

SAFETY CODE FOR IRON & STEEL SECTOR		
MINISTRY OF STEEL, GOVT. OF INDIA	ELECTRIC OVERHEAD TRAVELLING (EOT)CRANES	Doc. No: SC/14
		Rev no. : 00 Effective Date : --

1. OBJECTIVE

To provide a generic guideline for Electric Overhead Travelling (EOT) Crane safety practices to be observed in Iron & Steel Industries.

Associated Hazard: Electrical Shock, Electrical Flash, Electrical Burn, Fire, Slip/ Trip/ fall, Hit/ Press/ /Cut hazard, Fall of person from height, Fall of materials from height etc.

2. SCOPE

This guideline is applicable to all location of Iron and Steel Industries where for Electric Overhead Travelling (EOT) Crane is being used.

3. PROCEDURE

3.1 DEFINITIONS:

- i. **Overhead Travelling Crane:** Overhead travelling crane consists essentially of a girder (or girders) attached at each end to carriages, travelling along elevated tracks fixed in location, and a trolley or crab equipped with a hoisting mechanism, travelling along such girder (or girders).
- ii. **Rated Lifted Load** — The rated lifted load from the mechanism design considerations shall mean the external load lifted and handled by the crane and shall include in addition to the safe working load, weight of rope and lifting tackles such as magnets, grabs, lifting beams, book blocks, but shall exclude wind load.
- iii. **Safe Working Load** — The maximum external load excluding the weight of the lifting tackles under specified conditions for which the crane may be used. This may be a variable quantity for a jib crane. If the grab forms an integral part of the suspended gear, then the weight of the gear shall also be included in the safe working load.

3.2 Design & Engineering Controls to Ensure Safety:

- i. **Passage ways and clearance for over-head travelling crane (Ref Bihar Factories Rules, 1950, 56-B.)**
 1. (a) Passage-way shall be provided along and adjacent to every rail-track of every over-head travelling crane of such width that there is a clear space of not less than 50 cm between crane operating on the track and

any column, fixture or fixed structure, so that no person working or walking over the passage –way may be struck by any part of the crane.

- (b) There should be railings at a height of at least 90 c. m. from the floor of the passage –way on the both the side, with at least two rail and with a toe board at a height of at least 10 c .m. from the floor.

Provided that if there is a wall or sheeting on one side of the walk –way the railings may be provided on only the other side.

- (c) Safe access ladders with hand rail shall be provided at convenient places and at suitable frequent intervals so that's the crane driver or any other person going up the crane or crane track may not have to walk long distances on the passage-way.
- (d) Where there are more than one cranes operating in the same way as on the same run-way, the number of access ladders shall be provided in the considerations of the easy and safe accessibility to the different crane.

- 2. For the repair of the track equipment of the cranes and for the greater convenience and safety in changing track wheels if there is no sufficient distance between the end of the crane and the wall of the building, special recesses or the platform with safe access ladders shall be built at different places in the building.

- 3. The vertical clearance between the floors of the Crane Bridge or trolley foot-walks or platforms on the travelling cranes and over-head trusses, structural parts or any other permanent fixture shall not be less than two meters (see Annexure1).

- 4. The provision of sub rule i) shall apply only to factories constructed after the 1st January,1975 and also to crane installed in existing factories after the said date and sub rules ii) and iii) shall apply to the factories constructed after the 4th February,1963and the crane installed in existing factories after the said date.

Provided that chief inspector may, with the approval of the state governments, exempt any such factory in the respect of any particular over-head travelling crane from the operation of any provision of the said – rules subjects to such conditions as he may specify in writing.

- 5. In the respect of any over-head travelling crane already in the operation on the date of the coming into force of this rule in any factory, the chief inspector may, by order in writing, direct such measure to be taken within a specified time as he may consider practicable and necessary to prevent accident due to the movement of the crane.
- 6. These rules are without any prejudice to, and in addition to and not in derogation to the provision of section 32 of the factories act, 1948; and
- 7. The chief inspector may, with the approval of the state governments, exempt any overhead travelling crane in any factory from the operation of the provisions of this rule subject to such conditions as he may specify in writing

ii. Following display should be provided on the EOT cranes:

SL	TYPE OF BOARD	CONTENTS	WHERE TO PLACE
1	Name Plate	Safe Working Load, Manufacturer Name & Year of Manufacturing	Both outer of the bridge girders
2	'Inspection Date' Board	Last date of inspection, Due date of inspection & Done by – Due date: After 1 year) (As per Factory Act)	Outer side hand railing of one of the girders
3	'Danger' Board	As per IS 2551 (Relevant for application)	Protective panel cubicle front cover & Main incoming switch
4	'Caution' Board	a) Unauthorized persons are not allowed on the crane gantry b) Use Safety Helmet, Safety shoe, Safety goggles, safety jackets, Safety belt and other required PPEs while going to crane gantry	Crane gantry approach stair case hand railing
5	'Instruction' Board for boarding	a) Inform operator through bell switch before climbing the crane b) Cut off Safety switch before boarding on the crane	Near all corner boarding approach to the crane
6	Do's & Don'ts Board	Do's & Don'ts for Crane operator	Inside the operator cabin
7	Do's & Don'ts Board	Do's & Don'ts for maintenance crew	Near the panels and on the girder
8	Important Telephone numbers	Following minimum telephone number should be displayed: Fire Brigade Ambulance Security Shift Safety Control room of that area Line managers of that area Head of that area	a. In crane operator's cabin b. Near control panel/E-room
9	Hazards on the particular crane	1. Gas hazards if any 2. Fire hazards 3. Slip, trip, fall on same level and from height 4. Clearance between fixed point	Near the entrance of the crane b. Both sides of Girder c. Any other suitable location
10	Information about workplace	Name of the crane Capacity Make Nature of job Specification	the entrance of the crane or any other suitable location

Note: Sl. No. 1&2 shall be painted in bold letters on the crane in such size and clarity, that it is easily visible, readable from Floor Level

- iii. Sick bay/Maintenance Bay/Hospital bay shall be provided if there is more than one crane in the same track.
- iv. Anti-collision system shall be provided to detect the other crane in the same track which in-turn shall slow and stop the crane along with Audio-Visual alarm in the operator's cabin.
- v. All outdoor type power angles shall be provided with Safety catch
- vi. All the incoming Isolator, Circuit breaker, switches etc. shall be provided with positive isolation facility having pad locking arrangement
- vii. Portable CO2 fire extinguisher of 4.5Kg is to be kept in the crane operator's cabin, both sides of electric panel area/E-room & both side Girder of the crane. Crane having two Girder and no electrical room may have only near both sides of control panels
- viii. Two-way Safety switches shall be provided at four corners of the crane, one at the outside and another at the inside of the crane to put OFF the power of complete crane. In addition, following safety switches must be provided on the crane:
 - a. one Safety switch shall be provided near the entry & exit of the crane operators cabin to put OFF the power of complete crane
 - b. one Emergency switch shall be provided inside the crane operator's cabin to put OFF the power of complete crane
 - c. switch shall be provided at the entry to the trolley to put OFF the power of complete crane
- ix. One calling bell shall be provided at the entrance of the crane for communicating with the crane operator before enter or exit to or from the crane. Minimum One system shall be provided in the both side of the crane gantry.
- x. Auto closing gate shall be provided in the crane operator's walkway for the safe entry to the crane.
- xi. Safety hand railings of square bars shall be provided along and adjacent to every rail-track of Overhead Travelling Cranes or crane operator's walk-way / passage-way.
- xii. Safe access ladders with hand rails shall be provided at convenient place for the crane operator or any other person going to or coming out from the crane. All the ladders should be provided as far as possible in the center of the end tie/end carriage to avoid risk of falling to zero meters. If it is not possible to shift the ladder at the center, Side protection with hand post for ladder at end side should be provided. The entire ladder should have wider steps to avoid slip from the ladder. Other than this ladder shall be provide in the following location also:
 - a. Crane walkway to the gantry
 - b. Crane walkway to power collector inspection platform
 - c. Trolley floor to crane walkway
 - d. Besides these, ladders shall be provided wherever found necessary
- xiii. Foot operated Switch shall be provided in the crane operators cabin to stop the Long Travel motion during emergency condition
- xiv. Staircase should be provided in place of ladder as far as possible for easy and safe access to different location e.g. access to the cabin from the bridge girder platform shall be via a staircase. Minimum width of staircase shall be 600 mm and inclination to the horizontal shall not be more than 48 degree. For special case it can be ± 10 deg.

- xv. Provision of control stop shall be provided along with pad locking arrangement and ON/OFF LED indication for all the motions on a suitable location of the girder for use during trial purpose and other control stop activity. This shall be included in the departmental approved control stop procedure as per positive isolation safety procedure. Suitable enclosure shall be provided to protect these arrangement from adverse environmental condition.
- xvi. Other than Gong Bell an audible warning device shall be provided on the crane which shall work automatically during running of Long Travel motion to warn people working below.
- xvii. Minimum four light shall be hung from the girder of the crane so that the working area under the crane is properly illuminated. Similar light also shall be hung from the trolley.
- xviii. Two-way switch shall be provided near the both side entrance of the E-room, so that light can be put ON or OFF from any side of the E-room
- xix. Emergency light shall be provided in the Crane operator's cabin and Electrical control room.
- xx. Provision of Light and Fan shall be provided near the power collector platform with ON/OFF switch.
- xxi. Provision shall be made to provide 220V lighting power from the Gantry during preventive maintenance or any emergency condition.
- xxii. Plug points of voltage 220 AC, 50Hz, having ELCB of 30 mA trip capacity shall be provided in the crane operator's cabin, both side of the girder, both sides of the panel and on the trolley to facilitate during maintenance work, which should have.
- xxiii. Panel nomenclature to be painted on the outer side of individual panel doors and all circuit components to be adequately labeled and all control cables properly ferruled to facilitate correct identification.
- xxiv. Provision shall be made to PUT OFF complete control and Main power from the protective panel or from the outside of the individual control panel. No work should be done inside the panel if there is any power present inside the panel
- xxv. All the panels shall be provided with positive isolation facility having pad locking facility.
- xxvi. All drive couplings and protruded extended shafts etc. are to be securely guarded.
- xxvii. There should be two limit switches for hoisting motion. The first one can be either a RGLS or CWLS but the final one should be a CWLS.
- xxviii. Lower limit switch shall be provided all Hoist motion equipped with a RGLS where ever possible to define the lower position of the crane.
- xxix. Open position interlock of all Service brake/disc brake/Storm brake shall be provided
- xxx. Normally open (NO) type proximity switch shall be used. For DC application 24V to 30V DC proximity shall be used. For AC application 24V to 240V AC/DC proximity shall be used.
- xxxi. Operator cabin shall be designed so that the driver has a clear view of all work areas or so that he may adequately follow all operations with the aid of suitable equipment (e.g. camera)
- xxxii. Entrance of the operator's cabin shall be protected against accidental opening. Sliding doors, and outward opening doors of operator's cabin must lead to landings
- xxxiii. It must be possible to clean the both sides of windows of the operator's cabin without any risk
- xxxiv. Lock of the operator's cabin must be able to operate from inside as well as outside
- xxxv. Spring operated or Dead man switch type Master controller shall be provided to avoid starting of any unwanted motion of the crane. Lay out and characteristics of controller shall conform IS -13558 (Part 1): 1992 and IS 13558 (Part 5): 1993.
- xxxvi. Operator's cabin shall be provided with clear head room of not less than 2000mm and shall be fitted with a guard rail of at least 1.0M height

- xxxvii. Evaporator of the Air conditioner in operator's cabin shall be critically positioned to avoid head injury of operator
- xxxviii. Necessary protective barrier shall be provided to avoid any accidental contact with live electrical parts. If the live parts cannot be made access proof, no maintenance job shall be carried out without full positive isolation of incoming power
- xxxix. Load Testing: Before putting the crane into operation, it shall have all motions tested with the hook carrying (a) the safe working load, and (b) 25percent overload. During the 25-percent overload test the geared speeds need not be attained but the crane shall show itself capable of dealing with the overload without difficulty. Test should be done in accordance with IS -807. Load testing shall be done for a newly commissioned crane. Load testing with safe working load to be done if there is any structural change made after commissioning.
- xl. Deflection test of girder with Safe working load may be carried out once in every 10 years. However annual inspection report by competent person for every crane as per Factory Act Rules to be maintained.
- xli. All the crane shall be provided with necessary rescue arrangement on the crane to rescue any person during abnormal situation
- xl.ii. Locks of all the doors of E-room, Operator's cabin shall be designed to operate from inside as well as from outside of the room/cabin. Lock shall have the facility to open the door from the inside room/cabin without any key.
- xl.iii. All Air conditions shall be equipped with a system to eliminate falling of condensate water on the shop floor
- xl.iiii. Single Hook Protection for liquid handling cranes :All new cranes handling liquid metal should be equipped with Single Hook Protection using the 4 nos load cells in the top sheave of the crane MH. The controller will see the readings of these 4 nos load cells and compare them for appreciable difference in weighment readings. Based on the difference in weighment setting, the hoisting motion will be tripped and alarm generated in the Operator's cabin.

3.3 EOT Crane Operational Safety aspect guidelines:

3.3.1 Requirement of Crane operators: {IS 13367 (Part 5): 1992}

Overhead crane operators must be physically able to perform their duties, and in compliance with industry standard.

The crane driver shall:

- i. be competent, which means person shall have the necessary ability, knowledge and skill for operating the crane, so that person can act effectively in a job or any situation
- ii. be more than 18 years of age
- iii. be fit, particularly with regard to eyesight, hearing, reflexes, the stature to operate the **crane safely**, ability to judge distances, heights and clearances;
- iv. NOTE- Evidence that the driver is medically fit to drive a crane shall be obtained before appointment and recertified at an interval of not more than one year. Certificate shall be kept in the department and shall be produce as and when required
- v. be trained in the type of crane being driven and have knowledge of the crane and its safety devices

- vi. understand fully the duties of the slinger and signaler and be familiar with the signal code shown in Fig. 2 and any alternative methods of relaying the signals which are to be used for the operation being undertaken in order to implement safely the instruction of the slinger or signaler
- vii. be familiar with the fire appliances on the crane and be trained in their use.
- viii. Before operating the crane, operator shall be authorized to operate the crane by a competent person nominated by the department.
- ix. Be drug and alcohol free during any lifting event
- x. Have the ability to react quickly in an emergency

NOTE- It is also recommended that a record of the drivers training and experience is maintained. Such records should be made available to the appointed person

3.3.2 General Safety Guideline for operators:

Operator must follow the Do's and Don'ts as given below:

	DO'S		DON'TS
1.	Wear Safety Helmet, Safety shoe, Safety goggles, safety jackets, Safety belt (Where required) and other required PPEs before leaving the operator rest room for going to the crane	1	Don't operate the crane if the signal is not clear or given by more than one person.
2	Wear safety goggle in open type cabin	2	Don't operate unless the over hoist limit switch is functioning.
3	Acquire information about the crane shut down or break down.	3	Don't make oblique pull which misalign rope with hoist.
4	Know the standard hand signal.	4	Don't lift unless load slings are centered on hook or load is properly balanced.
5	Follow written instruction provided in the cabin (if any).	5	Don't move a load over people in the shop floor.
6	Pull all the controllers in 'Zero' while not in operation.	6	Don't create panic for any abnormality of the crane, stop the crane and inform the ground crew.
7	Put OFF individual hoist safety switches which is not in operation.	7	Don't use mobile phone; talk with others, read newspaper and magazine during the crane operation.
8	Ring the gong bell before starting the crane.	8	Don't operate the crane if feel sick, feeling giddiness or high Blood pressure. Inform the ground crew.
9	Watch proper rigging on load before lifting.	9	Don't try to come out from the cabin during the power failure.

10	Lift load a few inches and test hoist brake before making complete lift.	10	Don't leave operating position with suspended load on hook.
11	Move the crane knowing the ground hazards or according to the signal on the shop floor.	11	Don't leave the crane before ensuring the control power is OFF and all controllers are in 'Zero' position.
12	During L T movements ring the gong bell if automatic bell is not working.	12	Do not operate the crane by any other parts of the body. Operate the crane with the hands only.
13	Inform the concern maintenance agency immediately if any abnormality noticed like heavy vibration, jerking, heavy noise, bad smell , visible damage , smoke etc.	13	Don't operate the crane if under the influence of alcohol or drugs
14	Check the emergency light(if provided)	14	Do Not allow riders on loads or hooks.

3.3.3 Pre-operational Test:-

At the start of each work shift, operators shall do the following steps before making lifts with any crane or hoist:

- i. Check the condition of Pilot lamp (RED & GREEN)
- ii. Check the physical conditions of controller
- iii. Check Overall cleanliness of the Cabin
- iv. Check for any damage of window glasses and cleanliness
- v. Test communication system provided inside the cabin
- vi. Check Fan, light & Air conditioner condition(if provided)
- vii. Test the Hoist-limit switch. Slowly raise the unloaded hook block until the limit switch cuts and crane goes off.
- viii. Visually inspect the hook, load lines, trolley, and bridge as much as possible from the operator's station; in most instances, this will be the floor of the building.
- ix. If possible, test the lower-limit switch.
- x. Test all direction and speed controls for both bridge and trolley travel.
- xi. Test all bridge and trolley limit switches, where provided.
- xii. Test the pendant emergency stop (wherever applicable).
- xiii. Test the hoist brake to verify there is no drift without a load.
- xiv. Check the Gong bell and test the Auto alarm for LT movement
- xv. Immediately report any abnormality to shift-in-charge

3.3.4 Parking/Leaving of crane:

Whenever leaving or parking the cranes, following safe practices (as a minimum) shall be observed:

- i. Raise all hooks up to limit switches.
- ii. Place all controls in the "off" position.

- iii. Place main power switch in the “off” position.
- iv. Make a visual check for any dangerous condition.
- v. Report any defects immediately.

3.3.5 Safe Practices for Signalers:

The signaler should:

- i. be competent, which means person shall have the necessary ability, knowledge and skill for giving signals, so that crane operator can act effectively in a job or any situation
- ii. be more than 18 years of age,
- iii. be fit with particular regard to eye sight, hearing, mobility, ability to judge distances, heights and clearances;
- iv. understand the signal code shown in Fig. 2 for the crane being operated and be able to give clear and precise signals
- v. be capable of directing the safe movement of the crane and load
- vi. Only one person is the designated signaler.
- vii. Maintain line-of-sight with the operator.
- viii. Ensure the operator acknowledges every signal.
- ix. Stop the operation if comprehension is lost.

3.3.6 Hand Signal:

STANDARD HAND SIGNAL:-

There are nine industry standard hand signals that are used for communication between the operator in the crane's cab and the floor person. These signals are:



HOIST (RAISE)

With forearm vertical— and forefinger pointing up— move hand in small horizontal circle



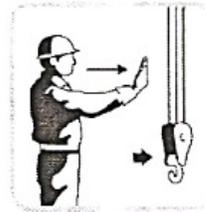
STOP

With arm extended—and palm down—hold position rigidly



LOWER

With arm extended downward— and forefinger pointing down— move hand in small horizontal circle



BRIDGE TRAVEL

With arm extended forward— and hand open and slightly raised — make pushing motion in direction of travel.



TROLLEY TRAVEL

With palm up— and fingers closed — point in direction of motion, and jerk hand horizontally.



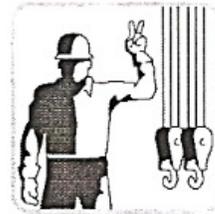
STOP

With arm extended—and palm down—hold position rigidly.



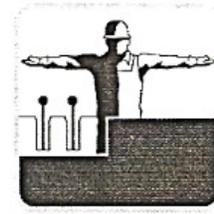
EMERGENCY STOP

With arm extended—and palm down—move hand rapidly to the right and left.



MULTIPLE HOIST

Hold up one finger to indicate 1, and two fingers to indicate block 2. Follow with regular hand



MAGNET DISCONNECT

With palms up, crane operators spreads both hands apart

3.3.7 Daily checklist of Crane operators:

Checklist for EOT crane operation

Department:

Crane / equipment name:

Date:

Sl	Check Points	OK/Not OK	Remarks (if any)
1	All controllers in 'Zero' position		
2	Operation of emergency / Safety switch		
3	Status of Red / Green signal lamps		
4	Individual hoist safety switch		
5	Electric bell		
6	Communication system with ground crew (if any)		
7	Operation of Over hoist limit switches (Rotary only)		
8	Operation of Over lowering limit switch (if provided)		
9	Condition of Cabin glass panes, Seat, Light & Fan		
10	Overall cleanliness of the operator's cabin		
11	Cross travel end limit switch		
12	Operation of Brakes		
13	Under – slung lights (Girder / Trolley lights)		
14	Availability of Fire Extinguisher		
15	Locking of Hook if provided		
16	Any other abnormality.....		

3.3.8 Training of Crane Operators:

Training to the crane operator shall be provided as per IS 13583 (Part 1).

3.4 Safety during EOT Crane maintenance:

3.4.1 General Requirement:

- i. A Standard Operating Procedure (SOP) shall be prepared and followed for maintenance of crane during shutdown and breakdown.
- ii. Before the maintenance work on a crane is taken up, the group in-charge shall inform the operation shift in-charge regarding the nature and duration of work and take necessary work permit.
- iii. Before starting any maintenance work, a six direction hazard form shall be filled up by the group in-charge or any one person authorized by him and shall explained to all the person working in that group
- iv. The crane which is to be shut down for maintenance and repair, shall be brought to the repair bay or to the repair platform or to any other suitable place where the crane may be shut down for maintenance with least interference to other cranes.
- v. Only the designated crane operator or a specially trained and authorized person having knowledge and skill regarding safe operation of various mechanisms of the crane shall be allowed to operate a crane during maintenance job of the crane.
- vi. When the crane is brought to the required place, the group in-charge of maintenance shall arrange for necessary barrication;
- vii. Use of scaffolding on the crane for repair maintenance work shall be prohibited except for location not otherwise possible
- viii. Persons deployed on the crane during maintenance or supervision should have secured foothold while at work and must guard themselves against tripping, slipping or getting unbalanced. They must make use of **full body harness with double lanyard** wherever necessary. The group in-charge shall brief this to all persons before start of work

3.4.2 Safety Watcher

Following the Risk Assessment and the application of the control measures above, there may be a need to appoint a safety watcher to control the general work. This safety watcher must be a dedicated role and not an active part of the working party. The working party team leader must have the correct equipment as a suitable means of communicating to the working party and crane drivers.

3.4.3 Climbing on the running crane:

One calling bell shall be provided at the entrance to the crane for communicating with the crane operator before going to the crane. Minimum one calling bell or any other system should be provided in the both gantry side entrance. Crane operator, maintenance crew or any other person want to enter into the crane must communicate with the crane operator by ringing the bell or any other system.

After hearing the sound of the bell, crane operator must stop the crane within a reasonable distance. If communication is possible through eye contact then person must communicate to the crane operator regarding entry to the crane. On getting the permission from the crane operator and/or stopping of the crane, person must put off one of the safety switch provided at the four corners of the crane and board onto the crane. After boarding same switch to be put on and again press the Calling bell for giving clearance to run the crane. Same method must be followed during coming out from the crane.

3.4.4 Trapping/hitting by Adjacent Cranes running on same track

To prevent trapping/hitting by adjacent cranes, Positive isolation for other cranes on the same track or cranes working above/below shall be implemented.

For crane positioned at one side of the building (sick bay/Hospital bay/Repair bay), wheel stoppers shall be placed on both the tracks of required side at a distance of minimum six meters from the crane. In case of a middle crane, stopper shall be fixed up on both sides at minimum six meter away from the crane.

While placing or removing the wheel stopper in the track rail, it must be ensured that the other cranes should not move in that bay by placing one person in other crane operator's cabin to guide him and switching off the power of the other crane for the duration. The hazard to the person involved in placement or removal of stopper can be eliminated by using the wheel stopper.

A red flag of minimum size of 2meter X 3meter is to be hanged at the middle of the span, at least one meter from the wheel stopper towards the moving crane zone.

All wheel stoppers shall be locked by positive isolation lock with the gantry and to be mention in the permit to work form.

For working on power rail or power collector, power of power rail to be positively isolated and all phase shall be shorted and grounded by metallic chain and locked. It will be over and above the positive isolation on the Tracks as mentioned in this clause.

During erection / Dismantling of cranes or when crane is required to be kept down for more than one week, double wheel stopper shall be provided.

3.4.5 Trapping by Adjacent Cranes running on parallel track/Gantry

To prevent trapping/hitting by adjacent cranes running on parallel bays/tracks following actions to be taken for planned maintenance or unplanned maintenance jobs:

- a) There should be railing at height of at least 900mm from the floor of crane gantry/passageway on both sides, with at least two horizontal members in the railing and with toe board at a height of at least 100mm from the floor.
- b) No one shall rest/support or put any gas cutting/welding equipment/anchor safety belt or kept any material on the railing of running crane side.

If the width between the railing of the gantry/passageway is less than 1000mm or there is a chance of dashing during working on crane under shutdown or breakdown by the running crane, positive isolation system to be implemented.

3.4.6 Trapping by Motions on the crane

To prevent trapping by any of the crane motions (i.e. hoist, cross travel, long travel, and cab traverse), Isolation/ Restriction of the crane being worked must be applied. This trapping can be between a crane motion and the crane structure or a crane motion and fixed building structures such as roof trusses, gantry columns, handrails, gantry long travel buffers. All the motion other than the motion required to be tried/work shall be made OFF either from the panel or from Control stop panel provided on the gantry. Positive isolation standard shall be followed for that.

During any powered tasks where it is a requirement to be on the crane whilst movement takes place, necessary precautions shall be in place.

Necessary barricade shall be provided to avoid any trapping potential from open drum and ropes, pulley blocks, reeling drums, thrusters, brakes, Floating shafts and couplings.

Restriction of any stored energy must also be considered, for example, hoist assemblies and fixed masts will lower under gravity when released, spring thrusters will close/open when isolated.

3.4.7 Protection from incoming power before working in electric panels:

All those electrical panels or Junction Boxes, where maintenance jobs are carried out in close proximity to 415V or above incoming live voltage, live portion shall be made access proof with suitable barriers or other engineering means. If that is not possible then in such electrical panels no maintenance job shall be carried out without full positive isolation of the incoming power.

Compliance with Low Voltage safety rules and High Voltage Safety Rules, including specific Works Supplement is mandatory.

Additional control measures must be adopted during any live observational testing on moving equipment.

a) Live Power Rail

Low Voltage and High Voltage safety rules must be adhered to.

b) 690V power rail

No person should stand near 690V power rail. For observation person should keep distance not less than 6m from live power rail

Before working on power rail positive isolation shall be done as per standard

Isolation – Cabin Operated cranes

Isolation of cranes for electrical work must only be undertaken by competent personnel, multiple isolators may exist for main, auxiliary, and magnet circuits.

For any type of isolation, danger boards and locks should be used in accordance with the isolation standard

Boarding Switches shall not be used for isolation; they are only to be used for accessing/egressing the cranes.

Isolation - Remote Control cranes

Access to remote control boxes shall be controlled through SOP

A separate SOP shall be made for the operation and maintenance of Remote control crane

NB: The placing of personal danger boards on the transmitter is not a secure isolation in itself. The crane to be worked on must be isolated at the appropriate isolation point.

3.4.8 Inspection of hoist limits switch

Each department shall have a systems and procedures in place to inspect Hoist limit switch, minimum once in a day for those cranes which are running on regular basis. For those cranes which are running intermittently shall be checked before starting the crane and register shall also be maintained for that. Separate register shall be maintained for each crane and each motion. Any abnormality shall be mentioned in the register and shall rectify as soon as possible.

3.4.9 Fall of object from the crane or Crane gantry

If work is to be undertaken adjacent to an open edge where equipment or tools have the potential to fall, then effective measures shall be put in place to prevent such equipment falling from height, this may include hand tool lanyards, tool bags for carrying hand tools and bolt boxes for the storage and carrying of bolts, nuts etc. Controls should also be implemented to ensure personnel do not enter the danger zone below. This could include visual display, physical barriers and/or safety watcher. Materials left on the crane or crane gantry must be stored and secured safely. The level of control will be dependent on the level of the risk. The safety watcher must be posted in a safe area where they would not be exposed to the risk of falling objects.

All materials and equipment used during maintenance should be removed on completion of the task, to avoid items falling from the crane during use.

A final check of the work area, for loose objects, must be made by the working party leader before signing off the crane access control and notification sheet.

3.4.10 Work Above or Below Crane Gantries:

This section details the precautions to be observed when work is carried out on gantry columns, above or below crane tracks, or anywhere in the space traversed by an overhead crane and its load. The items shown below would require a permit to work system

Definition of Work above or below crane gantries

- i. Work erecting, dismantling or on scaffolding above the height of adjacent structures in the bay.
- ii. Work erecting, dismantling or on scaffolding on or beside gantries and columns.
- iii. Work erecting, dismantling or on scaffolding on board a crane (changing lamps, etc).
- iv. Work from a temporary platform above ground level within the space traversed by EOT crane where there is a danger of being struck by that crane or load.
- v. Work from a Mobile Elevating Work Platform (MEWP), which is used to gain access to the crane or crane tracks or when the MEWP is used for other work where there is a danger of being struck by a crane or its load.
- vi. Work using a mobile crane where there is a danger of being struck by an overhead crane or its load
- vii. Work which entails bringing in mobile plant which could be struck by overhead crane or its load

Work from a fixed structure/platform risk analysis of individual task should identify the suitable controls in place to prevent collision from the crane/load to the structure.

Warning lights must be clearly placed on any temporary structure erected in the crane working zone and left in place even when work is not ongoing. These must be visible to crane drivers traversing that area. Orange Flashing Lights indicating crane drivers proceed with caution, Red Flashing lights indicating crane drivers not to pass this point, until Red Light has been withdrawn.

3.4.11 Scaffolding

If a scaffold or working platform is to be erected in a position where it could be struck by a crane or its load, the person responsible for erection, along with Person-In-Charge of Cranes must assess the risk of any protrusions into the crane traversing space. The Person-In-Charge of Cranes must ensure that the Working agency has checked that a traversing crane cannot strike the platform and any persons working on the platform.

When erecting, working from and dismantling scaffolding a person must be kept in the operator cabin of the running crane to ensure that crane shall not strike scaffolding or any person.

Once the scaffolding has been erected the working agency will determine:

- a. Can the scaffold be struck by the crane structure – If the scaffold can be struck by the crane structure the task owner must ensure appropriate controls are in place to prevent such a collision. This may include isolation/ stop of the crane.
- b. Can the scaffold be struck by the crane load - If the scaffold can be struck by the crane load, the working agency will assess the potential and the consequences should a collision occur between the crane load and the scaffold structure. If the level of risk is identified as "significant" appropriate controls must be implemented to prevent such a collision.

In addition to the controls detailed in a and b above, the working agency will ensure that a flashing light is attached to an appropriate point to highlight the scaffold to approaching crane drivers. This light must be effective for the duration that the scaffolding is erected.

If a scaffold is erected attached to the crane, Person-In-Charge of Cranes should ensure that a controlled pass of the full length of the bay is undertaken, to ensure clearance of the scaffold. If the scaffold could collide with a fixed building structure the crane should be prevented from travelling to that position. The Working agency should not be allowed to travel on this scaffold when the crane is moving. During the erection, removal, and whilst work is being undertaken on the platform a positive isolation system must be followed by the Person-In-Charge of Cranes.

3.4.12 Working of Mobile Cranes in the vicinity of EOT crane

Before using a mobile crane in any building or gantry traversed by an Overhead Crane, the person responsible for the work must obtain a work permit from the Person-In-Charge of Cranes.

Power rail must be isolated if any part of the crane, ropes or load are within 6m.

3.5 Unplanned Movement

Where an overhead crane could move due to wind force, track gradient, etc, effective measures must be taken to prevent any unplanned movement.

Consideration when working on hoist equipment must be made of the potential effects of gravity. e.g. blocks, fixed masts will lower if brake lifted. Wherever possible hoist equipment should be lowered to floor level and the drive chain/motion immobilised.

If it is necessary for a crane to temporarily enter a sick bay zone or inside the barrication, effective measures shall be taken by the Person in Charge of Cranes to ensure the safety of all men working within that zone.

3.6 Environmental conditions - Gas/Fumes/Dust/Heat/Molten Metal

- i. Cranes can be exposed to gas risks and air borne contamination. Conditions can deteriorate where it becomes unsafe to work and personnel should leave the area.

- ii. Access to the crane should be prevented if there is a possibility that the Environmental conditions may prevent safe egress from the crane. The working party must take Gas detector or Respiratory Protective Equipment (RPE) onto the crane if such risks are identified.
- iii. When working in High temperatures the supervisor must maintain an awareness of the workforce condition.
- iv. Single working on crane is not permitted, and if a person feels unwell he must leave the area immediately.
- v. Wherever possible, cranes must not be parked in the vicinity of poor atmospheric conditions for maintenance purposes, e.g. over furnaces, steam etc. Consideration should also be taken for hazards from weather conditions (wind, rain, etc). Risk assessments should identify the suitable precautions, which need to be undertaken.

REFERENCES

1. IS13473 Part 1,
2. Factory Act 1948,
3. Bihar Factories Rules, 1950
4. IPSS 1-11-015-12
5. Tata Steel India Safety Standard: Safety standard for cranes, SS/ ELEC-10