TATA

TATA POWER

PROCEDURE FOR MATERIAL HANDLING AND STORAGE

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C O N T E N T S

1 INTRODUCTION
- 1.1 Purpose
- 1.2 Scope
- 1.3 Terminology

2 RESPONSIBILITIES
- 2.1 Station head
- 2.2 Competent Authorised Person
- 2.3 Supervisors

3 PERSONNEL
- 3.1 Specialists (personnel certified to carry out the work)

4 INSPECTION AND CERTIFICATION

5 HAND TRUCKS

6 FORK LIFT TRUCKS
- 6.1 Operations
- 6.2 Parking
- 6.3 Operating Areas
- 6.4 Attachments
- 6.5 General Operations
- 6.6 Rough Terrain

7 CRANES

8 SIGNALS

9 GENERAL PRECAUTIONS

10 LIFTING ACCESSORIES

11 LOAD SECURITY

12 MATERIAL STACKING AND UN-STACKING
- 12.1 Stacking
- 12.2 Un-stacking

13 PALLETS

14 TENSION STRAPPING

15 CONTAINERS

16 MANUAL LIFTING TECHNIQUES

17 CRANE SAFETY CHECKLISTS

18 INSTALLATION OF WIRE ROPE CLIPS OR DOUBLE SADDLE CLIPS

19 RISK CONTROLS

20 REFERENCES

21 RECORDS

22 TRAINING & COMMUNICATION

23 VERIFICATION

24 EXCEPTION

25 REVIEW

1 INTRODUCTION

1.1 Purpose

The purpose of this document is to provide procedures to assist the safe handling of materials (manual handling and mechanical handling).

1.2 **Scope:** This procedure applies to all operating and project sites of Tata Power Group companies including JVs/ Subsidiaries.

This document describes the requirements for the following –

- Responsibilities in materials handling.
- The requirements for specialist personnel.
- Lifting equipment requirements, ranging from a fork lift truck to a heavy lift mobile crane to a simple eyebolt.
- The requirements for the safety of materials in transit and in store.
- This document does not override any other company regulations, international or local regulations.
- Regulations relating to lifting equipment.

1.3 Terminology

Abbreviations terms and references used frequently in this document are defined in the Tata Power Cos Procedure for material Handling

Definition

Banks man: The person who is responsible for giving directions to a crane operator

Anti-two-blocking device - a device that, when activated, disengages all crane functions whose movement can cause two-blocking.

Competent person - one who is capable of identifying existing and predictable deficiencies in mobile cranes and boom trucks.

Emergency operations - operations that include fire, power line contact, loss of stability, or control malfunction.

Health-care professional - any licensed/registered/certified health-care provider working within his or her license/registration/certification and providing medical services to employees. This includes physicians, physician assistants, nurse practitioners, and registered nurses.

Mobile crane - a crane that is self-propelled. This includes crawler cranes, wheel-mounted cranes, and any variations thereof. Overhead cranes, gantry cranes, side boom tractors, trolley boom cranes, and cranes with a rated capacity of one ton or less are specifically excluded.

Periodic inspection - detailed safety and maintenance inspection performed by a qualified person to verify compliance with the provisions of local/country standards

Qualified person - one who, by possession of a recognized degree, certificate, or professional standing, or certified government body or who by extensive knowledge, training, and experience, has successfully demonstrated the ability to solve or resolve problems relating to mobile cranes and boom trucks.

Two-blocking - the condition in which the lower load block or hook assembly comes in contact with the upper load block or boom point sheave assembly. (Condition under which the load block or load suspended from the hook becomes jammed against the crane structure preventing further winding up of the hoist drum)

SWL - Safe working load

SLI – Safe load indicator, it is a system which cut-off all the unsafe crane operations if overloaded and anti two blocking comply.

Safe access route to the place for the crane set up shall be checked with SS or SFE. Ensure that ground can carry the load of the crane. If soil is soaked with water the loading capability is significantly reduced. Check for underground cables and pipes as well as vicinity to any above ground obstructions like fire hydrants, firewater valves and pits. Ensure that trailer bringing the load also has a safe access, not blocked by the intended set up of the crane.

Load: Weight of load can be from equipment data sheet, marking on packing, marking on pipe spool, calculation (add 15% allowance for inaccuracies) or weighing. Guessing the weight of the load is not allowed. Crane user shall maintain record of how the weight was derived until the lift is successfully completed.

Length x Width x Height (LxWxH): Is required for bigger equipment for deciding lifting radius and lifting height. For bigger surface, say above 25 m2, also wind loads need to be considered. For small pipe spools, valves etc. this data is not required.

Lift Radius: Maximum horizontal distance between the point at which the centre of crane rotation meets the ground and the vertical centreline passing through the load lifting attachment.

Lift Height: The height above the setting of the crane that the load must be lifted to. To derive at the boom height the length of hook, slings and load must be added as well as some free space above any equipment the load will be slew over.

Eccentric Load: Load centre of gravity does not correspond to the geometrical centre, e.g. an unevenly loaded container. In case of eccentric load for heavy loads, say above 2 T, centre of gravity should be calculated and lifting points defined accordingly. For light loads the most practical is to determine the centre of gravity by trial and error without lifting the load completely off the ground.

Ground for crane set up safe: Can the ground support the point load from outriggers or crawlers? Ground loading capability must be established. Underground cables and pipes exposed to the load of the crane shall be identified and if required protected by spreading the load by e.g. applying spreaders under the outriggers. Experiences at site and elsewhere have shown that paved areas are not necessarily having the loading capability as per design.

Safe workload at lift radius will be derived from the selected Crane Load Chart for the calculated lift radius and boom length. Adjustment shall be done in relation to valid load test and only **90%** of the load test value shall be considered as safe workload.

Weight of hook block, slings and attachments shall be derived from crane load chart and tables for slings.

Total weight is the sum of the weight of the load and weight of hook block, slings and attachment.

Capacity loading will be calculated by dividing the total weight with the safe workload at lift radius. It shall not exceed 85%. For capacity loading above 85% a lifting plan is required. No capacity loading above 100% shall be allowed, equal to 90% of load test. If Safe Load Indicator is not installed the capacity loading shall not exceed **60%;** if above a lifting plan is required. For lifting personnel the capacity loading must be below 50%.

Attachment description: List type of slings; belts, wire ropes, chains, shackles etc. to be used to attach the load, if required make a simple sketch under lift description.

Standard lift: If load to be lifted weighs less than **15** ton, it is a standard lift. The crane user is required to complete "Mobile Crane Planning & Risk Assessment Checklist".

Standard lift in non-hazardous area: If the lift is carried out without any risk to damage lines or equipment containing hydrogen, hydrocarbon, H2S, corrosive or toxic chemicals, steam, instrument air and nitrogen it is in a non-hazardous area. If it is carried out in a hazardous area a risk assessment for the risks related to possible damage of these system must be done together with SS or SFE before the lift will be permitted. The lower section of the "Mobile Crane Planning & Risk Assessment Checklist" shall be used; "Risk Assessment for Crane Operation in Running Plants"

Dunnage: Packing material usually made of wood.

2 RESPONSIBILITIES

2.1 Station Head

The station head is responsible for ensuring that:

- A competent authorised person is appointed to control the inventory of lifting equipment and arrangements
- Its periodic examination in accordance with relevant standards and procedures.
- All supervisors involved in materials handling understand the requirements of this standard.
- A system of review and control is established to ensure that the implementation of this standard is assessed on a regular basis as appropriate to the requirements of the operation.

2.2 Competent Authorised Person (CAP)

The Competent Authorised Person (CAP) is competent by virtue of training, experience and qualification and is appointed to examine lifting equipment on behalf of the Station Head. He is not only competent to inspect for damage, deterioration or other defects, but is also capable of assessing and advising what effect such defects will have on the strength and function of the lifting equipment. CAP qualifications must be assessed and verified.

The CAP must supervise the examination and maintenance of all loose lifting equipment within his area of responsibility every six months and must ensure timely inspection and test of other items of lifting equipment requiring inspection and testing by third party.

The CAP must maintain a register and keep a copy of certificates for each piece of lifting equipment under his control.

This information must include:

- Date received
- Serial number
- Description
- Safe working load
- Date last inspected / certified
- Colour code
- Date destroyed

This record is to include permanently attached slings on equipment under his responsibility, and will be available for inspection by Safety Advisors.

2.3 Supervisors

Supervisors are responsible for ensuring that persons under their supervision who are involved in, or are within the area, where materials handling operations are being conducted:

- Are trained in the techniques required for the safe execution of their work.
- Only use equipment which has been inspected and certified in accordance with requirements.
- Do not try to manually handle an article which is beyond their physical capability to manage.
- Are aware of the hazards associated with, and on the perimeter of, their work area.
- Understand and comply with the requirements of this standard.

3 PERSONNEL

All company staff and contractors receive basic instruction in manual lifting and handling techniques during their induction. This basic instruction must be emphasised at safety meetings with supplementary material such as training packs, posters and booklets. The correct technique for manual lifting is shown in section 16.

3.1 Specialists

Materials handling involves a number of specialist activities which are carried out by people either as their full-time occupation or as an additional part of their job.
These activity related tasks include:

- Riggers and Slingers
- Banks men
- Pedestal crane operators
- Mobile and Crawler crane operators
- Fork lift truck operators
- Self-load (truck mounted loading arm) truck drivers

All personnel shall be selected, trained, appointed and managed in compliance with local legislation.

4 INSPECTION AND CERTIFICATION

All materials handling equipment (e.g. fork lift trucks, cranes and lifting accessories) used must be inspected, tested and certified in accordance with the Tata Power Cos checklist for the above Equipments.

5 HAND TRUCKS

Hand trucks are for moving loads over short distances (typically less than 100m), and shall be specially designed for lifting and moving packages or pallets e.g. hand pallet trucks. In the latter case, the facility to jack up the truck shall be incorporated. Hand pallet trucks are suitable for loads up to 1500kg.

General Requirements

- Hand pallet trucks must be clearly marked with their SWL and have an in-date certificate of inspection / test from a third party competent person as per Factories Act & Rules.
- Hand trucks must not be used on sloping steel surfaces such as ramps and particularly not on long inclines (maximum recommended gradient 1:15). If there is no alternative, consideration should be given to using trucks fitted with brakes.
- Hand trucks must not be used on uneven or soft surfaces. Such surfaces, e.g. cracked concrete, distorted tarmac, sand and grassy areas, increase both the physical effort required and the risk of toppling.
- Special care must be taken when using hand trucks in split level areas, e.g. loading bays, especially where no guard rails are fitted.
- Hand trucks must have all their wheels in contact with the working surface at all times during their use.
- Users of hand trucks must report any mechanical defects to the appropriate supervisor.

6 FORTLIFT TRUCKS

Fork lift trucks used in plant premise shall include industrial and rough terrain types.

6.1 Operations

Only fork lift truck operators who have been properly trained and certified (valid license from RTO) shall operate a fork lift truck.

Before using a fork lift truck, operators must check the truck and associated equipment to ensure they are in safe and proper condition. Operators must ensure audible and visual warning equipment is working correctly by carrying before using the fork lift.

6.2 Parking

When unattended, fork lift trucks must be left with the fork arms tilted forward and lowered to rest on the ground. The engine must be switched off, the key removed and the handbrake applied.

Ignition keys must be kept in a safe place and only issued to authorised operators for the duration of the duty period or task. When not in use, fork lift trucks must be parked in secure areas.

6.3 Operating Areas

- Care must be taken at all times during fork lift truck operations to avoid pedestrians, other vehicles and hazards within their area of operations. Fork lift truck operators must only drive in areas where they are authorised to do so.
- Fork lift trucks must only be used in areas where there is enough room for safe operation. Particular care must be taken to ensure that fork lift trucks used in aisles have enough room to circulate and manoeuvre either loaded or empty.
- Sharp bends and overhead obstructions must be avoided as far as possible. Special care must be taken to avoid hazards such as loading bays, excavations, columns, pipe work, racks and other plant.
- Industrial fork lift trucks must only be driven on suitable surfaces; road humps and rough or soft surfaces are to be avoided.
- Fork lift trucks must not be operated on excessive gradients. (In general, fork lift trucks should be driven forwards up a slope, backwards down a slope and in line with the incline. It shall be necessary to raise the forks slightly at the bottom of a slope to avoid grounding.)
- Fork lift trucks must not be operated across gradients.

Stability of Fork Lift Trucks

Loads and Handling

- Fork lift trucks must only be used to lift loads within their certified capacity.
- Loads must be correctly placed and secured on the forks to avoid tipping forwards or sideways.
- Wherever possible, fork lift trucks must be driven with the forks in the lowered position and with the mast slightly tilted back. The forks should be so adjusted that the fork heels should never touch the ground.
- Movement with loads in excessively raised positions must be avoided to minimise the danger of toppling, especially on uneven surfaces and while cornering.
- Fork lift trucks must only be used for loads which can be carried safely on the forks or attachments fitted. Non-standard, un-packaged and excessively wide loads must be avoided wherever possible. In particular, long tubes must be carried using appropriate attachments.

6.4 Attachments

- Fork lift trucks must only be used with attachments which have been specifically designed, constructed and certified for it and the intended load, and attachments must only be used as prescribed.
- Attachments must be produced by a recognised specialist manufacturer and must be certified in accordance with IS standards.
- Care must be taken to ensure that where attachments are used, any consequential de-rating of lifting capacity is not exceeded.

6.5 General Operations

- Operators must not carry passengers anywhere on the fork lift truck.
- Operators must not allow pedestrians to walk underneath the load.
- A load must not be picked up if someone is standing close to it.

- Fork lift trucks must only be driven in a direction where visibility is not blocked.
- Stacking and un-stacking on inclines must never be attempted.
- Rapid acceleration, hard braking and sharp cornering which increase the risk of load tipping must be avoided.
- Operators must exercise caution and drive slowly on slopes, uneven and damaged surfaces.
- Particular care must be taken when operating in proximity to pedestrians and other vehicles.
- Operators must obey site traffic regulations or, in their absence, must keep to the left.
- Operators must be aware of hazards in and at the perimeter of their areas of operation.

6.6 Rough Terrain

The operation of rough terrain fork lift trucks involves special hazards which require additional care and consideration:

- Care must be taken at all times to ensure that traction is retained. Loss of traction due to the nature of the terrain or weight transfer taking load off the driving wheels is to be avoided.
- Care must be taken and speeds minimised to reduce the risk of load toppling caused by the imbalance induced when operating on rough terrain.
- Operators must ensure that the parking brake is capable of holding the fork lift truck stationary on an incline. (Some rough terrain vehicles are capable of climbing inclines steeper than those on which the parking brake will hold the vehicle.)
- Checks for overhead obstructions must be made before lifting and transporting loads.
- Special care must be taken near power lines and other materials handling vehicles such as mobile cranes.
- Driving rough terrain fork lift trucks on public roads must be kept to a minimum. When public road travel is necessary, fork arms must be removed, folded or protected in some way so that they do not present a hazard to other road users. Where this is not possible, forks must be painted or otherwise made highly visible.
- Rough terrain fork lift truck operators must wear seatbelts while operating their vehicles.

7 CRANES

Cranes used in the plant include wheeled and tracked mobile units with fixed or telescopic booms, self loading truck, loading arm type units fitted to trucks and diesel hydraulic excavators when they are fitted with lifting attachments.

Please refer Mobile Crane Safety Procedure No. P-008 available in Sangam / click attached PDF file.

8 SIGNALS

Prior to any lifting operation being made a banksman is to be appointed and identified to the crane operator. This applies without exception in cases where:

- The load exceeds 50% of the rated capacity of the crane in the configuration used for the lift.
- The lifting is of heavy or large loads.
- Any portion of the load or load lift route is obscured from the crane operator's direct line of sight.
- Lifting operations are to or from a boat or offshore platform.

In cases where the lift is small, routine, less than 50% of the rated capacity of the lifting appliance, within visual contact of the crane operator at all times and has the authority of the work site supervisor, this requirement may be waived.
Banksmen are to wear a luminous orange or green waistcoat, must always be in a position to have a good view of the whole operation, and are to establish clear visual or radio communication with the crane operator prior to the commencement of any lift. If two banks men are required, the crane operator must be aware of the division of responsibilities between the two. Only one banksman must give signals to the crane operator at a time.
The banksman is the only person permitted to pass instructions to the crane operator, and the crane operator is not permitted to follow instructions from persons other than the banksman. The banksman must direct lifting operations and signal to the crane operator using standard hand signals

A crane must not be operated unless:

- The banksman has a clear view of the load, lifting assembly and crane operator to give signals.
- The banksman has checked that Riggers and all other personnel are clear of the vicinity of the load.
- The crane operator has a clear view of the banksman to receive signals.
- Banksmen, Riggers and other personnel involved in crane operations must wear safety helmets and other relevant personal protective equipment. The crane operator is exempt from this requirement while he is in the crane cab, operating the crane.

Crane activities must cease in the event of any emergency or potentially dangerous situation and the crane operator must immediately obey all emergency stop signals.

9 GENERAL PRECAUTIONS

1. Cranes must not be left unattended whilst suspending a load. When not in use and left unattended, crane cabs and control compartments must be kept closed with controls or power-packs locked off and the vehicle parked without obstructing normal access.
2. Cranes must not be used for any purpose other than for lifting in a vertical plane.
3. Crane booms must not be used to apply sideways force to an object, for example during demolition, tree felling or pushing materials and boxes.
4. Cranes must not be used as winches to drag materials or equipment.
5. Cranes must not be used if they are not fully rigged or are in a defective condition, e.g. if outriggers do not fully extend, there are hydraulic fluid leaks or controls and safety equipment are defective.
6. Lifting operations must be conducted cautiously without hoisting, lowering or slewing at excessive speed.
7. Load swinging and snatch loading must be avoided.
8. On completion of crane operations, the crane boom and hook must be properly secured before the crane operator leaves the crane. The crane boom must be left on

any fitted rest, with the hoist rope slackened, or pointing downwind with the boom angle lower than 45□.

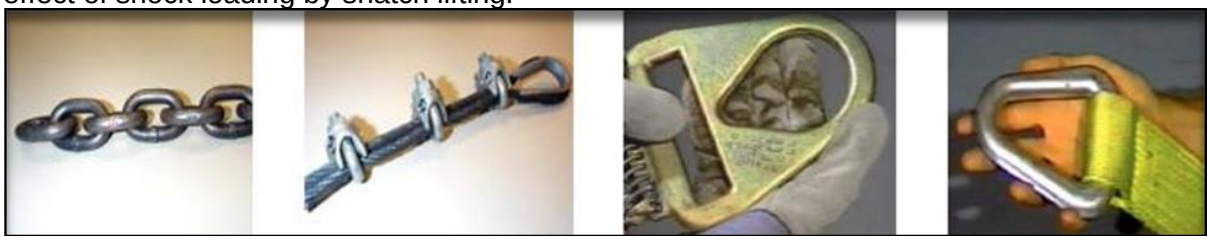
9. Any defect or damage to the crane or its structure affecting the safety of the crane or personnel must be reported to the Asset Holder. The crane must be taken out of service immediately the defect or damage is detected and not used until it has been rectified, and re-certified if necessary, or clearance to use the crane has been given in writing by the CAP.

10 LIFTING ACCESSORIES

Any piece of equipment used to attach a free or contained load to a crane hook, or hoist a load by hand, or put load restraining ropes under tension is classed as a lifting accessory. Lifting accessories are listed and defined. For many of these items (e.g. swivels, elevators, trolleys, runway beams, etc), there are no specific definitions for their use and operation.

All lifting accessories must be:

- Stored in a suitable, secure location under cover and dedicated to the purpose. The location must be under the direct control of the CAP.
- Colour coded in accordance with the HSE Standard and Colour Codes. Lifting accessories which are incorrectly colour coded must be stored in a separate clearly marked area.
- Checked before they are used to confirm their correct rating for the work to be done.
- Visually examined for defects and damage prior to use. Equipment in unacceptable condition must be tagged and set aside for repair or disposal in the same place as incorrectly colour coded accessories.
- Used only within their certified safe working load ratings.
- Loaded progressively without shock loading.
- Removed from service for inspection, testing and re-certification if it is suspected they have been subjected to loads in excess of their rated capacities, including the effect of shock loading by snatch lifting.



Chain **Wire** **Metal Mesh** **Synthetic**

10.1 Chains

The chains used in chain slings, chain block hoists and to secure loads must not be:

- Hammered to reshape distorted links.
- Joined together using bolts and nuts.
- Shortened by twisting or knotting.
- Subjected to load if the chain is kinked or twisted and the links cannot move freely.

10.2 Fibre Slings

Also known as webbing and flat belt slings, fibre slings are made of synthetic material and may have a round or flat cross section. Their use must be restricted to lifting items such as

coated pipe and turbine rotors which could be damaged by lifting with conventional chain or wire rope slings.
Fibre slings must be protected from sharp edges, by sacking or similar padding, and from chemical damage.

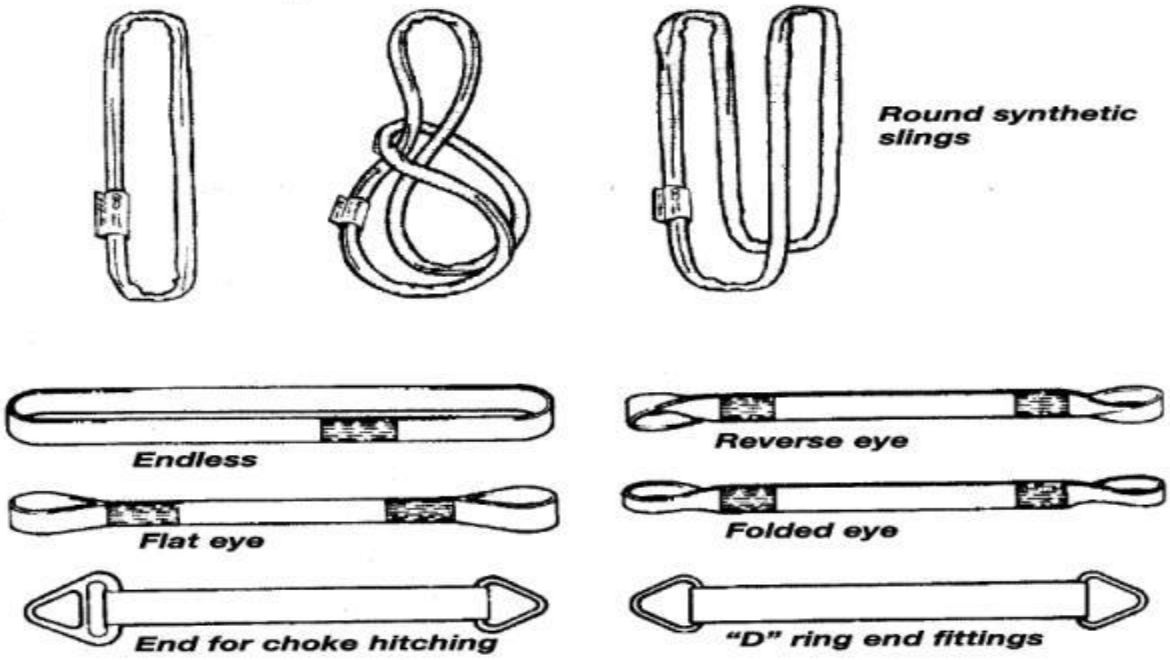
Lifts using fibre slings must always be vertical to avoid:

- Overloading the edge of a flat sling.
- The risk of tearing the sling.
- The risk of cutting a sling by lateral movement of the sling over sharp edges.

10.3 Wire Rope and Wire Rope Slings

Wire ropes must be not be used when:

- More than five of the wires can be seen to be broken in any five diameter length, or three or more closely-grouped wires are broken.
- Permanent distortion such as bulging, crush damage, stranding and core protrusion is visible.
- During materials handling operations involving wire rope slinging, ensure that:
  - The correct sling or combination of slings for the load to be lifted is selected.
  - Slings are not dragged along the ground or deck.
  - Slings are kept well away from operations involving welding and flame cutting.
  - Riggers and slingers wear protective leather gloves and that hands are clear of slings before lifting commences. Wire rope should be passed from hand to hand and not allowed to slide through the hands.
  - Allowance is made for a reduction in the rated capacity of multi-leg slings due to the angle between the legs of the assembly. Always consult a Sling Chart and Safe Working Load Tables.
  - Slings are not bent round sharp corners of a load.
  - A sling is only connected to a shackle by passing the shackle pin through one eye of the sling.
- When a reeving sling is used, the bight is not forced down onto the load. The included angle formed by the sling must not exceed 120□.
- Tag lines are attached to long, heavy and awkward loads.
- All personnel stand clear before the operation commences.
- Spinning loads without tag lines or which cannot be stopped from spinning with tag lines must be carefully lowered to the ground or deck to kill the spin.
- Loads are supported so that slings can be removed from underneath without damaging them.



10.4 Sling Angles

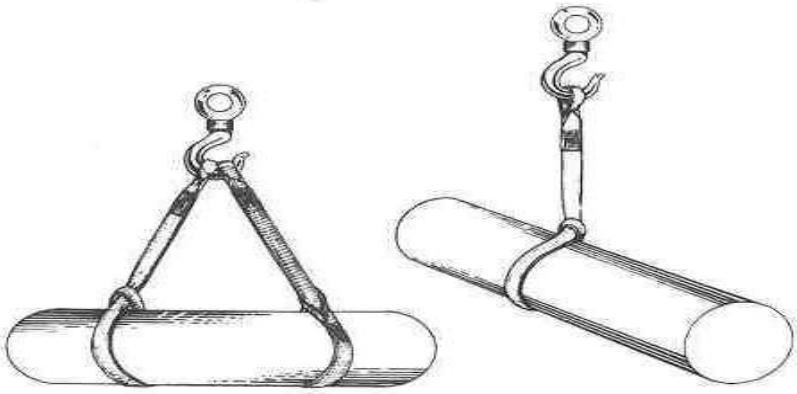
For min/max of sling angles, refer to IS Standard Specification Wire Rope Slings and Sling Legs for General Lifting Purposes
WLL for synthetic sling

Colour No Stripes	Tonne	Vertical	Choke	Basket	30°	60°	90°	120°
Violet 1	1	1	0.8	2	1.9	1.7	1.4	1.00
Green 2	2	2	1.6	4	3.8	3.4	2.8	2.00
Yellow 3	3	3	2.4	6	5.7	5.1	4.2	3.00
Orange 4	4	4	3.2	8	7.6	6.8	5.6	4.00
Red 5	5	5	4.0	10	9.5	8.5	7.0	5.00
Brown 6	6	6	4.8	12	11.4	10.2	8.4	6.00
Blue 8	8	8	6.4	16	15.2	13.6	11.2	8.00
Olive 10	10	10	8.0	20	19.0	17.0	14.0	10.00
Grey 12	12	12	9.6	24	22.8	20.4	16.8	12.00

Indicator stripes – each stripe represents 1 tonne WLL – safety factor 8:1

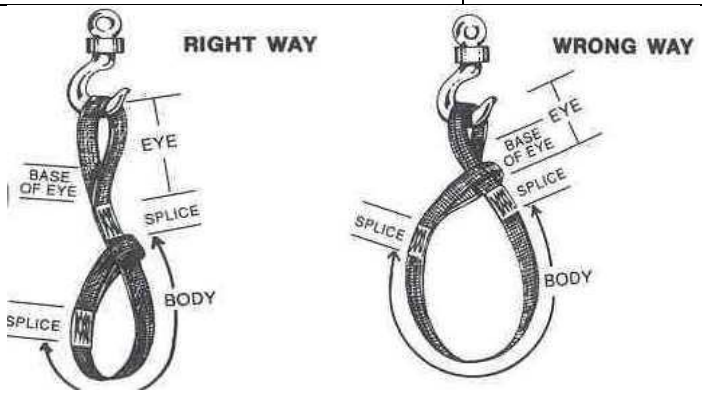
Do's and Don'ts

The sling should be rigged in a manner that provides proper load control. It is dangerous to use only one sling to lift a load which might shift and slide out.

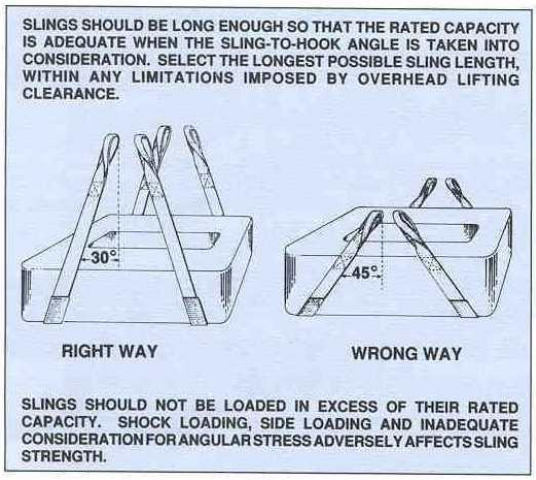


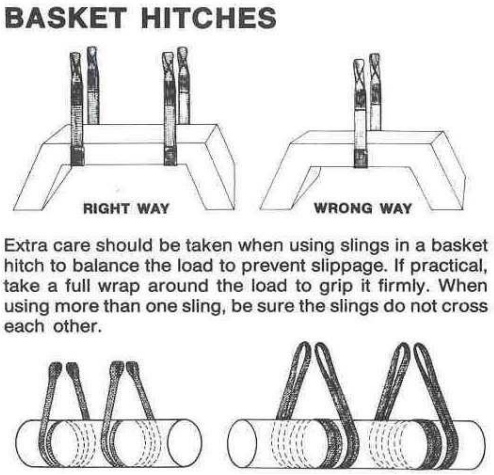
RIGHT WAY WRONG WAY

Be sure that the lifting device is directly over the center of gravity. If this is difficult to determine, it must be discovered by cautious experimentation. Raise the load carefully. If the load is unbalanced, lower and correct the position of the slings until the balance is correct.



SLING SHOULD BE OF SUFFICIENT LENGTH TO ENSURE THAT THE CHOKE ACTION IS ON THE SLING BODY - NEVER ON THE SLING SPLICE OR ON THE BASE OF THE SLING EYE.





SLING SHOULD BE PROTECTED FROM BEING CUT BY SHARP CORNERS, EDGES, PROTRUSION OR ABRASIVE SURFACES

10.5 Wire Rope Clips

Wire rope slings and semi-permanent terminations of wire ropes are frequently made using wire rope clips. These provide a quick and easy way to terminate wire ropes and when properly applied including the insertion of a thimble in the eye of the sling, and the application of sufficient torque to the securing nuts, provide up to 80% of the strength of the original rope.

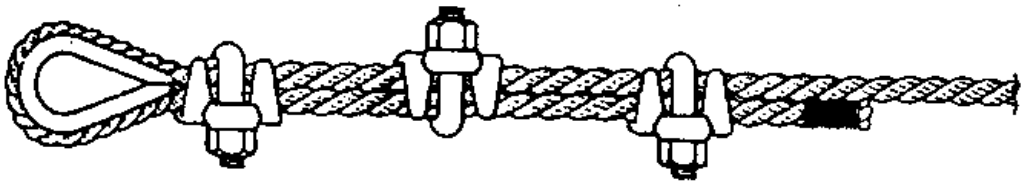
U-Bolt clips must have the U-Bolt section on the short end of the rope, and the saddle on the longer end of the rope. The incorrect installation of one clip can reduce efficiency of the connection by 60%.

When making up a sling or termination, always ensure that:

- Never use fewer than the number of clips recommended in Table 4
- New clips are used; used clips do not have the full holding ability
- A thimble is inserted in the eye of the sling; this prevents the rope from wearing and deforming
- The clips are fitted in accordance with the manufacturer's instructions
- All threads and nut bearing surfaces are greased, unless manufacturer's instructions state otherwise
- Full recommended torque settings are achieved, e.g. 49Nm for 16mm diameter rope
- A record is kept of measured torque values when terminations are first made and during each subsequent periodic check
- Periodic checks of torque settings are carried out as specified below:
    - as soon as the service load is hung on the rope
    - after 24 hours in service
    - after 7 days in service
    - after 1 month in service
    - at 6 monthly intervals from the date of installation

Correct use of Wire rope slings

RIGHT WAY FOR MAXIMUM ROPE STRENGTH



WRONG WAY: CLIPS STAGGERED

WRONG WAY: CLIPS REVERSED

10.6 Shackles

Ensure that:

- Shackles are matched to the grade of sling in use.
- The correct shackle pin is used. Never replace a pin with a bolt and nut.
- Threaded shackle pins are secured in place with seizing wire prior to use.
- Pre-slung loads, e.g. containers and bottle racks, with slings permanently attached are only fitted with “nut and cotter pin” shackles. The use of screwed pin shackles on pre slung loads is forbidden.

10.7 Plate Clamps

Wherever possible, plates must be lifted using shackles inserted in holes near the edge of the plate. If there are no holes in the plate, a plate clamp must be used and only one plate at a time must be lifted. Packing must not be inserted between the jaws of the clamp and the plate.

10.8 Eyebolts

- Eyebolts must be screwed down to the shoulder or until the threaded section reaches the end. Shoulder type eye bolts are preferred. Care must be taken to avoid mis-matching of dissimilar threads.
- Ensure that eyebolts and lifting lugs supplied by equipment manufacturers are for the whole of the load and not just for a particular part of the assembly, e.g. the top cover of a horizontally split compressor.

- Eyebolts must only be used in combination with hooks when a shackle which comfortably accommodates the hook is fitted between the hook and the eyebolt. Slings must never be passed through eye bolts; use shackles with the eye of the sling attached to the shackle.

10.9 Hooks

Care must be taken during materials handling operations to ensure that:

- The safety latches on crane and sling hooks are in good working order and that the latches close properly.
- Hooks are only used in conjunction with other lifting accessories such as rings and slings which fit properly and are secure on the hook.
- Personnel are kept clear of the swing path of a hook.
- Personnel do not place themselves underneath a hooked load.

10.10 Chain Blocks

For operations involving the use of chain blocks or chain hoists, users must ensure that;

- The correct rating of chain hoist is used for the load to be lifted.
- Only one man operates the hoist and he is able to operate it with ease (otherwise a larger capacity hoist should be used).
- Loads do not remain suspended for any length of time without securing the pull chain to prevent the load dropping.
- The load chain is not run out to the point where the load is entirely dependent on the bolt holding the dead end of the chain.
- The load chain is not used to encircle the load (a sling must be used).
- A load is not lifted or tilted with the tip of the chain block hook.

10.11 Load Binders

These devices, also known as chain tensioners, are used to tighten the chains used to secure loads on trucks, trailers, etc. There are two types of load binder, one operating on the eccentric lever principle and called a lever-type, the other operating on the principle of a bottle screw and called a ratchet-type.

When using load binders, operators must ensure the following:

- Use a binder only while standing on the ground; do not stand on the load being secured.
- Position a lever-type binder so that the handle is being pulled down to tension the chain.
- Do not extend lever-type binder handles; if additional leverage is required, use a ratchet type binder.
- After tensioning the chain, check that the lever handle is touching the chain and secured in that position either with the free end of the chain or with soft wire.
- Take great care when releasing a lever-type binder after a journey; there may be stored energy in the chain which could cause the binder handle to whip.
- When releasing a lever-type binder by hand, use an open hand palm upwards under the handle; never grip the handle and always stand clear of the path of the moving handle.
- Levers which cannot be released by hand are to be prised open by using a steel bar under the handle, with the operator standing clear to avoid injury from whip action.

11 LOAD SECURITIES

Inadequately secured loads present a hazard because they shall shift or fall and cause injury or damage. Whatever the mode of transportation, e.g. truck, van, helicopter or ship, personnel who load materials must ensure that loads are properly secured. The persons in charge of the mode of transportation, e.g driver, pilot or Master, must satisfy themselves that the load is secure before leaving.

During the loading of materials and goods onto any mode of transportation, the following must apply:

- Where items have to be stacked; the heaviest ones must be placed at the bottom.
- Ensure a friction contact between the load and its platform; avoid metal-to-metal contact, slippery surfaces and loose dunnage or packing material.
- Pack loads tightly before the load securing equipment is applied so that they do not vibrate free during transit.
- Keep the load centre of gravity as low as possible and near the centreline.
- Distribute loads evenly over the load platform.
- Protect items that could be damaged by rain with covers.
- Load securing devices, e.g. load binders, must be used as designed and be in good condition.
- Loads must be secured such that the failure of one leg of the securing system must not result in failure of the others.
- Ensure that load securing material such as rope, chains and webbing straps do not pass over sharp edges which could cut or weaken them.

- Rope used for securing loads must be steel wire greater than 8mm diameter, polypropylene, polyester, sisal or manila. Nylon rope must not be used.
- Pipes of the same OD must be loaded together as much as possible. If pipes of different diameters are loaded together, dunnage must be used to separate the different sizes.

12 MATERIAL STACKING AND UNSTACKING

12.1 Stacking

Stacking materials maximises space utilisation and facilitates materials control. When planning materials stacking, the following points must be considered:

- The permissible floor loading and the design load-handling capability of storage racks and bins.
- The site layout with adequate walkways and aisles.
- Materials routing in and out.
- Method of stacking to be used.
- Available or required materials handling facilities and equipment.
- Area lighting with avoidance of shadow areas.
- Pallet design and load bearing capacity.

Factors governing the size of stacks are volume and area available, and size, bulk, weight, type, rigidity and fragility of materials to be stacked. Note that loaded pallets must not normally be stacked more than three high.

Stability of stacks must be determined by:

- A safe ratio of height to base area.
- Sound interlocking of the materials, either naturally or artificially.
- How much of the aggregate weight is borne by the components in the lowest tier of the rack.
- Good placement of every component in a stack, with no overhangs.

Heavy items of equipment stored in custom-built crates or containers must not be stacked on top of the other (only the bases of these containers are designed to bear the load of the contents).

Stacks must be positioned at least 0.5m from walls or bulkheads and must not allow footing for persons to gain access to unguarded machinery. Racks must be inspected periodically by the CAP to determine its condition and confirm its continuing capability to support the loads for which it was constructed.

12.2 Un-stacking

The majority of incidents involving the collapse of stacked materials occur when a stack is being taken down. During this activity, the following must apply:

- One person only is responsible for the manner in which the stack is reduced.
- If the person in charge had no part in the erection of the stack, he is to familiarise himself before work begins.
- The stack is to be taken down tier by tier without “taking bites” out of it.
- Tubular or other fencing around the stack is to be reduced in height as the stack is reduced.

- The area around the stack is to be kept clear of tripping hazards.

13 PALLETS

- Only purpose-built pallets in good condition and without loose or broken boards and blocks must be used for transporting loads. Damaged pallets must be taken out of service and returned for repair or disposal.
- Loads must be secured on pallets with tension strapping, plastic shrink-wrap, cargo netting or, alternatively, using a box pallet.
- Pallets must be secured on the load platform. Webbing straps and binders, ropes or chains shall be used providing the pallets and their loads are strong enough. The use of cargo netting is adequate for light loads.
- If chains are used, their tension must be such that the load on the pallet is not distorted and the load fastenings slackened. If pallets are to be loaded into a constrained area, e.g. in a container or on a truck with side boards, then netting, ropes or chains shall not be required if movement can be prevented by using chocks.
- Where pallets are stacked, each layer must be separately restrained from movement in any direction.
- Lashings must not be attached to, or pass under, the strapping used to secure the load on the pallet and each pallet in the top layer of a stack must be cross-lashed. Empty pallets must also be secured during transportation.

14 TENSION STRAPPING

Frequent use is made of tensioned steel wire, steel banding and plastic strapping to secure individual packages and boxes or to secure loads on pallets. The strapping is normally applied with a hand operated tool and removed with side-cutters. During application and removal of tension strapping, personnel must:

- Ensure that strapping tools are in good condition and properly maintained.
- Use strapping tools in accordance with manufacturers' instructions.
- Wear hand protection and avoid trapping fingers under the strapping.
- Beware of strapping "whiplash" when its tension is released for removal.
- Coil up removed strapping and place it in a suitable waste bin or skip.

15 CONTAINERS

The containers referred to here meet the ISO 1496 specifications for freight containers of the totally enclosed general purpose type for transportation by road, rail or sea.
Before loading a freight container with cargo, an internal and external inspection must be carried out to ensure that:

- The container has a valid CSC plate showing tare weight, SWL payload, maximum gross weight and ID number.
- The lifting bridle is within the specified inspection period and colour coded to this effect.
- There is no obvious damage such as distortion of floor/sides/roof, bent lifting eyes or cracked welds.
- Any floor planking is in good condition with no broken or missing planks and no protruding nails.

- The doors operate properly, can be easily opened/closed and secured, and sealing strips are intact.
- The interior is clean, dry and free from vermin.
- Any labels or markings relating to previous cargoes are removed or painted over.
- Containers must be loaded in accordance with a load plan drawn up to ensure that:
  - Cargo to be loaded does not exceed the SWL of the container.
  - Cargo can be stowed securely with loose items bagged or crated to prevent transit damage.
  - Problems are not created for those who will unload the container at its destination.
  - Heavy items are stowed as low in the container as possible.
  - Lightweight items are packed on top of heavy ones.
  - The centre of gravity of the loaded container is below the midpoint of its height.
  - The centre of gravity of the loaded container is near the midpoint of its length and width.
  - The load is evenly distributed over the floor area.
  - No more than 60% of the weight of cargo is at one end, in less than half the length of the container.

If a container is not fully packed across its width, cargo must be secured to lashing points inside the container to prevent load shift during transit. Liquid in barrels, e.g. lubrication oil must be transported with screwed caps for filling/emptying of contents uppermost. Where there is the possibility of leakage of liquid cargo, precautions must be taken to minimise the possibility and provide a means to absorb any leakage. Truck mounted containers must be secured using twist-locks. When a container is received at its destination, it must be checked for any warning signs, e.g. Dangerous Goods, Radioactive Materials, etc., before the doors are opened. Container doors must always be opened carefully in case cargo has shifted during transit and is liable to fall out of the open doors.

16 MANUAL LIFTING TECHNIQUES

Back injuries are one of the most common types of industrial accident and although they may occur at a specific time, they are usually the result of many years of incorrect manual lifting. Back injuries can be prevented by proper lifting and the correct manual lifting technique is described below.

- Keep the chin in and do not let the head drop forwards or backwards.
- Take up a crouching or squatting position by bending the knees while keeping the back straight; this does not necessarily mean vertical. The important thing is not to bend the back.
- Take a firm grip of the object to be lifted, using the palm of the hands and the roots of the fingers.
- Wherever possible, grip diagonally opposite corners of the load, one of them underneath.
- Keep the arms as close to the body as possible allowing the body, rather than the shoulders, arms or wrists, to take the weight.

- Straighten the legs and use the thigh muscles to achieve the lift. When lifting from the ground, take up the squatting position and allow the legs to do all the work. Lift in stages, i.e. from floor to knee and from knee to carrying position. When lifting and in the carrying position, the leading foot must be pointing in the direction of travel.
- Avoid standing with a heavy load; if you must stop, set it down by reversing the lifting procedure described in the previous step.
- Do not carry a load which obstructs your view and always ensure that your line of travel is clear of obstructions.
- Never attempt to change your grip while actually carrying a load. If a change is necessary, set the load down on a firm support, change your grip and lift the load up again.
- If the object to be handled is too heavy or awkward, get help. The lifting method for two or more people is the same as for one person. If mechanical lifting devices are available, use them.

17 CRANE SAFETY CHECKLIST

Sr. No	Pre-operations Safety checklist	Yes / No	Remarks
1	Up to date test and examination certificates available for site management to inspect.		
2	Daily/weekly maintenance and inspections carried out.		
3	Cab windows clean and screen wipers, where fitted, in working order.		
4	Cab and floor clean and free from obstruction.		
5	Crane controls in neutral before starting up		
6	Gauges and instruments reading correctly after start-up.		
7	Safe load indicator fully operational and, where fitted, the automatic overload indicator is working correctly with the correct cam/program selected and fitted.		
8	All other limit switches, e.g. "over hoist", operating correctly.		
9	All ropes free and without visible defects.		
10	Where applicable, tyre pressures as recommended by the manufacturer and tyres free from potentially dangerous damage.		
11	All tools and equipment checked and stowed correctly.		
12	Fire extinguisher, if fitted, is fully charged, free from visible defect and within periodic examination date.		
13	Tracks in good operational condition.		
14	No restrictions on access - check overall dimensions of crane compared with operating area.		
15	Work areas clearly visible and illuminated if necessary.		
16	Ground capable of taking loads (outriggers, crane, load, wind speed).		
17	Approach and work areas as level as possible.		
18	Adequate protections from overhead power lines.		
19	If outriggers used, they are set in the correct position as per crane manufacturer's instructions, locked and properly supported.		
20	Ample room to swing and lift crane boom clear of obstructions and rear of crane clear of obstacles.		
21	Weights of loads known and correct lifting accessories available.		
22	Supervision of proposed lift available on site.		
Sr. No	**Checks during operation**	**Yes / No**	**Remarks**
1	Loads lifted carefully within safe radius as per duty chart.		
2	Crane operating from planned/approved positions		

	only		
3	Banksman working in correct manner		
4	Crane hook positioned directly over load.		
5	Crane motions smooth and safe		
6	Crane at safe distance from open excavations.		
7	Safe load/radius indicators working correctly		
8	All lifting accessories of correct type and serviceable.		
9	Loads not slewed over people and persons not standing or walking under suspended loads.		
10	Crane boom remains clear of overhead power lines.		
11	When travelling with load suspended, load carried as near to ground as possible, level route followed and boom radius changes made to accommodate load movement on inclines.		

18 INSTALLATIONS OF WIRE ROPE CLIPS OR DOUBLE SADDLE CLIPS

Amount Rope Turn Back	From Thimble (mm)	Torque in Foot-Pounds	
3	2	80	-
5	2	95	
6	3	120	15
8	3	130	30
10	3	160	45
12	3	180	65
13	3	280	65
14	3	300	95
16	3	390	95
20	4	450	130
22	4	470	225
25	5	650	225
28	6	850	225
30	6	920	360
35	7	1100	360
38	7	1200	360
40	7	1300	430
45	7	1800	590
50	8	1900	750
56	8	2100	750
64	9	2500	750
74	10	2700	750

Table 4 Installation of Wire Rope Clips

1 The manufacturer's requirements must be followed for specialised or non standard clips.

Rope Diameter	Thimble (mm)	Torque	

(mm) Minimum Number of Clips1		Unlubricated Bolts (ft-lb)	
5	**2**	**1**	**30**
6	**3**	**100**	**30**
8	**3**	**130**	**30**
10	**3**	**130**	**45**
12	**3**	**160**	**65**
13	**3**	**280**	**65**
14	**3**	**350**	**130**
14	**3**	**400**	**130**
20	**3**	**450**	**225**
22	**4**	**480**	**225**
25	**5**	**920**	**225**
28	**5**	**1000**	**360**
30	**6**	**1400**	**360**
35	**6**	**1600**	**500**
40	**6**	**1700**	**500**

19 RISK CONTROLS

Risks Control

- ✓ Excessive load: Don't lift load, use suitable equipment
- ✓ Not correctly packaged: Re-package before lifting
- ✓ Incorrectly slung load: Correct slinging before lifting
- ✓ Load will fall: Use correct lifting equipment

20 REFERENCES

References Title

1. The Factories Act, 1948
2. The Maharashtra Factories Rules, 1963
3. BS 4430 Recommendations for the safety of powered industrial trucks
4. BS 7121 Parts 1 to 10
5. Code of practice for safe use of cranes,
6. BS 6570 Code of practice for the selection, care and maintenance of steel wire ropes
7. BS 6521 Guide for proper use and maintenance of calibrated steel link lifting chains
8. BS 6166 Lifting slings, Part 3: Guide to the safe use of lifting slings for multi-purposes
9. BS 6210 Code of practice for safe use of wire rope slings for general lifting purposes
10. BS 6968 Guide for use and maintenance of non-calibrated round steel lifting chain and chain slings
11. BS 6939 Recommendations for intermediate bulk containers (IBCs) for dangerous goods
12. ISO 3691 Powered trucks - Safety code
13. ISO 5053 Powered trucks – Terminology
14. ISO 830 Freight containers – Terminology
15. ISO 1496 Freight containers - Specifications for series 1 freight containers
16. BS 1290 Wire Rope Slings and Sling Legs for General Lifting Purposes

21**. Records: NIL**

22. Training & Communication:

22.1. Training on Scaffold Safety Procedure shall be carried out to cover for following-

a. Competent Person,
b. Scaffolding Supervisor,
c. Scaffolder

22.2. Initial Communication to be done through Corporate Communication, Email and subsequently shall be made available at safety portal at Sangam.

23. VERIFICATION

23.1. Verification of implementation shall be done during Scaffold Safety procedure audit, field safety visit and site inspections.

24. Exceptions: Any Exception to this procedure shall only be done as per Document Control .Procedure (TPSMS/GSP/DC/014).

25. Review:

24.1. Review of this procedure shall be done as and when but not later than once in every three (03) years. Typical Factors like Changes in legislation, Review of Incident Reports, Inspection & Audit findings, Feedback from users, Recommendations in Incident investigation reports may be inputs for the review and revision of the procedure.

24.2. In case release of revised procedure gets delay due to obtaining feedback or any other reasons, safety advisory may be issued immediately to take precautions for the proposed changes in the procedure and revised procedure should be released subsequently.