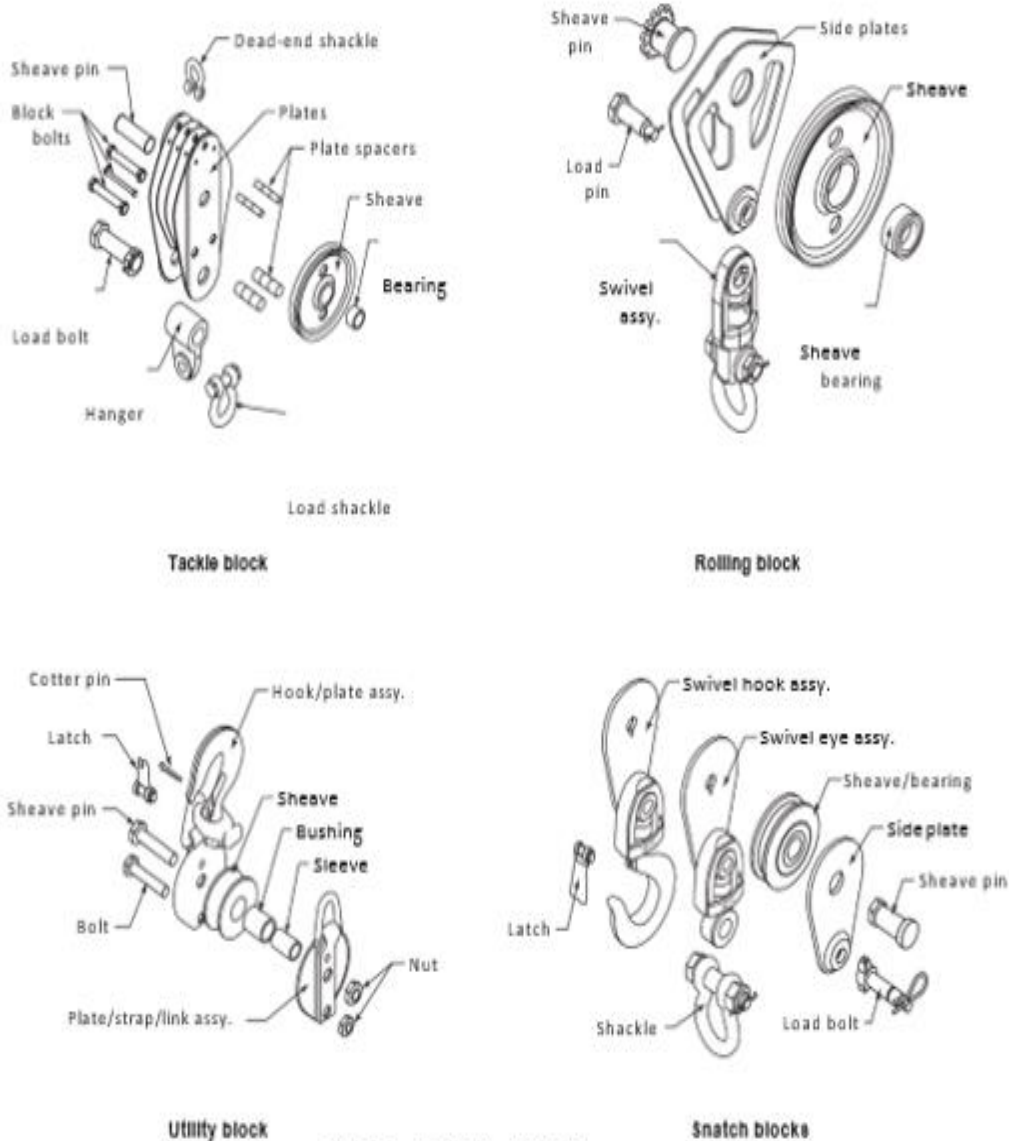


Fig 13 Typical Rigging Block Components.

6.3.2. IDENTIFICATION

Each new rigging block shall be marked by the manufacturer to show name or trademark of manufacturer rated load and rope size(s)

6.3.2. Removal Criteria

Rigging blocks shall be removed from service if conditions such as the following are present and shall only be returned to service when approved by a competent person.

- excessive sheave groove corrugation or wear
- loose or missing nuts, bolts, cotter pins, snap rings, or other fasteners and retaining devices
- indications of heat damage, including weld spatter or arc strikes

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- excessive pitting or corrosion
- bent, cracked, twisted, distorted, stretched, elongated, or broken load bearing components
- excessive wear, nicks, or gouges
- a 10% reduction of the original or catalogue dimension at any point
- excessive damage to load bearing threads.
- evidence of unauthorized welding or modifications.
- missing or illegible identification.
- misalignment or wobble in sheaves.
- other conditions, including visible damage that cause doubt as to the continued use of the rigging block.

6.3.2. Rigging Practices

- The rigging block components shall be fully engaged, with all fasteners and retaining devices in place and in good working order before use. No Alterations or modifications is allowed.
 - Contact with sharp edges that could damage the rigging block should be avoided.
 - Shock loading should be avoided.
 - The load applied to the rigging block should be in-line with the sheave and load fitting(s) to prevent side loading of the block.
 - Ensure the rope is in the sheave groove when the rigging block begins to take load.
 - **The line load multiplied by the block load factor shall not exceed the rated load of the rigging block (see Fig. 14).**
 - Rigging blocks should not be dragged on an abrasive surface.
 - Load line fittings shall not contact the rigging block sheave(s).

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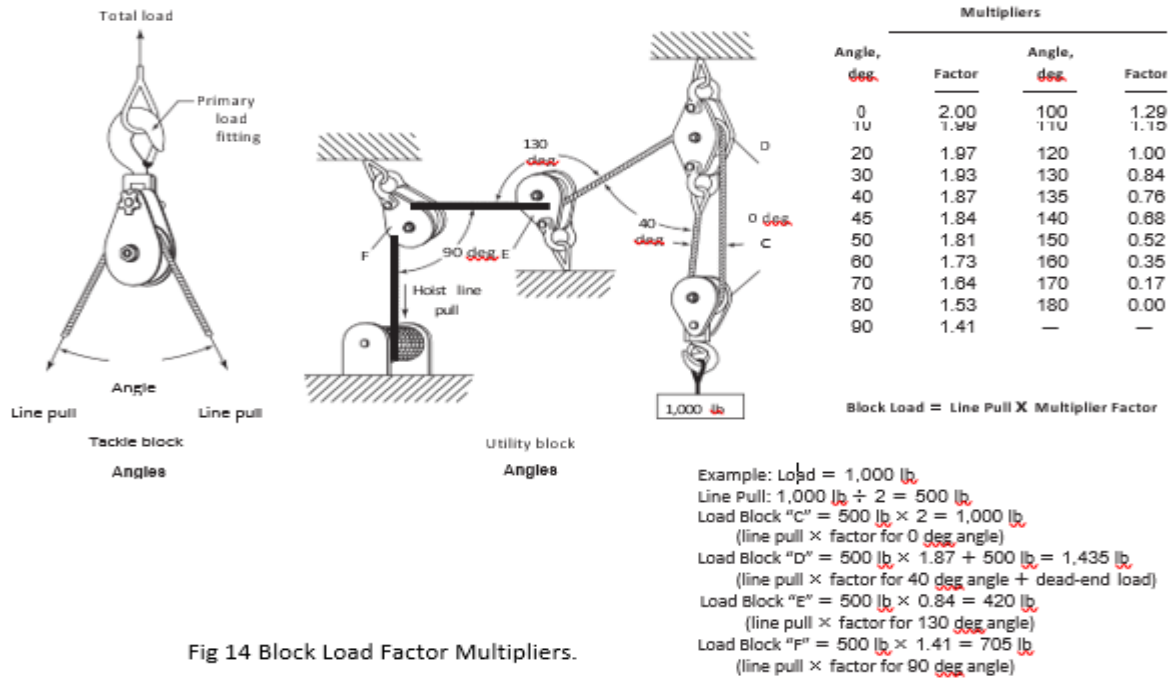


Fig 14 Block Load Factor Multipliers.

6.5 Effect of Environment

Temperature

- When hardware, excluding swivel hoist rings and carbon steel eyebolts, is to be used at temperatures above 204°C or below -40°C, the hardware manufacturer to be consulted.
- When carbon steel eyebolts are to be used at temperatures above 135°C or below -1°C, the hardware manufacturer be consulted.

Chemically Active Environments

The strength of adjustable hardware can be affected by chemically active environments such as caustic or acid substances or fumes. The hardware manufacturer should be consulted before use in chemically active environments.

6.6 Inspection, Repair and Removal

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All Rigging hardware to be inspected prior to use.

All rigging hardware to inspected at interval of 3 month as per L&S Standard checklist and colour coded.

Annual Inspection & Certification

All Tools and tackle used for the purpose of raising and lowering of the load, should be thoroughly examined by a competent person at least once in every period of twelve months.

All lifting tools and tackle to be tested at SWL only, not beyond that SWL in any case.

For the purposes of this section a lifting machine or a chain, rope or lifting tackle shall be deemed to have been thoroughly examined if a visual examination supplemented, if necessary, by other means such as Ultra Sonic testing and MPT or by the dismantling of parts of the gear, has been carried out as carefully as the conditions permit in order to arrive at a reliable conclusion as to the safety of the parts examined.

Frequency of test: As per Factory Act 1948, Section 29 and Rajasthan Factory Rules Schedule 6 , sub section 57 point no 6.

S.No	Tool and Tackle Description	Frequency	Inspection Type
1	Chain Pulley Block	1 Year	Visual Inspection. Load test at SWL. UT & MPT of hooks
2	Wire Rope /Metal Mesh/Chain Sling	1 Year	Visual Inspection. Load test at SWL.
3	Synthetic Web Sling	1 Year	Visual Inspection
4	Shackles	1 Year	Visual Inspection. Load test at SWL. UT/MPT.
5	Rigging block & Hooks	1 Year	Visual Inspection. Load test at SWL. UT & MPT of hooks
6	Turn Buckle	1 Year	Visual Inspection & Competent Person requirement.
7	Eye Bolts & Nut	1 Year	Visual Inspection & Competent Person requirement.
8	Wire Rope Clip	1 Year	Visual Inspection & Competent Person requirement.
9	Wedge Socket	1 Year	Visual Inspection & Competent Person requirement.
10	Mobile Crane	1 year	Load test of crane in particular configuration, MPT /UT of lifting hooks, load bearing pins. Validation of SLI etc.

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Repairs and Modifications

No modifications of rigging hardware are allowed.

Replacement parts, including nuts, pins, and bolts, shall meet or exceed the original equipment manufacturer's specifications.

Any repair to be carried out on rigging hardware to be done in presence of OEM. After repair hardware to be tested by competent person.

Welding on rigging hardware is completely prohibited.

7. CHAIN PULLEY BLOCK

7.1 Definition:

- Safe Working Load (SWL): The maximum mass, which the block shall raise, lower or suspend in a particular service condition.

7.2 Requirement:

- Hand-operated chain pulley blocks are used extensively for material handling during construction, erection and maintenance activities in our operations, this guideline serves the purpose to bring clarity on the examination and load testing of the Chain pulley block

7.3 Procedure:

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Following steps shall be followed during initial selection & Procurement of Chain pulley block.

- All parts of chain pulley blocks should be of good construction, sound material adequate strength properly maintained and thoroughly tested examined by competent person (approved by state) once in every period of 12 months.
- No Chain Pulley block should be taken into use for the first time in the factory, mine and project site unless it has been tested, and all parts have been thoroughly examined by a competent person and a certificate of such test and examination specifying the working load or loads and signed by the person making the test.
- Each site has to ensure that manufacturer submits the examination certificate mentioning that chain pulley block has been subjected to proof load test of 1.5 times the working load limit through a length of lift, which will ensure that every part of the block mechanism and each tooth of the gears come under load. If such a certificate is not being produced by the service provider then HZL shall ensure that such testing & certification is done through competent person of state prior to taking the chain pulley block inside the premises for the first time.

Following steps shall be followed After procurement & while usage of Chain pulley block at work site.

- The HZL mandates that each chain pulley block shall be examined by a competent person at the
- interval of every 12 months, after the first time load test (i.e. Examination & testing every 12 month
- after initial load test by competent person arranged by OEM.
- The chain pulley block shall be considered to be examined if following three conditions are compiled:
 - **Visual examination:** Inspection of load chain and hooks for deformation, condition of the gears and guide loaders, condition of the geared traveling trolley and supporting structures. All links are examined clearly for deformation and mainly the contact points to be thoroughly inspected. The safety latches of top and bottom hooks also to be verified for its proper functioning.
 - **Annual Load Test:** Each Chain pulley block shall be loaded with a test weight equal to 100% of SWL load limit which shall be raised and lowered throughout the length of the chain, ensuring that every part of the block mechanism and each tooth of the gears come under load. When the hand chain is released at any point during raising and lowering, the brake shall hold the weight. If required by competent person chain block to be inspected by opening its part to come to final conclusion for future usage and certification of chain block.
 - **Periodical Inspection:**
 - Regular Quarterly inspection shall comprise of (checklist of chain pulley block in L&S Procedure)
 - Visual inspection

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- Chain pulley blocks to be checked for lubrication and deformation free gearing systems.
- Checking of load chain.
- Checking the load hooks.
- Certificate of Test and Examination (Annually): A certificate of test and examination shall be verified & retained, giving the following information for each chain pulley block:
 - Safe working load,
 - Distinguishing mark,
 - Description,
 - Range of lift,
 - Load chain size and grade,
 - Number tested, and
 - Operational proof load applied.

7.4 Marking:

After the chain pulley block passes the annual examination by a competent person it shall be permanently marked and legibly stamped with the following information:

- Safe Working load
- Details of Testing & validity
- Date of testing
- Due date of testing
- Site Specific Identification mark or colour code.

Note: Any slip observed during the load test or any other defects observed by competent person to be taken serious event and that chain pulley block to be tagged and removed from the service.

8. COLOR CODING PROCEDURE FOR LIFTING TOOL AND TACKLE.

In order to have better traceability and transparency of lifting tool and tackle procedure had been developed to assist user to inspect and identify tools and gears suitable for lifting and shifting operation in our daily operation.

The following information must be available for each accessory or piece of lifting equipment (including hired-in equipment).

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- Safe Working load of the equipment.
- Unique/Serial number to identify the equipment.
- Date of last statutory inspection.
- Due date of statutory inspection.

All lifting accessories shall be thoroughly inspected at 3 monthly intervals. Upon satisfactory results of the thorough examination, the Colour Code shall be painted on every piece of lifting gear. The colour indicates to the user that a thorough examination has been performed within the prescribed period.

The safe working load, unique /serial number and date of test and due date test must be clearly marked on all lifting equipment and accessories and must be visible. This can be done by putting sticker, painting required information of lifting gear or putting tags.

A certificate of test and examination specifying safe working loads must be available on request for all such equipment and accessories.

User and inspector to follow Checklist for inspection of the lifting tools and tackle as prescribed in HZL lifting Standard.

In case of unsatisfactory results, the equipment shall be quarantined, coloured black if to be disposed, if repairable to be coloured white and locked away to prevent unintended use. If the equipment cannot be repaired, it shall be rendered useless and quarantined. List of equipment quarantined must be submitted to UIC champions at the end of each month.

A new colour shall be introduced every 3 months and each colour shall be valid for a period of 4 months. One-month overlap is to ensure lifting gear is available for use at all times and colour coding is complete in due period.

HZL practice is to have all available lifting accessories examined and colour coded in every fiscal quarter in month of April, July, October, January. Any lifting gear that does not have a visible colour band or where the colour is out of date, shall not be used. It shall be returned to the store. Such equipment shall not be re-issued or used until after satisfactory thorough examination by a lifting equipment Inspector appointed by Zone Chairman or his nominee.

Painting of the colour codes shall be the responsibility of the asset custodian or his nominee and shall be witnessed by the UIC lifting champion or his representative.

All work sites shall have a lifting gear Colour Code Identity Board with the current colour codes displayed.

Colour coding for year.

Month	April	May	June	July	August	September	October	November	December	January	February	March	April
Valid Colour	Yellow	Yellow	Yellow	Green	Green	Green	Blue	Blue	Blue	RED	RED	RED	
One month	Yellow	Yellow	Yellow	Yellow	Green	Green	Green	Blue	Blue	Blue	RED	RED	RED

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Colour for Quarantined lifting tools Black.



Colour for Repairable lifting tools White.



Size and position of Colour Code: Colour coding should be done such that it is easily visible for inspection during its usage on site.

S.No	Lifting tools	Size of colour code
1	Wire rope, Metal mesh sling, chain sling	2 inch colour band on each side of sling socket
2	Chain block	2 Inch circumferential band on chain pulley block and hook block assembly.
3	Shackle, eye bolt, turn buckle	2 inch colour band on each side leg.

9. MANAGEMENT RECORDS

One years Records shall be retained in compliance with the site and legislative

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requirements with the Engineer in-charge.

9.1. Audit Requirements

Each site & Corporate Safety shall audit compliance with this standard as part of its HSE audit program.

9.2. Standard Renewal Process

This standard shall be reviewed and revised as necessary and, at a minimum, not later than three years from the date of the last revision.

9.3. Deviation Process

Deviations from this standard must be authorized by Location Head in consultation with Corporate Safety Head. Deviations must be documented, and documentation must indicate causes of deviations with safety plan. Deviation authorization must be renewed periodically not greater than 12 months.

9.4. Training and communications requirements

Company line management has the responsibility to communicate the mandatory requirements of this standard to all personnel involved with mobile crane equipment. Each Zone is required to develop the detailed procedure abiding all standard requirements for effective implementation of standard.

Any person designing or approving a lifting plan must be trained and certified as competent through a Vedanta authorized agency once in every three years and shall undergo internal refresher training and internal re-authorization through written assessment annually.

Rigger and signalman must be trained and certified once in every 3 years by Vedanta authorized agencies. Internal refresher training and internal re-authorization through written assessment should be done annually.

Mobile crane operators must be trained and certified for specific crane operations once in every three years, ideally by OEMs or OEM authorized agency or Vedanta authorized agencies. Internal refresher training and internal re-authorization through written assessment should be done annually.

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Types of Training

Stage 1 : This is mandatory before a person is authorized for designing/ preparing lift plan. Course content of the training program should cover following topics.

- Understanding ASME Standards & LOLER Guidelines
- Types of cranes, parts and correct application
- Conditions that reduce capacity of a crane
- Crane leverage and load leverage
- Forward stability and backward stability of a crane
- Highlights of ASME B 30.5 Standards & its implementation
- Understanding characteristics of a mobile crane
- Types of rigging hardware, slings and wire ropes
- Correct inspections and applications of rigging hardware, slings and wire ropes.
- Correct procedures for hand signals (Theory)
- Principle of operations Quadrants of operation
- Understanding & Correct interpretation of load charts.

Stage 2: This is mandatory before a person is authorized for approving lift plan. Person who had completed the stage 1 are qualified for stage2 training. Course content of the training program should cover following topics.

- Understanding considerations to be made prior to undertaking Mobile Crane Inspections
- Understanding Indian & ASME standards on Crane Inspections
- Practical on inspections rigging hardware used on mobile cranes
- Considerations for preparing checklists
- Practical on pre- use inspections
- Practical on Mobile Crane Annual Inspection

9.5. Custodian and contact

The custodian for this standard is Corporate Safety. The contact for this standard is the Standard Rules and Procedures sub-committee of Site.

10. ANNEXURE :

10.1. LIFTING PLAN FORMAT

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A lift plan will have following document to ensure all necessary precaution are taken for executing lift. Worker engaged in lift are made aware about the requirement of lift and method to execute it safely following highest safety procedure for safe lift.

Document required:

1. Lift Plan Format.
2. Dry run comments.
3. Pre-Lift Meeting.
4. Method of statement for rigging step and calculation.
5. Crane pre-inspection checklist.
6. Hand Signal.
7. Emergency Plan
8. Crane Planning and Risk Assessment sheet
9. Area Layout and crane position.

1. Sample Format

Description of Work.: कार्य का विवरण		Location: स्थान	
HOD Of Department विभाग के एच.ओ.डी.		Equipment: उपकरण:	
Lift Plan Prepared By: लिफ्ट योजना तैयार की		Date: तारीख:	
Mobile Crane Used: मोबाइल क्रेन :			
Name of Contractor/Crew Making Lift: ठेकेदार / कू बनाने का नाम लिफ्ट बनाना			
Name of Rigger: रिगर का नाम:			
Name of Signal Man: सिग्नलमैन का नाम:			
PERMIT NO:			

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Mobile Crane Configuration and other related information

Maximum Operating Radius Used: अधिकतम ऑपरेटिंग त्रिज्या:	
Boom Length Used: बल्ली की लंबाई:	
Clearance Between Boom and Load बूम और लोड के बीच निकासी:	
Clearance to Surrounding Facilities: आसपास के सुविधाओं के लिए मंजूरी:	
Clearance to High Voltage Lines उच्च वोल्टेज लाइनों के लिए निकासी:	
Stability of Ground under Crane /Outriggers क्रेन / आउटरीगर्स के नीचे ग्राउंड की स्थिरता:	
Extra Blocking/Matting Needed अतिरिक्त अवरुद्ध / मैटिंग की आवश्यकता है:	
Maximum Allowable Wind अधिकतम स्वीकार्य हवा:	
Actual Wind Speed वास्तविक हवा की गति:	
Illumination level at site in night रात में साइट पर रोशनी का स्तर:	

TOOLS & TACKLE

Tool & Tackle Description	Capacity	Qty	Certificate No

TOOLS CHECKLIST BEFORE USE

Tools	Chain pulley block	Wire rope Sling	Chain Sling	Web Sling	D / Bow-Shackle	Wire rope clamp	Eye Bolt	Wire Mesh Slings

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(Tick <input checked="" type="checkbox"/> whichever is applicable)	YES/NO	YES/N O	YES/N O	YES/N O	YES/N O	YES/NO	YES/N O	YES/N O
Is there any Physical Damage?								
Is SWL marked?								
Is test date and due date is marked?								
Is Hook with Safety Latch provided								
Is slings padded or protected from the sharp edges of their loads?								

CALCULATIONS:

Crane's Lifting capacity (SWL from Load Chart) क्रेन की भारोत्तोलन क्षमता (भार चार्ट से एसडब्ल्यूएल)	
Weight of Load भार का भार:	
Weight of Block & Rigging ब्लॉक और रिगिंग का वजन:	
Total Lift Weight (J+K) कुल लिफ्ट वजन (जे + के)	
Percent (%) of Crane's load chart capacity (L/I*100%) क्रेन की लोड चार्ट क्षमता (एल / आई * 100%) का प्रतिशत (%)	
Classification of Lift लिफ्ट का वर्गीकरण	
Included Angle between Sling and load. गोफन और लोड के बीच कोण शामिल है	
Type of Hitch	

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Tension on Slings	
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DRY RUN COMMENTS

Signature of Lift Plan Designer

Signature of Lift Plan Approver

- **In Case of critical lift Engineer in charge of job will inform Unit Head and further communicated to Crane champion and rescue team of unit.**

PRE LIFT MEETING

Topics to be discussed.

Appoint a signal man.

Discuss hand signals to be used.

Crane Operator and signal man to introduce each other and to rest of the team. Discuss about the load to be lifted.

Discuss about the rigging plan including rigging tools and tackle and their capacities and on each tool & tackle and method of statement.

Discuss how load will be lifted and swing to transfer load from initial point to destination.

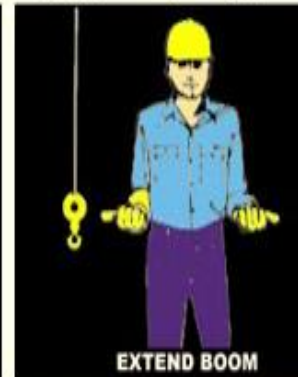
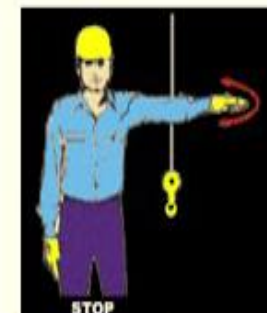
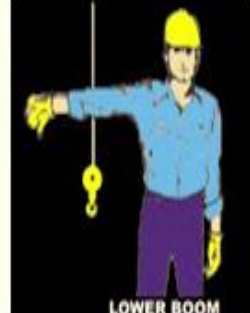
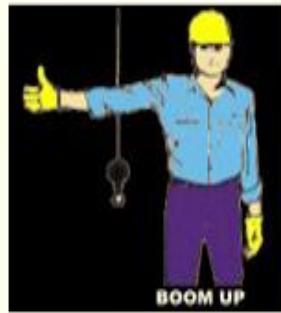
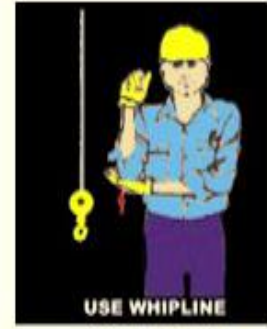
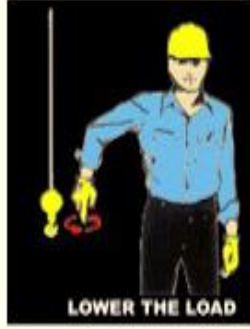
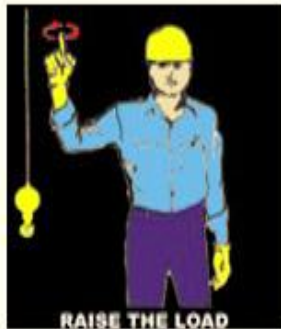
Discuss about the emergency procedure and area cordon off.

HAND SIGNAL

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Crane Signals



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Crane Planning & Risk Assessment Checklist

This is the second set of checks and shall be done by lift plan maker before the lift is started with the crane set up at the place for the lift. These checks must be done for each new set up even if the same crane is deployed in different set ups. This is not replacement of JSA.

DESCRIPTION	YES	NO		REMARK
Does lift radius and boom length check with the planned: With the crane set up measure the lift radius and check the boom length required. For hydraulic cranes the boom length can be read on the SLI and the lift radius measured checked against the SLI reading for lift radius. For crawler cranes boom length is fixed and can be taken from the load chart using the relevant configuration. If lift radius or/and boom length is bigger than planned, the capacity loading must be recalculated to check that the loading still is within prescribed limit; 50% to 90%.				
Are outriggers fully extended, placed on load spreaders and crane leveled: Check that all 4 outriggers are fully extended to the marking on each of the outriggers. It is not allowed to proceed with the lift if any of the outriggers cannot be fully extended. If possible always use the spreaders provided with the crane under the outriggers.				
Is the crane leveled as per spirit level installed in the crane? If the crane will move free on wheels - or on crawler with the load suspended ensure it will stay leveled.				
Are out riggers set on solid ground free from water logging/soaking and on safe distance from any excavation, storm-water channel, pit, trench etc.: Do not allow the crane setting on ground with water logging or soil soaked with water as the ground loading capability might be much lower than expected. The distance of any outrigger to an excavation, storm-water channel, pit (not RCC pit), trench must at least be equal to the depth of the cavity. Outriggers should not be placed above storm-water culverts without spreading the load.				
Is crane slewing/movement free from any obstruction with at least 0.6 m: Check that the crane can slew with the prescribed safety margin of 0.6 m, if not possible barricade the area to stop personnel access.				
Do not permit the lift if visibility is limited by e.g. heavy rain or fog. Avoid lift during non-daylight hours. Do not lift during thunderstorm.				
Is the crane free of any oil leakage: When walking around the crane check for any oil leakage from the hydraulic system especially on the outriggers? Is weather condition safe for lift: High wind speed will have a significant impact on loads with high wind areas. The wind might cause the lift line to get out of plumb and cause the crane to topple. If wind speed is above 32 km/hr - the lift shall be stopped.				

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Are slings marked with safe load, valid color-coding and without any visual damage. All slings, belts, shackles shall be visual inspected for wear and tear, cuts before any lift. No damage shall be accepted				
Are slings protected from sharp edges on the load: Incidences have happened when sharp edges have cut through the belts and caused the load to drop. Ensure that the slings are protected by e.g. fitting wooden beams between load and slings.				
Is angle between sling and load more than 60 degrees: A small angle will cause high load on the sling and load.				
Are shackles used if more than 2 slings are attached to the hook: To avoid undue load on the slings from each other, the slings shall be connected to the hook by help of shackles if more than 2 slings are used.				
Is the load free from adhesion:				
Are lifting lugs free from visual defects: Visual inspect lifting lugs for any defects.				
Is load center of gravity known: For eccentric load with unknown center of gravity always determine center of gravity by trial and error without lifting the load completely off the ground.				
Is lift line plumb: It is not allowed to use the crane for dragging the load as this could cause the crane to topple. The lift line shall hang vertical free from any obstruction above the center of gravity of the load.				
Is the lift area free from any other conflicting activities: During the lift other activities in the direct vicinity and especially under the load must temporarily be stopped?				
Is signaler in high visibility vest: Ensure that the person signaling to the crane operator is in high visibility vest.				
Is lift area barricaded? Are the slinger and signaler clear of the lifted load: This is the ultimate precaution for all lifts? No person shall be allowed under suspended load. If it is not practical to barricade the area other means to keep people away must be used.				
Never Leave load unattended when lifted: Signal Man and crane operator are not allowed to leave the job site or crane while load is lifted in any case. If it is required by crane operator or signal man to leave job site for unavoidable reason, they should bring down load safely on ground/stable platform before leaving the site.				
No Marching of mobile crane, crawler crane with load.				
Dry run before critical and heavy lift.				
All crane safety interlocks are successfully operational and no bypass to interlocks.				
Is capacity loading below 90%.				
Is electrical overhead line away from the tip of crane boom: When crane boom, fully extended, is pointed towards the overhead line the distance must be away from the vertical projection of the line on the ground (As GESM Standard, table attached). Consult Electrical engineer as a part of Risk assessment. Never use a crane to lift any				

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load under a charged line within the limited approach boundary as specified in GEEM standard. If required, the line must be isolated and permit given by authorized electrical person.

Line to line voltage	Limited approach boundary ^a		Restricted approach boundary ^a	Prohibited approach boundary ^{a, b, c}
	Overhead electric lines (Conductors not insulated for the voltage)	Any energized circuit parts and conductors		
51 to 300 ^d	3.1 m 10 ft	1 m 3 ft 3 in.	Assume high probability of unintentional contact	
301 to 750 ^d	3.1 m 10 ft	1 m 3 ft 3 in.	0.3 m 1 ft	0.03 m 1 in.
751 to 13,800	3.1 m 10 ft	1.5 m 4 ft 11 in.	0.7 m 2 ft 2 in.	0.18 m 7 in.
13,801 to 34,500	3.1 m 10 ft	1.8 m 6 ft	0.8 m 2 ft 7 in.	0.26 m 10 in.
34,501 to 115,000	3.3 m 10 ft 8 in.	2.4 m 8 ft	1.05 m 3 ft 5 in.	0.81 m 2 ft 8 in.
115,001 to 230,000	4.0 m 13 ft	4.0 m 13 ft	1.6 m 5 ft 3 in.	1.5 m 4 ft 11 in.

Emergency Plan (Related to Rigging work area)

Rigging Calculation:

Following point to be considered here:

Sling angle

Sling capacities

Calculate tension on each sling with type of hitch.

Is load rigged keeping CG in mind.

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AREA LAYOUT WITH CRANE POSITION:

Sketches, AutoCAD drawings of the area, with clear mention of barricaded area and escape route.

Pre- Operation Checklist						
MACHINE MAKE		Rated Capacity	Machine No.	Site		Date
Area	S.No	Description		OK	NOT OK	REMARKS
Fluid Level	1	Crankcase Oil				
	2	Coolant level				
	3	Hydraulic oil	No Go			
CAB	4	Electrical system				
	5	Service /Parking Brakes				
	6	Swing Break				
	7	Gauges/ meters				
	8	Housekeeping				
	9	Fire Extinguisher				
	10	Load Chart	No Go			
	11	Windows/ Mirrors				
	12	Seat Belts				
	13	Check all mirrors, including the one for the hoisting drum				
Functional Test	14	Leveling device	No Go			
	15	Steering	No Go			
	16	Outriggers	No Go			
	17	Boom Up/Boom Down	No Go			
	18	Hoists Up/Down	No Go			
	19	Hoist Brakes	No Go			
	20	Swing Brake	No Go			
	21	Wind speed indicator	No Go			
	22	Anti-Two-Blocking Device	No Go			
	23	Safe Load Indicator	No Go			
Other Checks	24	Safety Latches	No Go			
	25	Wedge Socket				
	26	Sheaves				

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	27	Wire Rope Retainers				
	28	Outrigger Mats	No Go			
Name of Operator			Signature			
Name of Engineer			Signature			