



- 5.6.3 Sign boards (1 m x 1.5 m in size) shall be displayed prominently with the following wording at the access points to the construction areas - "CONSTRUCTION AREA, PPE REQUIRED TO BE WORN BEYOND THIS POINT".
- 5.6.4 Arrangement for rendering prompt and adequate first aid to the injured persons shall be maintained at every work site. Depending upon the magnitude of the work, the availability of an ambulance at a very short notice (a telephone call) shall be ensured.
- 5.6.5 First-aid arrangements commensurate with the degree of hazard and with the number of workers employed shall be maintained in a readily accessible place. Arrangements shall be made for calling the medical officer, when such a need may arise. It is recommended that foreman / assistant foreman / supervisor/ permanent workmen who are normally present at each working phase in each shift are given adequate training on first-aid methods.

5.7 STRUCTURAL WORK, LAYING OF REINFORCEMENT & CONCRETING

5.7.1 General provisions

- I. The erection or dismantling of buildings, structures, civil engineering works, formwork, false work and shoring should be carried out by trained workers only under the supervision of a competent person.
- II. Precautions should be taken to guard against danger to workers arising from any temporary state of weakness or instability of a structure.
- III. Formwork, false work and shoring should be so designed, constructed and maintained that it will safely support all loads that may be imposed on it.
- IV. Formwork should be so designed and erected that working platforms, means of access, bracing and means of handling and stabilizing are easily fixed to the formwork structure.

5.7.2 Erection and dismantling of steel and prefabricated structures

- I. The safety of workers employed on the erection and dismantling of steel and prefabricated structures should be ensured by appropriate means, such as provision and use of:
 - ladders, gangways or fixed platforms;
 - platforms, buckets, boatswain's chairs or other appropriate means suspended from lifting appliances;
 - safety harnesses and lifelines, catch nets or catch platforms;
 - Power-operated mobile working platforms.



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- II. Steel and prefabricated structures should be so designed and made that they can be safely transported and erected.
- III. In addition to the need for the stability of the part when erected, the design should explicitly take following into account:
 - the conditions and methods of attachment in the operations of transport, storing and temporary support during erection or dismantling as applicable;
 - Methods for the provision of safeguards such as railings and working platforms, and, when necessary, for mounting them easily on the structural steel or prefabricated parts.
- IV. The hooks and other devices built in or provided on the structural steel or prefabricated parts that are required for lifting and transporting them should be so shaped, dimensioned and positioned as:
 - to withstand with a sufficient margin the stresses to which they are subjected;
 - Not to set up stresses in the part that could cause failures, or stresses in the structure itself not provided for in the plans, and be designed to permit easy release from the lifting appliance. Lifting points for floor and staircase units should be located (recessed if necessary) so that they do not protrude above the surface;
 - To avoid imbalance or distortion of the lifted load.
- V. Store places should be so constructed that:
 - there is no risk of structural steel or prefabricated parts falling or overturning;
 - storage conditions generally ensure stability and avoid damage having regard to the method of storage and atmospheric conditions;
 - Racks are set on firm ground and designed so that units cannot move accidentally.
- VI. While they are being stored, transported, raised or set down, structural steel or prefabricated parts should not be subjected to stresses prejudicial to their stability.
- VII. Every lifting appliance should:
 - Be suitable for the operations and not be capable of accidental disconnection;
 - Be approved or tested as per statutory requirement.
- VIII. Lifting hooks should be of the self-closing type or of a safety type and should have the maximum permissible load marked on them.
- IX. Tongs, clamps and other appliances for lifting structural steel and prefabricated parts should:
 - (a) be of such shape and dimensions as to ensure a secure grip without damaging the part;
 - (b) Be marked with the maximum permissible load in the most unfavorable lifting conditions.



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- X. Structural steel or prefabricated parts should be lifted by methods or appliances that prevent them from spinning accidentally.
- XI. When necessary to prevent danger, before they are raised from the ground, structural steel or prefabricated parts should be provided with safety devices such as railings and working platforms to prevent falls of persons.
- XII. While structural steel or prefabricated parts are being erected, the workers should be provided with appliances for guiding them as they are being lifted and set down, so as to avoid crushing of hands and to facilitate the operations. Use of such appliances should be ensured.
- XIII. A raised structural steel or prefabricated part should be so secured and wall units so propped that their stability cannot be imperiled, even by external agencies such as wind and passing loads before its release from the lifting appliance.
- XIV. At work places, instruction should be given to the workers on the methods, arrangements and means required for the storage, transport, lifting and erection of structural steel or prefabricated parts, and, before erection starts, a meeting of all those responsible should be held to discuss and confirm the requirements for safe erection.
- XV. During transportation within the construction area, attachments such as slings and stirrups mounted on structural steel or prefabricated parts should be securely fastened to the parts.
- XVI. Structural steel or prefabricated parts should be so transported that the conditions do not affect the stability of the parts or the means of transport result in jolting, vibration or stresses due to blows, or loads of material or persons.
- XVII. When the method of erection does not permit the provision of other means of protection against fall of persons, the workplaces should be protected by guardrails, and if appropriate by toe-boards.
- XVIII. When adverse weather conditions such as snow, ice and wind or reduced visibility entail risks of accidents, the work should be carried on with particular care, or, if necessary, interrupted.
- XIX. Structures should not be worked on during violent storms or high winds, or when they are covered with ice or snow, or are slippery from other causes.
- XX. If necessary, to prevent danger, structural steel parts should be equipped with attachments for suspended scaffolds, lifelines or safety harnesses and other means of protection.



- XXI. The risks of falling, to which workers moving on high or sloping girders are exposed, should be limited by all means of adequate collective protection or, where this is impossible, by the use of a safety harness that is well secured to a strong support.
- XXII. Structural steel parts that are to be erected at a great height should as far as practicable be assembled on the ground.
- XXIII. When structural steel or prefabricated parts are being erected, a sufficiently extended area underneath the workplace should be barricaded or guarded.
- XXIV. Steel trusses that are being erected should be adequately shored, braced or guyed until they are permanently secured in position.
- XXV. Load-bearing structural member should not be dangerously weakened by cutting, holing or other means.
- XXVI. Structural members should not be forced into place by the hoisting machine while any worker is in such a position that he could be injured by the operation.
- XXVII. Open-web steel joists that are hoisted singly should be directly placed in position and secured against dislodgment.

5.7.3 Reinforcement

- I. Ensure that workers use Personnel Protective Equipment like safety helmet, safety shoes, gloves etc.
- II. Don't place the hand below the rods for checking clear distance. Use measuring devices.
- III. Don't wear loose clothes while checking the rods.
- IV. Don't stand unnecessarily on cantilever rods.
- V. To carry out welding/cutting of rods, safety procedures/precautions as required are followed.
- VI. For supplying of rods at heights, proper staging and/or bundling to be provided.
- VII. Ensure barricading and staging for supplying and fixing of rods at height.
- VIII. For short distance carrying of materials on shoulders, suitable pads to be provided.
- IX. While transporting material by trucks/trailers, the rods shall not protrude in front of or by the sides of driver's cabin. In case such protrusion cannot be avoided behind the deck, then it



should not extend 1/3rd of deck length or 1.5 M whichever is less and tied with red flags/lights.

5.7.4 Concreting

- I. Ensure stability of shuttering work before allowing concreting.
- II. Barricade the concreting area while pouring at height/depths.
- III. Keep vibrator hoses, pumping concrete accessories in healthy conditions and mechanically locked.
- IV. Pipelines in concrete pumping system shall not be attached to temporary structures such as scaffolds and formwork support as the forces and movements may affect their integrity.
- V. Check safety cages & guards around moving motors/parts etc. provided in concreting mixers.
- VI. Use Personal Protective Equipment like gloves, safety shoes etc. while dealing with concrete and wear respirators for dealing with cement.
- VII. Earthing of electrical mixers, vibrators, etc. should be done and verified.
- VIII. Cleaning of rotating drums of concrete mixers shall be done from outside. Lockout devices shall be provided where workers need to enter.
- IX. Where concrete mixers are driven by internal combustion engine, exhaust points shall be located away from the worker's workstation so as to eliminate their exposure to obnoxious fumes.
- X. Don't allow unauthorized person to stand under the concreting area.
- XI. Ensure adequate lighting arrangements for carrying out concrete work during night.
- XII. Don't allow the same workers to pour concrete round the clock. Insist on shift pattern.
- XIII. During pouring, shuttering and its supports should be continuously watched for defects.

5.8 ROAD WORK

- 5.8.1 Site shall be barricaded and provided with warning signs, including night warning lamps at appropriate locations for traffic diversion.
- 5.8.2 Filled and empty bitumen drums shall be stacked separately at designated places.



- 5.8.3 Mixing aggregate with bitumen shall preferably be done with the help of bitumen batch mixing plant, unless operationally non-feasible.
- 5.8.4 Road rollers, Bitumen sprayers, Pavement finishers shall be driven by experienced drivers with valid driving license.
- 5.8.5 Workers handling hot bitumen sprayers or spreading bitumen aggregate mix or mixing bitumen with aggregate shall be provided with PVC hand gloves and rubber shoes with legging up to knee joints.
- 5.8.6 At the end of day's work, surplus hot bitumen in tar boiler shall be properly covered by a metal sheet, to prevent anything falling in it,
- 5.8.7 If bitumen accidentally falls on ground, it shall be immediately covered by sprinkling sand, to prevent anybody stepping on it. Then it shall be removed with the help of spade.
- 5.8.8 For cement concrete roads, besides site barricading and installation of warning signs for traffic diversion, safe practices mentioned in the chapter on "Concreting", shall also be applicable.

5.9 CUTTING/WELDING

- 5.9.1 Common hazards involved in welding/cutting are sparks, molten metal, flying particles, harmful light rays, electric shocks etc. Following precautions should be taken:
 - I. Dry chemical type fire extinguishers shall be made available in the work area.
 - II. Adequate ventilation shall be ensured by opening manholes and fixing a shield or forced circulation of air etc. while doing a job in confined space.
 - III. Ensure that only approved and well-maintained apparatus, such as torches, manifolds, regulators or pressure reducing valves, and acetylene generators, be used.
 - IV. All covers and panels shall be kept in place, when operating an electric Arc welding machine.
 - V. The work piece should be connected directly to Power supply, and not indirectly through pipelines/structures/equipment etc.
 - VI. The welding receptacles shall be rated for 63 a suitable for 415V, 3-Phase system with a scraping earth. Receptacles shall have necessary mechanical interlocks and earthing facilities.
 - VII. All cables, including welding and ground cables shall be checked for any worn out or cracked insulation before starting the job. Ground cable should be separate without any loose joints.
 - VIII. Cable coiling shall be maintained at minimum level, if not avoidable.
 - IX. An energized electrode shall not be left unattended.



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- X. The power source shall be turned off at the end of job.
- XI. All gas cylinders shall be properly secured in upright position.
- XII. Acetylene cylinder shall be turned and kept in such a way that the valve outlet points away from oxygen cylinder.
- XIII. Acetylene cylinder key for opening valve shall be kept on valve stem, while cylinder is in use, so that the acetylene cylinder could be quickly turned off in case of emergency. Use flash back arrestors to prevent back-fire in acetylene/oxygen cylinder.
- XIV. When not in use, valves of all cylinders shall be kept closed.
- XV. All types of cylinders, whether full or empty, shall be stored at cool, dry place under shed.
- XVI. Forced opening of any cylinder valve should not be attempted.
- XVII. Lighted gas torch shall never be left unattended.
- XVIII. Store acetylene and oxygen cylinders separately.
- XIX. Store full and empty cylinders separately.
- XX. Avoid cylinders coming into contact with heat.
- XXI. Cylinders that are heavy or difficult to carry by hand may be rolled on their bottom edge but never dragged.
- XXII. If cylinders have to be moved, be sure that the cylinder valves are shut off.
- XXIII. Before changing torches, shut off the gas at the pressure reducing regulators and not by crimping the hose.
- XXIV. Do not use matches to light torches, use a friction lighter.
- XXV. Move out any leaking cylinder immediately.
- XXVI. Use trolleys for oxygen & acetylene cylinder and chain them.
- XXVII. Always use Red hose for acetylene and other fuel gases and Black for oxygen, and ensure that both are in equal length.
- XXVIII. Ensure that hoses are free from burns, cuts and cracks and properly clamped.
- XXIX. Avoid dragging hoses over sharp edges and objects
- XXX. Do not wrap hoses around cylinders when in use or stored.
- XXXI. Protect hoses from flying sparks, hot slag, and other hot objects.
- XXXII. Lubricants shall not be used on Ox-fuel gas equipment.
- XXXIII. During cutting/welding, use proper type goggles/face shields.



5.10 WORKING IN CONFINED SPACES

- 5.10.1 Following safety practices for working in confined space like towers, columns, tanks and other vessels should be followed in addition to the safety guidelines for specific jobs like scaffolding, cutting/welding etc.
- I. Shut down, isolate, de-pressurize and purge the vessel as per laid down procedures.
 - II. Entry inside the vessel and to carry out any job should be done after issuance of valid permit only in line with the requirements of OISD-STD-105.
 - III. Ensure proper and accessible means of exit before entry inside a confined space.
 - IV. The number of persons allowed inside the vessel should be limited to avoid overcrowding.
 - V. When the work is going on in the confined space, there should always be one man standby at the nearby man way.
 - VI. Before entering inside the vessels underground or located at lower elevation, probability of dense vapors accumulating nearby should also be considered in addition to inside the vessel.
 - VII. Ensure requisite O₂ level before entry in the confined space and monitor level periodically or other wise use respiratory devices.
 - VIII. Check for no Hydrocarbon or toxic substances before entry and monitor level periodically or use requisite Personal Protective Equipment.
 - IX. Ensure adequate ventilation or use respiratory devices.
 - X. Depending upon need, necessary respirator system, gas masks and suit shall be worn by everyone entering confined space. In case of sewer, OWS or in the confined area where there is a possibility of toxic or inert gas, gas masks shall be used by everyone while entering.
 - XI. Barricade the confined spaces during hoisting, radiography, blasting, pressure testing etc.
 - XII. Use 24V flameproof lamp fittings only for illumination.
 - XIII. Use tools with air motors or electric tools with maximum voltage of 24V.
 - XIV. Housekeeping shall be well maintained.
 - XV. Safety helmet, safety shoes and safety belt shall be worn by everyone entering the confined space.
 - XVI. Don't wear loose clothing while working in a confined space.



- XVII. In case of the vessels which are likely to contain pyrophoric substances (like Iron Sulphide), special care need to be taken before opening the vessel. Attempt should be made to remove the pyrophoric substances. Otherwise, these should be always kept wet by suitable means.
- XVIII. The cutting torches should also be kept outside the vessel immediately after the cutting.
- XIX. The gas cylinders used for cutting/welding shall be kept outside.
- XX. All cables, hoses, welding equipment etc., shall be removed from confined space at end of each work day, even if the work is to be resumed in the same space the next day.
- XXI. To the extent possible sludge shall be cleared and removed from outside before entering.
- XXII. No naked light or flame or hot work such as welding, cutting and soldering should be permitted inside a confined space or area unless it has been made completely free of the flammable atmosphere, tested and found safe by a competent person. Only non-sparking tools and flameproof hand lamps protected with guard and safety torches should be used inside such confined space or area for initial inspection, cleaning or other work required to be done for making the area safe.
- XXIII. Communication should be always maintained between the worker and the attendant.

5.11 PROOF/PRESSURE TESTING

- 5.11.1 Review test procedure before allowing testing with water or air or any other fluid.
- 5.11.2 Provide relief valves of adequate size while testing with air or other gases.
- 5.11.3 Ensure compliance of necessary precautions, step wise loading, tightening of fasteners, grouting etc. before and during testing.
- 5.11.4 Inform all concerned in advance of the testing.
- 5.11.5 Keep the vents open before opening any valve for filling/draining of liquid used for hydro testing. The filling/draining should not exceed the designed rate for pressure testing.
- 5.11.6 Provide separate gauges of suitable range for pressurizing pump and the equipment to be tested.
- 5.11.7 Provide gauges at designated locations for monitoring of pressures.
- 5.11.8 Check the calibration of all pressurizing equipment and accessories and maintain records.
- 5.11.9 Take readings at pre-defined intervals.



5.12 WORKING AT HEIGHTS

5.12.1 General Provision

- I. While working at a height of more than 3 meters, ISI approved safety belt shall be used.
- II. While working at a height of more than 3 meters, permit should be issued by competent person before commencement of the job.
- III. Worker should be well trained on usage of safety belt including its proper usage at the time of ascending/descending.
- IV. All tools should be carried in tool kits to avoid their falling.
- V. If the job is on fragile/sloping roof, roof walk ladders shall be used.
- VI. Provide lifeline wherever required.
- VII. Additional safety measures like providing Fall Arrestor type Safety belt, safety net should be provided depending upon site conditions, job requirements.
- VIII. Keep working area neat and clean. Remove scrap material immediately.
- IX. Don't throw or drop material/equipment from height.
- X. Avoid jumping from one member to another. Use proper passageway.
- XI. Keep both hands free while climbing. Don't try to bypass the steps of the ladder.
- XII. Try to maintain calm at height. Avoid over exertion.
- XIII. Avoid movements on beam.
- XIV. Elevated workplaces including roofs should be provided with safe means of access and egress such as stairs, ramps or ladders.

5.12.2 Roof Work

- I. All roof-work operations should be pre-planned and properly supervised.
- II. Roof work should only be undertaken by workers who are physically and psychologically fit and have the necessary knowledge and experience for such work.
- III. Work on roofs shouldn't be carried on in weather conditions that threaten the safety of workers.
- IV. Crawling boards, walkways and roof ladders should be securely fastened to a firm structure.
- V. Roofing brackets should fit the slope of the roof and be securely supported.
- VI. Where it is necessary for a person to kneel or crouch near the edge of the roof, necessary precautions should be taken.
- VII. On a large roof where work have to be carried out at or near the edge, a simple barrier consisting of crossed scaffold tubes supporting a tubing guardrail may be provided.



- VIII. All covers for openings in roofs should be of substantial construction and be secured in position.
- IX. Roofs with a pitch of more than 10 should be treated as sloping.
- X. When work is being carried out on sloping roofs, sufficient and suitable crawling boards or roof ladders should be provided and firmly secured in position.
- XI. During extensive work on the roof, strong barriers or guardrails and toe-boards should be provided to stop a person from falling off the roof.
- XII. Where workers are required to work on or near roofs or other places covered with fragile material, through which they are liable to fall, they should be provided with suitable roof ladders or crawling boards strong enough and when spanning across the supports for the roof covering to support those workers.
- XIII. A minimum of two boards should be provided so that it is not necessary for a person to stand on a fragile roof to move a board or a ladder, or for any other reason.

5.12.3 Work on tall chimneys

- I. For the erection and repair of tall chimneys, scaffolding should be provided. A safety net should be maintained at a suitable distance below the scaffold.
- II. The scaffold floor should always be at least 65 cm below the top of the chimney.
- III. Under the working floor of the scaffolding the next lower floor should be left in position as a catch platform.
- IV. The distance between the inside edge of the scaffold and the wall of the chimney should not exceed 20 cm at any point.
- V. Catch platforms should be erected over:
 - The entrance to the chimney;
 - Passageways and working places where workers could be endangered by falling objects.
- VI. For climbing tall chimneys, access should be provided by:
 - Stairs or ladders;
 - A column of iron rungs securely embedded in the chimney wall;
 - Other appropriate means.
- VII. When workers use the outside rungs to climb the chimney, a securely fastened steel core rope looped at the free end and hanging down at least 3 m should be provided at the top to help the workers to climb on to the chimney.
- VIII. While work is being done on independent chimneys the area surrounding the chimney should be enclosed by fencing at a safe distance.
- IX. Workers employed on the construction, alteration, maintenance or repair of tall chimneys should not:



- work on the outside without a safety harness attached by a lifeline to a rung, ring or other secure anchorage;
 - put tools between the safety harness and the body or in pockets not intended for the purpose;
 - haul heavy materials or equipment up and down by hand to or from the workplace on the chimney;
 - fasten pulleys or scaffolding to reinforcing rings without first verifying their stability;
 - work alone;
 - climb a chimney that is not provided with securely anchored ladders or rungs;
 - Work on chimneys in use unless the necessary precautions to avoid danger from smoke and gases have been taken.
- X. Work on independent chimneys should not be carried on in high winds, icy conditions, fog or during electrical storms.

5.13 HANDLING AND LIFTING EQUIPMENT:

5.13.1 General Provisions

Following are the general guidelines to be followed with regard to all types of handling and lifting equipment in addition to the guidelines for specific type of equipment dealt later on.

- I. There should be a well-planned safety program to ensure that all the lifting appliances and lifting gear are selected, installed, examined, tested, maintained, operated and dismantled with a view to preventing the occurrence of any accident;
- II. All lifting appliances shall be examined by competent persons at frequencies as specified in "The Factories Act".
- III. Check thoroughly quality, size and condition of all lifting tools like chain pulley blocks, slings, U-clamps, D-shackles etc. before putting them in use.
- IV. Safe lifting capacity of all lifting & handling equipment, tools and shackles should be got verified and certificates obtained from competent authorities before its use. The safe working load shall be marked on them.
- V. Check periodically the oil, brakes, gears, horns and tire pressure of all moving equipment like cranes, forklifts, and trailers etc. as per manufacturer's recommendations.
- VI. Check the weights to be lifted and accordingly decide about the crane capacity, boom length and angle of erection.



- VII. Allow lifting slings as short as possible and check packing at the friction points.
- VIII. While lifting/placing of the load, no unauthorized person shall remain within the radius of the boom and underneath the load.
- IX. While loading, unloading and stacking of pipes, proper wedges shall be placed to prevent rolling down of the pipes.
- X. Control longer jobs being lifted up from both ends.
- XI. Only trained operators and riggers should carry out the job. While the crane is moving or lifting the load, the trained rigger should be there for keeping a vigil against hitting any other object.
- XII. During high wind conditions and nights, lifting of heavy equipment should be avoided. If unavoidable to do erection in night, operator and rigger should be fully trained for night signaling. Also proper illumination should be there.
- XIII. Allow crane to move on hard, firm and leveled ground.
- XIV. When crane is in idle condition for long periods or unattended, crane boom should either be lowered or locked as per manufacturer's guidelines.
- XV. Hook and load being lifted shall remain in full visibility of crane operators, while lifting, to the extent possible.
- XVI. Don't allow booms or other parts of crane to come within 3 meters reach of overhead electrical cables.
- XVII. No structural alterations or repairs should be made to any part of a lifting appliance, which may affect the safety of the appliance without the permission and supervision of the competent person.

5.13.2 Hoists

- I. Hoist shafts should be enclosed with rigid panels or other adequate fencing at:
 - ground level on all sides;
 - all other levels at all points at which access is provided;
 - All points at which persons are liable to be struck by any moving part.
- II. The enclosure of hoist shafts, except at approaches should extend where practicable at least 2 m above the floor, platform or other place to which access is provided except where a lesser height is sufficient to prevent any person falling down the hoist way and there is no risk of any person coming into contact with any moving part of the hoist, but in no case should the enclosure be less than 1mt in height.



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- III. The guides of hoist platforms should offer sufficient resistance to bending and, in the case of jamming by a safety catch, to buckling.
- IV. Where necessary to prevent danger, adequate covering should be provided above the top of hoist shafts to prevent material falling down them.
- V. Outdoor hoist towers should be erected on firm foundations, and securely braced, guyed and anchored.
- VI. A ladder way should extend from the bottom to the top of outdoor hoist towers, if no other ladder way exists within easy reach.
- VII. Hoisting engines should be of ample capacity to control the heaviest load that they will have to move.
- VIII. Hoists should be provided with devices that stop the hoisting engine as soon as the platform reaches its highest stopping place.
- IX. Winches should be so constructed that the brake is applied when the control handle is not held in the operating position.
- X. It should not be possible to set in motion from the platform a hoist, which is not designed for the conveyance of persons.
- XI. Winches should not be fitted with pawl and ratchet gears on which the pawl must be disengaged before the platform is lowered.
- XII. Hoist platforms should be capable of supporting the maximum load that they will have to carry with a safety factor.
- XIII. Hoist platforms should be equipped with safety gear that will hold the platform with the maximum load if the hoisting rope breaks.
- XIV. If workers have to enter the cage or go on the platform at landings there should be a locking arrangement preventing the cage or platform from moving while any worker is in or on it.
- XV. On sides not used for loading and unloading, hoist platforms should be provided with toe-boards and enclosures of wire mesh or other suitable material to prevent the fall of parts of loads.
- XVI. Where necessary to prevent danger from falling objects, hoist platforms should be provided with adequate covering.
- XVII. Counterweights consisting of an assemblage of several parts should be made of specially constructed parts rigidly connected together.
- XVIII. Counterweights should run in guides.



- XIX. Platforms should be provided at all landings used by workers.
- XX. Following notices should be posted up conspicuously and in very legible characters:
- a) on all hoists:
 - on the platform: the carrying capacity in kilograms or other appropriate standard unit of weight;
 - on the hoisting engine: the lifting capacity in kilograms or other appropriate standard unit of weight;
 - b) on hoists authorized or certified for the conveyance of persons:
 - on the platform or cage: the maximum number of persons to be carried at one time;
 - c) on-hoists for goods only:
 - On every approach to the hoist and on the platform: prohibition of use by persons.
- XXI. Hoists intended for the carriage of persons should be provided with a cage so constructed as to prevent any person from falling out or being trapped between the cage and any fixed part of the structure when the cage gate is shut, or from being struck by the counterbalance weight or by articles or materials tailing down the hoist way.
- XXII. On each side in which access is provided, the cage should have a gate fitted with devices which ensure that the gate cannot be opened except when the cage is at a landing and that the gate must be closed before the cage can move away from the landing.
- XXIII. Every gate in the enclosure of the hoist shaft which gives access from a landing place to the cage should be fitted with devices to ensure that the gate cannot be opened except when the cage is at that landing place, and that the cage cannot be moved away from that landing place until the gate is closed.

5.13.3 Derricks

I. Stiff-leg derricks

- a) Derricks should be erected on a firm base capable of taking the combined weight of the crane structure and maximum rated load.
- b) Devices should be used to prevent masts from lifting out of their seating.
- c) Electrically operated derricks should be effectively earthed from the sole plate or framework.
- d) Counter weights should be so arranged that they do not subject the backstays, sleepers or pivots to excessive strain.
- e) When derricks are mounted on wheels:
 - a rigid member should be used to maintain the correct distance between the wheels;



- They should be equipped with struts to prevent them from dropping if a wheel breaks or the derrick is derailed.
- f) The length of a derrick jib should not be altered without consulting the manufacturer.
- g) The jib of a scotch derrick crane should not be erected within the backstays of the crane.

II. Guy derricks

- a) The restraint of the guy ropes should be ensured by fitting stirrups or anchor plates in concrete foundations.
- b) The mast of guy derricks should be supported by six top guys spaced approximately equally.
- c) The spread of the guys of a guy derrick crane from the mast should not be more than 450 from the horizontal.
- d) Guy ropes of derricks should be equipped with a stretching screw or turnbuckle or other device to regulate the tension.
- e) Gudgeon pins, sheave pins and fool bearings should be lubricated frequently.
- f) When a derrick is not in use, the boom should be anchored to prevent it from swinging.

5.13.4 Gin poles

- I. Gin poles should:
 - a) be straight;
 - b) consist of steel or other suitable metal;
 - c) be adequately guyed and anchored;
 - d) be vertical or raked slightly towards the load;
 - e) Be of adequate strength for the loads that they will be required to lift/move.
- II. Gin poles should not be spliced and if a gin pole is composed of different elements, they should be assembled in conformity with their intrinsic material strength.
- III. Gin poles should be fastened at their feet to prevent displacement in operation.
- IV. Gin poles, which are moved from place to place and re-erected, should not be taken into use again before the pole, lifting ropes, guys, blocks and other parts have been inspected, and the whole appliance has been tested under load.



- V. When platforms or skips are hoisted by gin poles, precautions should be taken to prevent them from spinning and to provide for proper landing.

5.13.5 Tower cranes

- I. Where tower cranes have cabs at high level, persons, capable and trained to work at heights, should only be employed as crane operators.
- II. The characteristics of the various machines available should be considered against the operating requirements and the surroundings in which the crane will operate before a particular type of crane is selected.
- III. Care should be taken in the assessment of wind loads both during operations and out of service. Account should also be taken of the effects of high structures on wind forces in the vicinity of the crane.
- IV. The ground on which the tower crane stands should have the requisite bearing capacity. Account should be taken of seasonal variations in ground conditions.
- V. Bases for tower cranes and tracks for rail-mounted tower cranes should be firm and level. Tower cranes should only operate on gradients within limits specified by the manufacturer. Tower cranes should only be erected at a safe distance from excavations and ditches.
- VI. Tower cranes should be sited where there is clear space available for erection, operation and dismantling. As far as possible, cranes should be sited so that loads do not have to be handled over occupied premises, over public thoroughfares, other construction works and railways or near power cables.
- VII. Where two or more tower cranes are sited in positions where their jibs could touch any part of the other crane, there should be direct means of communication between them and a distinct warning system operated from the cab so that one driver may alert the other of impending danger.
- VIII. The manufacturers' instructions on the methods and sequence of erection and dismantling should be followed. The crane should be tested before being taken into use.
- IX. The climbing operation of climbing tower cranes should be carried out in accordance with manufacturers' instructions. The free-standing height of the tower crane should not extend beyond what is safe and permissible in the manufacturers' instructions.
- X. When the tower crane is left unattended, loads should be removed from the hook, the hook raised, the power switched off and the boom brought to the horizontal. For longer periods or at times when adverse weather conditions are expected, out of service procedures should be



followed. The main jib should be slewed to the side of the tower away from the wind, put into free slew and the crane immobilized.

- XI. A wind speed measuring device should be provided at an elevated position on the tower crane with the indicator fitted in the drivers' cab.
- XII. Devices should be provided to prevent loads being moved to a point where the corresponding safe working load of the crane would be exceeded. Name boards or other items liable to catch the wind should not be mounted on a tower crane other than in accordance with the manufacturers' instructions.
- XIII. Tower cranes should not be used for magnet, or demolition ball service, piling operations or other duties, which could impose excessive loading on the crane structure.

5.13.6 Lifting ropes

- I. Only ropes with a known safe working capacity should be used as lifting ropes.
- II. Lifting ropes should be installed, maintained and inspected in accordance with manufacturers' instructions.
- III. Repaired steel ropes should not be used on hoists.
- IV. Where multiple independent ropes are used, for the purpose of stability, to lift a work platform, each rope should be capable of carrying the load independently.

5.14 VEHICLE MOVEMENT

- 5.14.1 Park vehicles only at designated places. Don't block roads to create hindrance for other vehicles.
- 5.14.2 Don't overload the vehicle.
- 5.14.3 Obey speed limits and traffic rules.
- 5.14.4 Always expect the unexpected and be a defensive driver.
- 5.14.5 Drive carefully during adverse weather and road conditions.
- 5.14.6 Read the road ahead and ride to the left.
- 5.14.7 Be extra cautious at nights. Keep wind screens clean and lights in working condition.
- 5.14.8 All vehicles used for carrying workers and construction materials must undergo predictive/preventive maintenance and daily checks
- 5.14.9 Driver with proper valid driving license shall only be allowed to drive the vehicle



- 5.14.10 Routes shall be leveled, marked and planned in such a way so as to avoid potential hazards such as overhead power lines and sloping ground etc.
- 5.14.11 While reversing the vehicles, help of another worker should be ensured at all times
- 5.14.12 An unattended vehicle should have the engine switched off
- 5.14.13 Wherever possible one-way system shall be followed
- 5.14.14 Barriers/fixed stops should be provided for excavation/openings to prevent fall of vehicle
- 6.10.15 Load should be properly secured
- 5.14.15 The body of the tipper lorry should always be lowered before driving the vehicle off.
- 5.14.16 Signs/signals/caution boards etc. should be provided on routes.

5.15 ELECTRICAL

5.15.1 General Provisions

- I. Only persons having valid licenses should be allowed to work on electrical facilities.
- II. No person should be allowed to work on live circuit. The same, if unavoidable, special care and authorization need to be taken.
- III. Treat all circuits as "LIVE" unless ensured otherwise.
- IV. Electrical "Tag Out" procedure MUST be followed for carrying out maintenance jobs.
- V. Display voltage ratings prominently with "Danger" signs.
- VI. Put caution/notice signs before starting the repair works.
- VII. All electrical equipment operating above 250V shall have separate and distinct connections to earth grid.
- VIII. Proper grounding to be ensured for all switch boards and equipment including Portable ones prior to taking into service.
- IX. Make sure that electrical switch boards, portable tools, equipment (like grinding machine etc.) don't get wet during their usage. If it happens, stop the main supply, make the tools dry and then only use them. Check proper earthing. All temporary switch boards/ KIOSKS put up at work site should be suitably protected from rain and the level of same should be high enough to avoid contact with water due to water logging.
- X. Don't work wet on electrical system.
- XI. Don't overload the electrical system.



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- XII. Use only proper rated HRC fuses.
- XIII. Industrial type extension boards and Plug sockets are only to be used.
- XIV. **ELCB for all temporary connections must be provided. Use insulated 3-pin plug tops.**
- XV. All power supply cables should be laid properly and neatly so that they don't cause hindrance to persons working and no physical damage also takes place to the cables during various construction activities.
- XVI. All Power cables to be properly terminated using glands and lugs of proper size and adequately crimped.
- XVII. Use spark-proof/flame proof type electrical fittings in Fire Hazard zones as per area classification under OISD-STD-113.
- XXVIII. Check installations of steel plates/pipes to protect underground cables at crossings.
- XIX. Don't lay unarmored cable directly on ground, wall, roof or trees. All temporary cables should be laid at least 750 mm below ground and cable markers should be provided. Proper sleeves should be provided at road crossings. In case temporary cables are to be laid on wooden poles/steel poles, the minimum cable heights should be 4.5 M.
- XX. Maintain safe overhead distance of HT cables as per Indian Electricity Rules and relevant acts.
- XXI. Don't connect any earthing wire to the pipelines/structures.
- XXII. Don't make any unsafe temporary connections, naked joints/wiring etc.
- XXIII. Ensure that temporary cables are free from cuts, damaged insulation, kinks or improper insulated joints.
- XXIV. Check at periodic intervals that pins of sockets and joints are not loose.
- XXV. Protect electrical wires/equipment from water and naked flames.
- XXVI. Illuminate suitably all the work areas.
- XXVII. All switchboards should be of MS structure only and incoming source should be marked.
- XXVIII. Hand lamps should not be of more than 24V rating.
- XXIX. Fire extinguishers (DCP/CO₂/Sand buckets) should be kept near temporary switch boards being used for construction purposes. Don't use water for fighting electrical fires.
- XXX. Insulating mats shall be provided in the front and back end of switch boards.
- XXXI. All parts of electrical installations should be so constructed, installed and maintained as to prevent danger of electric shock, fire and external explosion. Periodic checking/certification of



electrical safety appliances such as gloves, insulating mats, hoods etc. to be done/witnessed along with maintaining a register at site signed by competent authority.

- XXXII. A notice displaying following, should be kept exhibited at suitable places:
- prohibiting unauthorized persons from entering electrical equipment rooms or from handling or interfering with electrical apparatus;
 - containing directions as to procedures in case of fire, rescue of persons in contact with live conductors and the restoration of persons suffering from electric shock;
 - Specifying the person to be notified in case of electrical accident or dangerous occurrence, and indicating how to communicate with him.
- XXXIII. No other cables/pipes to be laid in trench used for electrical cables.
- XXXIV. Utmost care should be taken while excavating Earth from cable trench to avoid damage or any accident.
- XXXV. Sub-station floor cut-outs meant for switch board installations to be covered wherever installation is incomplete.

NOTE: A Residual Current Operated Circuit Breaker (RCCB) or Earth Leakage Circuit Breaker (ELCB), when installed, protects a human being to the widest extent. RCCB or ELCB should be provided as per Indian Electricity Rules.

5.15.2 Inspection and maintenance

- All electrical equipment should be inspected before taking into use to ensure suitability for its proposed use.
- At the beginning of every shift, the person using the electrical equipment should make a careful external examination of the equipment and conductors, especially the flexible cables.
- Apart from some exceptional cases, work on or near live parts of electrical equipment should be forbidden.
- Before any work is begun on conductors or equipment that do not have to remain live:
 - the current should be switched off by a responsible authorized person;
 - precautions should be taken to prevent the current from being switched on again;
 - the conductors or the equipment should be tested to ascertain that they are dead;
 - the conductors and equipment should be earthed and short-circuited;
 - Neighboring live parts should be adequately protected against accidental contact.



- V. After work has been done on conductors and equipment, the current should only be switched on again on the orders of a competent person after the earthing and short-circuiting have been removed and the workplace reported safe.
- VI. Electricians should be provided with approved and tested tools, and personal protective equipment such as rubber gloves, mats etc.
- VII. All conductors and equipment should be considered to be live unless there is a proof of the contrary.
- VIII. When work has to be done in dangerous proximity to live parts the current should be cut off. If for operational reasons this is not possible, the live parts should be fenced off or enclosed by qualified staff from the sub-station concerned.

5.15.3 Testing

- I. Electrical installations should be inspected and tested and the results recorded.
- II. Periodic testing of the efficiency of the earth leakage protective devices should be carried out.
- III. Particular attention should be paid to the earthing of apparatus, the continuity of protective conductors, polarity and insulation resistance, protection against mechanical damage and condition of connections at points of entry.

5.16 DEMOLITION

5.16.1 General provisions

- I. When the demolition of any building or structure might present danger to workers or to the public:
 - a) necessary precautions, methods and procedures should be adopted, including those for the disposal of waste or residues;
 - b) The work should be planned and undertaken only under the supervision of a competent person.
- II. Before demolition operations begin:
 - a) structural details and builders' drawings should be obtained wherever possible;
 - b) details of the previous use should be obtained to identify any possible contamination and hazards from chemicals, flammables, etc.;
 - c) An initial survey should be carried out to identify any structural problems and risks associated with flammable substances and substances hazardous to health.



- d) The survey should note the type of ground on which the structure is erected, the condition of the roof trusses, the type of framing used in framed structures and the load-bearing walls;
- e) a method of demolition should be formulated after the survey and recorded in a method statement having taken all the various considerations into account and identifying the problems and their solutions;
- III. All electric, gas, water and steam service lines should be shut off and, as necessary, capped or otherwise controlled at or outside the construction site before work commences.
- IV. If it is necessary to maintain any electric power, water or other services during demolition operations, they should be adequately protected against damage.
- V. As far as practicable, the danger zone round the building should be adequately fenced off and sign posted. To protect the public a fence 2m high should be erected enclosing the demolition operations and the access gates should be secured outside working hours.
- VI. The fabric of buildings contaminated with substances hazardous to health should be decontaminated. Protective clothing and respiratory devices should be provided and worn.
- VII. Where plant has contained flammable materials, special precautions should be taken to avoid fire and explosion.
- VIII. The plant to be demolished should be isolated from all other plant that may contain flammable materials. Any residual flammable material in the plant should be rendered safe by cleaning, purging or the application of an inert atmosphere as appropriate.
- IX. Care should be taken not to demolish any parts, which would destroy the stability of other parts.
- X. Demolition activities should not be continued under adverse climatic conditions such as high winds, which could cause the collapse of already weakened structures.
- XI. To prevent hazards, parts of structures should be adequately shored, braced or otherwise supported.
- XII. Structures should not be left in a condition in which they could be brought down by wind pressure or vibration.
- XIII. Where a deliberate controlled collapse technique is to be used, expert engineering advice should be obtained, and:
- a) it should only be used where the whole structure is to come down because it relies on the removal of key structural members to effect a total collapse;
- b) It should only be used on sites that are fairly level and where there is enough surrounding space for all operatives and equipment to be withdrawn to a safe distance.



- XIV. When equipment such as power shovels and bulldozers are used for demolition, due consideration should be given to the nature of the building or structure, its dimensions, as well as to the power of the equipment being used.
- XV. If a swinging weight is used for demolition, a safety zone having a width of at least one-and-a-half times the height of the building or structure should be maintained around the points of impact.

Demolition of structural steelwork

- I. All precautions should be taken to prevent danger from any sudden twist, spring or collapse of steelwork, ironwork or reinforced concrete when it is cut or released.
- II. Steel construction should be demolished tier by tier.
- III. Structural steel parts should be lowered and not dropped from a height.

5.17 RADIOGRAPHY

- 5.17.1 All radiography jobs shall be carried out as per BARC Safety Regulations
- 5.17.2 During field radiography, nearby area around the radiation source should be cordoned off.
- 5.17.3 If the field radiography is to be done at the same location repeatedly, it is advisable to provide either a wire fencing around or a temporary brick enclosure.
- 5.17.4 Special permission/permit should be taken for radiography from area-in-charge.
- 5.17.5 As far as possible, field radiography should be done only during night time when there is little or no occupancy there.
- 5.17.6 Radiation warning signals should be pasted all along the cordoned off area.
- 5.17.7 Entry into the restricted area by unauthorized persons should be strictly prohibited during exposure.
- 5.17.8 The radiation level along with the cordon should be monitored by a suitable and well-calibrated radiation survey meter.
- 5.17.9 All personnel working with radiography sources should wear appropriate protective equipment and film badges issued by BARC.
- 5.17.10 Protection facilities such as manipulator rod, remote handling tongs, lead pots, radiation hazard placards and means of cordon off shall be available at each site.
- 5.17.11 The radiography source shall never be touched or handled directly with hands.



- 5.17.12 The package containing radiography cameras and sources should never be carried by public transport like bus, train etc.
- 5.17.13 Radiography sources and cameras, when not in use, should be stored inside a source pit with lock and key arrangement as approved by BARC.
- 5.17.14 The storage room should preferably be located in an isolated area of minimum occupancy and radiation level outside the storage room should not exceed 0.25 mR/hr as per BARC Regulations.
- 5.17.15 In case of an accident (due to loss or of damage to radiography source), action should be taken in line with BARC Safety Rules/Guidelines.

5.18 GRIT SHOT/ SLAG BLASTING/ SPRAY PAINTING

- 5.18.1 Blasting for surface preparation should be used only after approval from competent person.
- 5.18.2 Air Compressor used for grit/shot/slag blasting/painting should have guard and positioned away from the work place.
- 5.18.3 Exhaust of the prime mover, if IC engine is used, should be fitted with PESO approved spark arrester (in case of work in hazardous area) and directed away from the work place.
- 5.18.4 In case of motor driven compressor, the body of the motor as well as the compressor to be properly earthed.
- 5.18.5 The hoses used for compressed air should be of proper quality, and health of the same to be ensured through regular check/ test.
- 5.18.6 The operator of grit/shot/slag blasting/painting should wear suitable PPE's including mask and the area should be cordoned off.
- 5.18.7 Adequate measures to be taken to suppress dust/spray particle.
- 5.18.8 When these activities are done in confined places, adequate measure to be taken including monitoring Oxygen level and ensuring proper ventilation.
- 5.18.9 Proper fire fighting arrangements are to be made where spray painting is in progress.
- 5.18.10 Some paints and their supplements are toxic also and emit offensive smell. PPE to workers should be suitable to address this issue.
- 5.18.11 "No Smoking Zone" boards should be displayed prominently in paints shop/ spray paint area.

5.19 FIRE PREVENTION AND FIRE FIGHTING

- 5.19.1 All necessary measures should be taken by the executing agency and owner to:
 - I. avoid the risk of fire;