Heavy Equipment Movement Safety Procedure

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1. OBJECTIVE:

Objective of this procedure is to cover the safe practices required for heavy equipment lifting and movement. This procedure is developed to establish mandatory requirements for practices to protect personnel from hazards associated with heavy equipment movement activities.

2. SCOPE:

This procedure applies to all operating plants and project sites of Tata Power Group companies including JVs/Subsidiaries.

3. EXPECTED RESULTS:

3.1. Manage jobs related to Heavy Equipment movement being done safely.
3.2. Control of incidents related to Heavy Equipment movements.
3.3. Compliance to Regulatory requirements related to Heavy Equipment Movement.

4. ACCOUNTABILITY & RESPONSIBILITY:

4.1. ACCOUNTABILITY: Concerned Division's Heads/Assets Custodian.
4.2. RESPONSIBILITY: Concerned Engineer/s

5. GLOSSARY/ DEFINITIONS:

Approver: Location Manager in charge of plant/dept. Authorized shall be as Per the permit to work procedure.

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.

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

Abnormal operating conditions—Environmental conditions that are unfavorable, Harmful, or detrimental to the operation of a mobile crane (e.g., excessively high or low ambient temperatures, exposure to weather, corrosive fumes, dust-laden or Moisture-laden atmospheres, and hazardous locations).

Competent Person - One who, by possession of a recognized degree, certificate, or professional standing and certified by government authority.

Critical lift—A lift using an Mobile crane where, because of the characteristics and properties or travel path of the load, a hoist failure or loss of control of the load could result in a serious personal injury, serious environmental incident, serious process safety incident, or significant disruption to operations.

Capacity loading - It 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%.

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

Hazard Identification & Risk Assessment - Hazard Identification & Risk Assessment is to identify and evaluate the hazards, Risk and put controls measures for safe execution of activities.

Hazard - Source or situation with potential for harm, something that can cause body injury / occupational illness, damage company property.

HIRA - Hazard Identification and Risk Assessment

Intended load = Dead load + Live load + wind load + Dynamic load.

Job - A piece of physical work defined by time or other limits and that has a clear start and end point.

JSA - Job Safety Analysis

Job Safety Analysis: Job safety analysis (JSA) is a procedure which helps integrate accepted safety and health principles and practices into a particular task or job. In a JSA, for each basic step of the job, it is to identify potential hazards and to recommend the safest way to do the job.

LEL - Lower Explosive Limit

LOTO - Lock Out Tag out

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 center of crane rotation meets the ground and the vertical centerline 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.

Non Routine Job / Task: Where an SOP / SMP is not available or the conditions of the SOP / SMP have changed

PPE - Personal Protective Equipment

PTW - Permit to Work

Periodic Inspection - Detailed safety and maintenance inspection performed by a qualified person to verify compliance with the provisions of legal requirements.

Risk - The likelihood (probability) which can lead to potential negative consequences.

Risk Assessment - A systematic and structured process whereby hazards present in a workplace, or arising from workplace activity, are identified, risks assessed / evaluated, and decisions prioritized in order to reduce risks to acceptable levels.

Rated load (capacity) - the maximum load designated by the manufacturer for which an individual hoisting system component is designed and built.

Shall - Mandatory requirement

Should - Optional requirement

SHE - Safety, Health and Environment

Severity - The level of consequence / harm of an event that could occur due to exposure to the hazard present.

SWL - Safe working load

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 85% of the load test value shall be considered as safe workload.

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.

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”.

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).

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

Task / Activity - A sequence of steps taken to conduct a job. A task is a sub element of a Job.

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

6. PROCEDURES:

6.1. Manual hoisting systems: This section describes the safety features for all new and existing manually powered chain hoists and lever-operated hoists.

6.1.1. New Manual Hoisting Systems Installation: All new manual hoisting systems shall meet the following mandatory requirements:

6.1.1.1. **Rated Load** - The rated load shall be marked on each hoist or lifting device and on the trolley if the hoist is hook-mounted (i.e. easily detached). These markings shall be clearly legible from the operating floor.

6.1.1.2. **Load Test** – The initial load test of manual hoisting systems will be 1.5 times the rated load. All subsequent tests of new hoisting systems and hoists with modified or altered load-suspension parts shall be load-tested before being placed in normal service. The load test shall not be less than 100 percent or more than 125 percent of the rated load unless recommended by the manufacturer or a competent person or regulatory requirements.

6.1.1.3. **Overload Limiting Devices** - Chain hoists and lever-operated hoists used for overhead lifting or drifting of loads shall be equipped with automatic overload devices to prevent lifting over capacity loads. The overload limiting device shall not exceed load test limit of the hoist's capacity. Lever-operated hoists shall have either a slip clutch overload limiting device or an overload-sensing lever handle.

6.1.1.4. **Load brakes** - Chain hoists and lever-operated hoists used for overhead lifting or drifting shall be equipped with an independent mechanical load brake to control the lowering of the load and to stop and hold a rated load. For lever-operated hoists, simple ratchet-and-pawl type brakes shall not be used for hoisting applications because of the risk of sudden or uncontrolled load drop if the ratchet-and-pawl mechanism fails.

6.1.1.5. **Trolley Safety lugs/rail sweeps** - Where hoists are mounted on trolleys, the trolley shall be equipped with safety lugs/rail sweeps, which protect against load drop in the event of wheel axle failure.

6.1.1.6. **Roller chain and wire rope hoists** - Roller chain hoists and wire rope lever-operated hoists shall not be used in overhead hoisting systems.

6.1.2. Existing manual hoisting systems, installation

6.1.2.1. With the exception of overload-limiting devices, all existing manual hoisting systems shall meet all mandatory requirements for new systems. Existing hand-operated chain hoists not equipped with an overload-limiting device shall only be used under the following conditions:

6.1.2.1.1. The hoist shall be used under strict administrative controls that prohibit the hoist from being placed in any over-capacity condition.

6.1.2.1.2. The hoist shall be labeled with a permanent tag to indicate the absence of an overload-limiting device.

6.1.2.1.3. The hoist shall not be used to conduct a critical lift.

6.2. Electrical and Air Powered Overhead Hoists and Cranes:

This section describes safety features for all new and existing, overhead-supported, Powered hoists.

6.2.1. New electrical and air-powered hoisting Systems Installation

6.2.1.1. All new electric and air-powered hoist and crane installations must meet the following mandatory requirements. For precise movement and control two speed hoists shall be used.

6.2.1.2. **Rated load:** The rated load shall be marked on each hoist or lifting device and on the trolley if the hoist is hook-mounted (i.e., easily detached).These markings shall be clearly legible from the operating floor and markings shall be on both sides for top-running cranes.

6.2.1.3. **Load test:** All new hoisting systems and hoists and cranes with modified or altered load-suspension parts shall be load tested. The initial load test of electric or air powered hoisting systems will be 1.5 times the rated load. All subsequent load tests shall not be less than 100 percent or more than 125 percent of the rated load unless otherwise recommended by the hoist manufacturer or a competent person or regulatory authorities.

6.2.1.4. **Overload limiting device**: Powered hoists shall be equipped with an overload-limiting device to prevent the hoist from lifting over-capacity loads. The overload limiting device shall not exceed the test load limit of the hoist's rated load for electric/electronic load cell or mechanical devices. For air-powered hoists, this mandatory requirement for an overload-limiting device can be satisfied if the hoist is equipped with an air motor that shall not exceed of the rated load at standard operating pressure.

6.2.1.5. **Dual braking system**: Powered hoists shall be equipped with dual braking systems. All hoists must be equipped with a primary brake. A second braking system shall be one of the following:

6.2.1.6. An independent mechanical load brake that controls the lowering of the load and stops and holds a rated load if the primary brake fails;

6.2.1.7. Self-locking worm gear (40:1 ratio), which acts as an additional braking system because the self-locking worm feature acts as a holding brake.

6.2.1.8. Trolley safety lugs/rail sweeps: Trolleys and crane end trucks shall be equipped with safety lugs/rail sweeps to prevent the load from dropping if the trolley or end truck wheel axle fails.

6.2.1.9. Roller chain: Roller chain hoists shall not be used for overhead hoisting systems.

6.2.1.10. "Dead man" controls: All powered hoists and cranes shall be equipped with "dead man"- style controls that, when released, return to the off position and stop powered motion.

6.2.1.11. Clearly marked control station device: All pushbuttons shall have clear, legible markings to indicate all control station equipment functions.

6.2.1.12. Upper final limit device: All wire rope hoists shall have an upper final limit device to stop the upward hoisting motion beyond safe limits. For electric powered wire rope hoists, this upper final limit device is typically a weight or paddle upper limit switch. This switch shall be connected to open the mainline contactor in the motor feed circuit. A reset button must bypass the limit switch contact to provide the means of re-closing the contactor. This reset button shall immobilize the upward motion and allow the load to be safely lowered. It is preferred that the reset button be located in the control enclosure.

6.2.1.13. Over-travel protection: All chain hoists shall be designed and constructed so that the load hook shall not exceed the upper limit of travel.

6.2.1.14. Geared limit device: All powered wire rope and chain hoists shall be equipped with geared limit devices that prevent over travel while either raising or lowering the hook or load.

6.2.1.15. If an air-powered chain-hoist is equipped with physical chain stops that prevent chain over travel and a load-limiting device, then geared limit devices are not required. A permanent tag indicating the absence of a geared limit device shall be attached to any hoist without geared limit devices.

6.2.1.16. Trolley and crane bridge travel limit devices: Motorized trolleys and motorized crane bridges shall be equipped with travel limit devices to stop travel motion before the trolley or bridge strikes the end stops.

6.2.1.17. Mainline contactor: Electric powered hoists and cranes shall be equipped with a magnetically operated mainline contactor that interrupts power to all motors and is energized from the pendant pushbutton station. Momentary pressure on the Push button shall de-energize the mainline contactor.

6.2.1.18. Electrical grounding conductor: Electric hoists shall have a dedicated electrical grounding conductor in the electrification and control system to positively ground or earth all equipment.

6.2.2. Existing electric and air-powered hoisting systems, installation

6.2.2.1. All existing electric and air-powered hoist and crane installations must meet either the mandatory requirements for new installations.

6.2.2.2. If an electric chain hoist has a defective or damaged mainline contactor or if an electric powered hoist has a defective or damaged geared limit device or if any.

6.2.2.3. hoist does not have operable dual brakes (e.g. one brake is defective or damaged), then the following steps must be done:

6.2.2.4. Operator or Field Engineer must notify the Site/Project Manager of the abnormal condition immediately.

6.2.2.5. The damaged or deficient hoist or crane shall not be used. The damaged or deficient hoist or crane must be repaired and verified by field engineer.

6.2.2.6. Mainline contactor (chain hoists) administrative controls – All existing electric chain hoists without slip clutch overload protection shall be retrofitted with a mainline contactor circuit. All electric chain hoists with slip clutch overload protection, but without a mainline contactor, shall be equipped with a permanent tag indicating the absence of the mainline contactor.

6.2.2.7. Any electric chain hoist with slip clutch overload protection, but without a magnetic mainline contactor circuit, shall have an electric powered manual disconnect switch that is within sight of the hoist and accessible to the operator.

6.2.2.8. Administrative controls shall be employed to help ensure that the operator knows the location of the manual disconnect switch.

6.2.2.9. Mainline Contactor: Electric powered hoists and cranes shall be equipped with a magnetically operated mainline contactor that interrupts power to all motors and is energized from the pendant pushbutton station. Momentary pressure on the Push button shall de-energize the mainline contactor.

6.2.2.10. Geared limit device administrative controls - All electric powered hoists without geared limit devices shall employ administrative controls to help ensure that the upper final limit device or over travel protection is not used as a routine upper travel limit. A permanent tag indicating the absence of a geared limit device shall be attached to the hoist.

6.2.2.11. Dual brake deficiency - All hoists without an approved secondary braking system shall employ administrative controls to prevent the hoists from being used in critical lifts in which an uncontrolled load drop could cause a serious injury or incident. These hoists shall be equipped with a permanent tag indicating the absence of a secondary braking system. The administrative procedures are meant to keep personnel away from the load during hoisting operations and prevent the hoist from being used for critical lifts.

6.3. Overhead Hoisting Monorails Installation:

Important safety features for overhead hoisting monorails include the following:

6.3.1. Monorail end stops - All monorails shall have permanent end stops provided at the extremes of hoisting equipment travel.

6.3.2. Switches, turnarounds, lift sections, and other monorail track ends shall be provided with automatic safety stops to prevent trolleys from rolling off open ends.

6.3.3. Where a section of track must be opened to allow for the closing of fire doors, automatic track openers shall be provided. These devices must be so constructed that the closing of the door (i.e., manually or because of a fusible link's parting) opens the track and allows the door to close tightly. Track safety stops shall be automatically placed and retracted as the track is opened and closed.

6.3.4. Monorail extension modification - Whenever a monorail is extended, it shall be designed to carry the design load of the original system. The track sections must be compatible to help ensure that the trolleys do not slip off the different track sections.

6.3.5. Rated load markings - The rated load shall be marked on the monorail, and the markings shall be clearly legible from the operating floor. For lifting lugs that support hoisting equipment, the rated load shall be marked on the lug or in close proximity to it and shall be clearly legible from the operating floor.

6.3.6. Load test - All new monorails and recently modified or altered monorails shall be load-tested before being placed in normal service. The initial load test of the monorail will be 1.5 times the rated load. All subsequent load tests shall not be less than 100 percent or not more than 125 percent of the rated load unless recommended by the manufacturer or a qualified person.

6.3.7. The load test must be in line with the requirements of the statutory agency.

6.3.8. Multiple hoists on a single monorail - If multiple hoists are used on a single monorail, the sum of the hoist capacities should not exceed the marked monorail rated load. Where this is impractical, strict administrative control and proper hoist operating instructions shall be provided to prevent overloading of the monorail.

6.4. Inspection:

6.4.1. Initial inspection: Prior to initial use, all new, reinstalled, altered, or modified overhead hoisting systems shall be inspected by the Competent person to verify compliance with the applicable provisions of this standard. Records of inspections shall be maintained.

6.4.2. Inspection procedure for overhead hoisting systems: The inspection frequency for overhead hoisting systems in regular service is divided into two general classifications based on the service frequency of the hoist or crane.

The service frequency affects the nature of the critical components of the hoisting system and the degree of their exposure to wear, deterioration, or malfunction.

6.4.3. Inspections shall be done by the operator at prior to use every day.

6.4.4. Inspections shall be done by competent person every year as per legal requirements.

6.4.5. Preventive Maintenance: A preventive maintenance program shall be established and based on the equipment manufacturer. Dated records should be kept. Replacement parts shall be, at least, equal to the original manufacturer's specifications.

6.4.6. Maintenance procedure: Before adjustments and repairs are started on a hoisting system, the following precautions shall be taken:

6.4.6.1. If a load is attached to the hoisting system, it shall be removed.

6.4.6.2. If the hoisting system is electrical- or air-powered, all controllers shall be placed in the "off" position.

6.4.6.3. If the hoisting system is electrical- or air-powered, a lockout/tag out procedure shall be performed.

6.4.6.4. Any crane or monorail carrier shall be moved to a location in which it causes the least interference with other cranes or carriers on the system and operations in the area.

6.4.6.5. Effective warning signs and barriers shall be used where the maintenance work creates a hazardous area on the floor below the hoisting system.

6.4.6.6. Where other cranes or carriers are in operation on the same runways or monorail track, rail stops or a signal person shall be provided to prevent contact with the idle equipment.

6.4.6.7. Where runways are adjacent to the crane runway of the crane being repaired, and the center runway or center repair platform, or both becomes a work area that is not protected by wire mesh or other suitable protection, or if any hazard from the adjacent operations exists, the adjacent runway must also be restricted.

6.4.6.8. When cranes must operate on adjacent runways and through the restricted area, a signal person shall be provided.

6.4.6.9. All cranes shall come to a full stop prior to entering the restricted area and then are permitted to proceed through this area on a signal from the signal person.

6.4.6.10. If the hoist is suspended from a trolley, provisions should be taken to prevent movement of the trolley.

6.4.6.11. After adjustments and repairs have been completed and before the hoist is restored to normal operation, the following steps shall be taken:

a. Guards shall be reinstalled.

b. Safety devices shall be reactivated.
c. Parts that have been replaced and loose material shall be removed.
d. Maintenance tools (including hand tools) and equipment shall be removed.
e. Warning signs and barriers, when used, shall be removed.
f. Warning signs and barriers, when used, shall be placed and removed only by designated persons.

6.5. Operation:

6.5.1. Operators of overhead hoisting systems: Hoisting systems shall be operated only by the following personnel:

a. Qualified operators,
b. Maintenance and test personnel, when hoist system operation is performed as part of their duties and they are qualified operators,
c. Inspectors of hoisting systems who are qualified operators.

6.5.2. Operators shall attend formal training or instructions on the operation of the specific hoisting device or crane. Attendance shall be recorded. Operators shall be required to pass a practical operating examination. The practical operating examination must include actual operation of the specific hoisting device or crane in the presence of an experienced supervisor or qualified person who will verify the competence of the operator under examination. Successful "pass" of the examination shall be recorded. Failure requires repeat training and re-examination until "passing" mark is obtained.

6.5.3. Qualifications shall be limited to the specific type of equipment for which the operator was examined and passed. If an operator has not operated a specific type of equipment in the previous 12 months, he or she shall be re-qualified.

6.5.4. Before operating a hoisting system

6.5.4.1. The operator shall be familiar with all operating controls including remote control unit of the hoisting system and be instructed in the operation(s) to be performed. Instructions shall include, as applicable, the warnings on the hoist, the hoisting practices listed in this section, and the operation instructions portion of the manufacturer's manual.

6.5.4.2. If adjustments or repairs are appropriate or any defects are known, the operator shall report this promptly to the designated person.

6.5.4.3. The following restrictions shall be observed:

6.5.4.3.1. The operator shall not operate a hoisting system that bears an out- of-order or "do not operate" sign.

6.5.4.3.2. The operator shall not adjust or repair a hoisting system unless qualified to perform maintenance on it. Only a qualified maintenance person from OEM (Original Equipment Manufacturer) shall perform repairs to a hoisting or crane system.

6.5.4.3.3. The chain or rope shall not be used as a ground for welding.

6.5.4.3.4. A welding electrode shall not be touched to the chain or rope.

6.5.4.3.5. Hand-chain-operated hoists shall only be operated with hand power with no more than one operator operating each hand chain.

6.5.4.3.6. Manually operated lever hoists shall not be operated with an extension on the handle.

6.5.5. Applying the load: The following mandatory requirements shall be in effect when the load is applied:

6.5.5.1. The hoist rope or chain shall not be wrapped around the load.

6.5.5.2. The load shall be attached to the load hook by suitable means.

6.5.5.3. The sling or other device shall be properly seated in the base (i.e., bowl or saddle) of the hook. The hook latch shall not be allowed to support any part of the load.

6.5.5.4. The load shall not be applied to the point of the hook.

6.5.5.5. Before moving the load, the operator shall ascertain that chains or wire rope are not kinked or twisted or that multiple part chains or ropes are not twisted about each other.

6.5.5.6. The hoist shall not be operated unless the rope or chain is seated properly on the drum, sheaves, or sprockets.

6.5.5.7. Hoisting systems shall not be operated unless the hoist unit is centered over the load, except when authorized by a qualified person who has determined that the components of the hoist and its mounting would not be overstressed. If a load that is not centered under the hoist unit is to be picked up, precautions shall be taken to control the swing of the load when it is picked clear of its supports.

6.5.5.8. The operator shall not pick up a load in excess of the rated load for any of the individual hoisting system components (hoist, trolley, monorail, crane, lifting lug). A hoist overload-limiting device shall not be used to measure the maximum load to be lifted.

6.5.5.9. Specific attention should be given to balancing of the load and hitching or slinging to prevent slipping of the load.

6.5.6. Moving the load: The following mandatory requirements shall be observed when moving a load.

6.5.6.1. The operator shall not engage in any activity that diverts the operator's attention while operating the hoist. The operator shall be focused only on proper lifting operation.

6.5.6.2. The operator shall respond to signals from the designated person only.

6.5.6.3. However, the operator shall obey a stop signal at all times, no matter who gives it.

6.5.6.4. The operator shall not lift or lower a load with the hoist until the operator and all other personnel are clear of the load.

6.5.6.5. The operator shall be very clear about the path of the load to be travelled .Any obstruction in the path shall be identified and removed before starting movement of the load

6.5.6.6. The operator shall determine that there is adequate clearance between the load and hoisting system and all obstacles before moving or rotating the load.

6.5.6.7. The operator shall inch powered hoists slowly into engagement with a load. The operator should minimize inching and avoid quick reversals of direction.

6.5.6.8. A load shall not be lifted more than a few inches until it is well balanced in the sling or lifting device.

6.5.6.9. The place where the load is going to park should be checked for its levelness and strength in order to avoid imbalance while parking either in the vehicle or ground.

6.5.6.10. Each time a load approaching rated load is handled, the operator shall check hoist brake action by lifting the load clear of supports and continuing only after verifying that the brake system is operating properly.

6.5.6.11. On rope hoists, the load shall not be lowered below the point where less than two wraps of rope remain on each anchorage point of the hoist drum, unless a lower limit device is provided. In this case, no less than one wrap should remain on each anchorage point of the hoist drum.

6.5.6.12. The operator shall not carry loads over people at any time.

6.5.6.13. Personnel shall not be carried on the hook or the load at any time.

6.5.6.14. The operator shall avoid swinging the load or load hook when traveling the hoist.

6.5.6.15. On trolley mounted hoists contact between trolleys or between trolleys and stops should be avoided.

6.5.6.16. The operator shall not use the upper (or lower, if provided) limit device(s) as a normal means of stopping the hoist. These are emergency devices only.

6.5.7. Parking the load:

6.5.7.1. The operator shall not leave a suspended load unattended.

6.5.7.2. The load block should be positioned above head level for storage when not in use.

6.5.7.3. Care shall be exercised when removing a sling from under a landed and blocked load. The person who is removing the sling shall protect himself with appropriate PPE and position himself to avoid being struck or pinched by the sling.

6.5.8. Limitations on Lifts: Lifts in excess of the rated load shall not to be performed at any time.

6.5.9. Critical lifts: Every critical lift shall have a completed critical lift plan. Critical lift best practice for overhead crane equipment is attached in Annexure - 1.

7. Records:

7.1. Daily/Periodic Hoist/Monorail Inspection Forms (TPSMS/CSP/HEMS/005/FORM001, 002 & 003) - Retention - One (1) years

7.2. Annual Checklist / Form filled by competent person as per Factory Act - Retention – Three (3) years

8. Training & Communication:

8.1. Training of Heavy Equipment Movement Safety procedure shall be carried out to cover for following-

a) Operator
b) Rigger & Signalman

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

9. VERIFICATION

9.1. Verification of implementation shall be done during Heavy Equipment Movement Safety procedure audit, field safety visit and site inspections.

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

11. REFERENCES

- Indian Factory Act 1948 and State Factory Rules
- Permit-To-Work Procedure : (TPSMS/CSP/PTW/008)
- Job Safety Analysis (JSA) Procedure : (TPSMS/CSP/JSA/009)
- Hazard Identification & Risk Assessment (HIRA) Procedure : (TPSMS/GSP/HIRA/005)
- Lockout/Tag out Standard and Procedure : (TPSMS/CSP/LOTO/001)
- American Society of Mechanical Engineers (ASME) B30.2-2001, Overhead and Gantry
  Cranes—Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist
- ASME B30.11-1998, Monorails and Underhung Cranes
- ASME B30.16-1998, Overhead Hoists (Underhung)

- ASME B30.17-1999, Overhead and Gantry Cranes (Top Running Bridge, Single Girder, Under hung Hoist)
- ASME B30.21-1999, Manually Lever-Operated Hoists

12. Review:

12.1. 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.

12.2. 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.

13. ATTACHMENTS/APPENDIX :

13.1. Annexure 1- Critical lift best practice for overhead crane equipment.

13.2. Annexure 2- Overhead Crane pre-operational checklist (TPSMS/CSP/HEMS/005/FORM001)

13.3. Annexure 3- Crane Periodic inspection report format – Mechanical Items (TPSMS/CSP/HEMS/005/FORM002)

13.4. Annexure 4- Overhead crane Periodic inspection report format – Electrical Items (TPSMS/CSP/HEMS/005/FORM003)

Annexure – 1

Critical Lift best Practice for Overhead Crane Equipment

Purpose
The purpose of this best practice is to provide guidance to help ensure safe lifting of loads over critical equipment.

References
Heavy Equipment Movement

Principles
Live service lines and process equipment are vulnerable to damage if suspended loads are dropped on them. Use of proper hoisting equipment, and correct rigging and lifting practices to maintain control of the hoisted load will ensure the load is not dropped.

Definitions
Critical lift - a critical lift is a lift where a load suspended from an overhead lifting device travels over live equipment containing high hazard process and the potential exists to cause a release of the process and/or significant downtime, if the load were to become uncontrollable and drop.

Competent person - one by way of training and/or experience, is knowledgeable of applicable standards, is capable of identifying workplace hazards relating to the specific operation, is designated by the employer, and has the authority to take appropriate actions.

Designated person - one selected or assigned by the employer or employer's representative as being competent to perform specific duties.

Frequent inspection - visual examinations of hoisting equipment by the operator or other designated person with records not required.

Periodic inspection - visual inspection of hoisting equipment by a designated person who makes records of external conditions to provide the basis for a continuing evaluation.

High hazardous process – any process that falls within the definition of HHP (High Hazard Process) as defined in TATA POWER Safety manual.

Equipment requirements

Manual and powered hoisting units must be in compliance with all requirements of TATA POWER Standard for new hoisting equipment. The exceptions allowable for existing equipment are not allowable for hoisting equipment performing critical lifts.

If the powered and manual hoisting equipment does not meet all the requirements for new hoisting equipment (Tata Power Standard for Heavy Equipment Movement), then the live equipment which the hoisted load will be traveled over shall be protected with adequate dunnage to protect the live equipment against a dropped load.

One of the most important requirements for both powered and manual overhead hoisting equipment is a back up load brake to hold the load in case of failure of the primary brake. On manual hoists the ability of the hoist operator to stop and hold the load using the hand chain serves as the second back up braking means, if the primary brake were to fail.

Equipment inspection

All hoisting equipment including the rigging hardware must have a thorough visual and functional inspection by a competent person immediately before the critical lift.

In addition, prior to the critical lift, a competent person must ensure the periodic inspection is up to date and all discrepancies have been corrected. This inspection should comply with the periodic inspection procedures as indicated in the “Maintenance Inspection Procedures for Rigging and Hoisting Equipment “.

Critical lift plan

A written, dated and signed critical lift plan should be prepared by the lead designated person responsible and doing the work. The critical lift plan shall be reviewed and signed by all those directly involved in making the lift, and those potentially affected, including those required to secure the plant should a hoisted load fall and cause a process disruption. If the lifting plan is required to go beyond the end of the shift, the designated person responsible for the lift must coordinate with the new shift workers to make sure the conditions are understood and have not changed. If the conditions have changed, a new critical lift plan should be provided.

It is recommended that the “Overhead Hoisting Equipment Critical Lift Plan document be use to document the critical lift.

Operator qualifications

Floor operated cranes – Operators of floor operated top running and under hung cranes, shall have passed a practical operating examination, specific to the crane being operated.

Hoists – Operator must be familiar with all operating controls and be instructed in the operation(s) to be performed.

Procedures

All site, corporate, and plant procedures must be followed for the critical lift.

TPSMS/CSP/HEMS/005/FORM/001 Annexure-2

OVERHEAD CRANE PRE-OPERATIONAL CHECKLIST

Area / Location : **Date :**

CRANE NO.	CAPACITY	TYPE	LOCATION	SHIFT 1 2 3
OPERATORS NAME:	**INSTRUCTIONS: Check all items. Inspect and indicate as: Satisfactory – S, Unsatisfactory – U, or Not Applicable – NA**			

1. WALK AROUND INSPECTION		S/U/ NA	2. MACHINERY INSPECTION		S/U/ NA
a	Foundations		a	Holding Brake *	
b	Access		b	Load Control Brake	
c	Secured Items		c	Covers Secured	
d	Walkways/Handrails		d	Upper Sheaves *	
e	Bridge, Drive Motor		e	Wire Rope *	
f	Bridge Brake *		f	Hooks: Cracks, Wear, Deformation Throat Opening, Latch Operation *	
g	Hydraulics		g	Fluid Leaks	
h	Couplers/Connection Rods		h	Batteries	
i	End Trucks *		i	Electric Motors	
j	Rail Sweeps		j	Electric Panels	
k	Windlocks/Chock/Stops		k	Runway/Bridge Conductors	
l	Housekeeping		l	Runway/Bridge Collectors	
			m	Electrical Guards	
			n	Festoon System	
			o	Warning Tags/Signs	
			p	Exposed Electrical Hazards	
			q	Trolley Stops *	

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TPSMS/CSP/HEMS/005/FORM/001 Annexure-2

OVERHEAD CRANE PRE-OPERATIONAL CHECKLIST
Contd.

3.	OPERATOR CAB INSPECTION	S/U/ NA	4.	OPERATION INSPECTION	S/U/ NA
a	Housekeeping		a	Power Supply Relay *	
b	Warning Tags *		b	Manual Reset	
c	Cab Door(s)		c	Stop Button/Control *	
d	Fire Extinguisher		d	Pendant Buttons *	
e	Controls Identification		e	Upper Limit/Main *	
f	Electrical Enclosures		f	Upper Limit/Auxiliary *	
g	Pendant Strain Relief		g	Lower Limit/Main	
h	Visibility/Windows		h	Lower Limit/Auxiliary	
i	Safety Devices		i	Bridge Controls *	
j	Warning/Indicator Light		j	Bridge Brake *	
k	Alarms		k	Trolley Control *	
			l	Main Hook *	
			m	Auxiliary Hook *	
			n	Work Area	
			o	Runway Stops *	
			p	Travel Limit Relays *	

INSTRUCTIONS: Inspect all applicable items each shift of operation. Suspend all operations immediately when observing an unsatisfactory condition for asterisked (*) items. In addition, suspend operation when any unsafe condition is observed and immediately notify supervisor. Other conditions not affecting safety shall be noted under "Remarks" and reported to supervisor.

REMARKS:

Inspected By (Name & Signature) :

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TPSMS/CSP/HEMS/005/FORM/002 Annexure-3

OVERHEAD CRANE PERIODIC INSPECTION REPORT -FORMAT

Area / Location : ..... **Date :**

MECHANICAL ITEMS						
MAKE:		**CAPACITY:**		**LOCATION:**		
STATUS CODE:	**SR** – Should be Replaced **NR** – Needs Repair **R** – Repaired **SN** – See Notes **N/A** – Not Applicable					
ITEM	**OK**	**CODE**		**ITEM**	**OK**	**CODE**
Bridge				- Cam Followers/Guide*		
- Alignment				- Runway End-Stops		
- Girders (camber)				- Railway Sweeps/Safety Lugs		
- Rails				- Energy Absorbing Bumpers		
- Walks, Ladders, Railings				**Mono Rail**		
- Trucks to Girder Connection				- Girders		
- Trucks				- Girder Supports		
- Wheels, Driver*				- Sway Braces		
- Wheels, Idler*				**Misc.**		
- Wheels, Bearings*				- Clearances Overhead (3")		
- Axles & Coupling*				- Clearances Lateral (2")		
- Squaring Shaft				Rated Load Markings:		
- Squaring Shaft Bearings				- Each Side of Crane Bridge		
- Squaring Shaft Couplings				- Each Hoist/Load Block		
- Motor Coupling				**Trolley Drive**		
- Gear Reducer				- Wheels, Driver*		
- Gear Reducer Oil Seals				- Wheels, Idler*		
- Axle Pinion				- Wheels, Bearings*		
- Axle Gear				- Axles & Couplings		
- Runway Alignment				- Motor Couplings*		

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TPSMS/CSP/HEMS/005/FORM/002 Annexure-3

OVERHEAD CRANE PERIODIC INSPECTION REPORT - FORMAT

Contd.

ITEM	OK	CODE		ITEM	OK	CODE
- Gear Reducer				- Drum Grooving		
- Gear Reducer Oil Seals				- Drum Shafts		
- Axle Pinion				- Motor Pinion		
- Axle Gear				- Motor Gear		
- Cam Followers/Guides*				- Intermediate Pinion		
- Energy Absorbing Bumpers				- Intermediate Gear		
- End Stops				- Drum Pinion		
Hoist (M – Main) **(A – Auxiliary)**				- Drum Gear		
- Hook				- Hoist Case Bearing		
- Hook Bearing				- Mechanical Load Brake*		
- Sheaves*				- Friction Disc*		
- Sheave Bearings*				- Pawl*		
- Equalizer Sheave*				- Pawl Shifter		
- Rope/Chain				- Ratchet or Band		
- Rope Anchors				- Motor Coupling*		
				- Hoist Case Coupling*		

Needs Immediate Action:

Notes:

Circle One: **PASS** **FAIL**

INSPECTOR: (Name) _____ SIGNATURE: _____ DATE: _____

Items with * to be inspected prior to use as part of the Pre-Operational check and lubricated as needed. All other items to be inspected and lubricated annually.

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TPSMS/CSP/HEMS/005/FORM/003 Annexure-4

OVERHEAD CRANE PERIODIC INSPECTION REPORT - FORMAT

Area / Location : **Date :**

ELECTRICAL ITEMS						
MAKE:		**CAPACITY:**		**LOCATION:**		
STATUS CODE:	**SR** – Should be Replaced **NR** – Needs Repair **R** – Repaired **SN** – See Notes **N/A** – Not Applicable					
ITEM	**OK**	**CODE**		**ITEM**	**OK**	**CODE**
Brakes				- Trolley Motor Rings		
- M.H. Brake Shoes & Disc				- M.H. Motor Bearings		
- M.H. Brake Linings*				- M.H. Motor Brushes*		
- M.H. Brake Linkage				- M.H. Motor Rings		
- M.H. Brake Coil				**Misc.**		
- A.H. Brake Shoes & Discs						
- A.H. Brake Lining*						
- A.H. Brake Linkage						
- A.H. Brake Coil						
- Trolley Brake Shoes & Disc						
- Trolley Brake Lining*				**Controls**		
- Trolley Brake Linkage				*- For Magnetic Control*		
- Trolley Brake Coils				- Master Switches		
- Hydraulic Brake Bleeder*				- Push-button Station		
Motors				- M.H. Contactors		
- Bridge Motor Bearings				- A.H. Contactors		
- Bridge Motor Brushes*				- Trolley Contactors		
- Bridge Motor Rings				- Bridge Contactors		
- Trolley Motor Bearings				- M.H. Overhead Relays		
- Trolley Motor Brushes*				- A.H. Overhead Relays		

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TPSMS/CSP/HEMS/005/FORM/003 Annexure-4

OVERHEAD CRANE PERIODIC INSPECTION REPORT - FORMAT

Contd.

ITEM	OK	CODE		ITEM	OK	CODE
Controls (continued)				**Resistors**		
- Trolley Overhead Relays				- M.H. Resistors		
- Bridge Overhead Relays				- A.H. Resistors		
- M.H. Limit Switch Contacts				- Trolley Resistors		
- A.H. Limit Switch Contacts				- Bridge Resistors		
For Manual Drum Control				**Mainline**		
- M.H. Finger Tips*				- Mainline Switch		
- M.H. Segments*				- Fuses (Sizes.....)		
- A.H. Finger Tips*				- Power Wiring		
- A.H. Segments*				- Control Wiring		
- Trolley Finger Tips*				- Trolley Collectors*		
- Trolley Segments*				- Runway Collectors*		
- Bridge Finger Tips*				- Bridge Conductors		
- Bridge Segments*				- Runway Conductors		

Needs Immediate Action:

Notes:

Circle One: **PASS** **FAIL**

Inspected By :(Name)_____ **Signature:**_____ **Date :**_____

Items with * to be inspected prior to use as part of the Pre-Operational check and lubricated as needed. All other items to be inspected and lubricated annually.