1. **OBJECTIVE:**
To provide guidelines for safe Storage and handling of materials manually or by using moving machinery like Fork Lifts Trucks, Conveyors, Cranes and Hoists, Derricks.

**Associated Hazards:**

**Manual Material Handling**
- i) Improper lifting of objects is a major cause of back injuries in the workplace.
- ii) Improper manual lifting or carrying loads that is too large or heavy.
- iii) Crushed by falling materials or improperly stored materials.

**Material Handling Via Machine:**
- i) Capsizing/Toppling of Crane
- ii) Collapse/Failure of Boom
- iii) Failure of sling, rope, chain etc
- iv) Struck by the moving machine
- v) Object falling from height
- vi) Swinging & hitting of load to adjacent structure
- vii) Finger entanglement with rope, chain, sling etc while lifting
- viii) Electrocutions
- ix) Storm/ heavy wind

2. **Scope:**
This standard is applicable to all large, medium and small scale steel manufacturing units.

3. **Procedure:**
3.1 **Definitions:**
- **Competent person** - One who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary,
hazardous, or dangerous to people, 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 or her ability to solve or resolve problems related to the subject matter, the work, or the project.

### 3.2 Manual lifting.

Manual material handling includes any tasks which require a person to lift, lower, push, pull, hold or carry any object or material.

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1. **No employee shall be asked to carry loads above his capacity.**
2. **ISO Standard -11228 guidelines as given in Clause 7.1.3 to be followed.**
3. **Where possible, mechanical lifting equipment shall be used.**
4. **For lifting of materials manually, the safe lifting postures, principles of lifting and lifting techniques as described the following clauses, must be followed.**

#### 3.3. Ergonomics in manual handling:

Manual material handling tasks may expose workers to physical risk factors if these tasks are performed repeatedly or over a long period of time, it can lead to fatigue and injury. The main risk factors, or conditions associated with the development of injuries in manual handling tasks include:
i) Awkward posture (e.g. bending, twisting)
ii) Repetitive motions (e.g. bending, twisting)
iii) Forceful exertions (e.g. carrying or lifting heavy loads)
iv) Pressure points (.g grasping (contact form) loads, leaning against parts or 
surfaces that are hard or have sharp edges)
v) Static posture (e.g. maintaining fixed position for a long time)

3.3.1 Harmful effect of un-ergonomic manual handling
Repeated or continual exposure to one or more of these factors initially may lead to 
Fatigue and discomfort. Over time, injury to the back, shoulders, hands, wrists or 
Other parts of the body may occur. Injuries may include damage to muscles, 
tendons, 
Ligaments, nerves and blood vessels. Injuries of this type are known as 
Musculoskeletal disorder or MSDs.

3.3.2 Safety Guidelines:
ISO Standard -11228, Part 1: Lifting has recommended for two handled lifting under 
ideal conditions of:
  i) 25 kg for males
  ii) 25 kg for females
  iii) Standing symmetrically, unrestricted and upright
  iv) Trunk is upright and not rotated
  v) Horizontal distance to object less than 25 cm
  vi) Height of grip less than 25 cm above knuckle height
  vii) Firm grip on the object (neutral wrist posture)
  viii) Lifting duration of less than one hour per day
  ix) Frequency of lifting less than or equal to 0.2 lifts per minute
  x) Favourable environmental conditions

3.3.3 Lifting under non-ideal conditions decreases the safe lifting limit
For manual handling of cement bags, till mechanized arrangement of handling 
cement is fully implemented, 50kg load per person shall be allowed.
As per ISO Standard 11228, Part-2, following guideline is applicable for pushing and 
pulling.
### 3.3.4 Material lifting techniques

i) **Correct grip:** The correct grip makes use of the palm of the hand and roots of the fingers and thumb. Gripping with the fingertips shall be avoided as they will lead to strained fingers and muscles in the forearm.

ii) **Straight back:** In order to pick up a load with a straight back one must approach the task by flexing the hips, knees and ankles and the load must be held close to the body. The lift is to be brought about by the powerful muscles of the leg and not the back, which is to be kept straight throughout the movement. A bent back is a weak back and can lead to a strained back.

iii) **Head up:** One should practice raising the top of head and this will help to maintain a straight back an essential movement that has to be carried out prior to every lift. This will also enable to see where you are going. Correct foot position: One should always have the feet apart but not wider than the hips, and one foot should be in advance of the other. This leading foot shall be in the direction one intends to move.

iv) **Arm close to the body:** Lifting carrying or pushing with the arms away from the body results in needless strain being put on the chest, upper back and shoulder muscles. Keep arms as close to the body as possible.

v) **Use your body weight:** Properly employed body weight can be used in moving a load by acting a counterbalance and thus reducing the amount of muscular effort.

### 3.3.5 Good ergonomic Practice:

i) Provide mechanical aids such as conveyors, floor cranes, carts, balancing mechanisms, vacuum hoists, turntables, tilt tables, hooks, automatic pushers, wheels etc.to reduce manual handling.

ii) No head or shoulder load shall be permitted
iii) Minimize the total cumulative weight handled each day
iv) Change from lifting to pushing or from pushing to rolling
v) Introduce team lifting
vi) Modify the object (change the shape, change the size, use lighter containers,
    divide into smaller units, move the centre of gravity closer to the employee,
    create handles, improve casters, etc.).

vii) Provide education in proper body mechanics, in proper selection of clothing and
    footwear, in use of personal protective equipment, etc.

viii) Develop a work procedure and provide training.

3.3.6 Material includes
i) Small weights
ii) Cement bags
iii) Reinforcement rods
iv) Liquid containers
v) Light angles, channels, linear rolled structures, pipes, cables etc.
vi) Bricks mortars etc.

vii) Equipment parts
viii) Cartons

3.3.7 Basic lifts:
Proper lifting and handling will help protect against injury and make the job easier. It takes training and practice to do it right. The following are basic steps in safe lifting and handling.

**Principles of lifting:**

- ✔ Size up the load and make sure that the path is clear.
- ✔ Do not attempt to lift the load alone if it is too heavy or awkward. Get help.
- ✔ Keep the load close to the body.
- ✔ Use your thigh and leg muscles, not
the back, as the load is lift in one smooth movement.
✓ Have feet shoulder width apart, with the load between them.

<table>
<thead>
<tr>
<th>Safe Carrying-</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Keep a good grip on the load.</td>
</tr>
<tr>
<td>✓ Keep the load close to body.</td>
</tr>
<tr>
<td>✓ Keep loads at a reasonable height so where is he going one can see.</td>
</tr>
<tr>
<td>✓ Don’t twist back when carrying Load.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lower Material Slowly and Smoothly-</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Use the lifting principles but in reverse.</td>
</tr>
<tr>
<td>✓ When lowering a load onto a deep shelf, put it on the edge of the shelf and push it into place.</td>
</tr>
</tbody>
</table>

### 3.3.8 Modified Lifts:

The following lifting techniques may be required in circumstances that make lifting awkward.

**Two-person Lift:**
Both persons should be about the same height.

- One person takes charge of the lift, so that you are working together not against each other.
- Lift together, walk in step and lower the load together.

### 3.3.9 Additional tips to ensure safe lifting and carrying:

1. Wear appropriate clothing and safe, comfortable shoes.
2. Wear clothes that are comfortable around your hips, knees and shoulders.
3. Avoid wearing clothes with exposed buttons or loose flaps.
4. Shoes should be sensible, non-slip with broad based low.

### 3.4 Material handling via machine:

<table>
<thead>
<tr>
<th>Various type of machine used for material handling</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fork Lift</strong></td>
</tr>
<tr>
<td><img src="image" alt="Fork Lift" /></td>
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<tr>
<td><strong>Conveyor</strong></td>
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<td><img src="image" alt="Conveyor" /></td>
</tr>
<tr>
<td><strong>Crawler Crane</strong></td>
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<tr>
<td><img src="image" alt="Crawler Crane" /></td>
</tr>
</tbody>
</table>
3.4.1 General.

i) Every driver / Operator of material moving machinery shall possess adequate skill and documented training in the operation of the lifting appliance. Suitable sticker is to be pasted on the helmet of successful employees, as an easy way for supervisors to know if the person operating the equipment has been formally trained.

ii) No person under 18 years of age shall be employed for operations of these machines or for giving signals to operator.

iii) Driver must fasten the seat belt while driving Forklifts and similar type of industrial/commercial Vehicles e.g. Listers, Bobcats, 3-wheeler tempos etc.

iv) All lifting machines and lifting tackles shall conform:
   a) Identification Mark Number (as mentioned in the Test Certificate)
   b) Safe Working Load
c) Date of Last Test - No chain, rope or lifting gear shall be used unless –
   ➢ it is of good construction, adequate strength, suitable quality and free from any defects.
   ➢ it has been tested and examined once in a year for general use and once in six months for hot metal lifting use by a competent person and issued a certificate.

d) Rigging equipment for material handling shall be visually inspected prior to use on each shift. Defective rigging equipment shall be removed from service.

   ➢ Only steel chains and slings shall be used for securing / supporting heavy loads (>= 70 kg) and use of Manila ropes, Fibre ropes in rigging activities shall be strictly prohibited for heavy loads.
   ➢ Slings shall not be shortened with knots or bolts or other makeshift devices.
   ➢ Shock loading is prohibited.
   ➢ Suitable packing is to be provided to prevent contact with the sling to the sharp edge of the load.

v) Operator shall leave no machinery unattended, while power is on or load is suspended to above machinery.

vi) No person shall ride on suspended load or any lifting machine.

vii) All lifting machinery shall be tested by competent person yearly and the test record shall be maintained by the owner department.

viii) While material handling, following precautions to be taken:
   ➢ The load is safe and secured while lifting.
   ➢ Slinging method is proper for the load.
   ➢ Lifted load shall not exceed the safe working load of the slinging gear.
   ➢ The load is so slung that it will not collapse and does not damage the sling in gear.

ix) All persons at the site shall strictly use helmet with chin belt and shoes.
x) Two-crane lift is always considered to be critical and hence care should be taken to ensure a) proper planning for the lift, b) no lateral load on the boom and c) to use lifting tackles as far as possible.

3.4.2 Hazard during Material Handling via machine:

i) Capsizing/Toppling of Crane

ii) Collapse/Failure of Boom

iii) Failure of sling, rope, chain etc

iv) Struck by the moving machine

v) Object falling from height

vi) Swinging & hitting of load to adjacent structure

vii) Finger entanglement with rope, chain, sling etc while lifting

viii) Electrocutions

ix) Storm/ heavy wind

3.4.3 Fork Lift Trucks

A forklift is a workplace vehicle, designed to lift, carry and stack heavy loads using two forks situated at the front of the vehicle. Loads are usually secured on wooden pallets that fit over the forks. The formal name for a forklift is an "industrial truck".

Qualified Operator –

i) is a properly trained person by authorised trainer.

ii) must have valid Heavy driving license.

Proof of annual inspection - is a documentation indicating compliance of schedule inspection and maintenance of Forklifts.
3.4.3.1 General Procedures

i) Only authorized and trained personnel will operate Forklifts.

ii) All Forklifts will be equipped with FOPS (Falling Object Protective Structure), fire extinguisher, back-up alarm and seat belts. Seat belts will be worn at all times by the Operator.

iii) The operator will perform daily pre- and post-trip inspections.

iv) Any safety defects (such as hydraulic fluid leaks; defective brakes, steering, lights, or horn; and/or missing fire extinguisher, lights, seat belt, or back-up alarm) will be reported for immediate repair or have the Forklifts taken "Out of Service".

v) Operators will follow safety procedures while recharging battery for electric forklifts or refuelling for diesel forklifts.

vi) Loads will be tilted back and carried no more than 6 inches from the ground.

    Loads that restrict the operator's vision will be transported backwards.

vii) Forklifts will travel no faster than 5 mph or faster than a normal walk.
viii) Safety helmet will be worn by Forklifts Operators.

ix) Operator will sound horn and use extreme caution when meeting pedestrians, making turns and cornering.

x) Passengers may not ride on any portion of a Forklifts. Only the operator will ride Forklifts. "NO PASSENGERS" decals will be affixed on all Forklifts.

xi) If Forklifts are used as a man lift, an appropriate man lift platform (cage with standard rails and toe-boards) will be used.

xii) Aisle will be maintained free from obstructions, marked and wide enough (six foot minimum) for vehicle operation.

xiii) Lift capacity will be marked on all Forklifts. Operator will assure load does not exceed rated weight limits.

xiv) When un-attended, Forklifts will be turned off, forks lowered to the ground and wheels scotch blocked.

xv) All Forklifts (with exception of pallet jacks) will be equipped with a multipurpose dry chemical fire extinguisher. (Minimum rating; 2A:10B:C)

xvi) Any accidents / incidents must be reported to line managers/supervisors.

3.4.3.2 Operations:

i) If at any time a Forklifts is found to be in need of repair, defective, or in any way unsafe, the Forklifts shall be taken out of service until it has been restored to safe operating condition.

ii) Forklifts shall not be driven up to anyone standing in front of a bench or other fixed object.

iii) No person shall be allowed to stand or pass under the elevated portion of any Forklift, whether loaded or empty.

iv) Unauthorized personnel shall not be permitted to ride on Forklift.

v) Arms or Legs shall not be placed between the uprights of the mast or outside the running lines of the Forklifts.

vi) When a Forklift is left unattended, load engaging means shall be fully lowered, controls shall be neutralized, power shall be shut off, and brakes set. Wheels shall be scotch blocked if the forklift is parked.

vii) A safe distance shall be maintained from the edge of ramps or platforms while on any elevated dock, or platform or freight car. Forklifts shall not be used for opening or closing any doors.
viii) There shall be sufficient headroom under overhead installations, lights, pipes, sprinkler system, etc.

ix) An overhead guard shall be used as protection against falling objects. It should be noted that an overhead guard is intended to offer protection from the impact of small packages, boxes, bagged material, etc., representative of the job application, but not to withstand the impact of a falling capacity load.

x) A load backrest extension shall be used whenever necessary to minimize the possibility of the load or part of it from falling rearward.

xi) Forklifts shall not be parked so as to block fire aisles, access to stairways, or fire equipments.

3.4.3.3 Travelling:

i) All traffic regulations shall be observed, including authorized speed limits. A safe distance shall be maintained approximately three Forklifts lengths from the vehicle ahead, and the Forklift shall be kept under control at all times.

ii) Other Forklifts travelling in the same direction at intersections, blind spots, or other dangerous locations shall not be passed.

iii) The driver shall be required to slow down and sound the horn at cross aisles and other locations where vision is obstructed. If the load being carried obstructs forward view, the driver shall be required to travel with the load trailing.

iv) The driver shall be required to look in the direction of, and keep a clear view of the path of travel.

v) Grades shall be ascended or descended slowly. When ascending or descending grades more than 10 percent, loaded Forklift shall be driven with the load upgrade. On all grades, the load and load engaging means shall be tilted back if applicable, and raised only as far as necessary to clear the road surface.

vi) Under all travel conditions the Forklift shall be operated at a speed that will permit it to be brought to a stop in a safe manner.

vii) Stunt driving and horseplay shall not be permitted.

viii) The driver shall be required to slow down for wet and slippery floors.

ix) Running over loose objects on the roadway surface shall be avoided.

x) While negotiating turns, speed shall be reduced to a safe level by means of turning the hand steering wheel in a smooth, sweeping motion. Except when
manoeuvring at a very low speed, the hand steering wheel shall be turned at a moderate, even rate.

3.4.3.4 Loading.
i) Only stable or safely arranged loads shall be handled. Caution shall be exercised when handling off-centre loads which cannot be centered.
ii) Only loads within the rated capacity of the Forklifts shall be handled.
iii) The long or high (including multiple-tiered) loads which may affect capacity shall be adjusted.
iv) Forklifts equipped with attachments shall be operated as partially loaded Forklifts when not handling a load.
v) A load engaging means shall be placed under the load as far as possible; the mast shall be carefully tilted backward to stabilize the load.
vi) Extreme care shall be used when tilting the load forward or backward, particularly when high tiring. Tilting forward with load engaging means elevated shall be prohibited except to pick up a load. An elevated load shall not be tilted forward except when the load is in a deposit position over a rack or stack. When stacking or tiring, only enough backward tilt to stabilize the load shall be used.

3.4.3.5 Fuelling Safety:
i) Fuel tanks shall not be filled while the engine is running. Spillage shall be avoided.
ii) Spillage of oil or fuel shall be carefully washed away or completely evaporated and the fuel tank cap replaced before restarting engine.
iii) No Forklifts shall be operated with a leak in the fuel system until the leak has been corrected.
iv) Open flames shall not be used for checking electrolyte level in storage batteries or gasoline level in fuel tanks.

3.4.3.6 Inspection Records:
i) Inspection records of the inspected Forklift shall be maintained on critical items in use, such as brakes, Mast condition, Hoist chain condition etc. These inspection records should include, the date of inspection, the signature of the person who performed the inspection, and the serial number, or other identifier. This
inspection record should be kept readily available for review. The manufacturer's maintenance and inspection records, forms/checklist, or equivalent should be used.

3.4.4 Conveyors
i) The design of conveyor system must address the proper starting and stopping sequence, to prevent any material spillage and damage to the system.

ii) Means for stopping the motor or engine shall be provided at the operator’s station. Conveyor systems shall be equipped with an audible warning signal to be sounded immediately before starting up the conveyor.

iii) If the operator station is at a remote point, similar provisions for stopping the motor or engine shall be provided at the motor location.

iv) Belt conveyors shall be fitted with emergency trip wires (pull-chords) or stop buttons, which must be fully operative at all times.

v) Emergency stop switches shall be properly inter-locked so that the conveyor cannot be started again until the actuating STOP switch has been reset to running or “ON” position.

vi) Screw conveyors shall be guarded to prevent employee contact with turning screws.

vii) Where a conveyor passes over work areas, aisles or thoroughfares, suitable guards shall be provided to protect employees required to work below the conveyors.

viii) All crossovers, aisles, passageways shall be conspicuously marked by suitable signs.

ix) Conveyors shall be locked out or otherwise rendered inoperable and tagged out with a „do-not-operate” tag during repair and when operation is hazardous to employees performing maintenance work.

x) No person shall be allowed to ride on or cross over a conveyor.

xi) Guards shall be provided at all pulleys and belt nips and at all idlers and other places where the risk of trapping exists.

3.4.5 Cranes &Derricks:
A. General requirements-
i) The employer shall comply with the manufacturer's specifications and limitations applicable to the operation of any and all cranes and derricks. Where manufacturer's specifications are not available the limitations assigned to the equipment shall be based on the determinations of a qualified engineer, competent in this field and such determinations will be appropriately documented and recorded. Attachments used with cranes shall not exceed the capacity, rating, or scope recommended by the manufacturer.

ii) Rated load capacities, and recommended operating speeds, and special hazard warnings, or instruction shall be conspicuously posted on all equipment. Instructions or warnings shall be visible to the operator while at the control station. A chart indicating safe working load (SWL) at various inclinations or radii of jib shall be displayed in the driver's cabin. This is needed only in cases where automatic SWL indicator is not provided on the crane.

iii) Standard Hand signals, as shown in Fig.-1,2 and 3 shall be used to crane and derrick operators.

iv) Every lifting appliance or machine and every part thereof including all working gear and all other plant or equipment used for anchoring or fixing such appliances or machines shall be of good mechanical construction, sound material, adequate strength and free from defect. The employer shall designate a competent person who shall inspect all machinery and equipment prior to each use, and periodically during use to make sure it is in safe operating condition. Any deficiencies shall be repaired, or defective parts replaced, before further use.

v) A thorough, annual inspection of the hoisting machinery shall be made by competent person or competent private agency recognized by the department. The employer shall maintain a permanent record of the dates and results of all inspections for each hoisting machine and piece of equipment.

vi) A tag line or guide rope shall be used on all loads that swing freely. Guide ropes or tag lines shall be held by experienced persons.

vii) Care shall be taken to guard against injury to workers, or damage to scaffolds or buildings, from swinging loads.

viii) The operator shall avoid carrying loads over people. No one must walk below suspended load or the boom.
ix) When work is stopped or when the derrick is not in operation, the boom shall be lowered to a horizontal position or tied in place to prevent it whipping with the wind or other external force.

x) Only authorized personnel shall make sling hitches on loads.

xi) Workers shall not be allowed to ride on loads handled by derricks.

xii) Operators shall observe signals only from duly authorized persons. Under no circumstances shall a load be moved until the signal is received from authorized personnel. The Crane operator shall respond to signals only from appointed signaller but shall obey stop signal given by anyone at any time.

xiii) Belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains, or other reciprocating, rotating, or other moving parts or equipment shall be guarded if such parts are exposed to contact by employees, or otherwise create a hazard. Any anchoring or fixing arrangement provided in connection with the lifting appliances or machines shall be adequate and secured. Do not operate a crane, which does not have the facility of automatic braking (in case of power failure).

xiv) A minimum distance of one meter clearance shall be maintained between the swing radius of the greatest extension of the crane superstructure or counterweights and a stationary object, including the crane itself, while the crane is in operation. When this clearance cannot be maintained, suitable barricades or safeguards shall be used to isolate the pinch point hazard area.

No person should approach nearer than six meter of the crane truck, when crane is in motion or loaded.

xv) All exhaust pipes shall be guarded or insulated where contact by employees, in the performance of normal duties, is possible.

xvi) Crane shall be stationed: on a firm ground when operating.

xvii) When leaving crane, operator must:
    a) Lower any suspended load to the ground.
    b) Disengage the clutch.
    c) Engage all safety locks.
    d) Secure boom against high winds.

xviii) When parking overnight, in addition to the above:
    a) Release the load
    b) Lower the boom to ground
c) Provide wheel locks and wheel blocks

xix) Cranes must not be operated between sunset and sunrise without adequate lighting provision.
xx) When travelling up a gradient, the load shall be derrick out and when traveling down a gradient, the load shall be derrick into the minimum radius, and this position shall be corrected on reaching level ground. Otherwise, constant watch on the radius should maintained while travelling on uneven surfaces.

xxi) The mobile crane shall be fitted with suitable horn, head lights, side lamps, rear and stop lights and flashing direction indicator.

xxii) Cranes with cantilever type jib, when travelling without load, the jib should be lowered to a horizontal position.

xxiii) The pneumatic tyres shall be maintained at the correct pressure always.

xxiv) Do not block emergency egresses, electrical panel or fire equipment with a trucker load.
xxv) Lock out the malfunctioning equipment and schedule for repair by an authorised agency.

HAND SIGNALS

Overhead Cranes

**HOIST.** With fore arm vertical, thumb pointing up, move hand in small horizontal circle.

**LOWER.** With arm extended downward, thumb or pointing down, move hand in small horizontal circles.

**BRIDGE TRAVEL.** Arm extended forward, hand open and fingers slightly curved, make pushing motion in direction of travel.

**TROLLEY TRAVEL.** Palm up, fingers spread, thumb pointing in direction of motion, jerk hand horizontally.

**STOP.** Arm extended, palm down, move arm back and forth.

**EMERGENCY STOP.** Both arms extended, palms down, move arms back and forth.

**MULTIPLE TROLLEYS.** Hold up one finger for block marked "1" and two fingers for block marked "2". Repeat signals follow.

**MOVE SLOWLY.** Use one hand to give any motion signal and place other hand motion less in front of hand giving the motion signal (Finger slowly shown as example.)

Figure 1: Hand Signal - Overhead Crane
Figure 2: Hand Signals - Mobile Cranes

- **HOIST.** With forearm vertical, forefinger pointing up, move hand in small horizontal circle.
- **LOWER.** With arm extended downward, forefinger pointing down, move hand in small horizontal circle.
- **USE MAIN HOIST.** Tap fist on load then use regular signals.
- **USE WHIP LINE.** (Auxiliary Hoist) Tap elbow with one hand, then use regular signals.
- **RAISE BOOM.** Arm extended, fingers closed, thumb pointing upward.
- **LOWER BOOM.** Arm extended, fingers closed, thumb pointing downward.
- **MOVE SLOWLY.** Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal. (Hoist slowly shown as example.)
- **RAISE THE BOOM AND LOWER THE LOAD.** With arm extended, thumb pointing up. Flex fingers in and out as long as load movement is desired.
- **LOWER THE BOOM AND RAISE THE LOAD.** With arm extended, thumb pointing down. Flex fingers in and out as long as load movement is desired.
- **SWING.** Arm extended, point with finger in direction of swing of boom.
- **STOP.** Arm extended, palm down, move arm back and forth horizontally.
- **EMERGENCY STOP.** Both arms extended, palms down, move arms back and forth horizontally.
B. Additional requirements.

i) Whenever internal combustion engine powered equipment exhausts in enclosed spaces, tests shall be made and recorded to see that employees are not exposed to unsafe concentrations of toxic gases or oxygen deficient atmospheres.
ii) All cab glazing shall be safety glazing material. Windows shall be provided in the frontend on both sides of the cab or operator's compartment with visibility forward and to either side. Visibility forward shall include a vertical range adequate to cover the boom point at all times. The front window may have a section, which can be readily removed or held open, if desired. If the section is of the type held in the open position, it shall be secured to prevent inadvertent closure. A windshield wiper should be provided on the front window.

iii) Where necessary for rigging or service requirements, a ladder or steps shall be provided to give access to a cab roof.

iv) On cranes, guardrails, handholds and steps shall be provided for easy access to the car.

v) Cab Platforms and walkways shall have anti-skid surfaces.

vi) Fuel tank filler pipe shall be located in such a position, or protected in such manner, as to not allow spill or overflow to run onto the engine, exhaust, or electrical equipment of any machine being fuelled. An accessible fire extinguisher shall be available at all operator stations or cabs of equipment.

vii) Except where electrical distribution and transmission lines have been de-energized and visibly grounded at point of work or where insulating barriers, not a part of or an attachment to the equipment or machinery, have been erected to prevent physical contact with the lines, equipment or machines shall be operated proximate to power lines only in accordance with the following:

viii) For lines rated 50 kV or below, minimum clearance between the lines and any part of the crane or load shall be three meters.

ix) For lines rated over 50 kV, minimum clearance between the lines and any part of the crane or load shall be three meters plus one centimetre for each 1 kV over 50 kV., or twice the length of the line insulator, but never less than three meters.

x) In transit with no load and boom lowered, the equipment clearance shall be a minimum of 1.2 m for voltages less than 50 kV., and 3 m for voltages over 50 kV. up to and including 345 kV. and 4.8 m for voltages up to and including 750 kV.

xi) A person shall be designated to observe clearance of the equipment and give timely warning to insure that the required separation is maintained for all operations where it is difficult for the operator to maintain the desired clearance by visual means; While working under HT cables. Electrical department Representative and the job Supervisor must be present throughout the entire
duration of the jib. A written clearance MUST be signed by the Electrical Department, the Mechanical Department and Safety Officer, when Cranes operate near or below H.T. electrical cables.

xii) Cage-type boom guards, insulating links, or proximity warning devices may be used on cranes, but the use of such devices shall not alter the requirements of any other regulation of this part even if such device is required by law or regulation.

xiii) Any overhead wire shall be considered to be an energized line unless and until the person owning such line or the electrical utility authorities indicate that it is not an energized line and it has been visibly grounded.

xiv) Prior to work near transmitter tower where an electrical charge can be induced in the equipment or materials being handled, the transmitter shall be de-energized or tests shall be made to determine if electrical charge is induced on the crane.

xv) The following precautions shall be taken when necessary to dissipate induced voltage:

   a) The equipment shall be provided with an electrical ground directly to the upper rotating structure supporting the boom and

   b) Ground jumper cables shall be attached to materials being handled by boom of equipment when electrical charge is induced while working near energized transmitters. Crews shall be provided with nonconductive poles having large alligator clips or other similar protection to attach the ground cable to the load.

   c) Combustible and flammable materials shall be removed from the immediate area prior to operations.

xvi) No modifications or additions which affect the capacity or safe operation of the equipment shall be made by the employer without the manufacturer’s or a qualified engineer’s written approval. If such modifications or changes are made, the capacity, operation, and maintenance instruction plates, tags, or decals shall be changed accordingly. In no case shall the original safety factor of the equipment be reduced.
3.4.6 Crawler, locomotive, and truck cranes.

i) All jibs shall have positive stops to prevent their movement of more than 5° above the straight line of the jib and boom on conventional type crane booms. The use of cable type belly slings does not constitute compliance with this standard.

ii) All crawler, truck or locomotive cranes in use shall meet the applicable requirements for design, inspection, construction, testing, maintenance and operation as prescribed in the ANSI B30.5-1989, Safety Code for Crawler, Locomotive and Truck Cranes.

3.4.7 Tower cranes.

A. General Requirements

i) Tower cranes shall be erected, jumped and dismantled under the immediate supervision of a competent person, designated by the employer.

ii) Tower cranes shall be erected, maintained and used in accordance with the manufacturer’s specifications, recommendations and procedures. All modifications shall be approved by the manufacturer and engineered by professional engineer. The safety factors shall not be reduced by any modifications. The crane plates and charts shall be changed to reflect any modifications made.

iii) A professional engineer shall certify that the crane foundations and underlying soil are adequate support for the tower crane with its maximum overturning movement.

iv) Tower cranes shall be positioned whereby they can swing 360° without either the counterweight or jib striking any building, structure or other object, except:

   a) If the crane can strike an object or another crane, suitable limit switches shall be installed which will prohibit contact with such objects, or;

   b) 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 cane observed so that the operator(s) can be warned of imminent danger.
c) A secondary means of positive communications shall be established as a backup for possible direct voice communication failure.

v) 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.

vi) Tower cranes erected on a new foundation shall be tested as per following

a) The test shall consist of suspending a load of not less than 110% 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.

b) 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 firm's permanent equipment records. Records shall be made available to authorized representatives of the department, upon request.

vii) 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 radii for each allowable speed and each recommended counterweight load.

a) Such chart shall be posted in the operator’s cabin 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.

b) The chart shall be visible and readable to the operator while at the normal operating position.

viii) Operating controls shall be properly marked to indicate the function of the controls in each position.

ix) An operating and maintenance manual written in the English language shall be provided with each tower crane.

x) Limit switches shall be installed and shall be kept properly adjusted. They shall be protected or isolated in a manner which will prevent unauthorized tampering. Limit switches shall provide the following functions:
a) Safely limit the travel of the trolley to prevent it from hitting the outer end of the jib.
b) Limit the upward travel of the load block to prevent two-blocking.
c) Lower over travel limiting device shall be provided for all load hoist where the hook area is not visible to the operator.
d) Limit the load being lifted in the manner where by no more than 110% of the maximum rated load can be lifted or moved.

xi) 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.

xii) 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.

xiii) 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.

xiv) An approved and safe means shall be provided for access to operator’s cab and machinery platform.

xv) When necessary for inspection or maintenance purposes, ladders, walkways with railing or other fall protection devices must be provided and used.

xvi) 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.

xvii) 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 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.

xviii) All electrical equipment shall be properly grounded and protection shall be provided against lightning.

xix) When the operator is actually operating the crane, the operator shall remain in stationary position.

xx) 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.

xxi) Climbing jack systems used for raising a tower crane shall be equipped with overpressure relief valves, direct-reading pressure gauges, and pilot-operated hydraulic check valves installed in a manner which will prevent jack from retracting should hydraulic line or fitting rupture or fail.

xxii) 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.

xxiii) Counterweights shall be securely fastened in place and shall not exceed the weights recommended by the manufacturer for the length of jib being used. However, an amount of counterweight as recommended by the manufacturer shall be used.

xxiv) Tower cranes shall be inspected and maintained in accordance with the manufacturer’s recommendations or more frequently if there is reason to suspect possible defect or weakening of any portion of the structure or equipment.

xxv) 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.
B. Additional tower crane requirements:

i) An approved method must be instituted for transmitting signals to the operator. Standard hand signals for crane operations must 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 must be used.

ii) Tower cranes shall not be erected or raised when the wind velocity at the site exceeds 20 km.p.h. or that specified by the manufacturer.

iii) Tower crane operators shall be trained and experienced in tower crane operations;

iv) Adequate clearance shall be maintained between moving and rotating structures of the crane and fixed objects to allow the passage of employees without harm.

v) 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 attached to crane or to lifelines.

vi) Buffers shall be provided at both ends of travel of the trolley.

vii) Cranes mounted on rail tracks shall be equipped with limit switches limiting the travel of the crane on the track and stops or buffers at each end of the tracks.

viii) All hammerhead tower cranes in use shall meet the applicable requirements for design, construction, installation, testing, maintenance, inspection, and operations prescribed by the manufacturer.

3.4.8 Overhead and gantry cranes.

i) The rated load of the crane shall be plainly marked on each side of the crane. If the crane has more than one hoisting unit, each hoist shall have its rated load marked on it or its load block, and this marking shall be clearly legible from the ground or floor.

ii) Bridge trucks shall be equipped with sweeps, which extend below the top of the rail and project in front of the truck wheels.
iii) Except for floor-operated cranes, a gong or other effective audible warning signal shall be provided for each crane equipped with a power travelling mechanism.

iv) All overhead and gantry cranes in use, shall meet the applicable requirements for design, construction, installation, testing, maintenance, inspection, and operation.

v) On every stage gantry or other place where a lifting appliance having a travelling steewing motion is in use, an unobstructed passageway not less than 600 amide shall be maintained between.

3.4.9 Derricks.

i) All derricks in use shall meet the applicable requirements for design, construction, installation, inspection, testing, maintenance, and operation.

ii) A competent person shall ascertain the lifting capacity of the derrick and it shall not be overloaded. The test record shall be maintained.

iii) The mast, guy ropes, wire ropes, swivel hook, rope clamps, etc. of the derrick shall be thoroughly checked before erecting the derrick.

iv) All precautions shall be taken so that base of the derrick does not shift or sink.

v) Guys of the derrick shall be anchored tightly with strong structures / hold fasts / Anchorage blocks. The load being hoisted should not run against the derrick.

vi) All welded parts of Derricks (especially in bracing & stiffeners) should be periodically checked for any crack, or detects in metal itself.

vii) If bolted joints are used, check for proper bolts and their tightness.

viii) Derricks when used should be suitably anchored. The length of guy ropes used must not be less than 3 times the stick length. The lifting angle shared be within 5degrees after rigging. The derrick is to be tested to 1.25 times the safe working load. When not in use, the hoisting ropes are to be anchored and the gears properly guarded.

3.5 Rigging Equipments:

3.5.1 General Requirements for rigging equipment-

i) All the rigging equipment should carry their unique identification number & safe working load.
ii) No chain, rope or lifting gear shall be used unless –
   > it is of good construction, adequate strength, suitable quality and free from any defects.
   > it has been tested and examined once in a year for general use and once in six months for hot metal lifting use by a competent person and issued a certificate.

iii) Rigging equipment for material handling shall be visually inspected prior to use on each shift. Defective rigging equipment shall be removed from service.

iv) Only steel chains and slings shall be used for securing / supporting heavy loads (>= 70 kg) and use of Manila ropes, Fiber ropes in rigging activities shall be strictly prohibited for heavy loads.

v) Slings shall not be shortened with knots or bolts or other makeshift devices.

Shock loading is prohibited.

vi) Suitable packing is to be provided to prevent contact with the sling to the sharp edge of the load.

3.5.2 Rigging guide lines:

3.5.2.1 Determine-
   i) What are you going to lift?
   ii) What does it weigh?
   iii) Where is the center of gravity?
   iv) What type of rigging will you use?
   v) What configuration of rigging will you use (type of hitch)?

3.5.2.2 Center of Gravity-
   i) It is always important to rig the load so that it is stable. Load’s CG must be directly under the main hook & below the lowest sling attachment point before the load is lifted.
   ii) Determine center of gravity.
   iii) Place the hook directly above the center of gravity.
   iv) Rig load with pick points above center of gravity.
   v) If pic point cannot be placed above center of gravity, keep sling angle as great as possible.
3.5.2.3 Rigging equipment:

i) Alloy steel chain

ii) Wire rope

iii) Synthetic web

iv) Chain blocks / hooks / pull lifts

**A) Alloy steel chain - Inspection:**

i) A chain in use shall be thoroughly examined once at least every month by a responsible person.

ii) Alloy Steel Chains shall never be welded or exposed to excessive temperatures.

iii) Alloy Steel Chains shall have permanently affixed identification, size, grade and rated capacity

iv) Hooks, rings, welded or mechanical coupling links and other attachments when used with alloy steel chains shall have a rated capacity at least equal to that of chain.

v) Shop made hooks and links or make-shift fasteners, formed from bolts, rods, etc. or other such attachments, shall not be used.

vi) Rings, Hooks, Swivels and end links attached to a chain shall be of the same material as that of the chain.

vii) Chains should not be hammered (especially with load) either to strengthen the links or to force the link into position.

viii) The chain shall be free from bent, twisted, damaged or cracked links.

ix) The safe working load shall be reduced as follows when the diameter of the link is reduced due to wear and tear.
Alloy steel chain- Removal from Service:

Whenever wear at any point of any chain link exceeds 10 per cent reduction in diameter, the chain shall not be used and to be removed from site.

Non-alloy repair links cannot be used.

The stretch in the chains shall not be more than 5% of its original length.

(B) WIRE ROPES:

Wire Rope construction-

Wire Rope Lay-One complete wrap of a strand around the core.

Or

The lengthwise distance on a wire rope in which a strand makes one complete turnaround the rope's axis.
**Inspection & maintenance of Wire Rope**-

i) Every wire rope of lifting appliance and lifting gear shall be inspected by a responsible person for such use once in at least three months.

ii) The safe working load recommended by the manufacturer for various sizes and classification of wire ropes shall be followed.

iii) Wire ropes shall not be secured by knots.

iv) Wire ropes used for construction activities shall have a factor of safety 6 : 1. Only tested wire ropes shall be used.

v) The wire rope should be properly lubricated.

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**Defects in Wire Rope Sling:**

- **Kinking**
- **Bird caging**
- **Crushing**
- **Rusted Wire**

---

**Lubrication**
WIRE ROPES - Removal from Service

i) Each wire rope used in hoisting or lowering or in pulling loads shall consist of one continuous piece without knot or splice.

ii) Wire rope shall not be used if in any length of eight diameters, the total number of visible broken wire exceeds 10 per cent of total number of wires or if the rope shows other signs of excessive wear, corrosion or defect.

iii) In pendants or standing ropes, there should not be more than 3 broken wires in one rope lay / 3 broken wire in one strand. (A rope lay is the length along the rope in which one strand makes a complete revolution around the rope).

iv) Near attached fittings there should not be any broken wires.

v) Reduction in diameter of the rope due to core failure, abrasion, etc. should not be more than:

   a) 1.0 mm for ropes up to - 19 mm dia
   b) 1.5 mm for ropes of 22 - 28 mm dia
   c) 2.0 mm for ropes of 32 - 38 mm dia

vi) Rope stretch should not be more than 150 mm per 30 m length in the six strand wire ropes.

vii) No defects (bird caging, kinks, crushing, core protrusion etc.) shall exist in the wire rope.

Fixing of Wire Rope Clips:
When using U-bolt wire rope clips to form eyes, ensure the "U" section is in contact with the dead end of the rope.
(C) Synthetic Webbing sling- \textit{(Nylon, Polyester and Poly Propylene)}

**Inspection & maintenance of Synthetic Webbing sling-**

i) Synthetic webbing shall be of uniform thickness width and edges shall not be split from the webbing width.

ii) Fittings shall be –
   a) of a minimum breaking strength equal to that of the sling and
   b) free of all sharp edges that could in any way damage the webbing.

iii) Attachment of end fittings to webbing and formation of eyes-
   a) Stitching shall be the only method used to attach end fittings to webbing and to form eyes. The thread shall be in an eyes pattern and contain a sufficient number of stitches to develop the full breaking strength of the sling.

**Environmental Conditions-**

i) When synthetic web slings are used the following precautions shall be taken.
   a) Nylon web slings shall not be used where fumes, vapors, sprays, mists or liquid of acids or phenol are present.
   b) Polyester and polypropylene web slings shall not be used where fumes, vapors, sprays, mists or liquids of caustics are present.

**Synthetic Webbing sling - \textit{Removal from Service}**

Synthetic web slings shall be immediately removed from service if any of the following conditions are present.
a) Acid -or caustic burns.
b) Melting or charring of any part of the sling surface.
c) Snags, punctures, tears or cuts.
d) Broken or worn stitches or Distortion of fittings.

(D)Chain blocks / hooks / pull lifts: Inspection and Maintenance-

i) The Chain Blocks should have safety Latch both in the Top & the Bottom hook

ii) Chain blocks of proper lifting capacity supported by Test Certificate should be used for lifting known loads.

iii) Chain block must be checked, and tested periodically. It should be lubricated before every use.

iv) Never use undue effort to force the block to operate.

v) Ensure the slings are secure and load is free to be lifted.

vi) It should operate freely and the chain should not come out of pulleys.

vii) Ensure suspension points and anchorages are adequate for the full imposed load.

viii) Position the hook over the center of gravity of the load.

ix) No chain block / puller which has been tampered, be used unless it is thoroughly checked and tested by competent person.

x) Chain block / puller must be checked if stored for longer time, by subjecting to shock load, to observe slipping of load, jamming of links etc.

xi) Use wire rope / sling for tying in (do not use Manila or Fibre Rope for tying purposes)
3.6 STORING MATERIALS IN SAFE MANNER AT OPEN YARDS AND OTHER STORAGE PLACES IN STEEL INDUSTRY-

General Requirements:

3.6.1 Planning of Storage Layout

For any site, there should be proper planning of the layout for stacking and storage of different materials, components and equipments with proper access and proper manoeuvrability of the vehicles carrying the material. While planning the layout, the requirements of various materials, components and equipments to be stored shall be considered.

3.6.2 Following points should be taken into consideration for storing the material:

i) Materials stored at site shall not obstruct fire & smoke detectors and fire detection panels, fire extinguishers, fire hydrant points, first-aid equipment, lights, electrical switches, gas line drip pots, water seals and other emergency items/ equipments.

ii) All spares shall be placed in such a manner so that leaving clear access of at least 1 meter from such emergency items/ equipments.

iii) All spares shall be segregated and stored at designated places.

iv) Storage areas shall be kept free from accumulation of materials that constitute hazards from tripping, fire or explosion.

v) The permanent material storage area shall be hard barricaded and material stored temporarily may have indicative abreaction provided the stored material are stable and fully secured. No material shall protrude beyond the barricade.

vi) No material shall be stored or lie on the pathway, to avoid tripping hazards. Aisles and Passage-ways shall be kept clear to provide for the free and safe movement of Material handling equipment and people.
vii) Any pipe line (water supply, gas etc.) or electrical installation should not be used for Supporting any material or hanging load.

viii) All material stored in tiers shall be stacked, racked, blocked or otherwise secured to prevent sliding, falling or collapse, toppling.

ix) Incompatible material shall be stored in segregated manner so as not to cause fire/ other emergency situation.

x) Combustible materials such as packing boxes, fuel, lubrication and gunny bags are to be kept separately on designated areas for disposal, away from any ignition source to prevent fire.

xi) All materials shall be stacked tidily, firmly and maximum up to man height to prevent them from falling or causing some other pile to fall. In case of big material (more than man height), extra precaution should be taken like restriction of unauthorized entry, securing of material for preventing it from displacing.

xii) Power lines & Emergency equipment: Do not store materials under power lines or where materials may block access to emergency equipment.

xiii) Barricading: Spare yard should be barricaded, named and gates should be provided with locking provision. Only authorized person will allow entry of materials for unloading and loading in the Storage place. The storage place should be under lock & key rest of the times.

xiv) SOP’s for material handling: All Storage places/ yards should have approved SOP for handling and storage of materials.

xv) Training: Only trained person on material handling SOP’s should bellowed to handle the material.

xvi) Test certificates of tools & tackles: All the material handling equipment e.g. sling, D shackles, hook of the crane etc. should have valid test certificate readily available at the site for verification.

xvii) Location for Spares: All the spares should be kept only at their designated locations with UI numbers/ name of the spares mentioned on a tag. An inventory register to be maintained for each storage place.

3.6.3 Specific Requirements:

3.6.3.1 Pipes and Conveyor pulley-
i) Pipes and Conveyor pulley shall preferably be stored on appropriately designed sills or racks, and must be safely blocked to prevent rolling or spreading.

ii) Alternately, pipes of diameter higher than 300mm may be stored on ground with maximum two layers high and with proper use of choker block and Dunnage, in order to prevent rolling. When stacked in such fashion, the top most pipes are to be taken out first for use.

iii) When many small diameter pipes/rods are stored on ground, the pipes/rods are to be bundled into 3-4 units. Proper guards are to be provided to arrest any accidental rolling of the pipes.

iv) Stopping of rolling or sliding of pipes or Conveyor pulley with hands or feet is strictly prohibited.

3.6.3.2 Fabricated items:

i) Fabricated material shall be checked for stability at ground level. It is to be ensured that there is no chance of tilting, falling or rolling or slipping of material.

ii) The ground shall have sufficient strength to bear weight of the fabricated items.

iii) Fabricated items shall not be placed on loose soil.

iv) The storage area must be properly barricaded.

3.6.3.3 Sheet material:

All bundles shall be separated by strips of wood to facilitate handling, to minimize chances of shifting or sliding of the piles of material.

3.6.3.4 Scaffolding Materials:

i) All Material and parts of scaffold, when not in use shall be kept under good condition at designate place.

ii) Good Scaffold materials should not be mixed with scrap materials and parts.

3.6.3.5 Scrap Materials:

i) Scarp shall be removed from Storage Yard and disposed off promptly. Before Removal, scrap storage area shall be kept under barricading.
ii) Packaging material should be disposed off quickly and shall not be allowed to remain at storage yard.

iii) Wooden material with projected nail shall not be stored for future use. If the wooden materials are needed, all nails are to be removed, by appropriate means.

3.6.3.6 Fabrication Debris:

i) Debris shall not be thrown from upper stories, but be removed either by machinery or enclosed tilted passage / enclosed chutes. Accumulated debris shall be appropriately barricaded.

ii) All waste material and rubbish shall be removed from the immediate work area as the work progresses.

iii) All solvent waste, oily rags and flammable liquids shall be kept in metal containers with lid. These wastes shall be kept away from other combustible material (such as wood, papers, tyres etc.) & ignition source.

iv) Waste bins shall be kept at designated places for collection of different categories of wastes (ferrous / non-ferrous / other waste.

3.6.3.7 Slab/ Coils:

The maximum safe height of stacking is up-to 2 meters.

3.6.3.8 Impeller Fan with its Shafts:

Fan with Shaft should be kept at a rigid frame with saddle to avoid bending & rolling of the impeller fan shaft.

3.6.3.9 Heavy structure / Spares:

Stair should be provided for climbing on the spares more than 6 feet height for mounting of sling during lifting & lowering the heavy structures / spares in the yard/storage place.

3.6.3.10 Handling and Storage of Conveyor belts:

3.6.3.10.1 Handling:
i) Conveyor belts are generally supplied in cylindrical wooden or steel reels and in cases of overseas transportation, in fully enclosed steel reels, racetrack or similar.

ii) The reels are always equipped with a square centre to take each company’s winder shaft.

iii) Insert the shaft and make sure that it is protruding at least 200mm from each side to accommodate the slings or the forklifts. To avoid damaging belt edges you should use a spreader bar.

iv) The best practice for running out the belt is to use a braked stand. Small roll can be pulled from a freewheeling stand however, care should be taken to avoid the belt from running away.

v) If the belt is to be dragged along the ground, then care should be taken to ensure that no objects are blocking the area and the dragging area should be barricaded with indicative barricading tape.

vi) In cases, there is a headroom limitation it may be necessary to remove the belt from its reel and store it in a flat position. If that happens make sure that large loops are maintained to prevent carcass fracture.

3.6.3.10.2 Storage:

In any case the conveyor belts must be stored upright in the factory package until used, protected from direct sunlight and permanent water. The storage area shall be prepared for stable putting down of the reels and preventing the belts from being damaged by foreign parts.

A cool dry warehouse, free from direct sunlight, oil, or corrosive fumes is recommended.

3.6.3.10.2 Points of attention:

i) Ensure the soundness of the wrapping.

ii) Do not lean the belt against walls as this can cause telescoping.

iii) Before lifting the belt ensure that facilities can handle the weight and the dimensions, which are always marked on the reel side.

iv) If prolonged intermediate storage is necessary, it is advisable to suspend the coiled belt with one axle in two movable stands. If this is not feasible, the coil should be turned at intervals to change the contact surface.
v) In case of prolonged storage in the open air (for steel cord belts) the cut edge at the start and end of the belt must be protected from moisture. It may be advisable to coat the cut edge with cold splicing cement.

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<thead>
<tr>
<th>Sr. No.</th>
<th>Description</th>
<th>Status</th>
<th>Remark</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Planning of the layout for tacking and storage of materials are done.</td>
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<tr>
<td>2</td>
<td>Proper access of the vehicles carrying the material is provided</td>
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<td>3</td>
<td>Gap between fire detectors &amp; panels, fire extinguishers, first-aid equipment gas lines and other emergency equipments is at least one meter.</td>
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<td>4</td>
<td>Yard has designated place for stacking all kinds of materials/Spares.</td>
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<td>5</td>
<td>All materials/spares are segregated and stored at designated Places</td>
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<tr>
<td>6</td>
<td>Proper access has been made to reach to every material/spare</td>
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<tr>
<td>7</td>
<td>Storage areas are free from accumulation of materials that constitute hazards from tripping, fire or explosion.</td>
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<tr>
<td>8</td>
<td>Material storage area is appropriately barricaded and no materials are protruded beyond the barricade.</td>
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<td>9</td>
<td>No pipe lines (water supply, gas etc.) or electrical installations have been used for supporting any material or hanging any load.</td>
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<td>10</td>
<td>All material stored in tiers are stacked, racked, blocked or otherwise secured to prevent sliding, falling or collapse, toppling.</td>
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<td>11</td>
<td>Designated disposal places and bins for scraps like packing boxes, fuel, lubrication and gunny bags are provided.</td>
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<td>12</td>
<td>All materials are stacked tidily and up to a safe height to prevent them from falling or causing some other pile to fall.</td>
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<tr>
<td>13</td>
<td>No materials are stored under the power lines.</td>
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<tr>
<td>14</td>
<td>Spare yards are barricaded with controlled access.</td>
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<tr>
<td>15</td>
<td>Layout/ drawing of spare/ storage yard is available.</td>
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<tr>
<td>16</td>
<td>Spare yard has SOPs for loading / unloading process.</td>
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<td>17</td>
<td>Employees engaged in material handling at Spare yards are trained on material handling activities.</td>
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<tr>
<td>18</td>
<td>All the material handling equipment used at Spare yard is tested and certified.</td>
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<tr>
<td>19</td>
<td>Appropriately designed sills or racks are provided to stovepipes and Conveyor pulley to prevent rolling or spreading.</td>
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<tr>
<td>20</td>
<td>Pipes of dia more than 300mm is not stacked in more than two layers high</td>
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<tr>
<td>21</td>
<td>All fabricated materials are tested for its stability at ground Level.</td>
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<td>22</td>
<td>Stacking place of fabricated material is tested for its supporting strength. During stacking the material all care of soil / ground quality has been considered.</td>
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<tr>
<td>23</td>
<td>There is a schedule of disposal of waste material from spare yards. Sufficient bins are provided for it.</td>
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<tr>
<td>24</td>
<td>All Impellers, motors, rotors, gear box etc. are stacked on rigid frame with saddle/ support stand.</td>
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<tr>
<td>25</td>
<td>Proper access provided for safe access to heavy structures having height more than 6 feet.</td>
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<tr>
<td>26</td>
<td>Sufficient support provided to prevent falling of any unbalanced material stacked in yard.</td>
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</tr>
</tbody>
</table>
| 27 | Schematic diagram of the storage place is displayed at each Entry/ exit point indicating:  
  a. ‘You are here’ at each entry point.  
  b. Layout for stacking and storage of different materials, components and equipments with proper access and pathway directions.  
  c. Location of Fire extinguishers, Fire hydrant & fire alarms & nearest First Aid Box.  
  d. Display of “Unauthorized entry prohibited”.  
  e. Area ownership board is displayed. |
| 28 | Relevant Standard Operating Procedures (SOPs) for handling and storage of materials, training record of the concerned employees on the SOP are available at shop floor. Visual SOP should also be displayed. |
| 29 | MSDS is available and displayed for storage of any hazardous chemical in the stores. |
| 30 | All the electrical panels, DBs, switch board have proper Nomenclature. |
| 31 | Monthly audit system of Storage places/ yards against the standard is in place. |
| 32 | Proper visuals and cautionary signage’s are provided in spare yards with Emergency numbers, name of area owner. |
Signage can be used:

Signage of POISONOUS gas to be displayed wherever material is to be stored near the gas lines.
Signage are from http://www.freesignage.com/osha_caution_signs.php
Some good and bad examples of keeping spares:
References:

1. IAPA Manual,
2. IPSS: 1-11-024-16 & IPSS: 1-11-027-16
3. ISO Standard -11228 guidelines
5. SS/Gen-52-Tata Steel