LIFTING OPERATIONS SAFETY

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Document Change Note

Rev. No	Rev. Date	Comments / Changes
00	24-12-2022	New Issue
01	25-08-2025	Clause 4.6 and 4.7 Added minimum qualification and experience Clause 4.8 Added Use of Wireless Communication Clause 5.4 Inspection of crane as per IS 14470:1997 Clause 5.7.2 Tower crane Inspection post adverse weather conditions and ASLI Clause 5.7.3 Added ASLI Clause 5.9.1 Added operator Qualification and experience, Competency Evaluation and Operator designation Clause 5.16.3 Dos and Don't of Chain Pully block

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1. PURPOSE

This document provides minimum requirement for planning, execution and management of mechanized lifting operation with an aim to prevent incidents involving personal injuries and property damage.

The standard provides guidance on:

- Responsibilities and competence of personnel involved in lifting operations
- Risk Assessment and preparation of Lift Plans
- Safe use of lifting accessories; inspection requirements
- Execution of crane operations
- General instructions for Crane Operators
- General instructions for Signalman

To prevent accidents while carrying out lifting operation using –

- ✓ Mobile cranes
- ✓ Tower cranes
- ✓ Overhead Cranes
- ✓ Derricks/ Winches
- ✓ Jib cranes

Safe use of Lifting aids for lifting operations (Lifting Tackle) including-

- ✓ Chain Sling
- ✓ Synthetic Web Sling
- ✓ Retched blocks
- ✓ Chain pulley blocks
- ✓ Wire Rope Slings
- ✓ Shackles O" rings (Master Links)
- ✓ Spreader Bars/Beams

2. SCOPE

This procedure shall apply to AMNS project sites and related work areas including subcontractors to meet –

- Legal & Regulatory requirements
- ISO-45001 and ISO -14001 standard requirements
- AMNS HSEMS requirements
- Company HSE Policy

This procedure applies to all personnel working in AMNS Projects, who are required to carry out Rigging & Mechanized Lifting Operations, Inspection and Maintenance of Lifting Equipment and Lifting Gears.

The requirement and practices indicated in the Standard does not intend to replace any national or local legislation. In case of dispute, local laws shall prevail.

This standard does not cover the emergency response and rescue protocols.

The Law (Legal and Regulatory requirements)

Indian Factories Act – 1948

Every Lifting Appliance and every piece of lifting gear shall be thoroughly examined and where necessary tested (a) before it is used for the first time, (b) having already been used, if and whenever subsequently altered or repaired, before it is being used and at the times and interval set out in the section 28 to this regulation, which is every 6 months. The inspected and tested items shall be colour coded.

Gujarat State BOCW Rules – 2003

All the lifting appliances and gears used in the construction work shall correspond to the requirements of Chapter XI.

LOLER -1998:

The LOLER (Lifting Operations and Lifting Equipment Regulation) require that lifting equipment that is provided for work is:

- ✓ Strong and stable enough for the particular use and that it marked to indicate its S.W.L. (Safe Working Load)
- ✓ It is positioned and installed to minimize any risk.
- ✓ The equipment is used safety.
- ✓ All work is planned prior to commencement.
- ✓ The work is organized and carried out by competent people.
- ✓ The equipment has a thorough examination prior to use.
- ✓ The equipment is inspected and registered by a competent person.

3. DEFINITIONS AND ABBREVIATIONS

3.1. DEFINITIONS

Anti-Collision Device	Anti-collision devices (ACDs) rely on global positioning system (GPS) satellites for position updates. These exchange information through radio frequency transmissions to automatically brake and prevent collisions.
Lifting Operation	Refers to the operation of lifting or lowering a load using lifting equipment;
Lifting Equipment	refers to any device used for lifting or lowering a load and typically includes mobile cranes, tower cranes, gantry cranes, crawler cranes, hoists and elevating work platforms;
Load	Refers to any load being lifted or lowered by lifting equipment and typically includes materials, waste materials, plant, equipment and persons;
Simple Lift	Refers to any routine or regular lifting operation that requires one crane, is carried out where the lifting equipment is set up, lifting accessory and the load are the same in each case. An example of a common lift is the unloading of steel reinforcement from a delivery lorry at the same radius, using the same crane and lifting accessory;
Critical Lift	Any load more than 5 Ton or 75% of SWL and upto 90% and above are considered as critical lifts for the AMNS Project. Following activities also come under critical lift • Lifting of eccentric load (Center of gravity difficult to estimate). • The lifting of man basket • Lifting and lowering of load in Blind Spots • Tandem lifting also considered as critical lift Lifting plan is a mandatory requirement for critical lift.
Mobile and Stationary Crane	A Crane that is self-propelled. This includes crawler Crane, Wheel-mounted cranes and any variations thereof. Tower Crane, Gantry Crane, side boom tractors, overhead cranes, and trolley boom cranes etc. are also included. Cranes with a rated capacity of one ton or less area specifically excluded.
Pick and Carry Crane	A pick and carry is a self-propelled picks and carry vehicle. Pick and carry cranes, in various models such as F-15, F-17, F-20 etc. are available. These are hydraulic mobile cranes with slotted boom. Old generation cranes are to be avoided.
Safe Load Indicator (SLI)	SLI is a devise fitted on crane which will alert the operator with audio visual signal when the crane capacity approaches the actual load. SLI incapacities all functions of the cranes for overload condition allowing only functions for safe condition.
Safe Working Load (SWL)	In relation to an article of lifting gear or lifting appliance, means the load which is the maximum load that may be imposed on such article or appliance with safety in the normal working conditions as assessed and certified by competent person.
Competent Person	One who is capable of identifying existing and predictable hazards in the surrounding or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them
Qualified Person	One who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience has successfully demonstrated his /her ability to solve or resolve problems related to the subject matter, the work or the project.

Anti-two-blocking device, Limit Switch	A device which automatically cuts of during over hoisting or lifting
Controlled Load Lowering - CLL	CLL is a mechanism provided on Crawler Cranes to achieve gradual lowering of load (Hook) in a controlled manner. This is achieved by providing special mechanisms, like planetary system or separate reduction achieved via chain and gears, in power train of Hoist Lowering
Appointed Person	Rigging Foreman/ Supervisor who has been trained, having experience and authorized by Project Head for supervising lifting operations.
Capacity Loading	It will be calculated by dividing the total weight with the safe workload at lift radius. It shall not exceed 75%. For capacity loading above 75%, a lifting plan is required. No capacity loading above 100% shall be allowed, equal to 90% of load test. For lifting personnel the capacity loading shall be below 50%

3.2. ABBREVIATIONS:

LOLER	Lifting Operations and Lifting Equipment Regulation
HSE	Health Safety and Environment
JSA	Job Safety Analysis
HIRA	Hazard Identification and Risk Assessment
LSA	Life Saving Appliances
PPE	Personal Protective Equipment
SIMOPS	Simultaneous Operations
TBT	Toolbox Talk
ASLI	Automatic Safe Load Indicator
SWL	Safe Working Load
P&M	Plant & Machinery

4. ROLES & RESPONSIBILITIES

The Project Head and the Site HSE Manager are responsible for ensuring that the project is in compliance with the requirements mentioned in this procedure.

Training : HSE Department

Recordkeeping : HSE Department

4.1. Project Head (PH) / Section Heads

- Ensure that inspected and fit for purpose equipment only used for operations
- Ensure all required resources allocated for the lifting activity including competent manpower.
- Ensure that adequate and experienced supervision is provided
- Ensure that all lifting activities are carried out under PTW system.
- Prepare rigging plans for complex lift

- Prepare critical lift permits, Risk Assessment checklist, Permit to Work regarding cranes and rigging and any required rigging designs.
- Ensure that JSA and Risk Assessment are prepared and communicated to all involved employees.
- Ensure that all lifts are executed in accordance with this procedure and guidelines, instructions by Project Manager.
- Evaluate the qualifications/skill of field riggers and operators and determine that they are qualified to perform the work they are assigned.

4.2. Site Field Engineer/ Supervisor

- All lifts require one experienced field engineer/supervisor.
- Prepare rigging plans for complex lift
- Prepare critical lift permits, Risk Assessment checklist, Permit to Work regarding cranes and rigging and any required rigging designs.
- Ensure that JSA and Risk Assessment are prepared and communicated to all involved employees.
- Ensure that all lifts are executed in accordance with this procedure and guidelines, instructions by Construction Manager.
- Evaluate the qualifications/skill of field riggers and operators and determine that they are qualified to perform the work they are assigned.
- Verify that the crane is set up correctly and is at the correct operating radius.
- Verify that the crane is not working above capacity/ criteria given in lift category chart. (Refer to the Categories of Lifts).

4.3. Project Plant & Machinery (P&M) In charge

- Maintain master list of assets including the lifting equipment and the lifting gears with validated third-party inspection certificates.
- Provide guidance and instructions to contractor rigging coordinator/ engineer in-charge.
- Develop and review inspection checklist and operating procedures.
- Establish crane procurement and hire specifications.
- Conduct initial operational test of crane and pre-mobilization requirements.
- Ensure periodic inspections and maintenance of crane.
- Validation of Operators, Riggers and Signalmen and maintain records.
- Approve any crane modification in line with legal requirements and manufacturers' recommendations.
- Maintain records of testing, maintenance, repairs, and modification.

4.4. Contractors

- Nominate a competent rigging coordinator/engineer in- charge/lifting supervisor.
- Develop a lifting schedule, plan, and permits for all lifts.
- Execute all lifts in accordance with this procedure.

4.5. Rigging Supervisor/ Foreman

- The Rigging Supervisor/ Foreman nominated by the Management to be in overall control of the Lifting Operations must have had adequate training and experience and be competent (Holding Competency card from AMNS).

Duties

- Establish the weight of the load.
- Select crane suitable for lifting to be performed (SWL &, reach)
- Consideration of the operation location.
- Ensuring the crane has been thoroughly checked before use.
- Ensuring the system for reporting defects is in place.
- Selecting appropriate lifting gear.
- Ensuring the lifting gear has been thoroughly checked before use by riggers.
- Briefing all persons involved in the lifting operation to ensure that the safe system of work described in the method statement is understood.
- Checking if numerous loads are to be lifted over long period, to ensure that no changes are required in the safe system of work.
- Ensuring that there is Signalman designated to direct operator and Riggers.
- Able to give clear, unambiguous instruction to all members of the crane team.
- Able to assess the danger to the lifting operation and refer to Construction Manager for clarifications if required
- All hazards such as services (gas, water, electricity, etc.) above or below ground are identified and suitable precautions are taken.
- Ensure all persons involved in the lifting operation are competent and trained.
- HSE & Security departments to be notified in case of blocking roads.
- Ensure that the certificates are valid.
- Ensuring that the signaler / Bandsman readily identifiable to the crane operator (e.g. / by wearing high visibility clothing).
- Ensuring that the work place is provided with adequate lighting.
- Ensuring that the crane operator and the slingers clearly aware of the weight and hazardous/ asymmetric loads.
- Area is barricaded to prevent unauthorized entry
- Conduct Toobox talk covering communication/ coordination
- Never allow personnel under suspended loads at any given time

4.6. Crane Operator

He should be:

- Trained to the specific model of crane used.
- Able to assimilate and apply information with manufacturer instructions for the rigging operation and for maintenance of the crane.

- Aware that the crane is used on level ground or else set level on outriggers before any load is applied.
- Fully conversant with the correct use of outriggers and where outriggers should be fitted and aware of how to properly support the out rigger leg and monitor regularly
- Able to set and check the functioning of the Safe Load Indicator (SLI) and rated capacity limiter.
- Aware of the effects of the wind and other climatic effects on the crane and load.
- Able to resist pressures from the other persons to carry out the unsafe operations.
- Able to take action to avoid dangerous situation, including stopping the operation.
- Able to operate the fire extinguisher and fire suppressant equipment.
- Minimum qualification and experience based on crane type/model/capacity shall be clearly defined.

4.7. Riggers/Slingers

He Should

- Be responsible for attaching and detaching the load to/ from the crane lifting attachment and for using the correct lifting accessories and equipment in accordance with operation plan.
- Clearly indicate the crane operator and to the second slinger that the responsibility is transfers and to whom.
- Able to establish the weight and the effect of center of gravity, and to balance the load and judge the distances, height and clearance.
- Able to select the appropriate lifting accessories and check that they are in suitable condition.
- Ensure at all times that the load is under complete control by use of the tag line or whatever assistance is deemed necessary.
- Minimum qualification and experience for riggers shall be included along with competency evaluation and duties shall be confirmed including but not limited to BS 7121-1 Annex A, IS 13367 (Part1) : 1992, etc.

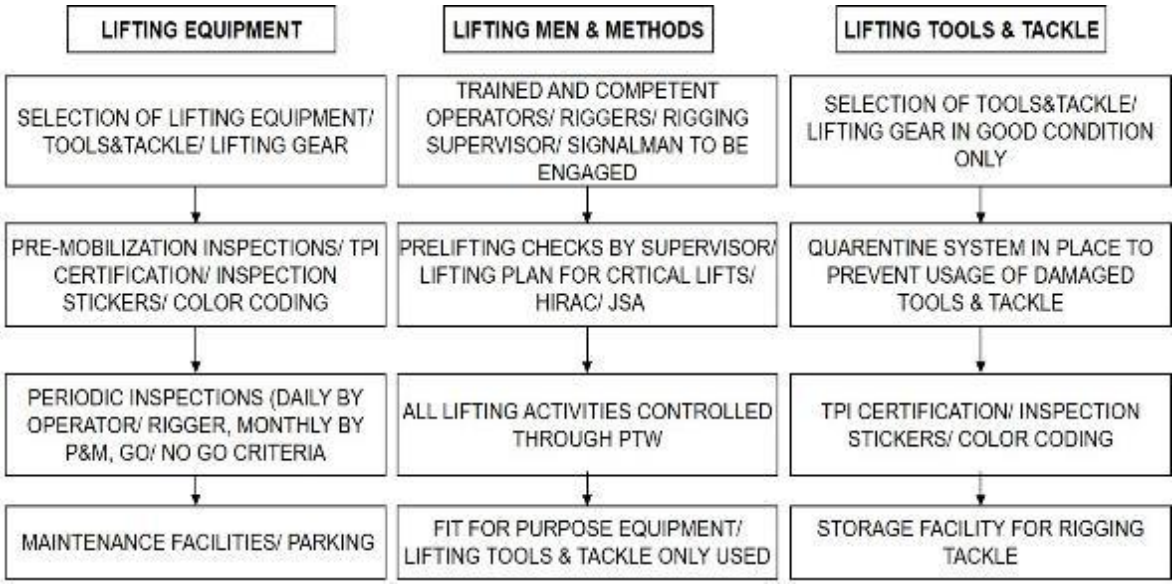
4.8. Signalman

He Should

- Direct the operator and riggers during entire lifting operations using standard signals.
- If the Signalman cannot see the load or maintain contact with the crane operator, may be use to relay instructions from the additional signalmen to the crane operator.
- Identified uniquely (Using high visibility vest different that other crew members)
- Use of wireless communication (walkie-talkies) with multi-bandwidth wherever required for ease of communication between adjacent other activities or SIMOPS.

5. SAFE LIFTING OPERATIONS ASSURANCE PROCESS

5.1. MECHANIZED LIFTING SAFETY ASSURANCE PROCESS FLOW CHART



5.2. HAZARDS ASSOCIATED WITH MECHANISED LIFTING

The hazards associated with mechanised lifting and material handling are:

5.3. CONSIDERATIONS PRIOR TO LIFTING ACTIVITY

SELECT - The correct type of equipment to perform the task (Based on condition of work location, total load/ shape/ nature, material, type of activity)

CHECK - The location where task is to be performed

- The condition of the equipment (must be inspected before use)
- The working conditions while in use
- Surroundings where such task is being carried out
- Weather conditions

USE - For intended purpose only

- For intended capacity only
- Adopt correct practices

5.4. GENERAL REQUIREMENTS

- Lifting equipment such as cranes, pick and carry, winches, chain blocks, hoists shall comply with National/ International standards and of proprietary manufacture.
- All mechanical lifting equipment intended to use shall be inspected (or re-inspected) and tested (or re-tested) by a Competent Person as mentioned below and certified before putting for use.
    - Load test criteria -
        - Every time it is reconfigured or
        - Reassembled after disassembled and
        - Once in a year.
        - Any change in load bearing component of lifting machinery.
- Inspection of cranes shall be as per IS 14470:1997 – Cranes Test Codes and Procedure.
- Third party testing has to be done within the AMNS premises
- The third party identified for the testing shall be from the AMNS authorized list of vendor.
- Only trained, authorized, competent and designated persons shall operate mechanical lifting equipment
- All lifting activities shall be carried out under PTW
- Conduct toolbox talk at the beginning of the activity each day along with crane operator, riggers, signal man and any others affected by the activity
- All lifting equipment shall be fitted with Automatic Safe Load Indicator (ASLI) and with valid calibration from manufacturer.
- SWL clearly marked/ legible and visible

- Never shut off the engine when a load is suspended
- Do not carry out lifting operations during wind speed >25 KMPH/ heavy rain/ lightning/ adverse weather conditions
- No one shall be allowed underneath the load, hoist or jib during lifting. Personnel shall not work or pass under suspended loads.
- Loads shall not be swung over the persons working nearby
- All machinery or equipment shall be shut down while repairs, fueling, or manual lubrication is being done.
- All cranes shall be equipped with at least one 6 Kg dry powder or carbon-dioxide fire extinguisher.
- Safe means of access i.e. ladder with 3-point contact should be provided to every part of a crane. If working above 1.8 M (6 Feet), Fall Protection must be provided.
- Persons shall not be permitted to get between a towing vehicle and the piece of towed equipment until both have been completely stopped with all brakes set.
- Cranes shall not be used for transport of personnel, except as prescribed in the hoisting of personnel by a personnel basket (Man Basket).
- Cranes must only be used for vertical lifting lowering of loads.
- Lifting shall be carried out slowly to prevent jerks/ swinging/ swaying of loads
- All reciprocating, rotating or moving parts, hot surfaces, exhaust pipes and other hot lines, shall be guarded or insulated to prevent injury/ create a hazard and fire.
- Instructions issued by the manufacturer should be followed under the conditions in which the lifting appliance should be used or not to be used or used with limitations

5.5. CRITICAL LIFT

The following elements should be considered while judging lift as critical lift -

- Weight of load to be lifted. (Load exceeding 75% of capacity of crane at the required reach shall be considered as critical)
- Weight of load more than 5 Ton
- Size and shape and nature of the Load
- Load bearing capacity of ground
- Facilities and other work within the boom range
- Lifting of man basket with workmen
- Two or more lifting equipment involved in the activity.

There shall be a lifting plan for all the critical lifting operations, describing with the help of drawing showing reach, load and crane capacity.

5.6. LIFTING EQUIPMENT FITNESS ASSURANCE

5.6.1. Mobilization and pre-deployment process

All lifting equipment brought to project site shall meet age criteria defined by AMNS under annexure. The vendor shall provide at least 3 years maintenance records stating

accidental damages/ modifications/ alterations/ replacement of critical parts. Anti-Two Block System and Safe Load Indicator (SLI) is a mandatory requirement for all types of lifting equipment.

Once the equipment reaches the site, it shall be inspected AMNS-appointed inspection team for integrity and fitness before load test & certification by Competent Person (TPI).

For any crane came to site which needs to be assembled on site, the vendor is to provide competent supervisor and technicians for the same and shall be carried out under PTW.

If the crane leaves the AMNS Project site, it must be re-inspected if it returns irrespective of the time away from the site.

5.6.2. Periodic inspections and maintenance

- All lifting equipment shall be inspected before start of each shift by operator using operator daily inspection checklist.
- All lifting equipment shall be inspected monthly by AMNS appointed inspection team for assessing integrity and fitness
- Annual load test & certified by Approved Competent Person (TPI).
- Preventive maintenance procedures recommended by the manufacturer shall be followed.

5.7. TYPES OF LIFTING EQUIPMENT

5.7.1. Mobile cranes:

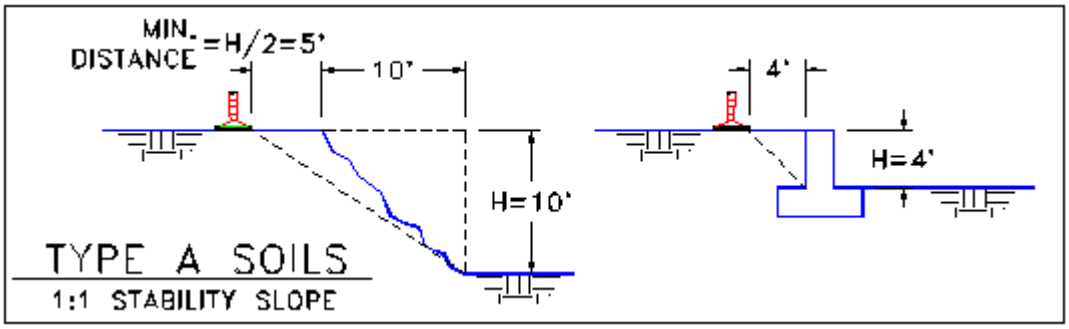
Specific requirements while using mobile cranes -

- Mobile crane is parked with extended out-riggers, on stable ground/ padded/ leveled so that the out riggers will not sink.
- No lifting or shifting job shall be under taken near the vicinity of any overhead lines.

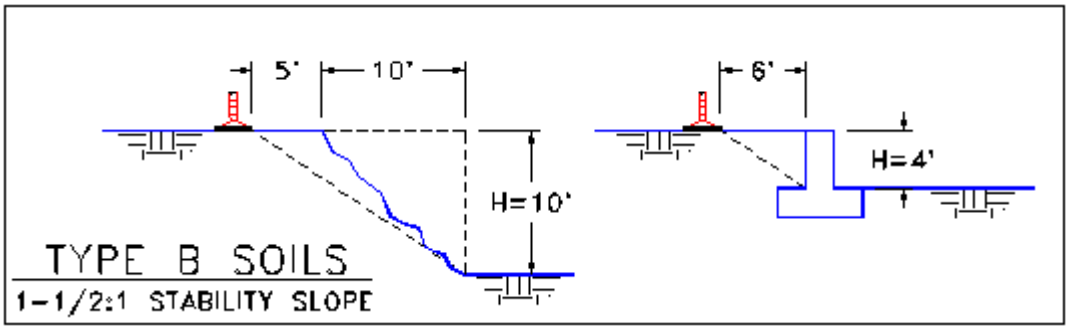
Minimum Safe Clearance values for various voltage levels:

Voltage kV Ph. to Ph. rms		Minimum Safe clearance (Metre)
6.6 kV		2.57
>6.6 kV	<= 11 kV	2.59
>11 kV	<= 22 kV	2.64
>22 kV	<= 33 kV	2.75
>33 kV	<= 66 kV	3.00
>66 kV	<= 132 kV	3.43
>132 kV	<= 220 kV	4.57
>220 kV	<= 400 kV	5.48

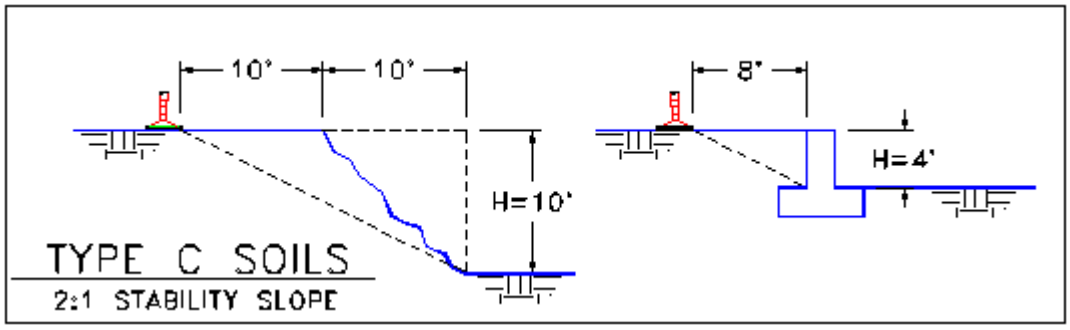
- Adequate clearance (minimum of three feet) shall be maintained between moving and rotating structures of the crane (swing radius) and fixed objects and swing area should be barricaded accordingly
- Inspection or determinations of road conditions and structures shall be made in advance to assure that clearances and load capacities are safe for the passage or placing of any machinery or equipment.
- Padding of crawler crane tracks shall be provided when load bearing capacity of the ground is inadequate
- Ensure minimum distance is maintained from edge of nearby excavation.
- Type A Soils - Cohesive soils with an unconfined compressive strength greater than 3,000 lb./square foot (psf). Examples are clay, silty clay, sandy clay and clay loam. Cemented soils such as caliche and hardpan are also considered type A.



- Type B Soils - Cohesive soils similar to above but with an unconfined compressive strength greater than 1,000 psf but less than 3,000 psf. Also granular noncohesive soils including angular gravel, crushed rock, dry rock that is unstable such as shale, previously disturbed soils, and soils that are fissured.



- Type C Soils - Cohesive soils with an unconfined compressive strength of 1,000 psf or less. Also granular soils including gravel, sand and loamy sand, submerged soils, soils from which water is freely seeping, and submerged rock that is not stable.



- NOTE: These categories are to be selected by a competent person based on an analysis of the soil properties, the excavation performance and the environmental exposure.

5.7.2. Tower cranes:

Specific requirements while erecting and using tower cranes -

- Tower cranes shall be erected by trained and competent personnel
- Ensure that the base preparation is adequate to erect intended size and capacity of tower crane
- Method statement and risk assessment shall be approved prior to erection of tower crane
- Tower cranes shall be erected under experienced supervision
- Consider hazards like electrical power lines, people movement, vehicle movement, potential future excavation requirements near to foundation
- Rescue system and safe descending of load in case of power failure
- Load test has to be carried out and certified after erection and prior to use
- Anti-collision device to be fixed in jib of tower crane in case of two tower cranes are placed near-by.
- Verticality test every 6 months. In case of, severe weather to be done post adverse weather conditions.
- Tower crane should have functional ASLI for (Automatic Safe Load Indicator) and other pre use inspections (BS 7121-3:2017 may be referred)

5.7.3. Overhead cranes:

Specific requirements while using overhead cranes -

- Overhead (EOT) crane shall be certified for its SWL by competent person
- Periodic inspection and maintenance of –
  - Long travel and cross travel rails and mechanisms
  - Gantry structure
  - Over travel/ over hoist / overload Limit switches & anti-collision sensors
- Operator/ remote operator shall have clear view of load to be lifted
- All over head cranes shall be fitted with long travel alarm/ flashing lights during long travel and effective automatic overload tripping devices
- Maintain two full wraps of cable on the hoisting drum.
- In the event of power failure, place controls in the “OFF” position to prevent unexpected startup upon restoration of power.
- Overhead cranes should have functional ASLI for (Automatic Safe Load Indicator) and other pre use inspections (BS 7121-2-1:2012 may be referred)

5.7.4. DERRICKS/ WINCHES

Specific requirements while erecting and using derricks -

- All individual components of derricks and winches shall be certified for SWL by competent person
- All anchor points shall be sound and capable of taking care of overall intended system load and SWL of each of associated pulleys/ hooks shall be greater than or equal to intended system load
- All the anchors are free from obstacles to prevent jamming/ jerking
- Operator of winch shall have clear view of load to be lifted or shall be provided with signalman

5.7.5. SINGLE ARM JIB CRANES

Specific requirements while using single arm jib cranes -

- All components of jib crane shall be certified for SWL by competent person
- Periodic inspection and maintenance of various components of jib cranes shall be carried out using checklists/ maintenance schedules recommended by manufacturer
- SWL clearly marked/ legible and visible. Never lift load higher than the SWL.
- Never drag load. Position the jib to lift the load vertically.

5.7.6. Manual or Motorized Chain Blocks

Specific requirements while using chain blocks -

- All components shall be certified for SWL by competent person
- Periodic inspection and maintenance of various components of either manual or motorized chain blocks shall be carried out using checklists/ maintenance schedules recommended by manufacturer
- SWL clearly marked/ legible and visible. Never lift load higher than the SWL.
- Loads shall not be handled horizontally while using chain blocks.
- The temporary lifting points in which the chain blocks are attached need to certified by a structural designer.

5.8. PRE LIFTING

5.8.1. Pre-operational Check

- Check all limit switches.
  - Over Hoist.
  - Over Lower.

- ❖ Boom Down till cut off.
- ❖ Boom Up till cut off

- ➢ Check that your computer is working correctly.
- ➢ Check that all your levers are doing the right function.
- ➢ Swing crane 360° to check that it is moving freely & there is no obstructions.
- ➢ Check that hoist rope is running freely though the sheaves.
- ➢ Check that all boom sections are moving in & out freely.
- ➢ If your crane is fitted with a top engine check all gauges.
- ➢ If your crane requires boom settings select the correct boom settings for the lift.
- ➢ Do a dry run of the lifts you are going to carry out.

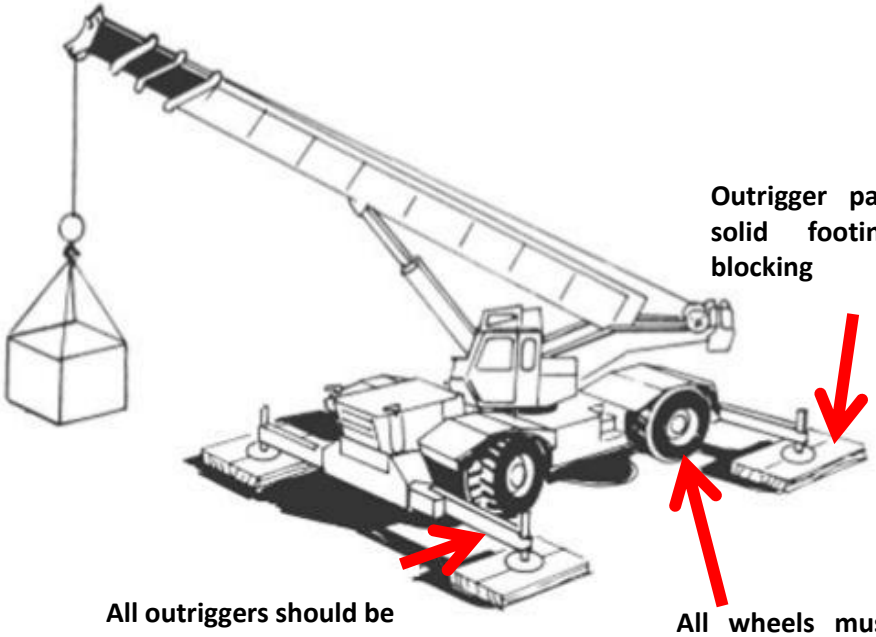
5.8.2. Positioning of the Crane

Positioning of crane correctly is every important. If it is not set up properly it can result in the crane becoming damaged or even worse turning over.

Listed below are the points you must be looking for when you are positioning your crane.

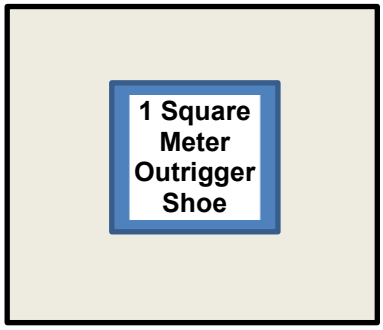
- ➢ Is the ground level?
- ➢ Are there any underground pipes or manhole covers?
- ➢ Has there been any excavations recently?
- ➢ Is it near any trenching?
- ➢ Is it on a road if so, has the relevant people been informed?
- ➢ Is there any rubbish and loose materials lying around?
- ➢ Are there any electrical cables on the ground?
- ➢ Are there any restrictions in your slew path?
- ➢ Is there any overhead power lines near buy?
- ➢ Are there any People working in the area you are going to be lifting?

Out-rigger Placement



An outrigger pad should be at least three times the square surface area of the outrigger shoe

3 Square Meter Pad Size



Standard Size of Round Outrigger Pads		
Dimension	Load Capacity	Weight
800*50mm	35t	25kg
800*60mm	40t	30kg
900*50mm	45t	30kg
900*60mm	50t	35kg
1000*50mm	50t	29.25kg
1000*60mm	60t	40kg
1000*70mm	75t	50.75kg
1000*80mm	80t	61.5kg
1200*60mm	90t	66.4kg
1200*70mm	110t	77.45kg

Standard of Square Outrigger Pads		
Dimension	Load Capacity	Weight
400*400*40 mm	12t	6.3kg
500*500*40 mm	15t	9.9kg
500*500*50 mm	18t	12kg
600*600*40 mm	20t	14.2kg
600*600*50 mm	25t	18kg
600*600*60 mm	30t	21.2kg
800*800*40 mm	35t	25.3kg
800*800*50 mm	40t	31.3kg
800*800*60 mm	45t	38.4kg
1000*1000*80 mm	100t	78kg

5.8.3. Before lifting operation

A meeting attended by the Crane operator, Signal person, person (s) to be lifted, and the supervisor responsible for the task to be performed will be held to understand and ensure Risk Assessment / JSA/ Lifting Plan/ PTW.

General requirements include;

- To carry out mechanized lifting activity under close supervision.
- Use only tested, certified and validated lifting tools and tackles for lift. Use of the same within their SWL
- Look for any visual damage of lifting gears such as wear and tear, kinks, twisting, cuts, damage of threads, etc. and replace with good one.
- Protect sling from sharp edges by proper packing while wrapping slings around load (structural member /pipe)
- Maintain sling angle between load and sling as per rigging scheme
- Loading shall be done in such a way that center of gravity of load shall be in line with lifting rope. Use more than 2 slings to balance load of irregular shape.
- Each time a crane is moved into service, or to a new location, the supervisor must conduct an inspection of the area in which the crane will be operating.

5.8.4. Rotating the Loads

When rotating the load, taglines or guidelines to control the load and swing shall be used. Lifting loads over workers shall not be permitted. Lifting load over the cab of the crane, mechanical equipment etc. should be avoided.

5.8.5. When Working near Overhead Power Lines

- Before starting any work near overhead power lines, you should always ensure they have been shut down and you have the relevant paper work from the electricity board.
- For crane operating near high voltage power lines following table to be referred

Voltage kV Ph. to Ph. rms		Minimum Safe clearance (Metre)
6.6 kV		2.57
>6.6 kV	<= 11 kV	2.59
>11 kV	<= 22 kV	2.64
>22 kV	<= 33 kV	2.75
>33 kV	<= 66 kV	3.00
>66 kV	<= 132 kV	3.43
>132 kV	<= 220 kV	4.57
>220 kV	<= 400 kV	5.48

5.8.6. Lifting operations during night (Dark hours)

- Avoid critical lift operation in night hours.
- If it is required, night hour's work should be planned by considering work hours, illumination, and other environmental conditions. No work shall be carried out with mobile crane in darkness if the area does not have proper illumination. Lifting in charge should not depend on the crane lights and it is his responsibility to arrange well in advance proper illumination (Minimum 100 Lux) all around work area. Care should be taken to avoid direct focusing of light on operator's cabin.

5.9. SPECIAL PRECAUTIONS

5.9.1. *Crane Operators*

The following information shall be known to all supervisors and crane operators. The content herewith should be made part of toolbox talk and establish that the information has been given and is understood by recording the TBT form.

- The crane operator is responsible for those operations under his direct control.
- All crane operator shall have a 3rd party competency certificate.
- Cranes shall not be used if any limit switches or other safety equipment is out of order. Whenever there is any doubt as to safety, the crane operator shall have the authority to stop and refuse to handle loads until safe conditions have been re-established.
- Each day before the crane is put into use the operator shall perform all movements and maintenance necessary to ensure that the machinery is functioning satisfactorily. He shall ensure that all safety devices are set and operating correctly and that the wire ropes are in approved working condition.

- When the crane operator is physically or mentally unfit, he shall not engage in crane operation.
- Operators taking prescription drugs shall inform supervisor and should aware of their effects while carrying out lifting operations
- The operator shall not engage in any practice that will divert his attention while operating the crane.
- When handling loads, the operator shall not start crane movement until the banksman or complete load is within his range of vision. The banksman shall be identified by a colored vest differentiating from others, and he shall assist the crane operator to make a safe lift.
- The crane operator shall respond to operating signals only from the appointed banksman, but he must obey an emergency stop signal from anyone at any time.
- In a situation where the operator cannot see the load, appropriate communication system (Like radio, signal man, etc) shall be established prior to start lifting.
- Never lift the load higher of further than needed.
- Never leave the controls unattended while a load is suspended. If it becomes necessary to leave the controls, lower the load to the floor.
- No equipment shall be used for loads exceeding its safe working load (SWL). When multiple wire rope or chain slings are used the angle of the legs shall be considered.
- Limit switches during normal operation must not be used as stopping devices.
- Operator designation must be legibly marked on scrum card for applicable crane type/capacity.
- Qualification and experience of crane operator per crane type/model/capacity.
- Operator competency may be evaluated as per BS 7121-1:2016, OSHA 1926.1427, IS 13367 (Part1) : 1992, etc.

5.9.2. RIGGING

- The rigger is responsible for properly attaching the load to the crane.
- He must be properly trained in slinging / rigging, the standard lifting hand signals and the general capabilities of the crane with which he is working.
- The load shall be attached to the hook by means of slings/ “O” Rings or other devices
- Select the correct lifting tackle for the job (Type suitable for the job, capacity, etc)
- Check the condition of the ropes, chains, slings, shackle and other lifting tackle applicable for the job
- Attach lifting tackle correctly (Right rigging methods)
- Check the maximum safe working load (SWL) of the slings on the chart.
- Suitable protection (softening) shall be provided between the sling and sharp unyielding surfaces of the load to be lifted.
- Remove slack from the sling, chain, or cable before lifting a load.

- A suitable container or basket shall be used for mass transportation of loose material, so that no material is likely to fall during operation. Test certificates must be obtained before using the basket or container from an authorized agency.
- He is authorized to give signals to the crane operator for load attachment only. In certain complicated lifts, the banksman may require the assistance of a rigger, but the riggers signals must be to the banksman and not to the operator.
- Cranes and the booms are positioned so that they lift the load vertically and in no case they shall be used for either pulling or pushing to prevent swinging of load.
- Protect the safety of others by keeping them away from or under suspended loads, and preventing them from crossing the area where work is in progress.
- Every worker must pay attention to the stages of the operation performed so that the job has a correct, chronological and constant sequence.
- Always wear required PPE during rigging activities

5.9.3. Signal Person/Banksmen

- Signal persons must be trained and tested on the signals to be used; this includes voice and telecommunications signals as well as hand signals.
- Signal persons must wear Orange Hi Visibility vests to improve recognition by operator during any movement of a crane lift or travel
- Only one person will assume signal duties and no other person will signal the operator during the lift.

  Exceptions:
- A person giving an emergency stop signal
- When 2 signal persons are needed for lifts
- The signal person must have validation from the PROJECT MECHANICAL department evaluator who assesses the individual and determines that the individual meets the skill requirements.
- Contractor and Engineer in charge/field engineer/supervisor shall ensure that under no condition, such signal person shall operate crane.
- Use of mobile phones/entertainment headphones during crane operation by crane operator and signal person is strictly prohibited and will leads to disciplinary action.

5.9.4. LIFTING TACKLE

- All the lifting tackle shall be inspected by the site HSE advisor and the concerned supervisor once in three months by use of checklist and distinctly colour coded for easy identification
- All items of lifting tackle shall be plainly die-stamped with an identification number and it's Safe Working Load (SWL)
- All lifting tackle shall have a valid test and inspection certificates and shall be made available for ready reference
- Equipment shall be free from any obvious defects and no lifting tackle shall be used beyond its certificate validity

5.10. Training / Validation / Licensing / Evaluation

5.10.1. Crane Operators

Operators of cranes must be trained and experienced. Operators shall successfully complete an assessment / testing / validation program by Project Maintenance department. Testing program may be 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.

- Refer - Crane Operator Training and Validation. To operate a crane; employees must at a minimum:
- All crane operators shall have valid heavy motor vehicle (HMV) license issued by Regional Transport Office (RTO)
- Be mentally alert and possess the physical ability to drive a motor vehicle safely.
- Display a responsible attitude and be of a minimum age of 25 years
- Have completed validation of ability to operate that specific crane through Project Maintenance department.
- Operator record should be kept in Crane Operator License Record.
- Mobile crane operators shall pass a medical examination once every year by a hospitals recognized by Care Nursing Home (Medical Center) and Project contract cell. Physical defects or emotional instability that could be a hazard to the operator or others may be cause for disqualification.
- The mobile crane operator must be able to read and understand English. Contractor supervisor will also assist the operator to understand crane operations and rigging requirements.
- The mobile crane operator should have sufficient knowledge for reading load chart, rigging plans (critical lift wt. > 5 Ton, multi crane lift).
- The mobile crane operator will inform his supervisor and Heavy equipment engineer if anyone is not in working condition. (i.e. Anti-two blocking, SLI).
- Equipment owner / Contractor after delivering the required training, should maintain the training / validation records for traceability for operators of the lifting equipment.
- The operator must able to interpret the crane's actual net capacity for every possible configuration of the machine.
- The mobile crane operator should have sufficient knowledge for reading load chart, rigging plans (for critical lift wt. > 5 Ton or threat, multi crane lift, (operator knowledge for rigging plan should be limited to heavy duty crane i.e. 200T and above tire mounted or 350T and above crawler crane).
- An employee must carry state / country driver’s license and SDP while operating crane and must display it upon request to authorized persons:
- The Contractor's HSE Representative must be advised of any change in the status of such license and endorsements (such as cancellation or suspension).
- The employee will not operate crane on or off the project / site after state / country driver's license is suspended, revoked, or otherwise affected.

5.10.2. Qualified riggers

- Rigger should be validated for rigging trade skill by Project Mechanical Dept.
- He should know the weight of the load, how to select the appropriate rigging for the load. And the differences between hitching configurations and different application of belt sling, able to interpret rigging set up and plan, lifting tools and tackles etc.
- He understand the concept of center of gravity and balancing of the load.
- He will use only lifting tool which are tested and of appropriate capacity as prescribed in checklist, he should physically check all lifting tools before use.

5.11. LIFTING PLAN

For complex, heavy lift and super heavy lift, for any lift exceeding 75% of SWL and upto 90% of SWL of crane and multiple crane lifts, a lifting plan is required in addition to the Mobile and Pick and Carry Crane Planning and Risk Assessment Checklist and critical lift permit.
Lifting plan will contain;

- Plot plan details
- Ground area preparation requirement.
- Mobile cranes with type and capacity, type of lift with counter weights.
- Crane hook weight
- Weight and dimension of load.
- Boom length and Boom angle.
- Maximum and minimum load radius.
- Crane capacity at maximum load radius
- Spreader bar with size, weight and capacity
- Slings size, capacity and its weight, included angle between slings,
- Tailing plan shown in both plan and elevation drawing
- Mobile cranes positions, marching with load.
- Clearance from nearest equipment/structures for both load and counter weights
- Permissible wind velocity
- Percentage loading of crane capacity etc.
- The Lifting Plan should be prepared by contractors authorized person, rigging specialist and approved by AMNS Project Mechanical Team and lead engineer.
- The lifting plan shall also include a detailed step-by-step description of the whole operation, method statement, and state authorized person shall supervise the lift.

5.11.1. Rigging scheme

- Prepare rigging scheme for heavy and super heavy lifts, as required. The scheme shall give details of total space / area requirement, plan / elevation of erection, method statement, sequence of operation, rigging data, hook up details, etc.

5.11.2. Authorized Permit Issuer Training and Authorization

- The appointment and training of Critical Lift Authorized Project Permit Issuers is similar to permit to Work and Confined Space Entry Authorized Permit Issuers. However, in addition, they will have sound and thorough knowledge in matters relating to the preparation and conduct of critical lifts. Practical experience in preparing critical lift permits under guidance will be an integral part of training. Appointment is made in writing; Authorized Permit Issuers, by the Project Team.

5.11.3. Details of Lifting Plan

- All lifting operations must be planned to ensure that they are carried out safely and that all reasonably foreseeable risks have been taken into account. A Lifting Plan is essentially a risk assessment for the work to be undertaken. The lifting plan shall detail in plan and elevation, to a suitable scale on an appropriate plot layout and shall contain as a minimum;
- The precise (manufacturers model number) crane and equipment to be used, not a generic type.
- The exact configuration of the crane e.g. boom length, boom angle, mast length counterweight, outriggers fully extended, or tracks extended or retracted.
- Plot Plans shall be detailed, comprehensive erection drawings that define all major elements of a Heavy Rigging Activity. The drawing(s) shall include, but is not limited to the following:
- A scale plan view showing the locations of lifting equipment, lifted items and their relationship with any potential obstructions.
- A scale elevation view that shows the relationship and clearances between the lifting equipment, lifted items, and potential obstructions. Lifting and tailing hook-ups including shackle, sling, and spreader bar sizes, lengths, and capacities.
- Rigged weight to be lifted. Together with the CoG position and the rigging geometry to suit that CoG and the imposed rigging lines.
- Crane capacities based on the actual working radii and the crane configuration.
- A description of the placement of crane mats and mats under transportation equipment, where required.
- A detailed written description that adequately describes any part of the lift not made clear by the drawings.
- A description of any "holds" that must be placed on existing plant structures or equipment that would interfere with the lift plan.
- Crane or Lifting System assembly drawing(s) showing area required for assembly, assist cranes required and labor required.
- Load delivery and placement location.
- Transportation equipment outlined for delivery of load, and includes both exit routes.
- Accurate diagram of the load including dressing.

- Position of the center of gravity of the load.
- Radius and capacity at pick-up and placement.
- Accurate load assessment including weight of hook block, rigging etc.
- In the case of multiple crane lifts assessment of the load share at all stages of the operation including any requirement for de-rating of capacity charts.
- Ground (soil) bearing pressure or outrigger loading for the crane together with resultant due to distribution system or foundation.
- Acceptable ground bearing pressure for the crane operational area.
- Actual ground conditions and profiles as they exist.
- Location of tailing crane.
- Location of access equipment and/or assist crane.
- Location of supports (temporary saddles) to complete dressing.
- Detail any specific access required other than that provided by assist crane.
- Layout should show all temporary works plus other construction activities in the area.
- Location of underground services within 6 feet of the cranes tracks or outrigger pads.
- Clearances to the load, parts of the crane etc. during all stages of the operation. All items offering potential obstruction.
- Maximum wind speed for the operation.
- Safety exclusion zone to be determined.
- Night/day lift designation (Night lifting operations shall not be permitted without approval from either the Construction or Deputy Construction Manager.

5.12. Assembly / Disassembly, Inspections, Tests, and Maintenance of Cranes

5.12.1. Inspection and Testing of Equipment and Tools-Tackles

- Initial Load Test: It is the responsibility of the manufacturers to carry out examination in their respective workshops.
- Operational Test: Load test of mobile cranes shall be ensured by Project Mechanical at the arrival to site. After approved load test, the hired crane should be deployed.
- Rated Load Test: In case of any repair or alteration to cranes, it shall be examined by a competent person for rated load before putting them in use.
- Periodic Inspection: It is the responsibility of Project Maintenance Departments to ensure periodic inspection for all cranes. Inspection will be done at least every 6 months.
- Periodic Examination: All cranes, Suspended Personnel Platform, Chain pulley blocks and all lifting tools and tackles shall be thoroughly examined by a competent person at least once in twelve months and a record of such testing is to be maintained in Form No 10. Project Maintenance Departments shall line up testing and certification agency for cranes and lifting tools tackles. Only inspected, tested and validated (by competent agency authorized by AMNS Project Team) shall be used.

- In case of rejection of any lifting tools tackles or machinery during testing by competent persons, same shall be clearly mentioned on them. Web sling shall be marked with "Rejected" by permanent marker and wire rope slings shall be embossed with alphabet "R" on its ferule to distinguish rejected slings.

5.12.2. Rigging Equipment

- A monthly inspection register of all rigging equipment, Rigging Equipment Register or equal) must be maintained at the site by the contractor rigging inspector/ competent person. Maintenance records should also be available for review.
- Clamps and lifting beams will be clearly labeled with the load capacity. Slings, chains, hooks, and shackles will be tagged, marked with the load carrying capacity and color coded as per yearly code scheme.
- Rigging equipment will receive a daily pre-use inspection by the operator and rigger. Rigging equipment will be inspected periodically fortnightly/monthly by a Competent Person nominated by the contractor. Periodic / monthly inspections will be documented, Monthly Inspection Report — Construction Equipment and Light Vehicles or equivalent.
- Periodic inspection should be done in accordance with Vendor/manufacturer's recommendations.
- Inspection and maintenance forms / checklist are included in Attachment for daily inspection / fortnightly/monthly maintenance of different types/models of cranes and equipment's.
- Rigging equipment that is worn or damaged to such an extent that, in the judgment of a Competent Person, it cannot be repaired satisfactorily, must be destroyed by cutting, and the lifting equipment register amended accordingly.

5.12.3. Assembly / Disassembly

- Cranes received for use (through purchase, contract obligations, or rental) must be assembled or disassembled in accordance with the manufacturer's instructions, recommendations, limitations, and specifications. Cranes should be load-tested in accordance with the manufacturer's specifications and limitations following the in-country regulations. Any permit requirement in Assembly / Disassembly will be approved by Project Management.

5.12.4. Erection location and approach route

- Select suitable location at site to position crane such a way that it is near to load pick up and final placing locations.
- Decide and develop route for movement of crane and trailer carrying load. Maintain sufficient road width, turning radius for crane and trailer carrying loads/heavy loads.
- All super heavy lift cranes shall preferably be escorted by traffic security.

5.12.5. Operator's cab or cabin

Operators cabin should following should be provided with;

- A suitable seat belt for driver, a foot rest and protection from vibration;

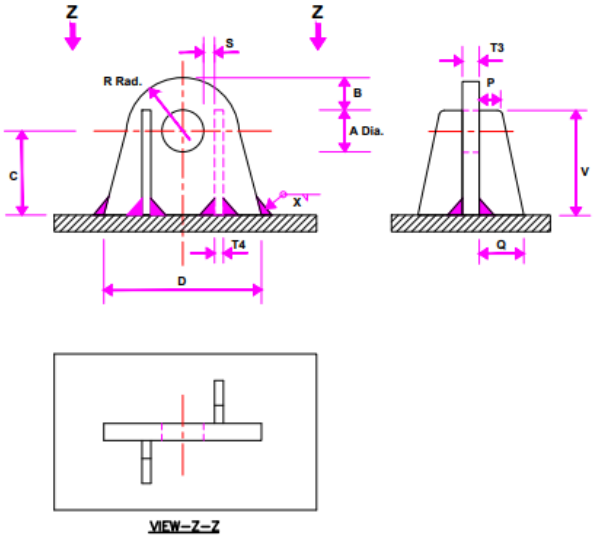
- Necessary access to working parts in cab;
- Adequate protection against the weather;
- Adequately ventilated and a suitable fire extinguisher.
- Refer to Attachment, Safety Device Requirements, for a list of minimum safety equipment / requirements.

5.12.6. Hooks

- Crane hooks must be made from either forging or casting (steel or alloy) that has been quenched and tempered and be fabricated as per manufacturer's specifications.
- The test certificate or documentation specified above must be provided for each hook stating the Working Load Limit (WLL) as specified by the manufacturer. The hook must be stamped and color coded as per yearly color scheme or otherwise identified and be traceable to the certification / documentation.
- A visual inspection and dimensional check must be performed on all crane hooks before they are initially put into use. For new cranes, a manufacturer's data sheet showing the safe working load and the full dimensional details of each hook, including throat opening, must be provided to AMNS Project Maintenance. All crane hooks must undergo magnetic particle or dye penetrant testing by manufacturer before they are initially put into use on any AMNS Project Site. If test information is not normally provided by the manufacturer, a Project competent person may advise on the test examination to be carried out (magnetic particle / dye penetrant testing or (x-rays.)The tip of the hook block should have a spring loaded safety latch.

5.12.7. Lift Lugs and Attachments

- Lift lugs must be inspected before the lift. The inspection should include the following:
- The size and quantity of all components must be checked, making sure that all parts, such as gussets and reinforcing plates, have been installed according to drawings.
- The location and orientation of lifting attachments must be checked for conformance to drawings and specifications.
- Attachment welds for lifting lugs must be inspected for conformance to drawings.
- A Dye penetrant test (DP) to be done for self-fabricated lifting lugs.
- Test records to be maintained with authorized tester signature.
- Any damage or nonconformity noted must be brought to the attention of the AMNS Project and rigging supervisor.
- Lift Lug calculation:



SWL t	A mm	B mm	C mm	D mm	T3 mm	R mm	X mm	P mm	Q mm	V mm	S mm	T4 mm
1	22	16	35	80	10	27	6	25	100	46	5	6
2	30	22	40	100	12	37	6	25	100	63	7	8
3	35	25	45	120	16	43	6	25	100	73	9	10
4	40	30	50	135	20	50	6	25	100	85	9	12
5	40	35	50	150	22	55	6	25	100	85	12	12
7.5	50	40	60	180	25	65	8	25	100	105	12	14
10	55	45	70	200	32	73	8	50	150	119	12	16
12	60	50	75	230	36	80	8	50	150	138	16	18
15	70	55	80	250	40	90	10	50	150	157	20	20
20	80	65	90	290	45	105	10	50	150	180	20	22
25	90	70	100	320	50	115	12	50	150	205	20	24
30	95	75	105	340	50	123	16	50	150	233	20	26
40	100	85	140	380	60	135	18	50	150	266	20	28
50	110	90	150	400	60	150	22	50	150	303	20	30

5.12.8. Slings/Rope

Safety Precautions for the use of wire Ropes and Slings

- Ensure that the correct rope / sling is in use. i.e. SWL of rope / sling.
- Clean and apply diesel or used oil lightly to prevent the slings from rusting.
- Inspect regularly for broken strands.
- Do not coil the slings as far as possible.
- Do not drag the slings on dirt or roads.
- Do not use them without proper packing in sharp corners.
- Do not use them at less than the prescribed included angle.
- Do not overload or subject ropes / slings to shock load.
- Follow proper method of securing dead end of wire rope when using a wedge socket i.e. the dead or short end of rope should have a clip attached to it or be looped back and secured itself by a clip.
- Do not attach the dead end of rope to the live side of the rope with a clip when using a wedge socket as this will seriously weaken the attachment.
- All slings must be tested in accordance with in country regulations and tagged, marked with the load carrying capacity and color coded as per yearly code scheme.
- No chain or wire rope with a knot shall be used at site.

- All slings must have a third party test certificate showing that they have been proof tested to as per legal requirements, stating the safe working load, size, and identification.
- All wire rope slings must be manufactured using a Flemish eye mechanical connection to form he sling eye. Crimped fold over eye connections are strictly prohibited.
- Components of the loose gear, at the time of its use, are renewed if one of its dimensions at any point has decreased by ten percent or more.
- A chain is withdrawn from use when it is stretched and increased in length which exceeds five percent of its length or when a link of such chain is deformed or is otherwise damaged or raised scarves of defective welds is appeared on it.
- Rings, hooks, swivels and end links attached to a chain are of the same material as that of such chain.

  Slings /rope / fiber rope that do not meet the minimum requirements of in country standards, legal requirements must be tagged; Danger — Don't Use It — Unsafe Tag, equivalent and rendered unusable before the slings are removed from the project. For example, cut through the lifting eyes on both ends of the sling

5.13. MAINTENANCE, REPAIRS, AND RECERTIFICATION

- Persons authorized to conduct maintenance and repair on cranes must meet the criteria for, and be designated as, a Qualified Person in accordance with the requirements.
- All maintenance and repairs shall be in accordance with manufacturer's recommendations. Maintenance of all cranes will be carried at a construction or PROJECT MECHANICAL site designated places.
- Repairs to cranes and rigging, other than the replacement of parts, must be carried out by the original manufacturer, the manufacturer's agent, or a mechanic approved by a Qualified Person. Any replacement part must be identical / equivalent to the original part.
- Appropriate recertification of a crane following repair must be accomplished before the crane is placed back in service. Recertification is an inspection equivalent to an annual inspection conducted by a Qualified Person.
- Where load-bearing components are repaired or replaced, rigging equipment must be tested by application of a "proof load"/ applicable test to the component as specified by a Competent Person, and then thoroughly examined. A test certificate stating the working load limit / safe working load and the proof load must be obtained. The test certificate and a record of the repair or modification will be placed in the rigging equipment register.
- Maintenance and repair of hired cranes will be done by agency owning the crane and subsequently validated by Project Mechanical department.
- Records of maintenance, repairs, and modification shall be maintained for three years by Project Mechanical Department.

5.14. MODIFICATIONS

- No modifications or alterations that affect the capacity or safe operation of the crane or rigging will be made by the project or any individual without the manufacturer's written approval. In case of alteration or modification designed and fabricated in accordance

with national or in-country requirements by a specialized vendor, the modified design must be approved by the by AMSN Project team.

- After modification, if a proof test is required by applicable standards, a test certificate stating the WLL / safe working load and the proof load / Applicable test must be supplied by a Govt. Approved Competent person.

5.15. Riggers / Rigging

5.15.1. Training

- Attachment describes typical qualification requirements based on OSHA guidelines and best practices in the construction industry. This can be referred to establish AMNS Project specific validation requirements.

5.15.2. Inspection

- Riggers must ensure that newly purchased slings are properly marked, proof-load tested, and inspected.
- User and Foreman will inspect wire rope and other rigging equipment thoroughly before use on each shift. Include the following items as a minimum:
  - ❖ Signs of damage or deterioration from prolonged use or misuse
  - ❖ Missing components, identification, or load testing information
  - ❖ Missing inspection tags or identifiers

  Note: Any rigging equipment found defective or deficient in the above areas must be tagged with a Danger — Don't Use It — Unsafe Tag, or equal, and returned for inspection and removal from service if damaged.
- Contractor Designated Rigging Inspector/competent person (Validated by Project Mechanical Team) will inspect all wire rope and rigging equipment each month. Records to be maintain Rigging Equipment Register or equal
- Designation of Competent and Qualified Persons (validated by Project Mechanical Team) must be documented
- Inspection register will be used to document monthly inspections and contain the following information, at a minimum:
  - ❖ Equipment / Component Description or ID Number
  - ❖ Inspector
  - ❖ Date of Inspection
  - ❖ Any defect identified and replacement etc.

5.15.3. Means of Communication

- In order to reduce the likelihood of incidents caused by misunderstandings, AMNS Project will adopt a common and recognized means of communication between the operator of the lifting equipment and the signaler/slinger. The agreed means of communication shall be documented in the lifting plan and followed by all those involved in lifting Project.

- It is prohibited for any person other than the appointed signaler/slingers are to communicate with the crane operator. The appointed signaler/slinger will wear a high-visible vest to indicate they are the responsible person. Crane operators are not permitted to accept signals from any person other than the appointed signaler/slinger.
- Where hand signals are used as the means of communication the signaler/slinger shall be within easy viewing distance of the crane operator. Where there is no clear line of site between the signaler/slinger and the crane operator, radio communication shall be used. On tower cranes where the driver's cab is more than 35 metros from the ground level radio communication is mandatory between the crane operator and the signaler/slinger

5.15.4. Hand Signals

Hand signals particularly used by the lifting supervisor or riggers and lifting equipment operators shall be followed.

Walkie talkies shall be given for clear signaling between the signal man and the operators instead of relying on the signals.

5.15.5. Radio Signals

- When using Radios, you must position it 1-2 inches away from your mouth then you press the talk button and pause for 2-4 seconds before speaking this allows the radio channel to open up.
- Then you must speak clearly and repeat your command 3 times and once you have finished your lift you must say Roger out, we do this to tell the crane operator that the job is finished.

5.16. GENERAL SAFETY GUIDELINES FOR CHAIN PULLEY BLOCKS

- Before hanging the chain pulley block on the structure, ensure for its adequate strength for structural member to withstand load.
- Don't hang the block by tip of the top hook on structure.
- Ensure that chain pulley blocks are tested and certified.
- When a chain pulley block is hung to an overhead beam with a help of sling, protect the sling against the sharp edges.
- The tip of the hook block should have a spring-loaded safety latch.
- Pulley blocks should have identification mark and SWL marked on them.
- Loads in excess of SWL should not be raised, lowered or suspended.
- The hand and load chains should hang freely without any knot or twist.
- The load should always be applied through seat of the hook. Side loading will distort and damage the hook. Use hook chuck for this.
- Do not overcrowd the hook with multiple slings. A shackle connecting the upper ends of sling legs can be put on the hook. This ensures vertical loading of the hook.
- Do not drop, throw the blocks across the floor surface. If dropped accidentally, get the block examined by a competent person before reuse.

- Chain pulley blocks are designed for lifting loads vertically and should not be used for pulling horizontally or at an angle. Dragging or Pulling of load is to be carried out by hook chuck only.
- Common misuses like hoisting person, lengthening load chain shall be prevented.

5.16.1. Inspection of Chain Pulley Block

Which might result in reduction of the groove diameter & give an uneven bearing surface from the rope

- There should be a straight line between the upper & lower hooks. Misalignment between the pulleys should be avoided at it causes rapid wear on the sheave and the rope

5.16.2. Inspection Points

- Brake Mechanism
- Hand Wheel
- Load Wheel
- Load Chain
- Hand Chain
- Gears
- Top Hook
- Bottom Hook

5.16.3. Dos & Don'ts of Chain Pulley Block

- Do not overload CPB
- Do not stand under the load
- Only one operator should pull on a single hand chain at one time
- Ensure that load chain is properly seated in wheels or sprockets before lifting
- Do not leave a suspended load unattended
- Never allow any person to ride on the load being lifted
- Inspect daily, before start of work, and record in daily inspection register
- Ensure that anchorage of winch pulley and structure can support the load.
- CPB shall not be used horizontally or at high inclination angles (IS 3832:2005 may be referred).

5.17. SAFETY GUIDELINES FOR WINCH

- Ensure load to be lifted is within the SWL of the winch.
- Select the correct winch to give required line pull.
- Ensure guards are provided for all moving parts of winch.

- Anchor the winch securely.
- Experienced and skilled operators only should operate the winch.
- Adequate warning signs shall be installed near the winch operating area.
- Ensure at least three windings of wire rope are available on the drum while lifting / lowering the load.
- Ensure that the brakes of the wire rope drum are in working condition.
- Ensure that the pawl of the winch is working so that reverse movement of the drum is prevented.
- Adequate protection should be provided to winch operator against abnormal weather.
- Ensure that daily before use and periodic inspection are conducted.
- Winch shall be tested by Government approved competent person.

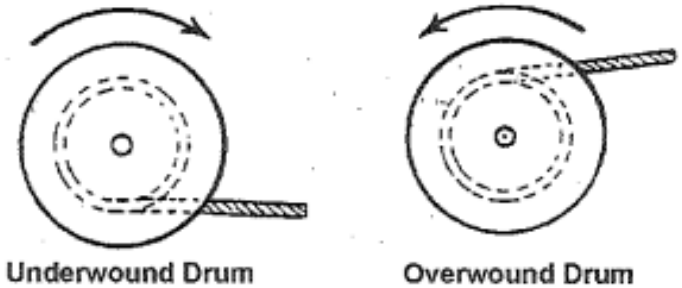
5.17.1. Inspection - Winches

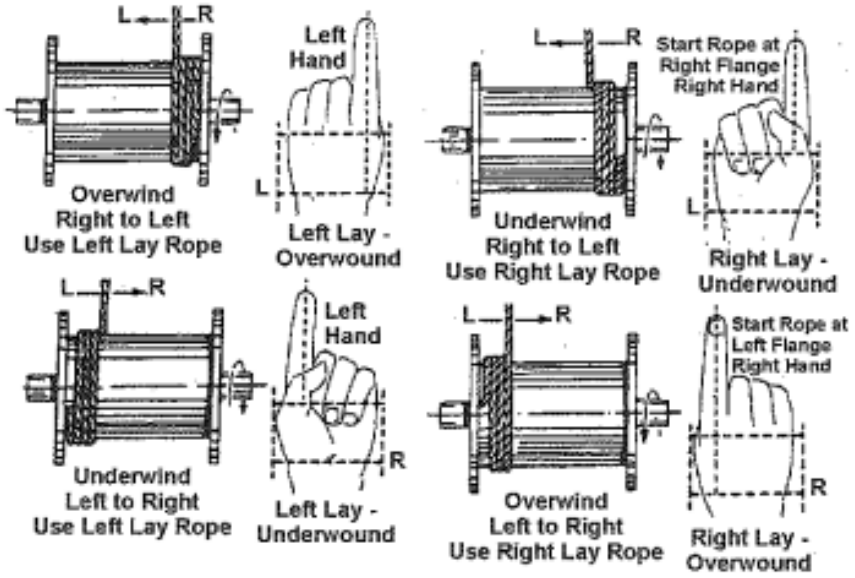
- Safe working load should be clearly mentioned on the winch.
- The rope should lay neatly on the drum and no bunched up.
- At least three dead turns of wire rope should remain on the drum always at the Termination point.
- The rope end on the drum should be securely anchored to drum.
- Electrically operated winches should be properly earthed.
- Rotating part of machines adequately guarded
- Wire rope should always properly spool on drum

5.17.2. Installation of winch

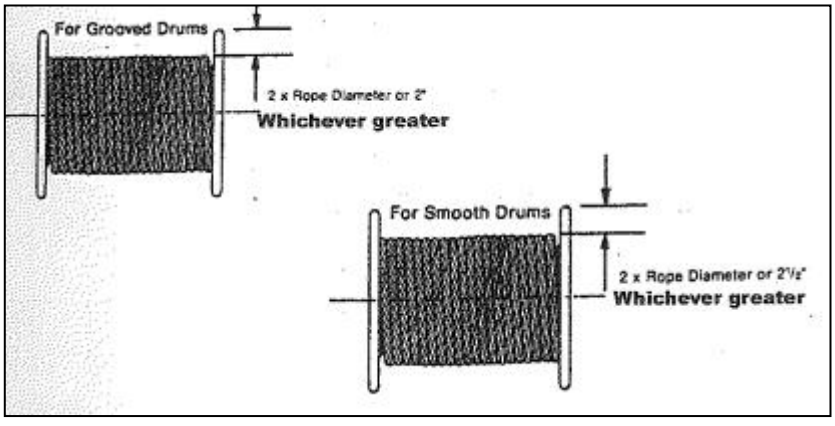
- The fleet angle is measured from the center of the drum to the center of the first diverting sheave / pulley then back to the inside flange at the middle of the drum
- If the fleet angle is too large or the distance between the drum and the first lead or diverting sheave is too short, the rope will not lay neatly on the drum and will create severe wear on the rope and the sheave flange
- Manufacturer's instruction on use and maintenance of winch shall be strictly followed.
- Only authorized person shall operate the winch.
- Winch shall not be overloaded. Safe Working load shall be clearly mentioned on the winch.
- Winch shall be installed on a level and strong ground and anchored securely.
- Number of layers of wire rope winding on the Drum shall be such that the bottom layers do not get crushed. Generally, more than three layers are not recommended.
- Wire rope termination at the drum shall be secure and at least three dead turns wire rope shall remain on the drum always.
- The mechanical brake with a pawl engaging with the gear of the rope drum shall be kept intact.

- All electrically powered winches shall be equipped with an effective magnetic release brake, which will be automatically applied to hold the wire rope when the machine is in 'stop' position.
- If wire rope way is on the ground level, it shall be barricaded to prevent persons crossing over the same. If required proper cross over arrangement shall be provided. And adequate number of pulleys shall be provided so that the wire rope does not fall on the ground.
- The pulleys of wire rope shall be anchored securely so as to take up the load being handled.
- Wire rope shall be lubricated at least once in week.
- Rotating and moving parts of the winch shall be guarded.
- Electrically operated winch shall be provided with proper earthing.
- Winch shall be inspected on weekly basis by the Maintenance Engineer.
- In addition to the weekly inspection, winch shall be inspected by competent person once in 12 months. Also, it shall be inspected by the competent when it undergoes major alteration or change.
- Drums should have adequate power and operational characteristics to perform all hoisting, holding and lowering functions when operated under all conditions and configurations as recommended and approved by the manufacturer.
- Drums should be provided with suitable clutching or power engaging devices that facilitate immediate starting and stopping of the drum motion.
- Drums should be provided with self-setting brakes that are capable of supporting all rated loads with recommended reeving.
- The brakes and clutches are provided with adjustments to compensate for wear and maintain adequate force in springs where used.
- The drums have sufficient rope capacity with recommended rope size and reeving to perform all hoisting and lowering functions under recommended and actual service conditions. In addition, all hoist drums should be provided with adequate means to ensure even spooling of the rope on the drum.





- Lay of the wire rope shall match details given in the above figure. For example, Left lay wire rope shall be used on over wound Right to Left drum. Wrong winding will cause slip of turns.
- At least two or three full wraps of rope remain on the drum in ail service conditions.
- The drum end of the rope should be anchored by a clamp, securely attached to the drums with an arrangement approved by the manufacturer.
- The drums should be provided with rims and flange guards of size sufficient to prevent the rope from jumping off the drum.
- Grooved drums should have the correct groove pitch for the diameter of the rope. The depth of the groove must also be correct for the diameter of the rope.



- The flanges on grooved drums should project either twice the rope diameter, or 2 inches beyond the last layer of rope, whichever of the two is greater.
- The flanges on ungrooved drums should project either twice the rope diameter, or 21/2 inches beyond the last layer of rope, whichever of the two is the greater.
- The fleet angle for grooved drums should lie between 1/2 deg and 1-1/2 deg for smooth drums it should not be more than 2° for grooved drums. If the fleet angle is not within the said limit, winding on the drum shall not be uniform.

- Whenever possible, a drum should be designed to hold all the rope on one smooth, even layer. Two and sometimes three layers are permitted, but more than three layers may cause crushing of the rope on the bottom layer as well as at the end of any layer where pinching occurs.
- To be certain that the rope spools evenly on the drum, either use a spooling device or keep the fleet angle to within the correct limits and keep tension on the rope at all times. Approximately 10% of the working load is recommended.
- It is often necessary to know the approximate spooling capacity of a given drum or reel for a particular rope diameter. The following method can be used to make this calculation.

Drum Capacity Factor	
Rope Diameter in Inches	**F**
	4.160
5/16	2.670
3/8	1.860
7/16	1.370
½	1.050
9/16	0.828
5/8	0.672
¾	0.465
7/8	0.342
1	0.262
1 ½	0.207
11/4	0.167
1 ½	0.138
11/2	0.116

a. Add the diameter of the drum (B) to the depth of the flange (A).

b. Multiply this sum by the depth of flange (A).

c. Multiply the result by the distance between the drum flanges (C).

d. Then multiply this result by the factor (F) listed in the above table opposite the size of rope to be installed.

Drum spooling Capacity = (B+A) xAxCxF, where A, B and C are in inches.

For example, if the diameter of the drum is 18 inches, the depth of the flange is 2 inches and the distance between drum flanges is 24 inches, the drum's capacity for a 3/4 inch rope is:

Spooling Capacity = (18+2) 2x24x0.465 = 446 feet.

- Use of grooved drums is more preferable than smooth drums as the grooves furnish better support for the rope than do flat surfaces, and more uniform winding results in less abrasive wear on the rope.

5.18. Pick & Carry Cranes (New Generation)

Pick & Carry cranes are widely used in the Indian Construction Industry for loading, unloading, and transportation materials. Mobile cranes are manufactured in compliance

with ASME–B.30.5 standard whereas Farana are manufactured based on vendor engineering standards.

Farana designs & manufacturing are not covered under any Indian/ International standards or Codes. Indian and Global statistics show that most of the crippling injuries and fatalities related to Pick and Carry and mobile cranes can be attributed to basic easily preventable hazards.

Pick & Carry cranes shall not be used for shifting materials, especially large dimensions.

Center of gravity must be monitored at all the times. IS 4573:2020 may be referred for all detailed operations.

Refer Safe Operating Procedure - ***AMNS-Project-SOP-HSEM-02 - Safe Operations of Pick & carry crane*** for detailed safety criteria in selection, fitness assurance and use of Pick &Carry cranes.

5.19. GUIDELINES FOR USE OF TOWER CRANE

The Tower Crane To Be Used Shall Be Checked for The Following,

- Load Chart: Each crane shall have a load chart which has clearly legible characters in English and figures displayed inside the crane is easily visible to the crane operator and shows the safe working load for all configurations of boom / counter weight / fly jib / lulling jib etc.
- Log book: If the equipment is not supplied with a log book then one should start, maintaining and keep on the work site for the regular, periodic recording of all inspections, tests, repairs, maintenance, and hours of service related to the machine. All entries should be dated and signed by the operator, and supervisor. The crane owner shall ensure that the log book remains with the crane and is kept up-to-date throughout the working period of the crane.
- Do not lock the swing break if the crane is not in lifting operation.

Safe Load Indicator (S.L.I.)

- All types of cranes shall be preferably fitted with safe load indicator. The SLI is usually used in association with overload cut-off devices. The specification of safe load indicator should conform to BIS, National / International standard or equivalent.
- By passing any safety feature will lead to disciplinary action/very heavy penalty or termination of contract.
- Every brake on the crane shall be fail-safe type i.e. brake will be automatically applied whenever there is a loss of power (pneumatic, hydraulic or electric).
- These brakes shall not get released until the power has been restored and only when deliberately released.
- The application of the brake shall have a direct effect on the hoisting drum and as such, no belts or chains are allowed between the brake and the drum.
- In hydraulic drives using a positive direct system of holding the load, the hoisting brake may be used only as an emergency fail-safe device and its application and torque must be as recommended by the manufacturer.
- The brake on the slewing drive shall be capable of preventing the jib/boom of crane from drifting under a wind pressure up to the maximum operating wind pressure

specified by the manufacturers.

Limiting switches

- All tower cranes of any configuration must be equipped with built-in safety devices which operate automatically to prevent damage to the machine if the operator make an error.
- The most important of these are the limit switches which would eliminate the possibility of crane overload or over-travel of crane components.

Every tower crane must have:-

- A hook height limit switch that causes the hoist drum to stop whenever the load hook reaches a predetermined maximum height position;
- A trolley travel limit switch that causes trolley motion to stop whenever the trolley reaches a predetermined maximum out or maximum in position;
- An overload limit switch that causes the hoist drum to stop whenever the load being hoisted exceeds the maximum rated load for any radius or whenever the over-turning moment exceeds the rated load moment. The overload limit switch should be installed in association with the automatic safe load indicator.
- Swing limit switch to avoid the collision with any structure or nearby other tower cranes working.
- Travel limit switches for rail mounted cranes that apply the carriage brake whenever the crane comes near the ends of the tracks.

5.19.1. General Safety Requirements for tower crane

- Tower cranes shall be erected, operated and dismantled under the immediate supervision of competent person, designated by the employer.
- Tower cranes shall be erected, maintained and used in accordance with the manufacturer's specifications, recommendations and procedures.
- Modifications shall be approved by the manufacturer and engineered by a professional engineer, PROJECT MECHANICAL. The safety factors shall not be reduced by any modifications. The crane plates and charts shall be changed to reflect any modifications made.
- A professional engineer shall certify that the crane foundations and underlying soil are adequate support for the tower crane with its maximum overturning movement.
- Tower cranes shall be positioned whereby they can swing 360° without either the counterweight or jib striking any building, structure or other object, except:
  - ❖ If the crane can strike an object or another crane, suitable limit switches or anti-collision device shall be installed which will prohibit contact with such objects.
  - ❖ Direct voice communications shall be established between any operator of the tower crane(s) involved and a signal-person so stationed where the boom and/or counterweight movement, and the object with which it may contact can be observed so that the operator(s) can be warned of imminent danger.

- ❖ A secondary means of positive communications shall be established as a backup for possible direct voice communication failure.

- Prior to installing a climbing tower crane within an existing building or new construction, a structural engineer shall certify that the building is designed to withstand the torque and floor loading created by the crane to be installed.
- Tower cranes erected on a new foundation shall be tested as per following the test shall consist of suspending a load of not less than 100% of the rated capacity for 15 minutes. The load shall be suspended from the furthest point of the length of boom (jib) to be used. The results of this test shall be within the manufacturer's recommendations and/or specifications.
- A record of each test shall be made and signed by the person responsible for conducting the test. Such records shall be maintained on the construction site for the duration of the construction work for which it was erected and subsequently made a part of the project's permanent equipment records.
- A capacity chart shall be furnished by each crane manufacturer, which shall include a full and complete range of crane load ratings at all stated operating radius for each allowable speed and each recommended counterweight load.
  - ❖ Such, chart shall be posted in the operator's cab or at the remote control stand in use. In lieu of the chart at the remote-control stand, a minimum of two weight capacity signs shall be affixed to the jib or boom.
  - ❖ The chart shall be visible and readable to the operator while at the normal operating position.
  - Operating controls shall be properly marked to indicate function of the controls in each position.
  - An operating and maintenance manual written in the English language shall be provided with each tower crane.
  - The crane shall not be used to pull vehicles of any type, remove piling, loosen formwork, pull away loads attached to the ground or walls, or for any operation other than the proper handling of freely suspended loads.
  - When the operator may be exposed to the hazard of falling objects, the tower crane cab and/or remote-control station shall have adequate overhead protection.
  - The operator shall be protected from the weather. If enclosed cabs are provided, they shall provide clear visibility in all directions and glass shall be approved safety glass or the equivalent.
  - An approved and safe means shall be provided for access to operator’s cab and machinery platform.
  - When necessary for inspection or maintenance purposes, ladders, walkways with railing or other fall protection devices shall be provided and used.
  - Each tower crane shall be provided with a slewing brake capable of preventing the jib or boom from rotating in either direction and stopping the rotation of the jib or boom while loaded, when desired. Such brake shall have a holding device which, when set, will hold the jib or boom in a fixed location without additional attention of the operator. When the crane is out of operation, the jib or boom shall be pointed downwind and the slewing brake shall be released so as to permit the jib or boom to weathervane, providing the jib or boom has a clear 360-degree rotation. Where a 360-degree rotation is not provided, the jib or boom shall be pointed downwind from the prevailing wind and the slewing brake set.

- Each tower crane shall be provided with a braking system on the trolley capable of stopping and holding the trolley in any desired position while carrying a maximum load. This brake shall be capable of being locked in a fixed location without additional attention of the operator. An automatic brake or device shall be installed which will immediately stop and lock the trolley in position in the event of a breakage of the trolley rope.
- Dedicated Earthing shall be provided for all Electrical Equipment installed in the Tower Crane with the help of suitable Earthing cables.
- Ensure earth leakage protection of electrical system with the help of suitable ELCB or MCCB.
- Suitable lightening arrestor shall be provided at the highest point of the tower carne structure and same will be connected to the dedicated Earthing system.
- Festoon cables shall to be laid properly to avoid obstruction with other components of Tower Crane while moving.
- Tower Crane body Earthing shall be ensured with the help of suitable GI Earthing Strip or Cables.
- When the operator is actually operating the crane, the operator shall remain in a stationary position.
- All crane brakes shall automatically set in event of power failure. Swing brakes shall also function in this manner or be capable of being set manually.
- Climbing jack systems used for raising a tower crane shall be equipped with over-pressure relief valves, direct-reading pressure gauges, and pilot- operated hydraulic check valves installed in a manner which will prevent jack from retracting should a hydraulic line or fitting rupture or fail.
- During periods of high winds or weather affecting visibility, i.e., fog, etc., only loads shall be handled that are consistent with good safety practices. Good safety practices shall be mutually agreed upon by the operator and the person in charge of the construction job, with due consideration given to manufacturer's specifications and recommendations.
- Counterweights shall be securely fastened in place and shall not exceed the weight as recommended by the manufacturer for the length of jib being used, however, an amount of counterweight as recommended by the manufacturer shall be used.
- Tower cranes shall be inspected and maintained in accordance with the manufacturer's recommendations or more frequently if there is reason to suspect a possible defect or weakening of any portion of the structure or equipment.
- Guy wires, wedges, braces or other supports shall be inspected at the beginning and at midpoint of each working shift to ascertain that they are functioning as intended.
- An approved method shall be instituted for transmitting signals to the operator. Standard hand signals for crane operations shall be used, whenever possible. However, if conditions are such that hand signals are ineffective, radio-controlled or electric-whistle signal or two-way voice communication shall be used.
- Tower cranes shall not be erected or raised when the wind velocity at the site exceeds 10 m/s or as specified by the manufacturer.
- Tower crane operators shall be trained and experienced in tower crane operations.
- Adequate clearance shall be maintained between moving and rotating structures of the crane and fixed objects to allow the passage of employees without harm.

- Employees required to perform duties on the horizontal boom of hammerhead tower cranes shall be protected against falling by guardrails or by a full body harness and lanyards with shock absorber attached to crane or to lifelines.
- Buffers shall be provided at both ends of travel of the trolley.
- Cranes mounted on rail tracks shall be equipped with limit switches limiting the travel of the crane on the track and stoppers or buffers at each end of the tracks.
- All hammerhead tower cranes in use shall meet the applicable requirements for design, construction, installation, testing, maintenance, inspection, and operation as prescribed by the manufacturer.

5.19.2. Routine Checks of Tower Crane

At the beginning of each shift or working day the operator if competent for the purpose or a competent person should carry out the following routine checks as appropriate:

- Checks as required by the manufacturer's instructions;
- Check that the safe load indicator is correctly set and/or fitted with the correct jib length (or jib and fly-jib lengths) and falls of hoist rope;
- Check that the correct load-radius scale appropriate to the jib length is fitted on the visual indicator;
- Check crane level indicator (where applicable);
- Check working space limiter/anti-collision system (where applicable);
- Check audio and visual alarming devices;
- Check the security of the counterweight or ballast where this is in the form of removable weights; check that the weights fitted correctly correspond to those shown on the counterweight chart for the operating condition.
- Check loosening of pins, bolts and nuts.
- Check the ropes, and rope terminal fittings and anchorages for obvious damage and wear.
- Check that all water is drained from any air receivers.
- Check the jib structure for damage.
- Check the operating pressures in any air and/or hydraulic system(s).
- Check leakage of brake fluid and hydraulic oil.
- Check the operation of the crane through all motions with particular attention to brakes to ensure that these are operating efficiently.
- Check the operation of all limit switches or cut-outs (use caution in making the checks in case of non-operation).
- On rail-mounted cranes the wheels and axles are in good condition; the cable drum is free to revolve and the cable does not foul on any part of the crane structure.
- All rail clamps and out-of-service anchorages have been released.

- The track is in good condition and clear of obstructions, and that there is no undue settlement, loose joints, cracks, or gaps between adjacent lengths of rail.
- The crane is placed out of service when the wind speed registered is near the manufacturer's safe working limit and that where an anemometer is fitted to the crane, it is in working order.
- Split pins and locking cellars are in position on jib and counter-jib ties and counterbalance hanger bars.
- The travel warning device operates.
- On a climbing crane all climbing frames and wedges are secure; and that the anchorages and wedges on any. Tower ties or tie frames are secure and locked in position where necessary.
- For safety and to prevent the risk of fire, the crane cabin is in a tidy state, is free from tins of grease and oil or other fluids; from rags, tools, shackles, and other materials, and that a fire extinguisher suitable for extinguishing both electrical and other types of fire is available in a convenient place in the crane cabin.
- Tower Crane Inspection Check list shall be followed.
- The operator must never leave the controls with a suspended load. The unexpected could happen and allow an unattended load to drop. If the operator leaves the cab he must:
- Lower the load, bring the hoist up to the jib and in close to the tower.
    - ❖ Raise the hoist on a luffing jib and position the jib at 15º
    - ❖ Allow the crane to weathervane. Shut off the main power and lock the switch box, the control
    - ❖ Console and the cab door.
    - ❖ Clamp the wheels to the rail (if applicable).
    - ❖ If in service height is higher than that allowed for out of service, the crane will to be anchored.

5.20. Lifting Gears

Sustainability of Equipment

- When selecting lifting equipment and accessories, it must be suitable for the work to be undertaken (taking into consideration the integrity of the equipment)
- The location in which it will be used (taking into consideration environmental factors such as weather, temperature extremes, ground surface and hazardous atmospheres)
- The people who will use it (taking into consideration access/egress and ergonomic factors such as design and location of controls, ventilation, protection from falling objects, exposure to high noise, etc.)
- Prevention of overturning or collapse of the equipment.
- Required documentation for Rigging and Lifting activities Documentation shall include but may not be limited to the following;
- Monthly & annual inspection reports for the equipment and wire ropes

- Manufacturer approved modifications that may affect the equipment
- Operator and signal person qualifications
- Tower crane foundation/support design
- When major repairs or adjustments of the equipment have been undertaken
- Employer-developed procedures (i.e. Assembly/disassembly, operational, and other procedures related to the safe operation of the equipment)
- Power line encroachment procedures/plan
- Prevention of dropped load through safety features such as anti-two-block systems and safety latches on hooks

Wire Rope Slings (Loop Type & Legged Type)

- Wire rope slings come in a variety of diameters, lengths and SWL;
- They also have 3 main types of termination. (Shown in the pictures below.)

A wire rope shall

- Possess sufficient strength to take the maximum load that may be applied.
- Withstand repeated bending without failure of wires from fatigue.
- Resist abrasion.
- Withstand distortion and crushing.
- Resist rotation.
- Resist corrosion.

- Wire rope sling inspections are usually based on the following rejection criteria:

  Broken wires: Wire breaks are usually caused by mechanical damage or corrosion. They reduce the strength of the rope and can cause hand injury to the user.

- The sling must be rejected and replaced if any strands are totally broken, wire breaks occur very close to each other or the number of wire breaks exceeds 5% of the total number of wires along a length equal to six times the diameter of the rope.

- The sling must be rejected if the nominal diameter of the rope has worn by more than 10% at any point.

  Rusting and corrosion

- Corrosion may occur if the sling is incorrectly stored or used in corrosive conditions.
- Surface rusting may also be a sign of internal corrosion, the extent of which is difficult to estimate. In this case the rope must be opened up to assess its internal condition.
- The sling must be rejected if a significant degree of internal corrosion is found, or corrosion is found in the splice.

  Deformation:

- The sling must be rejected if it contains deformation caused by kinks, bird caging, crushing, core failure or knots.

  Heat damage

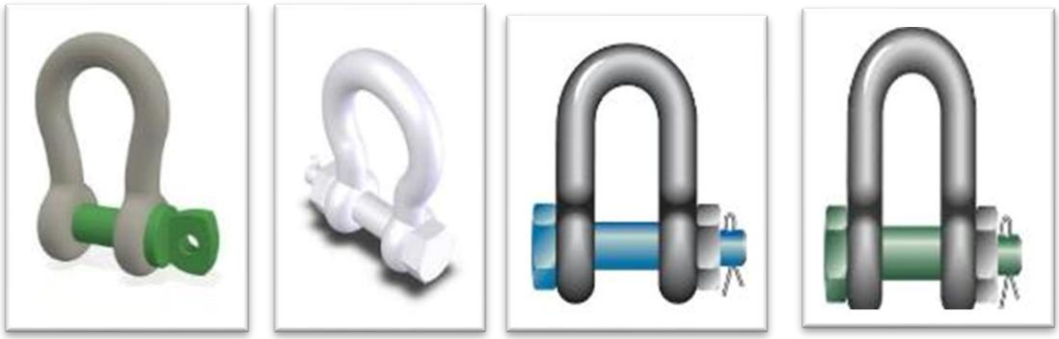
- Color changes of steel ropes can be a sign of overheating. Overheating damages the fiber core and weakens the rope's lubrication. The manufacturer's instructions must be observed regarding the permissible operating temperatures.
- Damage of sling eye fittings and attachments - special attention must be paid to the following points: o opening up and cracking of hooks deformation and wear of links or thimbles ferrule o cracks crushing or wear of ferrule or splice slide-through or looseness of splice or ferrule wire breaks concentrated near the ferrule or splice or in the splice the effect of the sling eye spreading force at the head of the sling eye o if an oversized pin or wrong thimble type is used breaking wires on the outer surface of the sling eye, e.g. if a soft eye and thin pin has been used effect of friction on the load-bearing surface of soft sling eyes

5.18.1 Shackles (Bow Shackles & D Shackles)

- There are two types of shackles available, one is the Bow Shackle and the other is the D Shackle both shackles come with different pins.

  Marking and Information

- The SWL must be clearly indicated on all lifting equipment and accessories. This may be by stenciling, labelling/tagging or other recognized means such as color code. Where a color code is used to indicate SWL, it must not clash with color codes indicating the most recent thorough inspection. Clear information must be published as to the accepted color code for SWL. Operating cabs of cranes, forklifts, etc. must have a load limit chart which indicates the SWL and de-rating in the various configurations and operating conditions. This chart must be easy to read and understood by the operator (taking into consideration literacy and language requirements).



Bow Shackles **"D" Shackles**

Chain Slings (Loop Type & Legged Type)

- There are 3 main grades of Chain Sling
- Grade M or grade 40 higher tensile steel.
- Medium carbon steel which produces good general-purpose chains hooks and shackles.
- Grade S or grade 60 alloy steel.
- Alloy steel giving lighter slings and fittings, having high shock absorbing properties and resistance to wear.
- Grade T or grade 80 alloy steel.
- High alloy steel, much harder than the lower grades giving greater resistance to wear at the same time retaining ample shock absorbing properties

Requirements for attachments to alloy steel chain slings follow:

a. All welded components in the sling assembly shall be proof-load tested as components or as part of the sling assembly.

b. Makeshift fasteners, hooks, or links formed from bolts or rods shall not be used.

Service level	Sling service	Frequent inspection(a)	Periodic inspection(b)

Normal	Service that involves use of loads within the rated load	Monthly	Yearly
Severe	Service that involves normal service coupled with abnormal operating conditions	Daily to weekly	Monthly to quarterly
Special or infrequent	Service that involves operation, other than normal or severe, which is recommended by a qualified individual	Before and after each occurrence	Before each occurrence or sequence of occurrences within a 30-day period

Visual examinations by the user with records not required. (b) Visual inspection by a qualified inspector making a record of the inspection or of apparent conditions to provide the basis for a continuing evaluation.

Nominal chain or coupling size (in)	Maximum allowable wear of cross-sectional diameter (in)
9/32	3/64
3/8	5/64
1/2	7/64
5/8	9/64
3/4	10/64
7/8	11/64
1	12/64
1-1/4	16/64
i.e. For other sizes, consult chain or sling manufacturer.	

- A chain sling must be taken out of use if:
- The sling's working load limit for different load situations is not clearly marked on the sling.
- The sling's master link, hooks or other components contain bends, fractures, warping, other deformation or the hook mouth has opened more than 10%.
- Any chain link has worn more than 10%. The chain links are measured in two planes. Their average dimensions must be at least 90% of their original dimensions. In this way, the level of wear until the next inspection can be predicted.
- Slashing, notching, pitting or corrosion caused by external factors is more than 10% of the material thickness, or the degree of deformation is visually perceptible.
- Color change caused by heat damage is perceived.
- Damage caused by weld splash is perceived.
- The mechanical connector is worn, bent, warped or cannot turn freely.

Lifting Belts/ Webbing Sling

- Synthetic web slings shall be labelled (a sewn-on leather tag is recommended).
- The label shall state the following:
  - ❖ manufacturer's name or trademark
  - ❖ manufacturer's code or stock number
  - ❖ rated loads for the types of hitches used
  - ❖ type of synthetic web material
  - ❖ an additional tag, sticker, or other identifier shall be added by the user to indicate when the next periodic inspection is required
  - ❖ factor of safety shall comply to 7:1 ratio
- if the **synthetic** web sling is to be used for critical lifts, the tag or other identification means shall be used to indicate that a proof test has been performed.
- **Periodic** Inspection - A periodic inspection shall be performed by a qualified inspector on a regular basis with frequency of inspection based on the following criteria:
  - ❖ frequency of sling use
  - ❖ severity of service conditions
  - ❖ nature of lifts being made
  - ❖ Experience gained on the service life of slings used in similar circumstances.
  - ❖ The periodic inspection shall be made at least annually and shall be documented by any one of the following methods:
  - ❖ Marking a serial number on the sling and maintaining inspection records by serial numbers.
  - ❖ Instituting a comprehensive marking program (such as color coding) to indicate when the next periodic inspection is required.
  - ❖ Marking each sling with a tag that shows when the next periodic inspection is required. This tag becomes the record.
- **A lifting belt must be taken out of use if:**
  - ❖ The working load limit marking is not clearly visible.
  - ❖ The belt has been overloaded.
  - ❖ The belt contains a knot.
  - ❖ The belt has extensive abrasion damage or is generally worn and dirty.
  - ❖ More than 10% of the warp yarns (load-bearing yarns) are severed or yarns are damaged on the belt edge.
  - ❖ The weft yarns are broken along a more than 5 cm length.
  - ❖ Slash damage or abrasion damage of the surface exceeds 10% of the transverse direction.
  - ❖ Damage has been caused by chemicals, heat or moisture.
  - ❖ Yarn breaks exist at the belt terminations or the terminations are considerably worn.
  - ❖ The joint stitching has come unstitched.

Round Slings

A round sling must be taken out of use if:

- ✓ The working load limit marking is not clearly visible.
- ✓ The sling has been overloaded.
- ✓ The inside of the sling is damaged.
- ✓ The sling contains a knot.
- ✓ The outer coating is broken to the extent that the inside is visible.
- ✓ The outer coating shows signs that a welding spark, lathe chip or equivalent has damaged the load-bearing yarns.
- ✓ The sling cover has extensive abrasion damage or is generally worn and dirty.
- ✓ Damage to the load-bearing yarn has been caused by chemicals, heat or moisture any lifting accessory which has been rejected must be segregated and destroyed. The Lifting Register must be updated to show the accessory is no longer in use

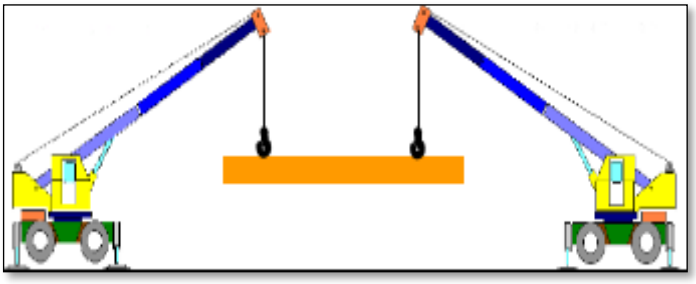
Pulleys

- Size of the wire rope and groove of the sheave should match otherwise, bigger rope will crush & smaller rope will be flattened as they pass over the sheave

Handling and Storage of Lifting Devices / Gears

- Proper handling of lifting devices is essential to ensure long-term usability of the equipment
- Proof tested to 125% of rated capacity.
- Marked with the rated capacity.
- Certified by a competent body.
- Inspected every month by P&M Team.
- Wire ropes must never be allowed to lie on the ground for any length of time or on damp or wet surface, rusty steel or near corrosive substances. They must be stored in a clean dry place; wire rope slings must be cleaned after use, inspected and hung on pegs to prevent corrosion and kinking.
- Lifting accessories must be stored in conditions that do not lead to damage or deterioration.
- Slings must be hung up to prevent damage.
- Chain blocks, turn buckles, chains and similar tackle should be hung up and lightly oiled.
- All rope must be kept away from flame cutting and electric welding operations.
- Avoid contact between any sling and solvents and chemicals.
- Suitable precautions should be taken to prevent any sharp edges of loads coming into contact with slings.

5.21. TANDEM LIFTING PROCEDURES



Each multiple crane lift using cranes requires a detailed engineering study, during the planning and the engineering of the lift, particular attention shall be focused on the following points:

Crane models:

Same Crane models, configurations and reeving should be used.

If the lifted loads are intended to be equally distributed between the cranes, the use of same crane models or at least models of the same capacity range will help to ensure comparable operating speeds and similar loading of the cranes. If the lifted loads are intended to differ between the cranes (e.g. one main crane/load and one smaller crane/load), the crane capacities will be selected accordingly. In this case, operating the cranes with similar capacity utilization will provide a consistent lift capacity safety margin.

If the cranes have different characteristics (e.g. operating speeds, system stiffness), the movement of the cranes may not be able to accurately synchronize. An assessment should be made of the effect of variation in plumb of the hoist ropes, which could arise from inequalities of speed, together with a determination of the means for keeping such inequalities to a minimum.

Position of the cranes:

The cranes should be positioned to minimize side loads on their booms.

- Whenever possible the cranes should be arranged to avoid slewing due to the risk of inducing side loads on the booms is very high during slewing operations.
- Check relative positions (cranes, attachment points, boom tips, etc.) at each stageof the lifting operation to ensure that no collisions can occur (between cranes and with external obstacles).

Ground preparation:

- Make sure that the ground resistance is sufficient in all positions and take into account that the ground pressures can add up if the cranes stand close to each other. Additional considerations are required if cranes are supported on barges.

Travel:

- Crane travel is common with multiple crane lifts. Crane travel speeds and additional capacity deration should be considered.

Weather:

- Weather conditions such as thunderstorms, strong winds, heavy rains, or Fog can pose different hazards and adversely affect the safety of crane operations.

- The crane should not be operated in wind speeds that are in excess of those specified in the operating instructions for the crane. Gusting wind conditions can have an additional adverse effect on the safe handling of the load and the safety of a crane.
- Instructions issued by the crane manufacturer regarding the out-of-service conditions shall be strictly followed.
- No Hoisting and Personnel lifting (Man-Basket) in winds above 25 Km/Hr.

Lifted Load:

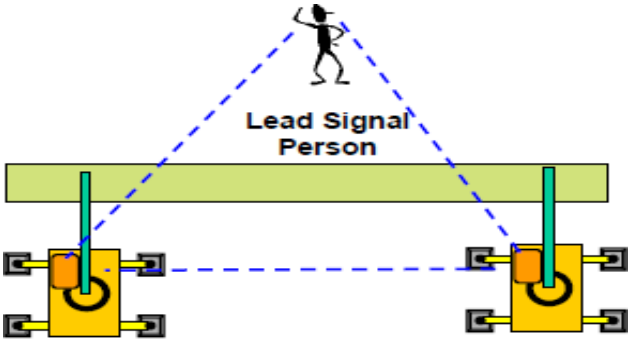
The load to be lifted and its center of gravity shall be precisely known:

- Weight of the lifted load, including the weight of the lifting gear. The lifted load maybe increased by e.g. casting and rolling margins, manufacturing tolerances, paint, corrosion, dust, ice and snow.

- The lifted load shall include the weight of the lifting accessories/attachments. When handling heavy or awkwardly shaped loads, the deduction from the rated capacity of the crane to allow the additional weight of the lifting accessories/attachments might be significant. The weight of the lifting accessories/attachments, and hook blocks, where appropriate, and its distribution should therefore be accurately known.
- Position of the center of gravity of the entire lifted load. Due to the rolling margins, manufacturing tolerances, paint, corrosion, dust, ice, snow, fluid, and rain water etc., the center of gravity of the load might not be known accurately and the load distribution between the cranes could therefore be uncertain, fluids may move the center of gravity during the lift.
- Wind sail area and projected surfaces. Wind sail area/surface is particularly crucial on job sites exposed to wind. Even in relatively light wind conditions, extra care should be taken when handling loads presenting large sail areas and/or big drag factors. (FEM has a guideline
- When lifting a load with 2 or more cranes, the slewing gear brakes should be released in order to avoid side loadings due to uncoordinated slewing movements. Only one crane should use the slewing gear brake to control this movement, be aware that in this case the slewing gear of only one crane might take the wind loads. Therefore the allowable wind speed shall be calculated accordingly. When the slewing movement is finished, all slewing gear brakes shall be reapplied.

  NOTE: the above guidance applies only to certain lifts with “parallel” crane movements but not to tandem lifts where the load is picked in front of the crane and set down between the cranes.)

Coordinating A Tandem Lifting



- Competent person needs to be designated as lift coordinator, He is responsible for conducting a pre-lift meeting with all operators, signalers and everyone involved with the critical lift.
- The coordinator may function as the lead signaler, He needs to stay where he can observe the entire lift as well as be in direct contact with each crane operator.
- Any additional load or obstructs needs to be monitor by signal person & lifting coordinator.
- When radios are used for communicating with all participants a channel needs to be reserved to prevent outside interference and possible confusion.

Rated capacity

- An extra safety margin should be incorporated into the lift plan to cover the aspects that lead to an increase of the loading of the individual crane(s). The evaluation of these factors (described in this document) can lead to a reduction of the permissible lift capacity for each crane.
- When lifting a load with more than one crane without the use of lifting beams, one or more cranes may be quickly overloaded if one or more cranes lift or lower the load depending on the position of the center of gravity of the load. In this case, neither of the rated capacity limiters will stop the load increasing movement. Therefore the utilization of the cranes' rated capacity should be reduced depending on the position of the center of gravity of the load and the position of the lifting point of each crane.

Lift Rigging / Equalizer beams

- Devices equalizer beams shall be used to reduce the risk of unintended load distribution of the cranes due to uncoordinated vertical movements.
- Such devices should be included in the engineering/planning of the lift and must be appropriately selected and dimensioned.
- The distribution of forces within the lifting accessories/attachments that arise during the lifting operation should be calculated. The lifting accessories/attachments used should, unless specially designed for the particular lifting operation, have a capacity margin well in excess of that needed for its proportioned load.

Risk assessment

- Before starting a Tandem lift with crane a detailed risk assessment of the planned lift shall be done for each phase of the lift and shall include as a minimum thefollowing:

Evaluation of load distribution between the cranes

This analysis should include possible shifting of the center of gravity during the lift.Such shift may occur due to movements of the load, change of the mass distributionof the load (e.g. fluids moving in containment), wind or other influences.

Rigging attachment above the center of gravity is a preferred method of attachmentfor load stability.

NOTE: If the lifting points are below the center of gravity of the load, anadditional risk of tilting (e.g. due to non-synchronous movements) exists. (Unstable equilibrium) see illustration below

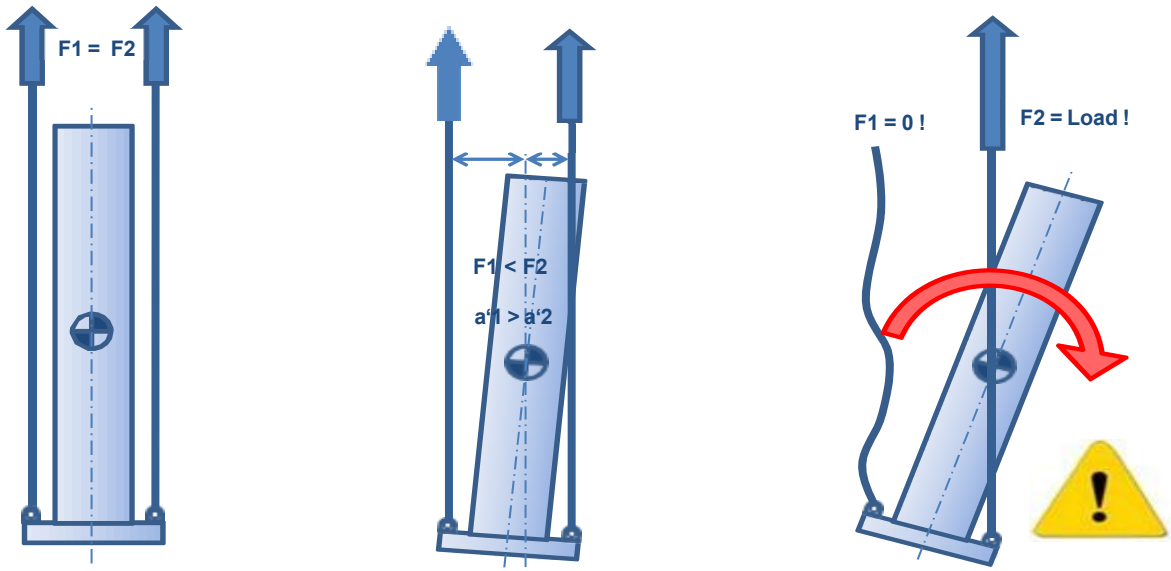


Illustration of the risk of toppling if the rigging attachment is below the center of gravity of the load.

Analysis of possible side loading

- Cranes are designed to withstand limited side forces on the crane booms. Although these forces are part of the load assumptions taking into account accelerations/ decelerations of load as well as wind forces on crane boom and load, it is unsafe to rely on this lateral strength to withstand horizontal loads of out-of-plumb lifts.
- The rated capacity limiter of the crane does not measure secondary load effects such as side loads.

Side loads can occur due to:

- Uncoordinated crane motions (one crane faster/slower than the other(s)), e.g.: uncoordinated luffing/ hoisting/ slewing with 2 cranes attached to one load will automatically lead to side loadings on the booms. In certain cases (following a thorough analysis), this effect might be reduced if only one crane uses the slewing gear brake.
- Ground-imperfection, e.g. local settling during travelling crane not level.
- Slewing a load with 2 or more cranes; special caution is required when one crane is actively slewing, it will rotate the second crane by “pushing” or “pulling” it! This will induce a side load on both cranes. If the load radius is small, the created side loads may become critical, especially if the cranes are configured with long boom combinations.

Swinging of a load

- Wind influence, especially when lifting loads with large wind sail areas. Special care should be given on this aspect in the case where the slewing brakes of one or more cranes are released, providing less resistance to wind load.
- Listing of cranes on barges
- Human error during operations
- Excessive side loads may also affect the structural integrity of the load itself and its attachment points.

Organization and Supervision

- A qualified person should be in attendance and in overall control of a multiple crane operation and shall be appointed as supervisor. Only this person shall give instructions to personnel operating machines except in an emergency, when a commonly recognized stop signal may be given by any person observing a situation leading to danger.
- If all the necessary points cannot be observed from one position, other personnel are required at various positions to observe and report to the supervisor in charge of the operation. The supervisor shall review the lift operation with the crane operators and other persons involved prior to the lift and define the rules and procedures (communication, emergencies, etc.)
- It may be advisable to perform a test lift without load and to execute all movements to confirm the correct configuration and sequences.

Communication

- The engineered lift should have a lift plan with a stepwise approach documented with intermediate checkpoints to allow step by step checking to determine the planned results are achieved. This lift plan needs to be communicated to all people involved.
- Any change in lifting plan must be documented and again communicated.
- Ensure efficient communication: crane operators must be able to report their actual status to the supervisor to allow him to get the full picture at any time of the lift. The communication signals/commands should be such to avoid misunderstandings, unintended movements in case of communication breakdown.

Crane operations and motions

- Crane motions must be coordinated very precisely by the supervisor. He must have continuous contact to all crane operators (e.g. via radio).
- Crane motions shall be performed at reduced speed.
- Crane motions shall be properly coordinated; any deviation shall lead to a stoppage and re-adjustment/re-alignment of the cranes.
- The slewing lock of each crane should always be disengaged during the lifting operation: slewing locks are designed to maintain and secure the crane superstructure in certain positions and to protect the slewing gear.
- During the whole lifting operation, the hoist ropes and their verticality shall be continuously monitored (visually or with instruments); any observation of an out-of-plumb situation shall lead to a stopping of the operation and an evaluation of the cause(s). Re- adjustment may be necessary.

5.22. Lifting Equipment Ageing Norms

Equipment aging norms are defined by Central HSE Department of AMNS and the same shall be followed.

Refer document AMNS/SAFE/71/SOP for details on “Equipment Aging Norms”.

6. CHECKING, CORRECTIVE AND PREVENTIVE ACTION

Periodic audits shall be carried out to assess the compliance to the procedure and effectiveness of the controls. Any deviations shall be reported to Project Manager/ Head of Department for corrective/preventive actions if needed.

7. TRAINING

Relevant employees are trained on this procedure and made aware of their role in Lifting Operation.
Training activities shall be documented and individual records shall be maintained.

8. RECORDS

S. N.	Title	Maintained by	Retention period
01	3rd Party Inspection & Testing Report / Certificates	HSE Department at Project site	Six months unless specified by the client
02	List of Lifting Machinery / Tools & Tackles	All Department at Project site	Six months unless specified by the client

9. REFERENCE DOCUMENTS

Document No.	Document Name
AMNS/Project/TS/HSEM/09	Plant and Machinery Operations
AMNS/Project/TS/HSEM/10	In-plant Traffic Management
AMNS/Project/TS/HSEM/12	Structural Steel erection
AMNS/Project/TS/HSEM/18	(SIMOP) Simultaneous Operations
AMNS/Project/TS/HSEM/23	Night Work
AMNS-Project-SOP-HSEM-02	- Safe Operations of Pick & carry crane

Standards

The following codes & standards apply to Lifting Equipment covered in this specification. Any deviation to these standards shall be approved by the Company variance control procedure.

S. No.	Standard	Title
ASME / ANSI Standards		
1.	ASME B30.3 and B30.4, BS2799	Tower Cranes
2.	ASME B30. 2, B30. 17 & B30. 18	Overhead, Gantry and Stacker Cranes

3.	ASME B30. 16	Overhead Hoists Underhung (Chain Blocks, Air Hoists)
4.	ASME B30, 23, ANSI A92.2/3/4/5/6	Mobile Work Platforms personnel Lifting Systems
British Standards		
5.	BS EN 13001-1:2004	Crane Safety, General Design, General Principles and requirements – Replaces BS 2573
6.	BS EN 13001-2:2004	Crane Safety, General Design, Load Actions – Replace BS 2573
7.	BS 5237:1985	Specification for Lifting Twist Locks
8.	BS EN 1677-1:2000	Components for slings, Safety Forged Steel Components. Grade - 8
9.	BS EN 1677-2:2000	Components for slings, Safety Forged Steel Lifting Hook with Latch, Grade - 8
10.	BS EN 1677-5:2001	Components for slings, Safety Forged Steel Lifting Hook with Latch, Grade - 4
11.	BS EN 12385-1:2002	Steel Wire ropes, Safety General requirements
12.	BS EN 12385-2:2002	Steel Wire ropes, Safety Definitions, Designation and Classification
13.	BS EN 12385-3:2002	Steel Wire ropes, Safety Information for use and maintenance
14.	BS EN 12385-4:2002	Steel Wire ropes, Safety Standard Ropes for General Lifting Applications.
15.	BS EN 12385-5:2002	Steel Wire ropes, Safety Standard Ropes Lifts
16.	BS ISO 1837:2003	Lifting Hooks, Nomenclature
17.	BS ISO 4308-1:2003	Cranes and Lifting Appliances, Selection of Wire Ropes, General
18.	BS EN 12644-1:2001	Cranes, Information for use and Testing, Instructions
19	BS EN 13157:2004	Cranes Safety, Hand Powered Lifting Equipment
20.	BS EN 1494:2001	Mobile or Movable Jacks and Associated Lifting Equipment
21.	BS EN 15056:2006	Cranes Requirements for Container Handling Spreaders
22.	BS 6037-22004	Code of practice for the planning, Design Installation and use of permanent installed access equipment, Travelling ladders and Gantries
23.	BS ISO 16881-1:2005	Cranes Design calculation for rail wheel and associated trolley track supporting structure general
24.	BS ISO 4306-5:2005	Cranes Vocabulary, Bridge and Gantry Cranes
25.	BS ISO 1756-1:2001	Tall Lifts, Platform lifts for mounting on wheeled vehicles, Safety requirements, Tail lefts for goods Coarse Thread
26.	BS ISO 8566-4:1998	Cranes, Cabins, Jib Cranes
27.	BS EN 13155:2003	Cranes Safety, Non-fixed load lifting attachments
28.	BS EN 13157:2003	Cranes Control and Control Stations
29.	BS EN 14439:2006	Cranes Safety, Tower Cranes
30.	BS EN 3810-4:1968	Glossary of terms used in materials handling; Terms used in connection with cranes
31.	BS EN 1492-1:2000	Textile slings, Safety Flat woven webbing slings, made of man-made fibres for general purpose use
32.	BS EN 1492-2:2000	Textile slings, Safety Round slings made of man-made fibres, for General purpose use
33.	BS EN 1492-4:2004	Textile slings, Safe Lifting slings for general service made for natural and manmade fibre rope

34.	BS ISO 10972-1:1998	Cranes Requirements for mechanisms, General
35.	BS 7121-1:2006	Code of practice for safe use of cranes, General
36.	BS 7121-3:2000	Code of practice for safe use of cranes, Mobile cranes
37.	BS 7333:1990	Specification for slewing jib cranes.
38.	BS ISO 1834:1999	Short link chain for lifting purposes, General conditions of acceptances
39.	BS EN 818-3:1999	Short link chain for lifting purposes, safety Medium tolerance chain for chain slings Grade 4
40.	BS EN 818-5:1999	Short link chain for lifting purposes, safety chain slings Grade 4
41.	BS 2575-1:1983	Rules for design of cranes. Specification for classification stress, calculations and design criteria for structure suspended but useful.
42.	BS 2573-2:1980	Rules for design of cranes. Specification for classification stress, calculations and design for mechanisms structure
43.	BS EN 1570:1999	Safety Requirements for lifting tables
Indian Standards		
44.	IS 13367 (Part-1):1992	Safe use of cranes – Code of Practice
45.	IS 3177: 1999	Code of practice for electric overhead travelling crane and gantry cranes
46.	IS 3443: 1980	Specification for cranes rail sections
47.	Doc No. CMD-III/1855/1/ Manual / 17 March 2008	Manual for wire rope
48.	IS 14469: 1997	Determining the stability of mobile crane
49.	IS 6521-1: 1972	Code practice for design of tower cranes
50.	IS 1367: 1994 (Part-6): 1994	Mechanical properties and test methods for nuts with specified proo loads
51.	IS 1856:1977	Specification for steel wire ropes for haulage purpose.
52.	IS 2266: 1989	Specification for steel wire ropes for general engineering purpose.
53.	IS 13870: 1993	Cranes and lifting appliances – selection of wire rope part -1 genera
54.	IS 807:2006	Design erection and testing (Structural Portion) of cranes and hoists –code of practice
55.	IS: 325: 1998	Three Phase Induction motors - Specification

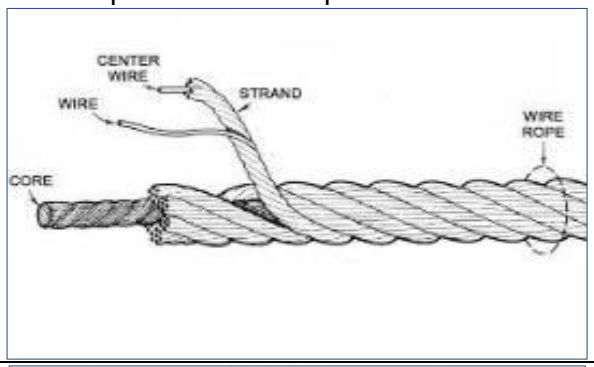
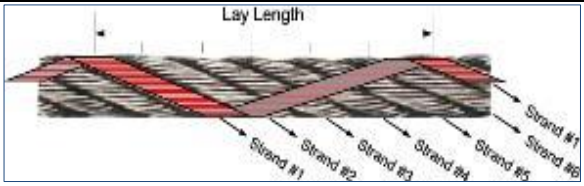
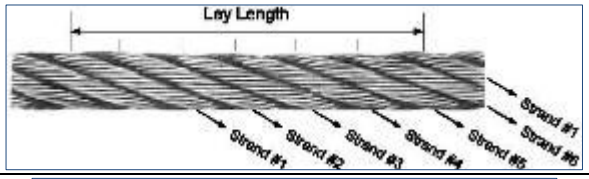
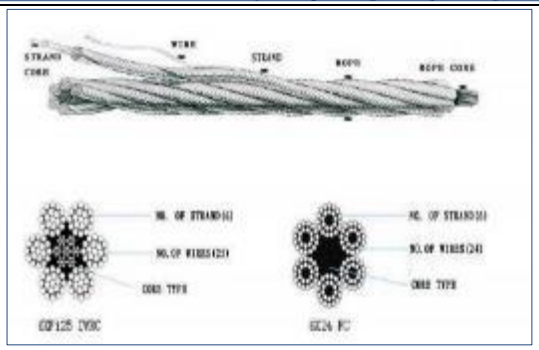
10. ANNEXURES

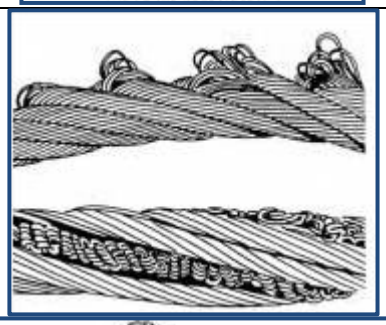
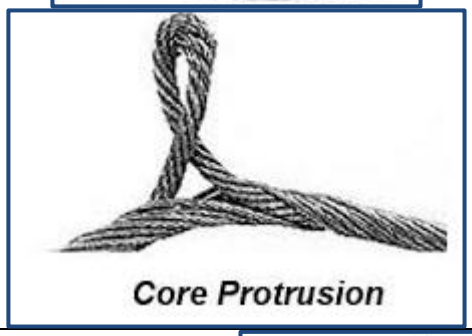
Annexure-1 - Wire rope and Web Slings inspection criteria
Annexure-2 - Color Coding for Lifting Tools and Tackle
AMNS/Project/TS/HSEM/10/F01 - Web Sling Inspection Checklist
AMNS/Project/TS/HSEM/10/F02 - Wire Rope Sling Inspection Checklist
AMNS/Project/TS/HSEM/10/F03 - Chain Slings Inspection
AMNS/Project/TS/HSEM/10/F04 - Shackles Inspection
AMNS/Project/TS/HSEM/10/F05 - Chain Pulley Block Inspection
AMNS/Project/TS/HSEM/10/F06 - Lever Hoist inspection checklist
AMNS/Project/TS/HSEM/10/F07 - Tirfors inspection checklist
AMNS/Project/TS/HSEM/10/F08 - Spreader beam inspection checklist

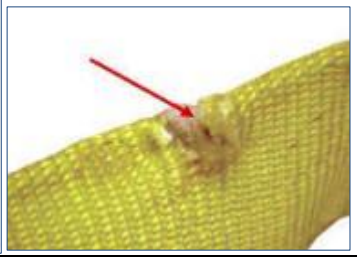
AMNS/Project/TS/HSEM/10/F09 - Pulley Block inspection checklist
AMNS/Project/TS/HSEM/10/F10 - Fork Lift inspection checklist
AMNS/Project/TS/HSEM/10/F11 - Winch Machine inspection checklist
AMNS/Project/TS/HSEM/10/F12 - Snatch Block inspection checklist
AMNS/Project/TS/HSEM/10/F13 - EOT Crane inspection checklist
AMNS/Project/TS/HSEM/10/F14 - Gantry Crane inspection checklist
AMNS/Project/TS/HSEM/10/F15 - Crawler Crane inspection checklist
AMNS/Project/TS/HSEM/10/F16 - Tyre Mounted Mobile Crane inspection checklist
AMNS/Project/TS/HSEM/10/F17 - Tower Crane inspection checklist
AMNS/Project/TS/HSEM/10/F18 - Man Basket inspection checklist
AMNS/Project/TS/HSEM/10/F19 - Material Hoist inspection checklist
AMNS/Project/TS/HSEM/10/F20 - Critical Lifting Assessment Plan
AMNS/Project/SOP/HSEM/02/F01 - Pick & Carry Inspection checklist
AMNS-Project-SOP-HSEM-01-F01-Man Lift inspection checklist

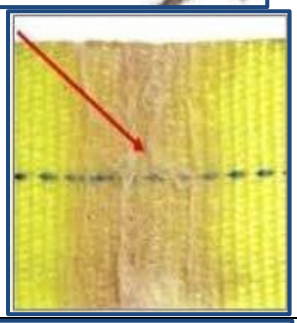
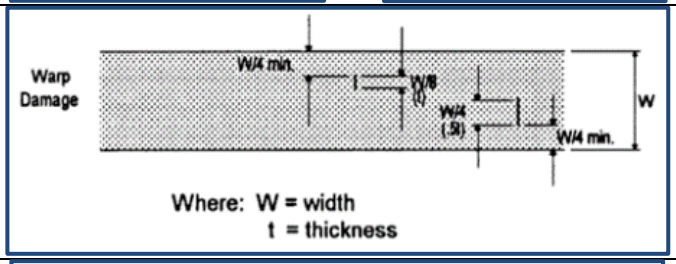
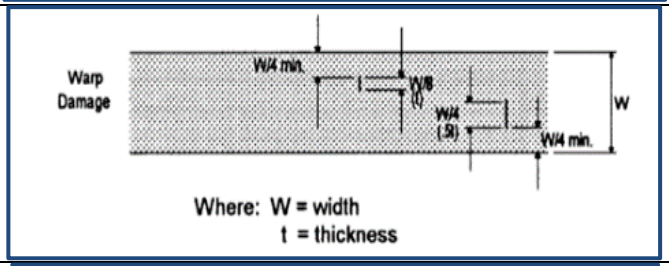
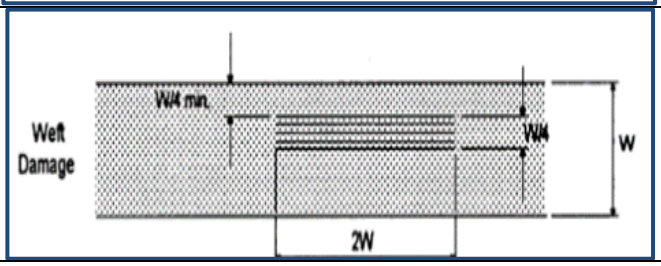
ANNEXURE-1

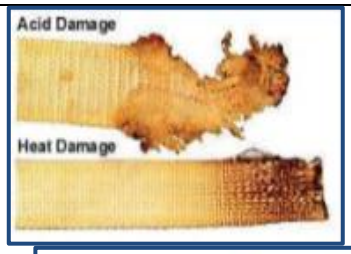
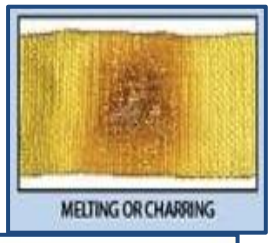
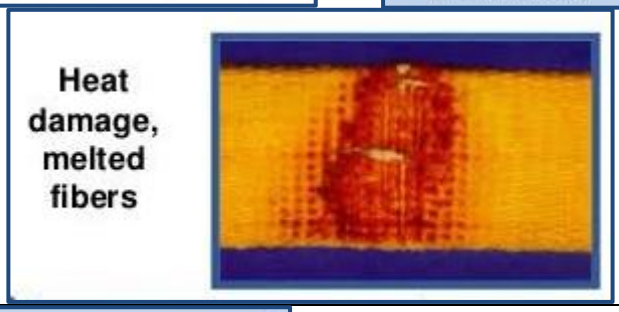
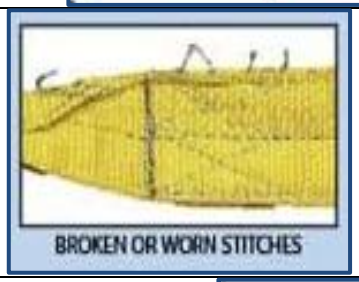
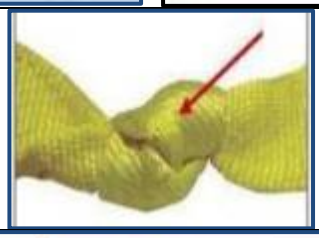
WIRE ROPE SLINGS AND WEB SLING INSPECTION CRITERIA

Sr. No	Description of Scenario	Reference Image
01	Three wires broken in one strand in one lay length of rope	Depiction of wire rope construction 
02	6 wires broken in one lay length of rope	 
03	More than 10% wires in any length of any diameters of the wire rope	 
04	Reduction of 1/3 dia of surface wires	
05	Reduction of 10% dia of total rope size at any point	

06	Bird cage of noticeable size	
07	Core protrusion in observable quantities	 
08	kink, which can't be reversible	 

09	Corrosion noticed	 
10	Damaged and improper crimping	 
11	Identification number mentioned on the TPI shall be matched with number on sling and ID Tag should be present	  
12	Length of an edge cut exceeds the web thickness	 

13	Penetration of abrasion exceeds 15% of the webbing thickness taken as a proportion of all plies;	
14	Abrasion occurs on both sides of the webbing and the sum of the abrasion on both sides exceeds 15% of the webbing thickness taken as a proportion of all plies	  
15	Warp thread damage up to 50% of the sling thickness extends to within 1/4 of the sling width of the edge or exceeds 1/4 the width of the sling;	
16	Warp thread damage to the full depth of the sling thickness extends to within 1/4 of the sling width of the edge or the width of damage exceeds 1/8 the width of the sling	
17	Weft thread damage allows warp thread separation exceeding 1/4 the width of the sling and extends in length more than twice the sling width	

18	Any part of the sling is melted or charred, or is damaged by acid or caustic	  
19	Stitches in load bearing splices are broken or worn	 
20	Knots in any part of slings	
21	Damaged eye	
22	Frayed sling edge	

ANNEXURE-2

COLOR CODING FOR LIFTING TOOLS AND TACKLES

Period of year	Specification	Color
1st Quarter (Jan – Mar)	WHITE color coding to be used after visual inspection as per checklist and found in good condition to use at site.	
2nd Quarter (Apr - Jun)	Green color coding to be used after visual inspection as per checklist and found in good condition to use at site.	
3rd Quarter (Jul – Sep)	Yellow color coding to be used after visual inspection as per checklist and found in good condition to use at site.	
4th Quarter (Oct – Dec)	Blue color coding to be used after visual inspection as per checklist and found in good condition to use at site.	
REJECTED	RED	