HINDUSTAN ZINC
Zinc & Silver of India

HZL Standards

"Overhead crane and hoist Standard"

	Issued by	Approved by
Name	Chairman, Corporate SRP sub Committee	Chairman, Corporate Safety Council
Sign.		
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Zone / Location	Members
Corporate Office	Mr. Vijay Goyal Ms. Priya Singh
Zone-1: DSC	Mr. Vivek Yadav Mr. Deepak Tatwa Mr. M. Parvez Mr. Sandeep Kanani
Zone-2: CSC	Mr. Vijay Nalwaya Mr. Rahul Nag
Zone-3: RAM	Mr. Sandeep Gupta
Zone-4: Zawar Mills & Mines	Mr. D N Shyam
Zone-5: ZSD	Mr. Abhishek Chaudhary Mr Rahul Khatik
Zone-6: SK & RDM	Mr. Shashank Shekhar Mr A K Jain Mr Anil Chaudhary
Zone -7:PMP	Mr Subham Soni
Zone-8: Kayad	Mr Amar Anirudhan
Champion (CSRP)	Mr. Vinod Jangid

DOCUMENT ISSUE

The "Overhead Crane and Hoist" Standard is issued by the Corporate Safety Council on behalf of Hindustan Zinc Limited management and forms a part of the HZL Integrated Management System.

Name: Vinod Jangir

Signed: .....

Date....27/01/2023

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1. SCOPE AND FIELD OF APPLICATION

This standard includes provisions that apply to the construction, installation, inspection, and maintenance of hand-operated and power-driven over- head and gantry cranes that have a top-running single- girder or multiple-girder bridge, with one or more top- running trolley hoists and underhung crane used for vertical lifting and lowering of freely suspended, unguided loads consisting of equipment and materials

2. REFERENCES

Corporate Policy

- HZL HSE Policy
- HZL Safety Principles

Corporate Standards

- Vedanta Crane and Lifting Safety.
- Standard for working at height
- Standard for General electrical safety
- Standard on LOTO
- Standard on Work Permit
- Standard on Vehicle and Driving
- Standard on Scaffolding
- Standard on Confined Space
- Factories Act (1948) and Rules (including State rules)
- ASME 30.2
- ASME 30.16
- IS 3177.1999
- IS 7847
- IS 13834 Part 1
- IS 13834 Part 5
- IS 15560.2005

3. Management Responsibilities

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

3.1 Authorised Engineer

- One who has relevant experience in overhead crane operations and is capable of identifying existing and predictable deficiencies in overhead cranes. He is trained on the standard as per Vedanta approved methodology once in 3 years and shall under internal refresher training and re-authorisation through written assessment annually.
- Check suitability of overhead crane/ hoist before lifting.
- Ensure use of tested lifting tool-tackles of appropriate capacity (sling / synthetic belt / D-shackle etc.)
- Ensure toolbox talk of all movements & rigging operations.
- Ensure operating locations are far enough away from shoring, excavations, trenches, buried utilities, foundations, etc. to eliminate the risk of collapse.
- Recording and documenting of daily and preventive checks.

3.2 Crane Champion

- One who has relevant experience in overhead crane operations and is capable of identifying existing and predictable deficiencies in overhead cranes. He is trained on the standard as per Vedanta approved methodology and appointed by APEX Chairman of Zone.
- Ensure overhead crane/hoist are annually tested by competent person as specified by factory inspector of state.
- PM & proactive maintenance of all cranes for smooth & safe operation and to ensure that record is maintained.
- Assist for critical lifts in plant

3.3 Rigging foreman/ signal man & riggers

- Trained as per Vedanta approved methodology once in 3 years and shall under internal refresher training and re-authorisation through written assessment annually.
- Will follow procedure to use overhead crane/hoist, best rigging practice for safe operation of crane.
- He will use only lifting tools which are tested & of appropriate capacity.
- Signal man will identify himself by wearing specific jacket.
- Not to use cell phone during overhead crane/hoist operation.
- Inspect lifting tools and tackle prior to use.

3.4 Overhead Crane/Hoist Operators

- One who has relevant experience in overhead crane/ hoist operations and is capable of identifying existing and predictable deficiencies in overhead crane/ hoist. He is trained ideally by OEM, OEM authorized agency or Vedanta authorised agency once in 3 years and shall under internal refresher training and re-authorisation through written assessment annually.
- Operate overhead crane/hoist using his best skill, will also check all interlock & safety devices are in working condition.
- He will inform his supervisor & concern plant engineer if any of the safety device is not in working condition.
- Report unsafe conditions or breach of procedural requirements to their supervisor.
- Comply with procedures and information provided in training and in the Crane safety program.
- Ask supervisor for assistance or clarification to maintain safe operations of cranes when necessary

- At the beginning of each operator's shift, the upper limit switch (anti-two-block) of each hoist shall be tried out under no load. Extreme care shall be exercised; the block protection shall be kept in line.
- While any employee is touching the load or hook, there shall be no hoisting, lowering, or traveling.
- Not to use cell phone during crane operation.
- Inspect overhead crane/hoist daily as per checklist. (Annex 1)

3.5 Contractor's Supervisor

- Comply with procedures and information provided in training and in the overhead crane/hoist safety program.
- Daily checklist compliance report to crane champion.
- Periodical refresher training to all overhead crane/hoist crew.

4. Standards/Guidelines

4.1 General Requirements

EOT cranes must be fitted with load indicators for capacities above 5 tons with overload protection.
Hand Operated dead man switch for LT,CT and hoisting operation.
Anti-collision devices for multiple crane installed on same bay.
Two level interlock for upper limit switch and min one interlock for lower limit switch.
Speed reduction and stop at bays ends.
Physical stoppers at end of travel of EOT track.
Interlocks to be routed through separate contractors.
All crane sensor for safety interlocks should be checked quarterly for correction and calibration wherever required by OEM /authorized representative.
Load cell and anemometer (if installed) must be calibrated annually. By OEM/Competent person.
Signage shall be provided over the crane which are not in use for longer duration and hooks of such cranes must either removed or rested. EOT cranes to be electrically isolated.

4.2 Markings — Crane

The SWL of the crane shall be marked on each side of the crane and shall be legible from the ground or floor.
Marking shall include Year of manufacturing, Unique identification number, SWL of Crane Test date, Due date.

4.3 Clearances

4.2.1 Clearance from Obstruction

Clearance shall be maintained between the crane and the building, as well as parallel running cranes and cranes operating at a different elevation, under all normal operating conditions. In the design of new cranes, all factors that influence clearance, such as wheel float, truss sag, bridge skewing, or trolley positions and configurations shall be considered. Where passageways or walkways are provided on the structure supporting the crane, obstructions shall not be placed so that personnel will be jeopardized by movements of the crane.

4.2.2 Clearance Between Parallel Cranes

If the runways of two cranes are parallel, and there are no intervening walls or structures, there shall be clearance provided and maintained between the two bridges and there shall be anti-collision devices installed to avoid the collision of cranes.

4.4 GENERAL CONSTRUCTION

4.4.1 Stops and Buffer

At the end of travel, physical stoppers must be installed along with speed reduction and stop at bay ends. Interlocks to be routed through separate contactors.
Stops shall engage the bumpers or bumper pads mounted on the trolley.

Stops shall be designed to withstand the forces applied by the bumpers.
Suitable buffers shall be fitted to each end of the end carriage assemblies and on both sides of crab or the bridge. Buffers shall be so mounted to permit easy rernoval of wheels. Limit switches shall be provided in such a way that drive motors are switched off before the buffers are pressed. Buffers will be provided between the cranes if more than one crane is running on the same track.
Spring buffers, hydraulic buffers and buffers made out of resilient plastic, rubber or polyurethane may be used. Wooden buffers shall not be used.
Buffers shall have sufficient energy absorbing capacity to bring the loaded crane or crab to rest from a speed 50 percent of the rated speed at a deceleration rate not exceeding 5 m/s'.

4.4.2 Brakes

The parts used for braking shall be made from hard wearing material with adequate thermal capacity for the duty required. Due allowance shall be kept for the brake drum capacity to dissipate heat generated due to frequent braking. The rubbing surface shall be smooth and free from defects. The brake lining shall be protected, from water,grease, oil or other adverse effects. The parts used for braking shall be made from hard wearing material with adequate thermal capacity for the duty required. Due allowance shall be kept for the brake drum capacity to dissipate heat generated due to frequent braking. The rubbing surface shall be smooth and free from defects. The brake lining shall be protected, from water, grease, oil or other adverse effects. Springs of electro-mechanical brakes shall be of the compression type and shall not be stressed in excess of 80 percent of the elastic limit of the material. Brake weights if provided shall be securely bolted to the levers and locked.
Hoist Motion Brake: All electrically operated hoisting motion shall be fitted with an electro-hydraulic/electro-magnetic fail safe brake. The brake will arrest the motion and hold at rest any load up to and including overload test load at any position of the lift. The provision shall be made to enable any lOad capable of over coming the friction in the system up to and including the test load to be lowered safely in a controlled manner in the event of power failure. Cranes handling dangerous liquids be fitted with an independent additional brake on the hoisting motion. Each of these two brakes shall have minimum braking torque.
Travelling & Traversing Motion: Every electrically operated travelling motion shall be fitted with a mechanical or hydraulic brake or an automatic electro-magnetic I electro-hydraulic brake or a combination of the two, if required. The brake shall be capable of bringing a fully loaded crane to rest with least possible shock from the highest speed it can attain with electro-magnetic/electro-hydraulic brakes, limit switches shall be provided in this motion.

4.4.3 Electrical Equipment

Wiring and equipment shall comply with Article 610 of ANSI/NFPA No. 70, National Electrical Code.
The control circuit voltage shall not exceed 600V for AC or DC.
The control circuit voltage in pendant push buttons shall not exceed 24V DC in case of metallic pendent. otherwise it should be Polycarbonate pendent if voltage exceeds up to 110V AC/DC.
Where multiple conductor cable is used with a suspended push-button station, the station shall be supported so that the electrical conductors are protected from strain.
Pendant control stations shall be constructed to prevent electrical shock. The push-button enclosure shall be at ground potential and marked for identification of all functions.
Electrical equipment shall be located or enclosed so that, under normal operating conditions, energized parts will not be exposed to inadvertent contact.
Energized parts of electrical equipment shall be protected from direct exposure to grease, oil, and moisture, and they should be protected from dirt.
If guards are provided for energized parts, the guards shall be constructed or located so that they cannot be deformed, under normal operating conditions, to make inadvertent contact with energized parts.
GESM standard requirement to be followed for all electrical installation.

4.4.4 Hoisting Equipment

Sheaves: Sheave grooves shall be free from surface defects which could cause rope damage. The cross-sectional radius at the bottom of the groove should be such as to form a close-fitting saddle for the size of rope used. The sides of the groove shall be tapered outward and rounded at the rim to facilitate entrance of the rope into the groove. Flange rims shall run true about me axis of rotation. Sheaves carrying ropes, which can be momentarily unloaded, shall be provided with close-fitting guards, or other devices, to guide the rope back into the groove when the load is reapplied. The sheaves in the bottom block shall be equipped with close-fitting guards that will minimize the possibility of ropes becoming fouled when the block is lying on the ground with the ropes loose. All running sheaves shall be equipped with means for lubrication. Permanently lubricated, sealed, or shielded bearings shall be acceptable.

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

Ropes: The hoisting ropes shall be of a recommended construction for crane service. The total load (rated load plus weight of load block) divided by the number of parts of line shall not exceed 20% of the minimum breaking strength of the rope. Socketing shall be done in a manner recommended by the rope or fitting manufacturer or a qualified person. Rope shall be secured to the drum as follows No less than three wraps of rope shall remain on the drum at each anchorage of the hoisting drum when the hook is in its extreme low position unless a lower- limit device is provided, in which case no less than one wrap shall remain. The rope end shall be anchored by a clamp attached to the drum, or by a socket arrangement specified by the crane or rope manufacturer. The rope clamps shall be tightened evenly to the manufacturer's recommended torque. Eye splices shall be made in recommended manner. Rope thimbles should be used in the eye. Wire rope clips shall be drop-forged steel of the single-saddle (U-bolt) or double-saddle type. Malleable cast iron clips shall not be used. For. spacing, number of clips, and torque values, refer to the clip manufacturer's recommendation. Wire rope clips attached with U-bolts shall have the U-bolt over the dead end of the rope and live rope resting in the clip saddle. Clips shall be tightened evenly to the recommended torque. After the initial load is applied to the rope, the clip nuts shall be retightened to the recommended torque to compensate for any decrease in rope diameter caused by the load. Rope clip nuts should be retightened periodically to compensate for any further decrease in rope diameter during usage. Swaged or compressed fittings shall be applied as recommended by die rope, crane, or fitting manufacturer or qualified person. Wherever exposed to ambient temperatures at the rope in excess of 180°F (82°C), rope having an independent wire-rope or wire-strand core, or other temperature damage-resistant core, shall be used. Replacement rope shall be the same size, grade, and construction as the original rope furnished by the crane manufacturer.

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

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

Hoist-Limit Devices (Switches): Prior to the initial use of any hoist during each shift, the operator shall verify operation of the upper limit device under no-load conditions. Two level interlocks for upper and minimum one interlock for lower limits to be provided in hoist. Interlocks to be routed through separate contactors. If more than one upper-limit device is present, only the operation of the primary upper-limit device need be verified. Care shall be exercised; the block shall be inched into the limit or run in at slow speed. If the device does not operate properly, the operator shall immediately notify to his supervisor. The hoist-limit device that controls the upper limit of travel of the load block shall not be used as an operating control in normal operation.

4.5 Warning devices or means for a crane with a power –traveling mechanism

All Cab, Floor Operated, Remote-Operated Cranes should be provided for installations where the ability of the operator to warn persons in the path of the load is impaired. Warning devices like power operated audible siren along with strobe light or equivalent can be used as warning device.

4.6 Inspection, Maintenance & Repair

Initial Inspection. New, reinstalled, altered, repaired, and modified cranes shall be inspected by a competent person prior to initial use.

Inspection procedure for cranes in regular service is divided into two general classifications based upon the intervals at which inspection should be performed. The two general classifications are designated as frequent and periodic, with respective intervals between inspection defined as follows:

Frequent Inspection. Visual examinations by the operator prior to use or at start of the shift and record of the same is to be maintained in operator log.

Periodic Inspection. Visual inspection of the equipment in place by a designated person making records of apparent external conditions to provide the basis for a continuing evaluation.

A preventive maintenance program should be established under periodic inspection. The program should be based on the recommendations outlined in the crane manufacturer's manual and, when appropriate, additional recommendations outlined by a competent person based upon review of the crane application and operation. Dated records should be placed on file/ SAP.

Replacement parts shall be at least equal to the original manufacturer's specifications.

Modifications affecting capacity or safe operation shall have the manufacturer's written approval and the crane shall be inspected by a competent person.

All maintenance required to be carried out on crane must be done by trained and authorized technician.

4.6.1 Rope Inspection & Replacement

All ropes should be visually inspected by the operator at the start of each shift. These visual observations should be concerned with discovering gross damage.

The inspection frequency shall be determined by a qualified person and shall be based on such factors as expected rope life, as determined by experience on the particular installation or similar installations; severity of environment; percentage of capacity lifts; frequency rates of operation; and exposure to shock loads

Periodic inspections shall be performed by a designated person. This inspection shall cover the entire length of rope. The individual outer wires in the strands of the rope shall be visible to this person during the inspection. Any deterioration resulting in appreciable loss of original strength, shall be noted and determination shall be made as to whether further use of the rope would constitute a hazard:

Rope Replacement

No precise rules can be given for determination of the exact time for rope replacement, since many variable factors are involved. Once a rope reaches anyone of the specified removal criteria, the rope shall be replaced.

Removal criteria for rope replacement shall be as follows:

In running ropes, twelve randomly distributed broken wires in one lay or four broken wires in one strand in one lay,

In rotation-resistant ropes, two randomly distributed broken wires in six rope diameters or four randomly distributed broken wires in thirty rope diameters

One outer wire broken at the contact point with the core of the rope, which has worked its way out of the rope structure and protrudes or loops out from the rope structure

Wear of one-third the original diameter of outside individual wires

Kinking, crushing, bird-caging, or any other damage resulting in distortion of the rope structure

Evidence of heat damage from any cause

Reductions from nominal diameter greater than those listed below

Rope Diameter	Maximum Allowable Reduction From Nominal Diameter
Up to ~6 in. (8 mm)	1/64 in. (0.4 mm)
Over 5/16 in. to 1/2 in. (13 mm)	1/32 in. (0.8 mm)
Over 1/2 in. to 3/4 in. (19 mm)	3/64 in. (1.2 mm)
Over3/4 in to 1 in (29 mm)	1/16 in. (1.6 mm)
Over 1 in. to 1-1/'2 in. (38 mm)	3/32 in. (2.4 mm)

Broken wire removal criteria cited in standard apply to wire rope operating on steel sheaves and drums The user shall contact the sheave, drum, or crane manufacturer, for broken wire removal criteria for wire ropes operating on sheaves and drums made of material other than steel.

Attention shall be given to end connections. Upon development of two broken wires adjacent to a socketed end connection, the rope should be re-socketed or replaced. Re-socketing shall not be attempted if the resulting rope length will be insufficient for proper operation.

4.6.2 Hook Inspection

Hooks shall be removed from service if damage such as the following is visible:

Excessive pitting or corrosion

Cracks, nicks, or gouges

Any wear exceeding 10% (or as recommended by the manufacturer) of the original section dimension of the hook.

Its load pin deformation: any visibly apparent bend or twist from the plane of the unbent hook throat opening: any distortion causing an increase in throat opening of 5% not to exceed 1⁄4 in. (6 mm) (or as recommended by the manufacturer)

Thread wear, damage, or corrosion evidence of excessive heat exposure or unauthorized welding.

Any sort of welding or hot work is strictly prohibited.

4.7 Crane Operation & Lift Planning

The Following shall apply to all personnel involved in overhead crane operations. Each operation must be classified into 2 types of lift. Routine/ Normal Lift or Critical Lift. All lift using EOT/Overhead crane are normal lift, if lifted weight is less than or equal to SWL of EOT/Overhead crane. In case of routine job related to operation shall be governed by SOP in-line with standard requirement. A lift is classified as critical lift if one or more criteria fulfils. Tandem Lifting either using 2 hoist of same crane or hoist of two different cranes. Using Man basket.

4.8 HANDLING THE LOAD

The crane shall not be loaded more than its SWL except for test purposes if required.

The combined load applied to more than one hoisting unit shall not exceed the SWL load of the crane when the crane has more than one hoisting unit.

The hoist rope shall be free from kinks or twists and shall not be wrapped around the load.

The load shall be attached to the load block hook by means of slings or other devices.

Care shall be taken to make certain that the sling clears all obstacles. The appointed person directing the lift shall ascertain that the load, sling, or lifting device is seated in the bowl of the hook, the load is secured, balanced, and positioned in the hook, sling, or lifting device before the load is lifted more than a few inches (millimeters) the hoist rope is not kinked, multiple part lines are not twisted around each other.

The hook is brought over the load in such a manner as to minimize swinging

The rope is seated in the drum grooves and in the sheaves.

During lifting, care shall be taken that there is no sudden acceleration or deceleration of the moving load.
Cranes shall not be used for side pulls,
The operator shall not cause the crane to lift, lower, or travel while anyone is on the load or hook.
The operator should avoid carrying loads over people. Load must never be moved over people of occupied structure.
The operator of a floor-operated crane having a lifting magnet should exercise caution due to the hazard of possible falling metal.
The operator shall check the hoist brake(s) at least once each shift if a load approaching the rated load is to be handled. This shall be done by lifting the load a short distance and applying the brake(s).
The load shall not be lowered below the point where three wraps of rope remain on each anchorage of the hoisting drum unless a lower-limit device is provided, in which case, no less than one wrap shall remain.
When two or more cranes are used to lift a load, one qualified person shall be in charge of the operation. This person shall analyze the operation and instruct other personnel involved in the proper positioning, rigging of the load, and the movements to be made.
The operator shall not leave the position at the controls while the load is suspended over an area accessible to people.

4.9 TESTING

- **Operational Tests**
  - New, reinstalled, altered, repaired, and modified cranes shall be tested by a competent person prior to initial use to ensure compliance with this volume.
  - Tests shall include, as applicable, the following functions:
    - lifting and lowering, trolley travel, bridge travel, hoist-limit devices
- **Load Test**
  - New, reinstalled, altered, repaired, and modified cranes should be load tested prior to initial use, as determined by a qualified person. It should be 125% of the rated load of the crane or hoist(s).(IS 3177)
  - Annual load test to be conducted, at 100% of the rated load of the crane or hoist(s) in presence of competent person. (VSS 7-rev 1).
  - NDT (UT/MPT) testing of crane hook assembly to be conducted annually.
  - If crane is derated, then load testing to be done half yearly.

4.10 Overhead Crane Operator

- Cranes shall be operated only by the authorized crane operator, maintenance, and test personnel (when it is required to perform their duties)
- No one other than personnel specified above shall enter a crane cab or pulpit, with the exception of persons such as oilers and supervisors, whose duties require them to do so, and then only in the performance, of their duties and with the knowledge of the crane operator.
- **Requirement for overhead Crane Operators**

  Operators shall be trained ideally by OEM, OEM authorized agency or Vedanta authorised agency once in 3 years and shall under internal refresher training and re-authorisation through written assessment annually. Operators and operator trainees shall meet the following physical qualifications:

  a. Have vision of at least 6/6 with or without corrective lenses.
  b. Be able to distinguish colors, regardless of position of colors, if color differentiation is required for operation. crane operators shall pass a medical examination once in every 06 months if Age above 45 years, annually if Age below 45 years. These Medical tests to be conducted by certified ophthalmologist.
  c. Be able to hear, with or without hearing aid, adequately for a specific operation.
  d. Should be trained on work at height as applicable.

4.11 Classification of Overhead crane

- This part establishes a general classification of cranes based on the number of operating cycles to be carried out during the expected life of the crane and a load spectrum factor which represents a nominal state of loading.
- The classification thus agreed constitutes the overall classification of the crane as a whole; it is intended for contractual and technical reference purposes and not for design purposes.
- The two factors to be taken into consideration for the purposes of determining the group to which a crane belongs are the class of utilization and the state of loading.
- **Class of Utilization**

Class of Utilization	Max No. of operating cycle	Remark
U0	$1.6x10^4$	Irregular use
U1	$3.2x10^4$	
U2	$6.3x10^4$	
U3	$1.25x10^5$	
U4	$2.5x10^5$	Regular Light use
U5	$5x10^5$	Regular intermittent Use
U6	$1x10^6$	Irregular Intensive use
U7	$2x10^6$	Intensive use
U8	$4x10^6$	
U9	$>4x10^6$	

- **State of loading**

State of Loading	Nominal Spectrum Factor K_p	Remark
Q1-Light	0.125	Cranes which hoist the safe working load very rarely and normally, light loads.
Q2-Moderate	0.25	Cranes which hoist the safe working load fairly frequently and normally moderate loads.
Q3-Heavy	0.50	Cranes which hoist the safe working load frequently and normally heavy loads

Q4-Very heavy	1.00	Cranes which are regularly loaded close to safe working load.

- **Load spectrum Factor K_p is given by the equation.**
  - $K_p \sum_0^1 \left(\left(\frac{Ci}{Ct}\right)\left(\frac{Pi}{Pmax}\right)\right)^m$
  - Where Ci-represent the average number of load cycle which occur at individual load level.
  - Ct-is total of all the individual load cycle at all load levels.
  - Pi- represent the individual load magnitude(load level)
  - Pmax- is heaviest load that may be handled by crane.(rated load)
  - m=3.

- **Classification of the crane as a whole**

  Having determined the class of utilization and the state of loading, the classification of the crane is determined as mentioned below.

State of Loading	Nominal Load Spectrum Factor K_P	Class of Utilization and maximum number of operating cycles									
		U0	U1	U2	U3	U4	U5	U6	U7	U8	U9
Q1-Light	0.125			A1	A2	A3	A4	A5	A6	A7	A8
Q2- Moderate	0.25		A1	A2	A3	A4	A5	A6	A7	A8	
Q3-Heavy	0.5	A1	A2	A3	A4	A5	A6	A7	A8		
Q4-Very Heavy	1.0	A2	A3	A4	A5	A6	A7	A8			

- **Group classification of a mechanism as a whole**
  - **Class of utilization of a mechanism**

The class of utilization of a mechanism is characterized by the assumed total duration of the use in hour. Ten nominal classes are defined.

The maximum total duration of use may be derived from the assumed average daily utilization time in hours, the number of working days per year, and the number of years of expected service.

Class of Utilization	Total duration of use (hour)	Remark

T0	200	Irregular use
T1	400	
T2	800	
T3	1600	
T4	3200	Regular Light use
T5	6300	Regular intermittent Use
T6	12500	Irregular Intensive use
T7	25000	Intensive use
T8	50000	
T9	100000	

- State of loading of the mechanism

The state of loading specifies to what extent a mechanism is subjected to its maximum loading or only to reduced loading. There are four different nominal states of loading.

The load spectrum factor for the mechanism, K_m is given by the equation.

$$K_m = \sum_0^1 \left(\left(\frac{ti}{tT}\right)\left(\frac{Pi}{Pmax}\right)\right)^m$$

- Where ti-represent the average duration of use of the mechanism at individual load level.
- t_T is total of all the individual duration at all load levels.
- Pi- represent the individual loading magnitude (load level)
- Pmax- is greatest loading magnitude applied to the mechanism. (rated load)
- m=3.

State of Loading	Nominal load Spectrum factor mechanism Km	Remarks

L1-Light	0.125	Mechanisms subjected very rarely to maximum load and normally, to light loads.
L2-Moderate	0.25	Mechanisms subjected frequently to the maximum load but normally, to rather moderate loads.
L3-Heavy	0.50	Mechanisms subjected frequently to the maximum load and normally to load of heavy magnitude.
L4-Very heavy	1.00	Mechanisms subjected regularly to the maximum load

- **Determination of group classification of the mechanism as a whole**

Having determined the class of utilization and the state of loading, the group classification of a mechanism can bedetermined

State of Loading	Nominal Load Spectrum Factor K_P	Class of Utilization and maximum number of operating cycles									
		T0	T1	T2	T3	T4	T5	T6	T7	T8	T9
L1-Light	0.125			M1	M2	M3	M4	M5	M6	M7	M8
L2-Moderate	0.25		M1	M2	M3	M4	M5	M6	M7	M8	
L3-Heavy	0.5	M1	M2	M3	M4	M5	M6	M7	M8		
L4-Very heavy	1.0	M2	M3	M4	M5	M6	M7	M8			

As per ISO 4301 Part 5: Guidance on classification of overhead travelling cranes and their mechanism in relation to crane usage.

Usage of Crane	Service Condition	Group classification of the appliance as whole	Group classification of the appliance as whole		
			Hoist	Traversing	Travelling
Manually powered crane		A1	M1	M1	M1
Workshop crane for assembly process		A1	M2	M1	M2
Power House crane		A1	M2	M1	M3
Maintenance crane		A1	M3	M1	M2

Workshop crane	Regular Light use	A2	M3	M2	M3
Workshop crane	Regular intermittent Use	A3	M4	M3	M4
Workshop crane	Intensive use	A4	M5	M3	M5
Crane in storage yards	Regular light use, hook duty intensive use, grab or magnet duty	A3	M3	M2	M4
Crane in storage yards		A6	M6	M6	M6
Scrap yard crane	Regular light use, hook duty intensive use, grab or magnet duty	A3	M4	M3	M4
Scrap yard crane		A6	M6	M5	M6
Ship Unloader		A7	M8	M6	M7
Container handling crane		A5	M6	M6	M6
Ship to shore container crane		A5	M6	M6	M4
Steelwork Crane					
Roll changing crane		A2	M4	M3	M4
Ladle crane		A7	M8	M6	M7
Soaking pit crane		A7	M8	M7	M7
Stripper crane		A8	M8	M8	M8
Charging crane		A8	M8	M8	M8
Foundry Crane		A5	M5	M4	M5

5. Management Systems

5.1 Support Resources

The following resources can be consulted for additional assistance:

- Plant Safety Committee
- Corporate Safety Committee.
- Critical Lift Group of Zone.

5.2 Management Records

Two years Records shall be retained in compliance with the site and legislative requirements with the Engineer in-charge.

5.3 Audit Requirements

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

5.4 Standard Renewal Process

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

5.5 Deviation Process

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

5.6 Training and communications requirements

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

5.7 Custodian and contact

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

6. ANNEXURE

Annexure 1

Reference Checklist : This is a sample checklist , however site can develop separate checklist based upon the experience or OEM recommendation but it include all the points mentioned in the below checklist.

Checklist for EOT & Hoist (Frequent Inspection)					
NAME OF CRANE :					
Sr. No.	**ITEM**	**DEFICIENCIES TO LOOK FOR**	**YES**	**NO**	**Comments/Remarks**

1	All functional operating mechanisms like LT/CT/Hoisting and as applicable	Check for any abnormality, Abnormal sound			
2	Hooter / Siren function	Working/Audible			
3	Anti-Collision/Stopper functioning	Malfunctioning /Bypasses			
4	Cross Traverse Limit Switches	Check operation of Limit Switch			
5	Emergency Stops (Pendant/Remote)	Malfunctioning /Bypasses			
6	Up/Down Rotary Limit Switches	Malfunctioning /Bypasses			
7	Hook Condition	Abnormal bending/Visual Inspection/Safety Latch.(Exemption in case hot metal handling)			
8	Wire Ropes condition	Check any kinking, crushing, damages on rope as per visual inspection			
9	Load-bearing chain (if used)	Wear, Rusting ,twist, distortion, improper dead-ending, foreign material (e.g. weld splatters) Stretch			
10	Brake System in Hoist	Slipping of Load/abnormal sound			
11	Pushbutton markings on Remote/Pendant as per Directions	Removed or illegible			

	(North,South, East, West)				
12	Load Test Done date/Due Dates	Labelling near Crane			
	Date:	Shift:			
	Operator:	**Shift I/C :**			