### 3.1.12 Intoxicating drinks & drugs and smoking

a) The Contractor shall ensure that his staff members & workers (permanent as well casual) shall not be in a state of intoxication during working hours and shall abide by any law relating to consumption & possession of intoxicating drinks or drugs in force.

b) The Contractor shall not allow any workman to commence any work at any locations of project activity who is/are influenced / effected with the intake of alcohol, drugs or any other intoxicating items being consumed prior to start of work or working day.

c) Awareness about local laws on this issue shall form part of the Induction Training and compulsory work-site discipline.

d) The Contractor shall ensure that all personnel working for him comply with "No-Smoking" requirements of the Owner as notified from time to time. Cigarettes, lighters, auto ignition tools or appliances as well as intoxicating drugs, dry tobacco powder, etc. shall not be allowed inside the project / plant complex.

e) Smoking shall be permitted only inside smoking booths, if any, exclusively designated & authorized by the Owner/EIL.

### 3.1.13 Penalty

The Contractor shall adhere consistently to all provisions of HSE requirements. In case of non-compliances and also for repeated failure in implementation of any of the HSE provisions, EIL/Owner may impose stoppage of work without any cost & time implication to the Owner and/or impose a suitable penalty.

The amount of penalty to be levied against defaulted Contractor shall be up to a cumulative limit of

2.0% (Two percent) of the contract value for Item Rate or Composite contracts with an overall ceiling of 1,00,00,000(Rupees One Crore).

0.5% (Zero decimal five percent) of the contract value for LSTK, OBE, EPC,BOO/BOOT, EPCC or Package contracts with an overall ceiling of 10,00,00,000(Rupees Ten Crores.)

This penalty shall be in addition to all other penalties specified elsewhere in the contract. The decision of imposing stop-work-instruction and imposition of penalty shall rest with EIL/Owner. The same shall be binding on the Contractor. Imposition of penalty does not make the Contractor eligible to continue the work in unsafe manner.
The amount of penalty applicable for the Contractor on different types of HSE violations is specified below:

| Sl. No. | Violation of HSE Norms | Penalty Amount |
|---|---|---|
| 1. | For not using personal protective equipment like Helmet, Safety Shoes, and other safety gadgets as applicable as per nature of work. | Rs.500/- per day/Item / Person |
| 2. | Working without Work Permit/Clearance | Rs.20,000/- per occasion |
| 3 | Execution of work without deployment of requisite field engineer / supervisor at work spot | Rs.5,000/- per violation per day |
| 4. | Unsafe electrical practices (not installing ELCB, using poor joints of cables, using naked wire without top plug into socket, laying wire/cables on the roads, electrical jobs by incompetent person, etc.) | Rs.10,000/- per item per day |


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| Sl. No. | Violation of HSE Norms | Penalty Amount |
|---|---|---|
| 5. | Working at height without full body harness, using non-standard/ rejected scaffolding and not arranging fall protection arrangement as required, like hand-rails, life-lines, Safety Nets etc. | Rs.10,000/- per case per day |
| 6. | Unsafe handling of compressed gas cylinders (No trolley, jubilee clips double gauge regulator, and not keeping cylinders vertical during storage/handling, not using safety cap of cylinder). | Rs.1,000/- per item per day |
| 7. | Use of domestic LPG for cutting purpose / not using flash back arresters on both the hoses/tubes on both ends. | Rs.5,000/-per occasion |
| 8. | No fencing/barricading of excavated areas / trenches. | Rs.5,000/- per occasion |
| 9. | Not providing shoring/strutting/proper slope and not keeping the excavated earth at least 1.5M away from excavated area. | Rs.5,000/-per occasion |
| 10. | Non display of scaffold tags, caution boards on erected scaffolds. | Rs.1,000/- per occasion per day |
| 11. | Traffic rules violations like over speeding of vehicles, rash driving, talking on mobile phones during vehicle driving, wrong parking, not using seat belts, vehicles not fitted with reverse horn / warning alarms / flicker lamps during foggy weather. | Rs.3,000/-per occasion per day |
| 12. | Absence of Contractor's RCM/SIC or his nominated representative (prior approval must be taken for each meeting for nomination) from site HSE meetings whenever called by EIL/Owner& failure to nominate his immediate deputy for such HSE meetings. | Rs.10,000/- per meeting |
| 13. | Failure to maintain HSE records by Contractor Safety personnel, in line with approved HSE Plan/Procedures/Contract specifications. | Rs.10,000/- per month |
| 14. | Failure to conduct daily site safety inspection (by Contractor's Site Engineer &safety officer), internal HSE meeting, internal HSE Awareness/Motivation Program and Site HSE Training at predefined frequencies (as approved in HSE Plan). | Rs.10,000/- per occasion |
| 15. | Failure to fill online/submit the monthly HSE report by 5th of subsequent month to Engineer-in-Charge/ Owner | Rs10,000/-per occasion and Rs.1,000/-per day of further delay |
| 16. | Poor House Keeping | Rs.5,000 /- per occasion per subject |
| 17. | Failure to report &follow-up accident (including Near Miss) reporting system within specific time-frame. | Rs.20,000/- per occasion |
| 18. | Degradation of environment (not confining toxic spills, spilling oil/lubricants onto ground) | Rs.10,000/- per occasion |


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| Sl. No. | Violation of HSE Norms | Penalty Amount |
|---|---|---|
| 19. | Not medically examining the workers before allowing them to work at height / to work in confined space / to work in shot-blasting / to work for painting / to work in bitumen or asphalt works, not providing ear muffs while allowing them to work in noise polluted areas, made them to work in air polluted areas without respiratory protective devices, etc. | Rs.5,000/- per occasion per worker |
| 20. | Violation of any other safety condition as per job HSE plan / work permit and HSE conditions of contract (e.g.using crowbar on cable trenches, improper welding booth, not keeping fire extinguisher ready at hot work site, unsafe rigging practices, non-availability of First-Aid box at site, not providing dead man handle switch for blasting, whiplash arrestor for the compressor line, not using hood with respiratory devices by blaster for shot//grit blasting, etc.) | Rs.5,000/- per occasion |
| 21. | Penalty for non-deployment of ambulance in case of man-power more than 500 or not providing dedicated emergency vehicle in case of man-power less than 500. | Rs.3,000 per day |
| 22. | Failure to carry-out Safety audit in time (internal & external),close-out of identified shortfalls of Observations of Safety Aspects(OSA),etc. | Rs.20,000/- per occasion (for internal audit &OSA). Rs.30,000/-per occasion for external audit |
| 23. | Carrying out sand blasting instead of grit/shot blasting | Rs.50,000/- per day |
| 24. | Failure to deploy adequately qualified and competent Safety Officer | Rs.10,000/- per day per Officer |
| 25. | Utilization of Hydraulic Mobile Crane /back-hoe loader for material shifting or any other unauthorized /unsafe lifting works | Rs.25,000/- per occasion |
| 26. | Any Fatal Accident | Rs.10,00,000/-per fatality |
| 27. | Any violation not covered above | To be decided by EIL/Owner. |

Note: Penalty amount deducted from the contractor shall be utilized by owner/EIC for the promotion of the safety during the currency of the project.

The Contractor shall make his field engineers/supervisors fully aware of the fact that they keep track with the site workmen for their behavior and compliance of various HSE requirements. Safety lapses / defects of project construction site shall be attributable to the concerned job supervisor / engineer of the Contractor, (who remains directly responsible for safely executing field works). For repeated HSE violations, concerned job supervisor / engineer shall be reprimanded or appropriate action, as deemed fit, shall be initiated (with information to EIL & Owner) by the concerned Contractor.

Contractor shall initiate verbal warning shall be given to the worker/employee during his first HSE violation. A written warning shall be issued on second violation and specific training shall be arranged / provided by the Contractor to enhance HSE awareness/skill including feedback on the mistakes/ flaws. Any further violation of HSE stipulations by the erring individuals shall call


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for his forthright debar from the specific construction site. A record of warnings for each worker/employee shall be maintained by the Contractor, like by punching their cards / Gate passes or by displaying their names at the Project entry gate. Warnings, penalizations, appreciations etc. shall be discussed in HSE Committee meetings by site Head of the Contractor.

3.1.14 **Accident/ Incident investigation**

All accidents/incidents shall be informed to EIL/Owner at least telephonically by Contractor immediately and in writing within 24 hours on Format No. HSE-2 as applicable, by Contractor. Thereafter, a Supplementary Accident/Incident investigation Report on Format No. HSE-3 shall be submitted to EIL/Owner within 72 hours. Near Miss incident(s), Dangerous accidents/incident shall also be reported on Format No. HSE-4 within24 hours. The accident/ incident shall be investigated by a team of Contractor's senior Site personnel (involving Site-in-Charge or at least by his deputy) for establishing root-cause and recommending corrective & preventive actions. Findings shall be documented and suitable actions taken to avoid recurrences shall be communicated to EIL/Owner. Owner/EIL shall have the liberty to independently investigate such occurrences and the Contractor shall extend all necessary help and cooperation in this regard. EIL/Owner shall have the right to share the content of this report with the outside world.

## 3.2 House Keeping

The Contractor shall ensure that a high degree of housekeeping is maintained and shall ensure inter-alia; the followings:

a) All surplus earth and debris are removed/disposed-off from the working areas to designated location(s).

b) Unused/surplus cables, steel items and steel scrap lying scattered at different places within the working areas are removed to identify location(s).

c) All wooden scrap, empty wooden cable drums and other combustible packing materials, shall be removed from work place to identified location(s).

d) Roads shall be kept clear and materials like pipes, steel, sand, boulders, concrete, chips and bricks etc. shall not be allowed on the roads to obstruct free movement of men & machineries.

e) Fabricated steel structural, pipes & piping materials shall be stacked properly.

f) Water logging on roads shall not be allowed.

g) No parking of trucks/trolleys, cranes and trailers etc. shall be allowed on roads, which may obstruct the traffic movement.

h) Utmost care shall be taken to ensure over all cleanliness and proper upkeep of the working areas.

i) Protective measures to be ensured with projected rebar by suitable means.

j) Trucks carrying sand, earth and pulverized materials etc. shall be covered while moving within the plant area/ or these materials shall be transported with top surface wet.

k) The contractor shall ensure that the atmosphere in plant area and on roads is free from particulate matter like dust, sand, etc. by keeping the top surface wet for ease in breathing.

l) At least two exits for any unit area shall be assured at all times – same arrangement is preferable for digging pits/ trench excavation/ elevated work platforms/ confined spaces etc.

m) Welding cables and the power cable must be segregated and properly stored and used. The same shall be laid away from the area of movement and shall be free from obstruction.

n) Upkeep/cleaning of site to be carried out on regular basis by the contractor. Contractor shall earmark the area for waste/scrap disposal and ensure that all waste/scrap arising out of the day's work is properly disposed to the earmarked area.

o) Hazardous waste shall be segregated and shall be kept separately at designated place.

p) Contractor shall present the status of housekeeping in HSE meeting.


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The Contractor shall carry-out regular checks (minimum one per fortnight) as per format No. HSE-11 for maintaining high standard of housekeeping and maintain records for the same. The Contractor shall provide supervisor for housekeeping exclusively for management of day-to-day housekeeping activities.

## 3.3 HSE Measures

### 3.3.1 Construction Hazards

The Contractor shall ensure identification of all Occupational Health, Safety & Environmental hazards in the type of work he is going to undertake and enlist mitigation measures. Contractor shall carry out HIRAC specifically for high risk jobs/critical jobs like

a) Working at height (+2.0 Mts height) for cold (incl. colour washing, painting, insulation etc.) & hot works.
b) Work in confined space,
c) Deep excavations &trench cutting (depth > 2.0 mts.)
d) Operation & Maintenance of Batching Plant.
e) Shuttering / concreting (in single or multiple pour) for columns, parapets & roofs.
f) Erection & maintenance of Tower Crane.
g) Erection of structural steel members / roof-trusses / pipes at height more than 2.0 Mts. with or without crane.
h) Erection of pipes (full length or fabricated) at height more than 2.0 Mts. height with Crane of 100T capacity.
i) All lifts using 100T Crane plus mechanical pulling.
j) All lifts using two cranes in unison (Tandem Lifting).
k) Any lift exceeding 80% capacity of the lifting equipment's (Hydraulic Mobile Crane, crane etc.).
l) Laying of pipes (isolated or fabricated) in deep narrow trenches – manually or mechanically.
m) Maintenance of crane / extension or reduction of crane-boom on roads or in yards.
n) Erection of any item at >2.0 Mts. height using 100T crane or of higher capacity
o) Hydrostatic test of pipes, vessels & columns and water-flushing.
p) Radiography jobs (in-plant & open field)
q) Work in Live Electrical installations / circuits
r) Handling of explosives &Blasting operations
s) Demolishing/ dismantling activities
t) Welding/ gas cutting jobs at height (+2.0 Mts.)
u) Lifting/placing roof-girders at height(+2.0 Mts.)
v) Lifting & laying of metallic / non-metallic sheet over roof/structures.
w) Lifting of pipes, gratings, equipment's/vessels at heights (+2.0 Mts.) with & without using cranes
x) Calibration of equipment, instruments and functional tests at yards / work-sites.
y) Operability test of Pump, Motors (after coupling) & Compressors.
z) Cold or Hot works inside Confined Space.
aa) Transportation & shifting of ODC consignments into project areas.
bb) Working in "Charged/Live" elect. Panels
cc) Stress Relieving works (Electrically or by Gas-burners).
dd) Pneumatic Tests
ee) Card board blasting
ff) Grit Blasting activity
gg) Catalyst loading/unloading
hh) Erection/dismantling of scaffolding
ii) Chemical cleaning


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The necessary HSE measures devised shall be put in place, prior to start of an activity &also shall be maintained during the course of works, by the Contractor. Copies of such HIRAC shall be kept available at work sites by the Contractor to enable all concerned carrying out checks / verification.

A list of typical construction hazards along with their effects & preventive measures is given in **Appendix-E.**

3.3.2 **Accessibility**

h) The Contractor shall provide safe means of access(in sufficient numbers)& efficient exit to any working place including provisions of suitable and sufficient scaffolding at various stages during all operations of the work for the safety of his workmen and EIL/Owner.

i) The Contractor shall implement use of all measures including use of "life line", "fall-arresters", "retractable fall arresters", "safety nets" etc. during the course of using all safe accesses& exits, so that in no case any individual remains at risk of slip & fall during their travel.

j) A ladder or step- ladder must have a level and firm footing, in case of use of fixed ladders, sufficient foot hold and hand hold to be provided.

k) The access to operating plant / project complex shall be strictly regulated. Any person or vehicle entering such complex shall undergo identification check, as per the procedures in force / requirement of EIL/Owner.

l) Accessibility to 'confined space' shall be governed by specific system / regulation, as established at project site.

3.3.3 **Personal Protective Equipment (PPEs)**

a) The Contractor workmen shall be permitted entry inside the project premises only with proper PPEs.

b) The Contractor shall ensure that all their staff, workers and visitors including their sub-contractor(s) have been issued (records to be kept) & wear appropriate PPEs like nape strap type safety helmets preferably with head &sweat band with ¾" cotton chin strap (made of industrial HDPE), High ankle safety shoes with steel toe cap and antiskid sole, Coverall, full body harness (CE marked and conforming to EN361), protective goggles, gloves, ear muffs, respiratory protective devices, etc. All these gadgets shall conform to applicable IS Specifications/CE or other applicable international standards. The Contractor shall implement a regular regime of inspecting physical conditions of the PPEs being issued / used by the workmen of their own & also its sub-agencies and the damaged / unserviceable PPEs shall be replaced forthwith.

c) Owner/EIL may issue a comprehensive color scheme for helmets to be used by various agencies. The Contractor shall follow the scheme issued by the owner/EIL and shall choose colour other than white (for Owner) or blue (for EIL). All HSE personnel shall preferably wear dark green band on their helmet or green color safety helmet so that workmen can approach them for guidance during emergencies.HSE personnel shall preferably wear such dresses with fluorescent stripes, which are noticeable during night, when light falls on them.

d) Florescent jackets with respective company logo to be worn by the contractor workmen with different color coding for categories like supervisor and workmen.

e) Workers required using or handling alkalies, acid or other similar corrosive substance at site shall be provided with appropriate protective equipment, in accordance with MSDS.

f) For shot blasting, the usage of protective face shield and helmets, gauntlet and protective clothing is mandatory. Such protective clothing should conform relevant IS Specification.

g) For off-shore jobs/contracts, contractor shall provide PPEs (new) of all types to EIL & Owner's personnel, at his (contractor's) cost. All personnel shall wear life jacket at all time.

h) An indicative list of HSE standards/codes is given under **Appendix-A**.


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i) Contractor shall ensure procurement & usage of following safety equipment's/ accessories (conforming to applicable IS mark / CE standard) by their staff, workmen & visitors including their subcontractors all through the span of project construction / pre-commissioning/ Commissioning:-

i. PPEs (Helmet with company name/logo, Safety Goggles, Coverall, Ear-muff, Face Shield, Hand Gloves, High Ankle Safety Shoes, Gum Boot etc.)
ii. Barricading tape / warning signs
iii. Rechargeable Safety torch (flame-proof)
iv. Safety nets (with tie-chords)
v. Fall arresters
vi. Emergency Man-basket/rescue kit for height works
vii. Portable ladders (varying lengths)
viii. Life-lines (steel wire-rope, dia. not less than 8.0 mm)
ix. Full body double lanyard Safety harness with Rebar/ladder hook or scaffolding hook.
x. Lanyard
xi. Karabiner
xii. Retractable fall arresters (various length)
xiii. Portable fire extinguishers (DCP type) – 5 kg&10 kg capacity
xiv. Portable Multi Gas detector
xv. Sound level meter
xvi. Digital lux meter
xvii. Fire hoses & flow nozzles
xviii. Fire blankets/ Fire retardant cloth (with eyelets)
xix. Flame retardant/Flame resistant coverall-based on hazard identification & risk assessment, if required.

3.3.4 **Working at height**

a) The Contractor shall issue permit for working (PFW) at height after verifying and certifying the checkpoints as specified in the attached permit (Format No. HSE-6). He shall also undertake to ensure compliance to the conditions of the permit during the currency of the permit including adherence of personal protective equipment's. Contractor's Safety Officer shall verify compliance status of the items of permit document after implementation of action is completed by Contractor's execution / field engineers at work site. HIRAC for specific works at height duly commented by EIL/Owner, shall be kept attached with particular Permit for Work (PFW) at site for ready reference & follow-up.

b) Such PFW shall be initially issued for one single shift or expected duration of normal work and extended further for balance duration, if required. EIL/Owner can devise block-permit system at any specific area, in consultation with project specific HSE Committee to specify the time-period of validity of such PFW or its renewal. This permit shall be applicable in areas where specific clearance from Owner's operation Deptt./Safety Deptt. is not required. EIL / Owner's field Engineers/Safety Officers/Area Coordinators may verify and counter sign this permit (as an evidence of verification) during the execution of the job.

c) All personnel shall be medically examined & certified by registered doctor, confirming their 'medical fitness(Vertigo or epilepsy must be covered under test report)for working at height. Contractor shall develop the model for conducting vertigo test. The fitness examination shall be done once in six months. Sticker for "PASS FOR HEIGHT WORK" shall be pasted on the safety helmet of the site personnel.

d) In case work is undertaken without taking sufficient precautions as given in the permit, EIL/Owner Engineers may exercise their authority to cancel such permit and stop the work till satisfactory compliance/rectification is arranged made. Contractors are expected to maintain a register for issuance of permit and extensions thereof including preserving the


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used permits for verification during audits etc.

e) The Contractor shall arrange (at his cost) and ensure use of Fall Arrester Systems by his workers. Fall arresters are to be used while climbing/descending tall structures or vessels / columns etc. These arresters should lock automatically against the anchorage line, restricting free fall of the user. The device is to be provided with a double security opening system to ensure safe attachment or release of the user at any point of rope. In order to avoid shock, the system should be capable of keeping the person in vertical position in case of a fall. All the fall arrest systems should be cleaned after use and stored in a clean &dry area. Defective Safety Harness, lanyards & life line must be discarded from workplace and record to be maintained.

f) The Contractor shall ensure that Full body harnesses with double lanyards conforming EN361 and having authorized CE marking is used by all personnel while working at height. The lanyards and life lines should have enough tensile strength to take the load of the worker in case of a fall. One end of the lanyard shall be firmly tied with the harnesses and the other end with life line. The harness should be capable of keeping the workman vertical in case of a fall, enabling him to rescue himself.

g) The Contractor shall provide Roof Top Walk Ladders for carrying out activities on sloping roofs in order to reduce the chances of slippages and falls.

h) The Contractor shall ensure that a proper Safety Net System is used wherever the hazard of fall from height is present. The safety net, preferably a knotted one with mesh ropes conforming to IS 5175/ ISO 1140 shall have a border rope & tie cord of minimum 12mm dia. The Safety Net shall be located not more than 6.0 meters below the working surface extending on either side upto. sufficient margin to arrest fall of persons working at different heights.

i) In case of accidental fall of person on such Safety Net, the bottom most portion of Safety Net should not touch any structure, object or ground.

j) Grade separators shall be provided in Pipe-rack/Tech-structures to arrest falling objects like welding spatters, welding rods, nuts, bolts, tools etc. and to facilitate U/G and A/G works simultaneously.

k) Beam Clamps may be used for construction of localized temporary working platforms sheds for welding booths etc. at height in all types of steel structure due to faster installation and requirement of less scaffolding materials.

l) Hanging Platform, manufactured by Standard HSE equipment vendors must be encouraged for painting of Buildings etc.

m) All the tools used at height (like spanner, screw driver etc.) shall be provided with securing arrangement like back-pack/waist pouch to prevent accidental slippage from worker hand.

n) The Contractor shall install temporary lightening arrester in tall structures during construction to save human life and to avoid damage to equipment's& machineries. During the possibility of a thunderstorm, all the work at height where a person can be exposed to lightning shall be stopped.

o) To the extent possible use Roller arrangement to shift overhead pipes from one end to other in Pipe Racks Area.

p) Providing of steel scaffold stair tower system with landings at regular intervals as and when required for height work.

q) The Contractor shall ensure positive isolation while working at different levels like in the pipe rack areas. The working platforms with toe boards & hand rails shall be sufficiently strong & shall have sufficient space to hold the workmen and tools& tackles including the equipment's required for executing the job. Such working platforms shall have mid-rails, to enable people work safely in sitting posture.

### 3.3.5 Scaffoldings& Barricading

a) Suitable steel scaffoldings only shall be provided to workmen for all works that cannot be safely done from the ground or from solid construction except such short period work that


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can be safely done using ladders or certified (by 3rd party competent person) man-basket. When a ladder is used, an extra workman shall always be engaged for holding the ladder. The ladder shall be inspected before use for cracked or split stiles, missing, broken, loose or damaged rungs & splinters. The ladder shall be of adequate length to enable it to extend to at least 1.0m above the landing place or working point. Metallic ladders shall be only used as access.

b) The Contractor shall ensure that the scaffolds used during construction activities shall be strong enough to take the designed load. Main Contractor shall always furnish duly approved construction-design details of scaffold &SWL (from competent designers) free of charge, before they are being installed/ constructed at site. Owner/EIL reserves the right to ask the Contractor to submit certification and or design calculations from his Head Office/ Design/Engineering expert regarding load carrying capacity of the scaffoldings. All steel tubing, couplers and fittings used for scaffolding shall conform to IS 3696 or an acceptable equivalent. Only metallic scaffold boards shall be allowed to use. Steel tubes shall be free from cracks, splits. Surface flaws & other defects. All couplers & fittings shall be properly oiled and maintained. Nuts shall have a free running fit on their bolts. Bolts with worn or damaged thread shall be replaced.

c) All scaffolds shall be inspected by a competent Scaffolding Inspector (person with scaffolding related experience in construction field and having a training of scaffolding supervisor from a institute/agency like National Safety Council etc.). He shall paste a GREEN tag (duly signed by competent Scaffolding Inspector) on each scaffold found safe and a RED tag (duly signed by competent Scaffolding Inspector) on each scaffold found unsafe. Scaffolds with GREEN tag only shall be permitted to be used and Scaffolds with RED ones shall immediately be made inaccessible. Work being found continuing on scaffolds with RED tag shall be considered unauthorized work by Contractor and may invite penalization from EIL/Owner. For every 120-125 $m^2$ /$m^3$ area / volume or its parts thereof minimum one TAG shall be provided.

d) The Contractor shall ensure positive barricading (indicative as well as protective) of the excavated, radiography, heavy lift, high pressure hydrostatic & pneumatic testing and other such areas. Sufficient warning signs shall be displayed along the barricading areas.

e) Scaffolding shall be constructed using foot seals or base plates only. Base plates shall be used below each standard on surface .Sole plate of timber shall be used beneath the base plate to achieve greater load distribution.

3.3.6 **Electrical installations**

a) All electrical installations/ connections shall be carried out as per the provisions of latest revision of following codes/standards, in addition to the requirements of Statutory Authorities and IE/applicable international rules& regulations:

- OISD STD 173 : Fire prevention & protection system for electrical installations
- SP 30 (BIS) : National Electric Code

b) All electrical installations shall be approved by the concerned statutory authorities.

c) All temporary electrical installations / facilities shall be regularly checked by the licensed/competent electricians of the Contractor and appropriate records shall be maintained in format no: HSE-12" Inspection of temporary electrical booth/installation at project construction site". Such inspection records are to be made available to EIL/Owner, whenever asked for.

3.3.6.1 The Contractor shall meet the following requirements:


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a. Shall make Single Line Diagram (SLD) for providing connection to each equipment's & machinery and the same (duly approved by EIL/Owner) shall be pasted on the front face of DBs (distribution boards) or JBs (Junction boxes) at every site.(A typical Switch Board Sketch is attached as Appendix -G)

b. Ensure that electrical systems and equipment including tools & tackles used during construction phase are properly selected, installed, used and maintained as per provisions of the latest revision of the Indian Electrical/ applicable international regulations.

c. Shall deploy qualified & licensed electricians for proper & safe installation and for regular inspection of construction power distribution system/points including their earthing. A copy of the license shall be submitted to EIL / Owner for records. Availability of at least one competent (ITI qualified) / licensed electrician (by State Elec. authorities) shall be ensured at site round the clock to attend to the normal/emergency jobs.

d. All switchboards / welding machines shall be kept in well-ventilated & covered shed/ with rain shed protection. The shed shall be elevated from the existing ground level to avoid water logging inside the shed. Installation of electrical switch board must be done taking care of the prevention of shock and safety of machine.

e. No flammable materials shall be used for constructing the shed. Also flammable materials shall not be stored in and around electrical equipment / switchboard. Adequate clearances and operational space shall be provided around the equipment.

f. Fire extinguishers and insulating mats shall be provided in all power distribution centers.

g. Temporary electrical equipment shall not be employed in hazardous area without obtaining safety permit.

h. Proper housekeeping shall be done around the electrical installations.

i. All temporary installations shall be tested before energizing, to ensure proper earthing, bonding, suitability of protection system, adequacy of feeders/cables etc.

j. All welders shall use hand gloves irrespective of holder voltage.

k. Multilingual (Hindi, English and local language) caution boards, shock treatment charts and instruction plate containing location of isolation point for incoming supply, name & telephone No. of contact person in emergency shall be provided in substations and near all distribution boards / local panels.

l. ELCB tester /test meter shall be used for testing the ELCBs operation. ELCBs testing shall be carried out by using ELCB tester on monthly basis but in specific cases like heavy rain as decided by owner/EIC. Record of the testing shall be maintained.

m. Regular inspection of all installations at least once in a month. (**Ref. Format HSE-12**).

3.3.6.2 The following features shall also be ensured for all electrical installations during construction phase by the contractor:

a. Each installation shall have a main switch with a protective device, installed in an enclosure adjacent to the metering point. The operating height of the main switch shall not exceed 1.5 M. The main switch shall be connected to the point of supply by means of armoured cable.


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b. The outgoing feeders shall be double or triple pole switches with fuses / MCBs. Loads in a three phase circuit shall be balanced as far as possible and load on neutral should not exceed 20% of load in the phase.

c. The installation shall be adequately protected against overload, short circuit and earth leakage by the use of suitable protective devices. Fuses wherever used shall be HRC type. Use of rewirable fuses shall be strictly prohibited. ELCB/RCCB (Residual Current Circuit Breaker) must be fitted with all Electrical installation. The earth leakage devices shall have an operating current not exceeding 30 mA.

d. All connections to the hand tools / welding receptacles shall be taken through proper switches, sockets and plugs.

e. All single phase sockets shall be minimum 3 pin type only. All unused sockets shall be provided with socket caps.

f. Only 3 core (P+N+E) overall sheathed flexible cables with minimum conductor size of 1.5 $mm^2$ copper shall be used for all single phase hand tools.

g. Only metallic distribution boxes with double earthing shall be used at site. No wooden boxes shall be used.

h. All power cables shall be terminated with compression type cable glands. Tinned copper lugs shall be used for multi-strand wires / cables.

i. Cables shall be free from any insulation damage.

j. Minimum depth of cable trench shall be 750 mm for MV & control cables and 900 mm for HV cables. These cables shall be laid over a sand layer and covered with sand, brick & soil for ensuring mechanical protection. Cables shall not be laid in waterlogged area as far as practicable. Cable route markers shall be provided at every 25 M of buried trench route.

When laid above ground, cables shall be properly cleated or supported on rigid poles of atleast 2.1 M high. Minimum head clearance of 6 meters shall be provided at road crossings.

k. Underground road crossings for cables shall be avoided to the extent feasible. In any case no underground power cable shall be allowed to cross the roads without pipe sleeve.

l. All cable joints shall be done with proper jointing kit. No taped/temporary joints shall be used.

m. An independent earthing facility should preferably be established within the temporary installation premises. All appliances and equipment shall be adequately earthed. In case of armored cables, the armour shall be bonded to the earthing system. IS: 3043 Code for earthing practices shall be followed at project site.

n. All cables(green colour) and wire rope used for earth connections shall be terminated through tinned copper lugs.

o. In case of local earthing, earth electrodes shall be buried near the supply point and earth continuity wire shall be connected to local earth plate for further distribution to various appliances. All insulated wires for earth connection shall have insulation of green colour. Periodical check tests of all electrodes should be carried out and record shall be maintained of such checks.


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p. Separate core shall be provided for neutral. Earth / Structures shall not be used as a neutral in any case.

q. ON/OFF position of all switches shall be clearly designated / painted for easy isolation in emergency.

### 3.3.7 Welding/ Grinding/Gas cutting

a) Contractor shall ensure that flash back arrestors conforming to BS:6158 or equivalent are installed on all gas cylinders as well as at the torch end of the gas hose, while in use.

b) All cylinders shall be mounted on trolleys and provided with a closing key. Empty & filled-up gas cylinders shall be stored separately with TAG, protecting them from direct sun or rain. Minimum 2 nos. of Portable DCP type fire extinguishers (10 kg) shall be maintained at the gas cylinder stores. Stacking & storing of compressed gas cylinders shall be arranged away from DG set, hot works, Elect. Panels / Elec. boards, etc.

c) The burner and the hose placed downstream of pressure reducer shall be equipped with Flash Back Arrester/Non Return Valve device.

d) The hoses for acetylene and oxygen cylinders must be of different colours. Their connections to cylinders and burners shall be made with a safety collar.

e) At end of work, the cylinders in use shall be closed and hoses depressurized.

f) Cutting of metals using gases, other than oxygen &acetylene, shall require written concurrence from Owner.

g) Grinding activity shall not be carried out in confined spaces without a valid work permit.

h) All grinding/cutting machines shall be guarded and fitted with Dead-Man switch and this shall not be bypassed any time.

i) All welding/grinding machines shall have effective earthing at least at distinctly isolated two points.

j) In order to help maintain good housekeeping, and to reduce fire hazard, live electrode bits shall be contained safely and shall not be thrown directly on the ground.

k) The hoses of Acetylene and Oxygen shall be kept free from entanglement & away from common pathways / walkways and preferably be hanged overhead in such a manner which can avoid contact with cranes, Hydraulic Mobile Crane or other mobile construction machinery.

l) Hot spatters shall be contained / restricted appropriately (by making use of effective fire-retardant cloth/fabric) and their flying-off as well as chance of contact with near-by flammable materials shall be stopped. The Fire retardant blanket shall be woven from ceramic yarn with eyelets.

m) The Contractor shall arrange adequate systems & practices for accumulation / collection of metal & other scraps and remnant electrodes and their safe disposal at regular interval so as to maintain the fabrication and other areas satisfactorily clean & tidy.

n) All gas cylinders must have a cylinder cap on at all times when not in use.

### 3.3.8 Ergonomics and tools & tackles

a) The Contractor shall assign to his workmen, tasks commensurate with their qualification, experience and state of health. Competency of the crane operator to be thoroughly checked prior to engaging in crane operation.

b) All lifting tools, tackles, equipment, trailers, trucks/dumpers, accessories including cranes shall be tested periodically by statutory/competent authority for their condition and load carrying capacity. Valid test & fitness certificates from the applicable authority shall be submitted to Owner/EIL for their review/acceptance before the lifting tools, tackles,


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equipment, trailers, trucks/dumpers, accessories and cranes are used. Third party inspection certificate is mandatory for all lifting tools & tackles before put into use.

c) Load testing of Cranes by competent person must be made mandatory after each modification/alteration of crane configuration/change in boom length. All heavy equipment's including cranes must be maintained in good condition &record of such maintenance shall be maintained. Routine preventive maintenance of the crane to be carried out& record to be maintained for such preventive maintenance. Healthiness of the crane to be checked by Crane Expert on regular basis as per manufacturer guidelines.
d) HIRAC/JSA for assembly/dismantling activity of the crane to be submitted for approval of EIC.
e) No one should stand/work below the mast & boom of the crane. Mast of the crane should not be used for unintended lifts.
f) Mast of the crane to be kept in right position during dismantling activity of the crane.
g) Log book of all crane to be maintained.
h) Only authorized person shall be allowed to give signal to the operator.
i) Lifting/Loading/Unloading activities shall be carried out by the trained riggers under supervision of rigging Foreman.
j) Prior to marching/movement of the crane, obstructions free access/route to be ensured.
k) Skilled Technician to be engaged for AC gas checking and refilling of refrigerant and should follow the safe operating procedure for cranes.
l) Manufacturer's instructions to be followed without any deviation.
m) The contractor shall not be allowed to use defective equipment or tools not adhering to safety norms.
n) Adequate capacity of Chain pulley blocks with valid TPI certificate to be used for lifting/lowering/dragging/erection of piping material .
o) Colour coding system for lifting tools & tackles shall be followed on quarterly basis for a particular colour as mentioned below:

| Period | Colour Code |
|---|---|
| January, February, March | Blue |
| April,May, June | Yellow |
| July, August, September | Green |
| October, November, December | Orange |
| For Quarantine (Unsafe Tools & Tackles) | Red |

Contractor shall arrange non-sparking tools for project construction works in operating plant areas / hydrocarbon prone areas.

i. Wherever required the Contractor shall make use of Elevated Work Platforms (EWP) or Aerial Work Platforms (mobile or stationary) to avoid ergonomical risks and workmen shall be debarred to board such elevated platform during the course of their shifting / transportation.

ii. Contractor shall ensure installation of Safe Load Indicator (SLI) on all cranes (while in use) to minimize overloading risk. SLI shall have capability to continuously monitor and display the load on the hook, and automatically compare it with the rated crane capacity at the operating condition of the crane. The system shall also provide visual and audible warnings at set capacity levels to alert the operator in case of violations.

iii. The contractor shall be responsible for safe operations of different equipments mobilized and used by him at the workplace like transport vehicles, Tower Crane, engines, cranes, mobile ladders, scaffoldings, work tools, etc. Strictly avoid standing close to Hydraulic Mobile Crane/vehicles tyres during operation.

iv. The contractor shall deploy cranes in good working condition of maximum allowable years of service from the year of manufacture as specified below: -

20 years for cranes of 50 MT & below capacity,25 years for 51 MT to 100 MT,30 years for cranes above 101 MT.


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v. In general Man basket shall not be lifted by Hydraulic Mobile Crane. Generally Crane shall be used for lifting the man basket.

vi. Tower Crane, Crane, Hydraulic Mobile Crane or equivalent, Hydraulic Rig &Boom Lift shall be inspected on fortnightly basis as per Format No. HSE-20, HSE-21, HSE-22, HSE-23 & HSE-24.

vii. The Contractor shall arrange periodical training for the operators of Hydraulic Mobile Crane, crane, excavator, mobile machinery, Tower Crane, etc. at site by utilizing services from renowned manufacturers.

viii. Hydraulic Mobile Crane or equivalent having steering control mechanism shall be permitted at construction site only for the purpose of loading/unloading. However, continuous rigger availability during marching of hydraulic crane at site shall be ensured by contractor.

### 3.3.9 Occupational Health

a) The contractor shall identify all operations that can adversely affect the health of its workers and issue & implement mitigation measures.

b) For surface cleaning operations, sand blasting shall not be permitted even if not explicitly stated elsewhere in the contract.

c) To eliminate radiation hazard, Tungsten electrodes used for Gas Tungsten Arc Welding shall not contain Thorium.

d) Appropriate respiratory protective devices(hood with respiratory devices) shall be used to protect workmen from inhalation of air borne contaminants like silica, asbestos, gases, fumes, etc.

e) Workmen shall be made aware of correct methods for lifting, carrying, pushing & pulling of heavy loads. Wherever possible, manual handling shall be replaced by mechanical lifting equipment's.

f) Fuelling of construction equipments/Diesel Generator set shall be carried out by hand operated pump.

g) In view of the congested working environment and associated hazards, deployment of manpower/machineries shall be in staggered manner keeping adequate safe distance between two adjacent work spot.

h) For jobs like drilling/demolishing/dismantling/steam blowing/cardboard blasting etc. where noise pollution exceeds the specified limit of 85decibels, ear muffs shall be provided to the workers. The Noise level monitoring record shall be maintained.

i) To avoid work related upper limb disorders (WRULD) and backaches, Display Screen Equipments' workplace stations shall be carefully designed & used with proper sitting postures. Power driven hand-held tools shall be maintained in good working condition to minimize their vibrating effects and personnel using these tools shall be taught how to operate them safely & how to maintain good blood circulation in hands.

j) The Contractor shall arrange health check-up(by registered medical practitioner) for all the workers at the time of induction. Health check may have to be repeated if the nature of duty assigned to him is changed necessitating health check or doubt arises about his wellness. EIL/Owner reserves the right to ask the contractor to submit medical test reports. Regular health check-ups are mandatory for the workers assigned with Welding, Radiography, Blasting, Painting, Heavy Lift and Height (>2m) jobs. All the health check-ups shall be conducted by registered Medical practitioner and records are to be maintained by the Contractor.

k) The Contractor shall arrange Medical Camps at regular intervals at work sites and labor colonies to assess health condition of workers.


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l) The Contractor shall ensure vaccination of all the workers including their families, during the course of entire project span.

### 3.3.10 Hazardous substances

a) Hazardous, inflammable and/or toxic materials such as solvent coating, thinners, anti-termite solutions, water proofing materials shall be stored in appropriate containers preferably with lids having spillage catchment trays and shall be stored in a good ventilated area. These containers shall be labeled with the name of the materials highlighting the hazards associated with its use and necessary precautions to be taken. Respective MSDS (Material Safety Data Sheet) shall be made available at site &may be referred whenever problem arises.

b) Where contact or exposure of hazardous materials are likely to exceed the specified limit or otherwise have harmful effects, appropriate personal protective Equipment's such as gloves, goggles/face-shields, aprons, chemical resistant clothing, respirator, etc. shall be used.

c) The work place shall be checked prior to start of activities to identify the location, type and condition of any asbestos materials which could be disturbed during the work. In case asbestos material is detected, usage of appropriate PPEs by all personnel shall be ensured and the matter shall be reported immediately to EIL/ Owner.

### 3.3.11 Slips, trips & falls

a) The contractor shall establish a regular cleaning and basic housekeeping programme that covers all aspects of the workplace to help minimize the risk of slips, trips & falls. The contractor shall take positive measures like keeping the work area tidy, storing waste in suitable containers & harmful items separately, keeping passages, stairways, entrances & exits especially emergency ones clear, cleaning up spillages immediately and replacing damaged carpet/ floor tiles, mats & rugs at once to avoid slips, trips & falls.

b) Grating removal permit system should be implemented during construction phase. So that after permanent gratings are installed on platforms and tech structure floors; removal of any gratings for whatever purpose (including for lifting piping material etc.) is required to be sanctioned by signed permit by HSE officers of both contractor and Engineer-in-charge. The spot where gratings are removed shall be hard-barricaded during course of work. The removed gratings shall be re-installed immediately after completion of work or at the time of cessation of work every day whichever is earlier and the permit shall be closed on daily basis. A register shall be maintained for recording all the grating removal permits and their closure shall be monitored on daily basis.

### 3.3.12 Radiation exposure

a) All personnel exposed to physical agents such as ionizing &non-ionizing radiation, including ultraviolet rays or similar other physical agents shall be provided with adequate shielding or protection commensurate with the type of exposure involved.

b) For Open Field Radiography works, requirements of Bhabha Atomic Research Centre (BARC)/ Atomic Energy Regulatory Board (AERB) shall be followed.

c) The Contractor shall implement an effective system of control (as described in the AERB regulations) at site for handling radiography-sources & for avoiding its misuse & theft.

d) The contractor shall generate the Format No: HSE-8 "Permit for radiation work" before start of work.

e) In case the radiography work has to be carried out at day time, suitable methodology to be used so that other works, people are not affected.

### 3.3.13 Explosives/Blasting operations


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a) Blasting operations shall be carried out as per latest Explosive Rules (Indian/ International) with prior permission. The Contractor shall obtain license from Chief Controller of Explosives (CCoE) for collection, transportation, storage of explosives as well as for carrying out blasting operations.

b) The Contractor shall prepare exclusive method statement (in cognizance with statutory requirements)for rock blasting works &diffusing unfired explosives, if any, at project site before carrying out actual task. Nowhere blasting shall be carried out by the Contractor or its agency without the involvement of competent supervisor and licensed blaster.

### 3.3.14 Demolition/ Dismantling

a) The contractor shall adhere to safe demolishing/ dismantling practices at all stages of work to guard against unsafe working practices.

b) The contractor shall disconnect service lines (power, gas supply, water, etc.)/ make alternate arrangements prior to start of work and restore them, ifrequired as directed by EIL/ Owner at no extra cost.

c) Before carrying out any demolition/dismantling work, the contractor shall take prior approval of EIL/Owner and generate the Format No.HSE-9. For revamp jobs in operating plants where location of underground utilities is not known with certainty, the contractor shall depute an experienced engineer for supervision and shall make adequate arrangements for Fire-fighting& First-Aid during the execution of these activities.

d) The Contractor shall arrange approved HIRAC/ Method Statement for the specific demolition / dismantling task and corresponding action plan commensurate with hazards / risks associated therein. In no case any activity related to demolition / dismantling shall be carried out by the Contractor without engaging own supervision / field engineer.

### 3.3.15 Road Safety

a) The Contractor shall ensure adequately planned road transport safety management system.

b) The vehicles shall be fitted with reverse warning alarms & flashing lights / fog-lights and usage of seat belts shall be ensured.

c) The Contractor shall also ensure a separate pedestrian route for safety of the workers and comply with all traffic rules & regulations, including maintaining speed limit of 20 KMPH or indicated by owner for all types of vehicles / mobile machinery. The maximum allowable speed shall be adhered to.

d) In case of an alert or emergency, the Contractor must arrange clearance of all the routes, roads, access. The Contractor shall deploy sufficient number of traffic controllers at project site routes / roads/ accesses, to alert reversing movement of vehicles & machinery as well as pedestrians. Experienced drivers/operators with valid driving license (LMV/HMV)shall be allowed to drive/operate the vehicles/equipment's. The Contractor shall maintain copy of PUC,RC and Insurance etc. for all the vehicles/equipment's.

e) Dumpers, Tippers, etc. shall not be allowed to carry workers within the plant area and also to & from the labour colony to & from project sites.

f) Hydraulic Mobile Crane or equivalent)shall only be allowed for handling(loading/unloading) the materials at fabrication/ storage yards and in no case shall be allowed to transport the materials over project / plant roads.

g) The Contractor shall not deploy any such mobile machinery / Equipment's, which do not have competent operator and / or experienced banks-man/signal-man. Such machinery/equipment's shall have effective limit-switches, reverse-alarm, front& rear-end lights etc. and shall be maintained in good working order.

h) The Contractor shall not carry-out maintenance of vehicles / mobile machinery occupying space on project / plant roads and shall always arrange close supervision for such works.


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i) For pipeline jobs, the contractor shall submit a comprehensive plan covering transportation, loading / unloading of pipes, movement of side booms, movement of vehicles on the ROW, etc.

j) Height barrier/Restriction to be provided on both side of the HT lines, if required.

k) Contractor's shall arrange /install visible road signs, diversion boards, caution boards, etc. on project roads for safe movement of men and machinery.

### 3.3.16 Welfare measures

Contractor shall, at the minimum, ensure the following facilities at work sites:

a) A crèche at site where 10 or more female workers are having children below the age of 6 years.

b) Adequately ventilated / illuminated rooms at labour camps & its hygienic up-keeping.

c) Reasonable canteen facilities at site and in labour camps at appropriate location depending upon site conditions. Contractor shall make use of "industrial" variety of LPG cylinder & satisfactory illumination at the canteens. Necessary arrangement for efficient disposal of wastes from canteens & urinals /toilets shall also be made and regular review shall be made to maintain the ambience satisfactorily hygienic &shall also comply with all applicable statutory requirements.

d) Adequately lighted & ventilated Rest rooms at site (separate for male workers and female workers).

e) Provision for suitable mobile toilets to be made available by Contractor for remote/scattered job locations.

f) Urinals, Toilets, drinking water, washing facilities, adequate lighting at site and labour camps, commensurate with applicable Laws/ Legislation.

g) The contractor shall ensure the test report of drinking water.

h) The contractor at periodic interval shall arrange to prevent mosquito breeding by fumigation/spraying of insecticides at workplace/fabrication yard.

### 3.3.17 Environment Protection

Contractor shall ensure proper storage and utilization methodology of materials that are detrimental to the environment. Where required, Contractor shall ensure that only the environment friendly materials are selected and emphasize on recycling of waste materials, such as metals, plastics, glass, paper, oil & solvents. The waste that cannot be minimized, reused or recovered shall be stored and disposed of safely. In no way, toxic spills shall be allowed to percolate into the ground. The contractor shall not use the empty areas for dumping the wastes.

The contractor shall ensure availability of stack emission test report of DG set. Monitoring of air quality emission of DG stack shall be carried out on yearly basis. However, air quality emission shall be monitored first time on commissioning of DG Set.

Contractor to submit Environmental Aspect Impact Register detailing the list of activities in his scope, the respective environmental impact and the actions taken to minimize the impact. Environmental Aspect Impact Register to be prepared as per Format HSE-18 and to be updated and maintained till job completion. Environmental Aspect Impact Register of the contractor shall be reviewed by EIL/Owner on half-yearly basis.

The contractor shall strive to conserve energy and water wherever feasible.

The contractor shall ensure dust free environment at workplace by sprinkling water on the ground at frequent intervals. The air quality parameters for dust, poisonous gases, toxic releases,


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harmful radiations, etc. shall be checked by the contractor on daily basis and whenever need arises.

The contractor shall not be allowed to discharge chemicals, oil, silt, sewage, sullage and other waste materials directly into the controlled waters like surface drains, streams, rivers, ponds. A discharge plan suggesting the methods of treating the waste before discharging shall be submitted to EIL/Owner for approval.

For pipeline jobs, top soil shall be stacked separately while making ROW through fields. This fertile soil shall be placed back on top after backfilling.

For offshore construction barges, arrangements shall be made for safe disposal of human, food & other wastes and applicable laws in this regard shall be followed.

### 3.3.18 Rules & Regulations

All persons deployed at site shall be knowledgeable of and comply with the environmental laws, rules & regulations relating to the hazardous materials, substances and wastes. Contractor shall not dump, release or otherwise discharge or disposes off any such materials without the express authorization of EIL/Owner. An indicative list of Statutory Acts & Rules relating to HSE is given under Appendix-D.

### 3.3.19 Weather Protection

Contractor shall take appropriate measures to protect workers from severe storms, rain, solar radiations, poisonous gases, dust, etc. by ensuring proper usage of PPEs like Sun glasses, Sun screen lotions, respirators, dust masks, etc. and rearranging/ planning he construction activities to suit the weather conditions. Effective arrangement (without creating inconvenience to project facilities & permanent installations) for protecting workmen from hailstorm, drizzle in the form of temporary shelter shall be made at site.

### 3.3.20 Communication

All persons deployed at the work site shall have access to effective means of communication so that any untoward incident can be reported immediately and assistance sought by them.

All health & safety information shall be communicated in a simple & clear language easily understood by the local workforce.

For information to all, typical subjects that should be communicated are: -

Inside the company (Top to down)

a. Quality Policy
b. HSE Policy contents
c. Environment Policy
d. HSE Objectives
e. Safety Cardinal Rules
f. HSE Target – reached or missed
g. Praises & Warnings to personnel for HSE Management
h. Safety Walk Through Reports and safety defects / shortfalls (by management)
i. HSE Audit results
j. Revised Statutory Health & Safety provisions, if any
k. H & S publicity
l. Suggestions

Inside the Company (Bottom to up)


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a. Complaints
b. Compliances on safety defects / shortfalls
c. Suggestions
d. Proposals for changes & improvements
e. HSE Reports (including near-miss reports)

### 3.3.21 Confined Space Entry

The contractor shall generate a work permit (Format No. HSE -7) before entering a confined space. People, who are permitted to enter into confined space, must be medically examined & certified by registered doctor, confirming their 'medical fitness for working in confined space'. All necessary precautions mentioned therein shall be adhered to. An attendant shall be positioned outside a confined space for extending help during an emergency. Effective communication shall be maintained between personnel in confined space and outside by combination of visual/voice or portable radio. Compressed gas cylinders shall not be taken into confine space. Entry Register for confined space to be maintained with the name and time of entry/exit. All appropriate PPEs and air quality parameters shall be checked before entering a confined space. It shall be ensured that the piping of the equipment which has to be opened is pressure- free by checking that blinds are in place, vents are open and volume is drained. Inside confined space works, only electrical facilities / installations of 24V shall be permitted. Contractor shall ensure usage of safe & suitable arrangement of oxygen supply for individual workmen (during the course of work in confined space), if oxygen concentration is found to be less than 19.5% (v/v) there. All persons must be made aware of the risk associated with Nitrogen &all precautionary measures shall be taken when vessel/sphere/pipelines etc. are being purged with nitrogen.
Rescue arrangement must be readily available at workplace to fulfill requirement of the emergency situation.

### 3.3.22 Heavy Lifts

a) The contractor shall submit detailed rigging study/ plan for EIL/ Owner approval prior to lifting equipment requiring a crane of approx. 100 MT capacity or more due to constraints of its dimensions, location of foundation height, approach & weight.
b) Contractor shall generate the format no. HSE-15 "Permit for heavy lift/critical erection"
c) The Safe Working Load (SWL) and manufacturer's serial numbers shall be clearly marked on the slings and the lifting gears, either by tagging, stamping, engraving or embossing.
d) Prior to actual lifting activities, contractor shall check the validity of the crane inspection certificate issued by statutory/ competent authority. This requirement shall also apply to all rigging equipment's utilized for the job.
e) The contractor shall, at all times, be responsible for all rigging activities.
f) The Contractor shall ensure medical fitness of all workmen who are engaged / involved in erection of equipment's, vessels etc. and such fitness checks shall be carried-out every six months interval with the help of a registered medical practitioner & record shall be maintained
g) Adequate safety measures such as positive barricading, usage of appropriate PPEs, permit to work, etc. shall be taken during all heavy or critical lifts.
h) Ground condition should be suitable to sustain the Ground Bearing Load of the Crane with full load condition.
i) For lifting any material (irrespective of shape, size or volume), at any height, it is always advisable to prepare a Plan of Erection (PoE) taking into consideration hazards & risks associated therein – this can enable people to put their own experiences of various natures & side-by-side establish a practical method for risk-free erection / lifts. The contractor shall


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prepare PoE & shall document the same, when risks are identified as "medium" or "high" and the same shall be approved by its competent / qualified engineer.

### 3.3.23 Key Performance Indicators

The contractor shall measure an activity in both leading & trailing indicators for statistical and performance measurement. The activities pertaining to key performance indicators are covered in Monthly HSE Report (Format No. HSE-5). The contractor shall try to achieve a statistically fair record and strive for its continual improvement.

Leading Indicators viz:-:

- Number of Safety Inductions carried-out at site (for workmen & staff members)
- Number of HSE inspections carried out
- Number of "Safety Walk Through" carried-out by site-head.
- Number of HSE shortfalls / lapses identified per contractor& closed-out in time.
- Number of Safety Meetings conducted (in-house / with contractors)
- Number of HSE Audits made (internal & external) vis-à-vis non conformances raised
- Number of HSE Awareness / Motivational program conducted by contractors
- Number of HSE Trainings conducted at site for supervisors & workmen
- Study of Near miss case reported
- Encouragements / Awards / Recognitions to workmen, job supervisors & field engineers.
- Suggestions for improvement

Trailing Indicators viz:-:

- Calculation of HSE statistics viz frequency rate, severity rate, LTA free man hours etc.
- Analysis of incidents / accidents (nature, severity, types etc.)
- Study of Incident / Accident with respect to :-
    - Variety
    - Period of the year / project span
    - Timings of the incident / accident
    - Age profile of victims
    - Body parts involved
    - Penalty levied for causing incident / accident

### 3.3.24 Unsuitable Land Conditions

Contractor shall take appropriate measures and necessary work permits/clearances if work is to be done in or around marshy areas, river crossings, mountains, monuments, etc. The Contractor shall make right assessment and take all necessary action for developing work areas to make them safe & suitable for crane operations or other vehicular movement before carrying out any project related activity / operation. Contractor shall take all necessary actions to make the surroundings of its site establishments (site office, stores, lay-down area etc.) work-worthy safe and secure.

### 3.3.25 Under Water Inspection

Contractor shall ensure that boats and other means used for transportation, surveying & investigation works shall be certified seaworthy by a recognized classification society. It shall be equipped with all life saving devices like life jackets, adequate fire protection arrangement sand shall possess communication facilities like cellular phones, wireless, walkie-talkie. All divers used for seabed surveys, underwater inspections shall have required authorized license, suitable life-saving kit. Number of hours of work by divers shall be limited as per regulations. EIL/ Owner shall have the right to inspect the boat and scrutinize documents in this regard.


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### 3.3.26 Excavation

The Contractor shall obtain permission from competent authorities prior to excavation wherever required.

The Contractor shall locate the position of buried utilities (water line, cable route, etc.) by referring to project / plant drawing / in consultation with EIL/Owner. The Contractor shall start digging manually to locate the exact position of buried utilities & thereafter use mechanical means.

In case of non-availability of sufficient data/drawings, underground services i.e. underground cable/ pipe shall be checked by cable detector/pipe locator by the contractor.

The Contractor shall keep soil heaps at least 1.5 M away from edge or a distance equal to depth of pit (whichever is more)

All excavated pits greater than 10 Sq.M plan area and depth more than 1.5M shall have at least two access routes for ingress and egress. Also, additional access routes shall be provided such that distance between any two access routes shall not be more than 20M.

The Contractor shall maintain sufficient "angle of repose" during excavation – shall also provide slope or suitable bench as decided by EIL / Owner.

The Contractor shall arrange "battering" or "benching" wherever required for preventing collapse of edge of excavations.

Avoid vertical wall of less than 2mtrs between two adjacent deep excavated pit/area. Further deep excavation should not be kept open for a longer duration.

The Contractor shall identify & arrange de-watering pump or well-point system to prevent earth collapse due to heavy rain / influx of underground water.

The Contractor shall arrange protective fencing/hard barricading with warning signal around excavated pits, trenches, etc. along with minimum 2 (two) entries, exits / escape ladders.

The Contractor must avoid "underpinning" / under-cutting to prevent collapse of chunk of earth during excavation.

The Contractor shall use "stoppers" to prevent over-run of vehicle wheels at the edge of excavated pits / trenches. Vehicles movement should be restricted to minimum three meters away from the excavated pit.

The Contractor shall arrange strengthening of "shoring" & "strutting" proactively to avoid collapse of earth / edges due to vehicular movement in close proximity of excavated areas / pits/ trenches, etc.

## 3.4 Tool Box Talks (TBT)

Contractor shall conduct daily TBT with workers prior to start of work and shall maintain proper record of the meeting. A suggested format is given below. The Job specific TBT is to be conducted by the immediate supervisor of the workers.

The Contractor shall conduct TBT before start of every morning or evening shift or night shift activities, for alerting the workers on specific hazards and their appropriate dos & don'ts. The Contractor shall provide sufficient rests to the site workmen and their foremen to avert fatigue & thereby endangering their lives during the course of site works.


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| TOOLBOX TALK RECORDING SHEET | | |
|---|---|---|
| Date & Time | | |
| Work Location | | |
| Subject (Nature of work) | | |
| Presenter | | |
| Hazards involved | | |
| Precautions to be taken | | |
| Worker's Name | Signature | Section |
| | | |
| | | |
| | | |
| Remarks, in any | | |

The topics during TBT shall include

- Hazards related to work assigned on that day and precautions to be taken.
- Any forthcoming HSE hazards/events/instruction/orders, etc.

The above record can be kept in local language, which workers can read. These records shall be made available to EIL/ Owner whenever demanded.

### 3.5 Training & Induction Programme

a) Initial induction of workers into Construction oriented activities and appraising them about the methodology of works and how to carry-out safely and the same should not be inter mixed with Tool Box Talks or HSE Training. In this regard careful action should be made& maintained for imparting HSE induction to every individual, irrespective of his task/designation/level of employment, whereas, HSE Training should be imparted to specific person/group of people who are to carry-out that specific task more than once – for example, Riggers must be trained for working at heights, welders must be trained for work in confined space, fitters/carpenters, mesons must be trained for work at heights, etc.
Contractor shall arrange suitable facilities (e.g training room/place, audio visual facilities etc.) for organizing such training on HSE.

b) Contractor shall conduct Safety induction programme on HSE for all his workers and maintain records. Sticker for "Safety Induction" shall be pasted on the safety helmet of the site personnel. The Gate Pass shall be issued only to those workers who successfully qualify the Safety induction programme. Contractor to conduct effective safety induction program at work site by making efforts to arrange Video film/Virtual Reality (VR) technology pertaining to the escape routes, assembly points, risks involved in the event of an emergency etc while imparting safety induction.

c) The Contractor brief the visitors about the HSE precautions which are required to be taken before their proceeding to site and make necessary arrangements to issue appropriate PPEs like Aprons, hard hats, ear-plugs, goggles & safety shoes etc., to his visitors. The Contractor shall always maintain relevant acknowledgement from visitor on providing him brief information on HSE actions.

d) Contractor shall submit job specific training schedule for approval of EIL/Owner &ensure that all his personnel possess appropriate training to carry out the assigned job safely. The training should be imparted in a language understood by them and should specifically be trained about

- Potential hazards to which they may be exposed at their workplace


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- Measures available for prevention and elimination of these hazards

The topics during training shall cover, at the minimum: -

- Why safety should be considered during work - explanation
- Education about hazards and precautions required
- Employees' duties & responsibilities
- Emergency and evacuation plan
- HSE requirements during project activities
- Fire fighting and First-Aid
- Use of PPEs
- Occupational health issues – dos & don'ts
- Local laws on intoxicating drinks, drugs, smoking in force
- Common environmental subjects – lighting, ventilation, vibration, smoke/fumes etc.

e) Records of the training shall be kept and submitted to EIL/ Owner.

f) The Contractor shall make regular program for conducting Safety Training on various topics related to various activities & their safe-guarding utilizing experienced persons / outside agency / faculty. A program for Safety Training (indicative list as per Appendix –F) shall be furnished by the Contractor in its HSE Plan.

g) For offshore and jetty jobs, contractor shall ensure that all personnel deployed have undergone a structured sea survival training including use of lifeboats, basket landing, use of radio communication etc. from an agency acceptable to Owner/EIL.

## 3.6 ADDITIONAL SAFETY REQUIREMENTS FOR WORKING INSIDE A RUNNING PLANT

As a minimum, the contractor shall ensure adherence to following safety requirements while working in or in the close vicinity of an operating plant:

a) Contractor shall obtain permits for Hot work, Cold work, Excavation and Confined Space from Owner in the prescribed format.

b) The contractor shall monitor record and compile list of his workers entering the operational plant/unit each day and ensure & record their return after completing the job.

c) Contractor's workers and staff members shall use designated entrances and proceed by designated routes to work areas only assigned to them. The workers shall not be allowed to enter units' area, tanks area, pump rooms, etc. without work authorization permit.

d) Work activities shall be planned in such a way so as to minimize the disruption of other activities being carried out in an operational plant/unit and activities of other contractors.

e) The contractor shall submit a list of all chemicals/toxic substances that are intended to be used at site and shall take prior approval of the Owner.

f) Specific training on working in a hydrocarbon plant shall be imparted to the work force and mock drills shall be carried out for Rescue operations/First-Aid measures.

g) Proper barricading/cordoning of the operational units/plants shall be done before starting the construction activities. No unauthorized person shall be allowed to trespass. The height and overall design of the barricading structure shall be finalized in consultation with the Owner and shall be got approved from the Owner.

h) Care shall be taken to prevent hitting underground facilities such as electrical cables, hydrocarbon piping during execution of work.


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i) Barricading with water curtain shall be arranged in specific/critical areas where hydrocarbon vapors are likely to be present such as near horton spheres or tanks. Positioning of fire tenders (from owner) shall also be ensured during execution of critical activities.

j) Emergency evacuation plan shall be worked out and all workmen shall be apprised about evacuation routes. Mock drill operations may also be conducted.

k) Flammable gas test shall be conducted prior to any hot work using appropriate measuring instruments. Sewers, drains, vents or any other gas escaping points shall be covered with flame retardant tarpaulin.

l) Respiratory devices shall be kept handy while working in confined zones where there is a danger of inhalation of poisonous gases. Constant monitoring of presence of Gas/Hydrocarbon shall be done.

m) Clearance shall be obtained from all parties before starting hot tapping, patchwork on live lines and work on corroded tank roof.

n) Positive isolation of line/equipment by blinding for welding/cutting/grinding shall be done. Closing of valve will not be considered sufficient for isolation.

o) Welding spatters shall be contained properly by using fire retardant blanket and in no case shall be allowed to fall on the ground containing oil. Similar care shall be taken during cutting operations. Fire watcher to be deployed to ensure the same.

p) The vehicles, cranes, engines, etc. shall be fitted with spark arresters on the exhaust pipe and got it approved from Safety Department of the Owner.

q) Plant air should not be used to clean any part of the body or clothing or use to blow off dirt on the floor.

r) Gas detectors should be installed in gas leakage prone areas as per requirement of Owner's plant operation personnel.

s) Flame proof electrical distribution board, plug and socket shall be used for electrical appliances.

t) Experienced full time safety personnel shall be exclusively deployed to monitor safety aspects in running plants.

### 3.7 Self-Assessment and Enhancement

The contractor shall develop a method of check & balance through self-assessment& enhancement techniques and shall explore the opportunities for continual improvement in the HSE system.

### 3.8 HSE Promotion

The contractor shall encourage his workforce to promote HSE efforts at workplace by way of organizing workshops/seminars/training programs, celebrating HSE awareness weeks &National Safety Day, conducting quizzes & essay competitions, distributing pamphlets, posters & material on HSE, providing incentives for maintaining good HSE practices and granting incentives/ bonus for completing the job without any lost time accident.

### 3.9 Lock Out and Tag Out(LOTO) for Isolation of Energy Source

a) Contractor shall follow the LOTO/Isolation procedure of owner for all energy source isolations installed/under purview by /of owner i.e. "Brown field"

b) For all the other energy source (not under purview of client/owner)i.e. "Green field" Contractor shall develop a system to ensure the isolation of equipments, pipelines, Vessel, electrical panels from the energy source covering following as minimum:-


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- Identification of all energy source viz electrical, mechanical, hydraulic, pneumatic, chemical, thermal, gravitational, radiation and other forms of stored or kinetic energy.
- Establishing the energy isolation devices viz manually operated electrical circuit breakers, disconnection switches, blind flanges, etc.
- Installation of Lock Out devices for preventing the inadvertent release of stored energy and Tag Out devices ("Danger", "Do Not operate" or Do not Remove"tags) to indicate that testing, maintenance or servicing is underway and the device cannot be operated until the tag out device is removed.
- Lock Out and Tag out log book
- Permit for isolation and de-isolation of energy source as per format No.: HSE-16
- Availability of competent persons like experienced operators at substations, pump house, units etc. supervisors etc.

c) Contractor shall ensure that all the sources are locked out and tagged properly before giving clearance to start the job.

d) After the completion of job, contractor shall ensure all tools and tackles are removed and nobody is present in the working area and signing on LOTO log book.

e) Only on confirmation of above the contractor will remove their lock and tag from the isolation points and give instructions for energizing the same. Only the person carrying out the task shall himself carry the key for the lock in /Lock out.

## 4.0 DETAILS OF HSE MANAGEMENT SYSTEM BY CONTRACTOR

### 4.1 On Award of Contract

The Contractor shall submit a comprehensive Health, Safety and Environmental Plan or programme for approval by EIL/Owner prior to start of work. The Contractor shall participate in the pre-start meeting with EIL/Owner to finalize HSE Plans which shall including the following:

- HSE policy & Objectives
- Job procedure to be followed by the Contractor for construction activities including handling of equipment's, scaffolding, electric installations, etc. describing the risks involved, actions to be taken and methodology for monitoring each activity. Indicative list of procedures is enclosed as Annexure-H
- EIL/Owner review/audit requirement.
- Organization structure along with responsibility and authority, on HSE activities.
- Administrative & disciplinary steps involving implementation of HSE requirements
- Emergency evacuation plan/ procedures for site and labour camps
- Procedures for reporting & investigation of accidents and near misses.
- HSE Inspection
- HSE Training programme at project site
- HSE Awareness program eat project site
- Reference to Rules, Regulations and statutory requirements.
- HIRAC
- Environment Aspect Impact Register
- Legal Register
- HSE documentation viz reporting, analysis & record keeping.

### 4.2 During Job Execution

Contractor shall implement approved Health, Safety and Environment management plan or programme including but not limited to as brought out under para 3.0. Contractor shall also ensure:

a) to arrange workmen compensation insurance, registration under ESI Act, third party liability insurance, registration under BOCW Act etc., as applicable.


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b) to arrange all HSE permits before start of activities (as applicable), like permits for hot work, working at heights (Refer Format No. HSE-6), confined space (Refer Format No. HSE-7), Radiation Work Permit (Refer Format No. HSE-8), Demolishing/ Dismantling Work Permit (Refer Format No. HSE-9),Permit for erection/modification & dismantling of scaffolding(Refer Format No:HSE-14),Permit for heavy lift/critical erection (Refer Format No:HSE-15) ,Permit for energy Isolation & De-isolation" (HSE-16) ,storage of chemical/explosive materials & its use and implement all precautions mentioned therein. In this regard, requirements of *Oil industry Safety Directorate Standard No.* Std -105 "Work Permit Systems" shall be complied with while working in existing Oil or Gas processing plants. List of the persons involved shall be maintained as annexure to the work permit issued for a particular activity.

c) to submit, timely, the completed checklist on HSE activities in Format No.HSE-1, Monthly HSE report in Format No.HSE-5 (use of web based package (www.eil.co.in/conthse) is compulsory wherever the facility is available else a hard copy is to be submitted), accident/ incident reports, investigation reports etc. as per EIL/Owner requirements. Compliance of instructions on HSE shall be done by Contractor and informed urgently to EIL/Owner.

d) that his top most executive at site attends all the Safety Committee/HSE meetings arranged by EIL/Owner and carries out safety walk regularly. Only in case of his absence from site that a second senior most person shall be nominated by him, in advance, and communicated to EIL/Owner for performing the above tasks.

e) display at site office and at prominent locations HSE Policy, caution boards, list of hospitals, emergency services available, safety signs like Men at work, Speed Limits, Hazardous Area, various do's & don'ts, etc.

f) provide posters, banners for safe working to promote safety consciousness.

g) identify, assess, analyze & mitigate the construction hazards& incorporate relevant control measures before actually executing site works. (HIRAC = Hazard Identification, Risk Analysis and Control).

h) identify, assess, analyze & mitigate the environmental impact & incorporate relevant control measures through Environmental Aspect Impact Register

i) Identify and comply to all applicable HSE related legal requirements by preparing and maintaining a Legal register.

j) To maintain & monitor the level of legal compliance at site, a committee shall be formed comprising of contractor's RCM as Head and lead representatives as member(s)from HR/Legal, HSE and discipline engineer(s) (Civil, Mechanical, Electrical, Instrumentation) as applicable. Committee shall review the applicable legal requirements during periodical meetings and monitor the compliance status.

k) arrange testing, examination, inspection of own as well as borrowed construction equipment's/ machinery (stationary &mobile) before being used at site and also at periodical interval, through own resources and also by 3rd party competent agencies (as deemed fit in statutes). Records of such test, examination etc. shall be maintained & shall be submitted to EIL/Owner as & when asked for.

l) carryout audits/inspection (internal & external) at his works as well as sub-contractor works as per approved HSE plan/procedure/programme & submit the compliance reports of identified shortfalls for EIL/Owner review.

m) Arranging HSE training for site workmen (of his own &subcontractors) through internal or external faculty at periodical intervals.

n) Assistance& cooperate during HSE audits by EIL/Owner or any other 3rd party and submit compliance report.

o) Generate & submit of HSE records/report as per this specification.

p) Contractor shall arrange minimum 100 lux. illumination level at construction site for night works& record shall be maintained.


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q) Mobile phones shall not be permitted in operational area of the Project Site. However, intrinsically safe mobile phone can be permitted on approval from EIL/Owner. Alternatively, telephone booth(s) may be set up by the contractor after obtaining approval from EIL/Owner. Use of mobile phone shall also be restricted during construction activities such as height work, erection of material, confined space and Pre-commissioning & Commissioning activities at all project sites.

r) The contractor shall assign responsible person as in charge for night works and it shall be informed to owner/EIL.

s) Appraise EIL/Owner on HSE activities at site regularly.

t) Carry-out all dismantling activities safely, with prior approval of EIL/Owner representative.

u) The Contractor shall ensure that "Hot works" and painting works do not continue at the same place/ location at project site for which chance or probability of "fire" incident exists.

### 4.3 During Short Listing of the Sub-Contractors

The contractor shall review the HSE management system of the sub-contractors in line with the requirements given in this specification. The contractor shall be held responsible for the shortcomings observed in the HSE management system of the sub-contractor(s) during execution of the job.

## 5.0 RECORDS

At the minimum, the contractor shall maintain/ submit HSE records in the following reporting formats:

| | |
|---|---|
| Safety Walk Through Report | HSE-1 |
| Accident/ Incident Report | HSE-2 |
| Supplementary Accident/ Incident Investigation report | HSE-3 |
| Near Miss Incident Report | HSE-4 |
| Monthly HSE Report | HSE-5 |
| Permit for working at height | HSE-5 |
| Permit for working in confined space | HSE-7 |
| Permit for radiation work | HSE-8 |
| Permit for demolishing/ dismantling | HSE-9 |
| Daily Safety checklist | HSE-10 |
| Housekeeping Assessment & compliance | HSE-11 |
| Inspection of temporary electrical booth/installation | HSE-12 |
| Inspection for scaffolding | HSE-13 |
| Permit for erection/modification &dismantling of scaffolding | HSE-14 |
| Permit for heavy lift/critical erection. | HSE-15 |
| Permit for Energy isolation and de-isolation. | HSE-16 |
| Permit for Excavation | HSE-17 |
| Environmental Aspect Impact Register | HSE-18 |
| HIRAC Register | HSE-19 |
| Checklist for Tower Crane | HSE-20 |
| Crane Inspection Checklist | HSE-21 |
| Hydraulic Mobile Crane Inspection Checklist | HSE-22 |
| Hydraulic Rig Inspection Checklist | HSE-23 |


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| | |
|---|---|
| Boom Lift Inspection Checklist | HSE-24 |
| Inspection reports of Equipment/tools/tackles | * |
| Report of Toolbox Talks | As indicated in specification |
| PPE issue report/register | * |
| Site inspection reports | * |
| Training records | * |

(*) The formats shall be developed by contractor in consultation with EIL/Owner.



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**APPENDIX-A**
**(Sheet 1 of 2)**

**A. IS CODES ON HSE**

| | |
|---|---|
| SP: 53 | Safety code for the use, Care and protection of hand operated tools. |
| IS: 838 | Code of practice for safety & health requirements in electric and gas welding and cutting operations |
| IS: 1179 | Eye & Face precautions during welding, equipment etc. |
| IS: 1860 | Safety requirements for use, care and protection of abrasive grinding wheels. |
| IS: 1989 (Pt -II) | Leather safety boots and shoes |
| IS: 2925 | Industrial Safety Helmets |
| IS: 3016 | Code of practice for fire safety precautions in welding & cutting operation. |
| IS: 3043 | Code of practice for earthing |
| IS: 3764 | Code of safety for excavation work |
| IS: 3786 | Methods for computation of frequency and severity rates for industrial injuries and classification of industrial accidents |
| IS: 3696 | Safety Code of scaffolds and ladders |
| IS: 4083 | Recommendations on stacking and storage of construction materials and components at site |
| IS: 4770 | Rubber gloves for electrical purposes |
| IS: 5121 | Safety code for piling and other deep foundations |
| IS: 5216 (Pt-I) | Recommendations on Safety procedures and practices in electrical works |
| IS: 5557 | Industrial and Safety rubber lined boots |
| IS: 5983 | Eye protectors |
| IS: 6519 | Selection, care and repair of Safety footwear |
| IS: 6994 (Pt-I) | Industrial Safety Gloves (Leather & Cotton Gloves) |
| IS: 7293 | Safety Code for working with construction Machinery |
| IS: 8519 | Guide for selection of industrial safety equipment for body protection |
| IS: 9167 | Ear protectors |
| IS: 11006 | Flash back arrestor (Flame arrestor) |
| IS: 11016 | General and safety requirements for machine tools and their operation |
| IS: 11057 | Specification for Industrial safety nets |
| IS: 11226 | Leather safety footwear having direct moulded rubber sole |
| IS: 11972 | Code of practice for safety precaution to be taken when entering a sewerage system |
| IS: 13367 | Code of practice-safe use of cranes |
| IS: 13416 | Recommendations for preventive measures against hazards at working place |


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**APPENDIX-A**
**(Sheet 2 of 2)**

## B. INTERNATIONAL STANDARDS ON HSE

| | | |
|---|---|---|
| Safety Glasses | : | ANSI Z 87.1, ANSI ZZ 87.1, AS 1337, BS 2092, BS 1542, BS 679, DIN 4646/ 58311 |
| Safety Shoes | : | ANSI Z 41.1, AS 2210, EN 345 |
| Hand Gloves | : | BS 1651 |
| Ear Muffs | : | BS 6344, ANSI S 31.9 |
| Hard Hat | : | ANSI Z 89.1/89.2, AS 1808, BS 5240, DIN 4840 |
| Goggles | : | ANSI Z 87.1 |
| Face Shield | : | ANSI Z 89.1 |
| Breathing Apparatus | : | BS 4667, NIOSH |
| Welding & Cutting | : | ANSI Z49.1 |
| Safe handling of compressed: | | P-1 (Compressed Gas Association Gases in cylinders 1235 Jefferson Davis Highway, Arlington VA 22202 - USA) |
| Full body harness | : | EN-361 |
| Lanyard | : | EN-354 |
| Karabiner | : | EN-362 and EN-12275 |


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**APPENDIX-B**

## DETAILS OF FIRST AID BOX

| SL. NO. | DESCRIPTION | | QUANTITY |
|---|---|---|---|
| 1. | Small size Roller Bandages, 1 Inch Wide | (Finger Dressing small) | 6 Pcs. |
| 2. | Medium size Roller Bandages, 2 Inches Wide | (Hand & Foot Dressing) | 6 Pcs. |
| 3. | Large size Roller Bandages, 4 Inches Wide | (Body Dressing Large) | 6 Pcs. |
| 4. | Large size Burn Dressing | (Burn Dressing Large) | 4 Pkts. |
| 5. | Cotton Wool | (20 gms packing) | 4 Pkts. |
| 6. | Antiseptic Solution Dettol (100 ml.) or Savlon | | 1 Bottle |
| 7. | Mercurochrome Solution (100 ml.) 2% in water | | 1 Bottle |
| 8. | Ammonia Solution (20 ml.) | | 1 Bottle |
| 9. | A Pair of Scissors | | 1 Piece |
| 10. | Adhesive Plaster (1.25 cm X 5 m) | | 1 Spool |
| 11. | Eye pads in Separate Sealed Pkt. | | 4 pcs. |
| 12. | Tourniqut | | 1 No. |
| 13. | Safety Pins | | 1 Dozen |
| 14. | Tinc. Iodine/ Betadine (100 ml.) | | 1 Bottle |
| 15. | Polythene Wash cup for washing eyes | | 1 No. |
| 16. | Potassium Permanganate (20 gms.) | | 1 Pkt. |
| 17. | Tinc. Benzoine (100 ml.) | | 1 Bottle |
| 18. | Triangular Bandages | | 2 Nos. |
| 19. | Band Aid Dressing | | 5 Pcs. |
| 20. | Iodex/Moov(25 gms.) | | 1 Bottle |
| 21. | Tongue Depressor | | 1 No. |
| 22. | Boric Acid Powder (20 gms.) | | 2 Pkt. |
| 23. | Sodium Bicarbonate (20 gms.) | | 1 Pkt. |
| 24. | Dressing Powder (Nebasulf) (10 gms.) | | 1 Bottle |
| 25. | Medicinal Glass | | 1 No. |
| 26. | Duster | | 1 No. |
| 27. | Booklet (English& Local Language) | | 1 No. each |
| 28. | Soap | | 1 No. |
| 29. | Toothache Solution | | 1 No. |
| 30. | Vicks (22 gms.) | | 1 Bottle |
| 31. | Forceps | | 1 No. |
| 32. | Snake –Bite Lancet | | 1No. |
| 33. | Note Book | | 1 No. |
| 34. | Splints | | 4 Nos. |
| 35. | Lock | | 1 Piece |
| 36. | Life Saving/Emergency/Over-the counter Drugs | | As decided at site |

Box size: Suitable size first aid box to be used for first aid items

Note : The medicines prescribed above are only indicative. Equivalent medicines can also be used. A prescription, in this regard, shall be required from a qualified Physician.


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**APPENDIX-C**

## TYPE OF FIRES VIS-À-VIS FIRE EXTINGUISHERS

| Fire / Extinguisher | Water | Foam | $CO_2$ | Dry Powder | Multi purpose (ABC) |
|---|---|---|---|---|---|
| Originated from paper, clothes, wood | ✔ | ✔ | can control minor surface fires | can control minor surface fires | ✔ |
| Inflammable liquids like alcohol, diesel, petrol, edible oils, bitumen | × | ✔ | ✔ | ✔ | ✔ |
| Originated from gases like LPG, CNG, $H_2$ | × | × | ✔ | ✔ | ✔ |
| Electrical fires | × | × | ✔ | ✔ | ✔ |

LEGEND : ✔ : CAN BE USED

× : NOT TO BE USED

**Note:** Fire extinguishing equipment must be checked atleast once a year and after every use by an authorized person. The equipment must have an inspection label on which the next inspection date is given. Type of extinguisher shall clearly be marked on it.



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**APPENDIX-D**

## List of Statutory Acts & Rules Relating to HSE

- The Indian Explosives Act and Rules
- The Motor Vehicle Act and Central Motor Vehicle Rules
- The Factories Act and concerned Factory Rules
- The Petroleum Act and Petroleum Rules
- The Workmen Compensation Act
- The Gas Cylinder Rules and the Static & Mobile Pressure Vessels Rules
- The Indian Electricity Act and Rules
- The Indian Boiler Act and Regulations
- The Water (Prevention & Control & Pollution) Act
- The Water (Prevention & Control of Pollution) Cess Act
- The Mines & Minerals (Regulation & Development) Act
- The Air (Prevention & Control of Pollution) Act
- The Atomic Energy Act
- The Radiation Protection Rules
- The Indian Fisheries Act
- The Indian Forest Act
- The Wild Life (Protection) Act
- The Environment (Protection) Act and Rules
- The Hazardous Wastes (Management & Handling) Rules
- The Manufacturing, Storage & import of Hazardous Chemicals Rules
- The Public Liability Act
- The Building and Other Construction Workers (Regulation of Employment and Condition of Service) Act
- Other statutory acts Like EPF, ESIS, Minimum Wages Act.


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**APPENDIX-E(Sheet 1 of 12)**

## CONSTRUCTION HAZARDS, THEIR EFFECTS & PREVENTIVE MEASURES

| ACTIVITY | TYPE OF HAZARD | EFFECT OF HAZARD | PREVENTIVE MEASURES |
|---|---|---|---|
| (A) EXCAVATION<br><br>Pit Excavation upto 3.0m | Falling into pit | Personal injury | Provide guard rails/ barricade with warning signal<br>Provide atleast two entries/ exits.<br>Provide escape ladders. |
| | Earth Collapse | Suffocation/ Breathlessness Buried | Provide suitable size of shoring and strutting, if required.<br>Keep soil heaps away from the edge equivalent to 1.5m or depth of pit whichever is more.<br>Don't allow vehicles to operate too close to excavated areas. Maintain atleast 2m distance from edge of cut.<br>Maintain sufficient angle of repose. Provide slope not less than 1:1 and suitable bench of 0.5m width at every 1.5m depth of excavation in all soils except hard rock.<br>Battering/benching the sides. |
| | Contact with buried electric cables<br>Gas/ Oil Pipelines | Electrocution<br>Explosion | Obtain permission from competent authorities, prior to excavation, if required.<br>Locate the position of buried utilities by referring to plant drawings.<br>Start digging manually to locate the exact position of buried utilities and thereafter use mechanical means. |
| Pit Excavation beyond 3.0m | Same as above plus<br>Flooding due to excessive rain/ underground water | Can cause drowning situation | Prevent ingress of water<br>Provide ring buoys<br>Identify and provide suitable size dewatering pump or well point system |
| | Digging in the vicinity of existing Building/ Structure | Building/Structure may collapse<br>Loss of health & wealth | Obtain prior approval of excavation method from local authorities.<br>Use under-pining method<br>Construct retaining wall side by side. |
| | Movement of vehicles/ Equipments close to the edge of cut. | May cause cave-in or slides.<br>Persons may get buried. | Barricade the excavated area with proper lighting arrangements<br>Maintain at least 2m distance from edge of cut and use stop blocks to prevent over-run<br>Strengthen shoring and strutting |


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**APPENDIX-E: (Sheet 2 of 12)**

**CONSTRUCTION HAZARDS, THEIR EFFECTS & PREVENTIVE MEASURES (...Contd.)**

| ACTIVITY | TYPE OF HAZARD | EFFECT OF HAZARD | PREVENTIVE MEASURES |
|---|---|---|---|
| Narrow deep excavations for pipelines, etc. | Same as above plus Frequent cave-in or slides | May cause severe injuries or prove fatal | Battering/benching of sides<br>Provide escape ladders |
| | Flooding due to Hydro- static testing | May arise drowning situation | Same as above plus<br>Bail out accumulated water<br>Maintain adequate ventilation. |
| Rock by excavation blasting | Improper handling of explosives | May prove fatal | Ensure proper storage, handling & carrying of explosives by trained personnel.<br>Comply with the applicable explosive acts & rules. |
| | Uncontrolled explosion | May cause severe injuries or prove fatal | Allow only authorized persons to perform blasting operations.<br>Smoking and open flames are to be strictly prohibited |
| | Scattering of stone pieces in atmosphere | Can hurt people | Use PPE like goggles, face mask, helmets etc. |
| Rock excavation by blasting (Contd) | Entrapping of persons/ animals. | May cause severe injuries or prove fatal | Barricade the area with red flags and blow siren before blasting. |
| | Misfire | May explode suddenly | Do not return to site for atleast 20 minutes or unless announced safe by designated person. |
| Piling Work | Failure of pile-driving equipment | Can hurt people | Inspect Piling rigs and pulley blocks before the beginning of each shift. |
| | Noise pollution | Can cause deafness and psychological imbalance. | Use personal protective equipment's like ear plugs, muffs, etc. |
| | Extruding rods/casing | Can hurt people | Barricade the area and install sign boards<br>Provide first-aid |
| | Working in the vicinity of 'Live-Electricity' | Can cause electrocution/ Asphyxiation | Keep sufficient distance from Live-Electricity as per IS code.<br>Shut off the supply, if possible<br>Provide artificial/rescue breathing to the injured |
| (B) CONCRETING | Air pollution by cement | May affect Respiratory System | Wear respirators or cover mouth and nose with wet cloth. |
| | Handling of ingredients | Hands may get injured | Use gloves & other PPE. |
| | Protruding reinforcement rods. | Feet may get injured | Provide platform above reinforcement for movement of workers or provide end caps for protection on reinforcement bars. |



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**APPENDIX-E :(Sheet 3 of 12)**

**CONSTRUCTION HAZARDS, THEIR EFFECTS & PREVENTIVE MEASURES (...Contd.)**

| ACTIVITY | TYPE OF HAZARD | EFFECT OF HAZARD | PREVENTIVE MEASURES |
|---|---|---|---|
| | Earthing of electrical mixers, vibrators, etc. not done. | Can cause electrocution/ asphyxiation | Ensure earthing of equipments and proper functioning of electrical circuit before commencement of work. |
| | Falling of materials from height | Persons may get injured | Use hard hats<br>Remove surplus material immediately from work place.<br>Ensure lighting arrangements during night hours |
| | Continuous pouring by same gang | Cause tiredness of workers and may lead to accident. | Insist on shift pattern<br>Provide adequate rest to workers between subsequent pours. |
| | Revolving of concrete mixer/ vibrators | Parts of body or clothes may get entrapped. | Allow only mixers with hopper<br>Provide safety cages around moving motors<br>Ensure proper mechanical locking of vibrator. |
| Super-structure | Same as above plus Deflection in props or shuttering material | Shuttering/props may collapse and prove fatal | Avoid excessive stacking on shuttering material<br>Check the design and strength of shuttering material before commencement of work<br>Rectify immediately the deflection noted during concreting. |
| | Passage to work place | Improperly tied and designed props/planks may collapse | Ensure the stability and strength of passage before commencement of work.<br>Do not overload and stand under the passage. |
| (C) REINFOR-CEMENT | Curtailment and binding of rods | Persons may get injured | Use PPE like gloves, shoes, helmets, etc.<br>Avoid usage of shift tools |
| | Carrying of rods for short distances/at heights | Workers may get injured their hands and shoulders. | Provide suitable pads on shoulders and use safety gloves.<br>Tie up rods in easily liftable bundles<br>Ensure proper staging. |
| | Checking of clear distance/ cover with hands | Rods may cut or injure the fingers | Use measuring devices like tape, measuring rods, etc. |
| | Hitting projected rods and standing on cantilever rods. | Persons may get injured and fell down | Use safety shoes and avoid standing unnecessarily on cantilever rods<br>Avoid wearing of loose clothes |



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**APPENDIX-E:(Sheet 4 of 12)**

**CONSTRUCTION HAZARDS, THEIR EFFECTS & PREVENTIVE MEASURES (...Contd.)**

| ACTIVITY | TYPE OF HAZARD | EFFECT OF HAZARD | PREVENTIVE MEASURES |
|---|---|---|---|
| | Falling of material from height | May prove fatal | Use helmets<br>Provide safety nets |
| | Transportation of rods by trucks/ trailers | Protruded rods may hit the persons | Use red flags/lights at the ends<br>Do not protrude the rods in front of or by the side of driver's cabin.<br>Do not extend the rods 1/3rd of deck length or 1.5m whichever is less |
| (D)WELDING AND GAS CUTTING | Welding radiates invisible ultraviolet and infra-red rays | Radiation can damage eyes and skin. | Use specified shielding devices and other PPE of correct specifications.<br>Avoid thoriated tungsten electrodes for GTAW |
| | Improper placement of oxygen and acetylene cylinders | Explosion may occur | Move out any leaking cylinder<br>Keep cylinders in vertical position<br>Use trolley for transportation of cylinders and chain them<br>Use flashback arrestors |
| | Leakage/ cuts in hoses | May cause fire | Purge regulators immediately and then turn off<br>Never use grease or oil on oxygen line connections and copper fittings on acetylene lines<br>Inspect regularly gas carrying hoses<br>Always use red hose for acetylene & other fuel gases and black for oxygen |
| | Opening-up of cylinder | Cylinder may burst | Always stand back from the regulator while opening the cylinder<br>Turn valve slowly to avoid bursting<br>Cover the lug terminals to prevent short circuiting |
| | Welding of tanks, container or pipes storing flammable liquids | Explosion may occur | Empty & purge them before welding<br>Never attach the ground cable to tanks, container or pipe storing flammable liquids<br>Never use LPG for gas cutting |



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**APPENDIX-E:(Sheet 5 of 12)**

**CONSTRUCTION HAZARDS, THEIR EFFECTS & PREVENTIVE MEASURES ...(Contd.)**

| ACTIVITY | TYPE OF HAZARD | EFFECT OF HAZARD | PREVENTIVE MEASURES |
|---|---|---|---|
| (E) RADIOGRAPHY | Ionizing radiation | Radiations may react with the skin and can cause cancer, skin irritation, dermatitis, etc. | Ensure Safety regulations as per BARC/AERB before commencement of job.<br>Cordon off the area and install Radiation warning symbols<br>Restrict the entry of unauthorized persons<br>Wear appropriate PPE and film badges issued by BARC/AERB |
| | Transportation and Storage of Radiography source | Same as above | Never touch or handle radiography source with hands<br>Store radiography source inside a pit in an exclusive isolated storage room with lock and key arrangement. The pit should be approved by BARC/AERB.<br>Radiography source should never be carried either in passenger bus or in a passenger compartment of trains.<br>BARC/AERB has to be informed before source movement.<br>Permission from Director General of Civil Aviation is required for booking radio isotopes with airlines. |
| | Loss of Radio isotope | Same as above | Try to locate with the help of Survey Meter.<br>Inform BARC/AERB (*) |
| (F) ELECTRICAL INSTALLATION ANDUSAGE | Short circuiting | Can cause Electrocution or Fire | Use rubberized hand gloves and other PPE<br>Don't lay wires under carpets, mats or door ways.<br>Allow only licensed electricians to perform on electrical facilities<br>Use one socket for one appliance<br>Ensure usage of only fully insulated wires or cables<br>Don't place bare wire ends in a socket<br>Ensure earthing of machineries and equipment's<br>Do not use damaged cords and avoid temporary connections<br>Use spark-proof/flame proof type field distribution boxes. |

(*) Atomic Energy Regulatory Board (AERB),
Bhabha Atomic Research Centre (BARC)
Anushakti Nagar, Mumbai – 400 094


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**APPENDIX-E:(Sheet 6 of 12)**

**CONSTRUCTION HAZARDS, THEIR EFFECTS & PREVENTIVE MEASURES (...Contd.)**

| ACTIVITY | TYPE OF HAZARD | EFFECT OF HAZARD | PREVENTIVE MEASURES |
|---|---|---|---|
| | | | Do not allow open/bare connections<br>Provide all connections through 30mAELCB<br>Protect electrical cables/equipments from water and naked flames<br>Check all connections before energizing |
| | Overloading of Electrical System | Bursting of system can occur which leads to fire | Display voltage and current ratings prominently with 'Danger' signs.<br>Ensure approved cable size, voltage grade and type<br>Switch off the electrical utilities when not in use<br>Do not allow unauthorized connections.<br>Ensure proper grid wise distribution of Power |
| | Improper laying of overhead and underground transmission lines/cables | Can cause electrocution and prove fatal | Do not lay un armoured cable directly on ground, wall, roof of trees<br>Maintain atleast 3m distance from HT cables<br>All temporary cables should be laid atleast 750 mm below ground on 100 mm fine sand overlying by brick soling<br>Provide proper sleeves at crossings/ inter-sections<br>Provide cable route markers indicating the type and depth of cables at intervals not exceeding 30m and at the diversions/termination |
| (G) FIRE PREVENTION AND PROTECTION | Small fires can become big ones and may spread to the surrounding areas | Cause burn injuries and may prove fatal | In case a fire breaks out, press fire alarm system and shout "Fire, Fire".<br>Keep buckets full of sand & water/ fire extinguishing equipment near hazardous locations.<br>Confine smoking to 'Smoking Zones' only.<br>Train people for using specific type of fire fighting equipments under different classes of fire.<br>Keep fire doors/shutters, passages and exit doors unobstructed.<br>Maintain good housekeeping and first-aid boxes (for details refer Appendix-B).<br>Don't obstruct assess to Fire extinguishers.<br>Do not use elevators for evacuation during fire.<br>Maintain lightening arrestors for elevated structures.<br>Stop all electrical motors with internal combustion. |


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**APPENDIX-E :(Sheet 7 of 12)**

**CONSTRUCTION HAZARDS, THEIR EFFECTS & PREVENTIVE MEASURES (...Contd.)**

| ACTIVITY | TYPE OF HAZARD | EFFECT OF HAZARD | PREVENTIVE MEASURES |
|---|---|---|---|
| | | | Move the vehicles from dangerous locations.<br>Remove the load hanging from the crane booms<br>Remain out of the danger areas. |
| | Improper selection of Fire extinguisher | It may not extinguish the fire | Ensure usage of correct fire extinguisher meant for the specified fire (for details refer Appendix-C).<br>Do not attempt to extinguish Oil and electric fires with water. Use foam cylinders/$CO_2$/sand or earth. |
| | Improper storage of highly inflammable substances | Same as above | Maintain safe distance of flammable substances from source of ignition.<br>Restrict the distribution of flammable materials to only min. necessary amount.<br>Construct specifically designed fuel storage facilities.<br>Keep chemicals in cool and dry place away from heat. Ensure adequate ventilation.<br>Before welding operation, remove or shield the flammable material properly.<br>Store flammable materials in stable racks, correctly labeled preferably with catchment trays.<br>Wipe off the spills immediately |
| | Short circuiting of electrical system | Same as above<br>Can cause Electrocution | Don't lay wires under carpets, mats or door ways<br>Use one socket for one appliance.<br>Use only fully insulated wires or cables.<br>Do not allow open/bare connections.<br>Provide all connections through 30mAELCB.<br>Ensure earthing of machineries and equipments. |
| (H) VEHICULAR MOVEMENT | Crossing the Speed Limits (Rash driving) | Personal injury | Obey speed limits and traffic rules strictly.<br>Always expect the unexpected and be a defensive driver.<br>Use seat belts/helmets.<br>Blow horn at intersections and during overtaking operations.<br>Maintain the vehicle in good condition.<br>Do not overtake on curves, bridges and slopes. |
| | Adverse weather condition | Same as Above | Read the road ahead and ride to the left.<br>Keep the wind screen and lights clean.<br>Do not turn at speed.<br>Recognize the hazard, understand the defense and act correctly in time. |


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**APPENDIX-E :(Sheet 8 of 12)**

**CONSTRUCTION HAZARDS, THEIR EFFECTS & PREVENTIVE MEASURES (...Contd.)**

| ACTIVITY | TYPE OF HAZARD | EFFECT OF HAZARD | PREVENTIVE MEASURES |
|---|---|---|---|
| | Consuming alcohol before and during the driving operation | Same as above | Alcohol and driving do not mix well. Either choose alcohol or driving.<br>If you have a choice between hitting a fixed object or an on-coming vehicle, hit the fixed object<br>Quit the steering at once and become a passenger. Otherwise take sufficient rest and then drive.<br>Do not force the driver to drive fast and round the clock.<br>Do not day dream while driving |
| | Falling objects/ Mechanical failure | May prove fatal | Ensure effective braking system, adequate visibility for the drives, reverse warning alarm.<br>Proper maintenance of the vehicle as per manufacturer instructions |
| (I) PROOF TESTING (HYDROSTATIC/ PNEUMATIC TESTING) | Bursting of piping<br>Collapse of tanks<br>Tanks flying off | May cause injury and prove fatal | Prepare test procedure & obtain EIL/owner's approval.<br>Provide separate gauge for pressurizing pump and piping/equipment.<br>Check the calibration status of all pressure gauges, dead weight testers and temperature recorders.<br>Take dial readings at suitable defined intervals and ensure most of them fall between 40-60% of the gauge scale range.<br>Provide safety relief valve (set at pressure slightly higher than test pressure) while testing with air/ nitrogen.<br>Ensure necessary precautions, stepwise increase in pressure, tightening of bolts/nuts, grouting, etc. before and during testing.<br>Keep the vents open before opening any valve while draining out of water used for hydro-testing of tanks.<br>Pneumatic testing involves the hazard of released energy stored in compressed gas. Specific care must therefore be taken to minimize the chance of brittle failure during a pneumatic leak test. Test temperature is important in this regard and must be considered when the designer chooses the material of construction. |



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**APPENDIX-E :(Sheet 9 of 12)**

**CONSTRUCTION HAZARDS, THEIR EFFECTS & PREVENTIVE MEASURES (...Contd.)**

| ACTIVITY | TYPE OF HAZARD | EFFECT OF HAZARD | PREVENTIVE MEASURES |
|---|---|---|---|
| | | | A pressure relief device shall be provided, having a set pressure not higher than the test pressure plus the lesser of 345 KPa (50 psi) or 10% of the test pressure.<br>The gas used as test fluid, if not air, shall be nonflammable and nontoxic. |
| (J) WORKING AT HEIGHTS | Person can fall down | May sustain severe injuries or prove fatal | Provide guard rails/barricade at the work place<br>Use PPE like full body harness, life line, helmets, safety shoes, etc.<br>Obtain a permit before starting the work at height above 2 meters<br>Fall arrest and safety nets, etc. must be installed<br>Provide adequate working space(min. 0.6 m)<br>Tie/weld working platform with fixed support<br>Use roof top walk ladder while working on a slopping roofs<br>Avoid movement on beams |
| | | May hit the scrap/material stacked at the ground or in between | Keep the work place neat and clean<br>Remove the scrap immediately |
| | Material can fall down | May hit the workers working at lower levels and prove fatal | Same as above plus<br>Do not throw or drop materials or equipment from height. i.e. do not *bomb* materials<br>All tools to be carried in a tool-kit<br>Bag or on working uniform<br>Remove scrap from the planks<br>Ensure wearing of helmet by the workers working at lower levels.<br>Multiple activities at same location to be avoided.<br>. |
| (K) CONFINED SPACES | Suffocation/ drowning | Unconsciousness, death | Use respiratory devices, if reqd.<br>Avoid overcrowding inside a confined space<br>Provide Exhaust fans for ventilation<br>Do not wear loose clothes, neck ties, etc.<br>Fulfill conditions of the permit |


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**APPENDIX-E:(Sheet 10 of 12)**

**CONSTRUCTION HAZARDS, THEIR EFFECTS & PREVENTIVE MEASURES (...Contd.)**

| ACTIVITY | TYPE OF HAZARD | EFFECT OF HAZARD | PREVENTIVE MEASURES |
|---|---|---|---|
| | | | Check for presence of hydrocarbons, $O_2$ level<br>Obtain work permit before entering a confined space<br>Ensure that the connected piping of the equipment which is to be opened is pressure free, fluid has been drained, vents are open and piping is positively isolated by a blind flange |
| | Presence of foul smell and toxic substances | Inhalation can pose threat to life | Same as above plus<br>Check for hydrocarbon and Aromatic compounds before entering a confined space<br>Depute one person outside the confined space for continuous monitoring and for extending help in case of an emergency |
| | Ignition/ flame can cause fire | Person may sustain burn injuries or explosion may occur | Keep fire extinguishers at a hand distance<br>Remove surplus material and scrap immediately<br>Do not smoke inside a confined space<br>Do not allow gas cylinders inside a confined space<br>Use low voltage (24V) lamps for lighting<br>Use tools with air motors or electric tools with max. voltage of 24V<br>Remove all equipment's at the end of the day |
| (L) HANDLING AND LIFTING EQUIPMENTS | Failure of load lifting and moving equipment's | Can cause accident and prove fatal | Avoid standing under the lifted load and within the operating radius of cranes.<br>Check periodically oil, brakes, gears, horns and tyre pressure of all moving machinery.<br>Check quality, size and condition of all chain pulley blocks, slings, U-clamps, D-shackles, wire ropes, etc.<br>Allow crane to move only on hard, firm and leveled ground.<br>Allow lifting slings as short as possible and check gunny packings at the friction points.<br>Do not allow crane to tilt its boom while moving<br>Install Safe Load Indicator.<br>Ensure certification by applicable authority. |



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**APPENDIX-E :(Sheet 11 of 12)**

**CONSTRUCTION HAZARDS, THEIR EFFECTS & PREVENTIVE MEASURES (...Contd.)**

| ACTIVITY | TYPE OF HAZARD | EFFECT OF HAZARD | PREVENTIVE MEASURES |
|---|---|---|---|
| | Overloading of lifting equipments | Same as above | Safe lifting capacity of derricks and winches written on them shall be got verified<br>The max. safe working load shall be marked on all lifting equipments<br>Check the weight of columns and other heavy items painted on them and accordingly decide about the crane capacity, boom and angle of erection<br>Allow only trained operators and riggers during crane operation. |
| | Overhead electrical wires | Can cause electrocution and fire | Do not allow boom or other parts of crane to come within 3m reach of overhead HT cables<br>Hook and load being lifted shall preferably remain in full visibility of crane operators. |
| (M) SCAFFOLDING, FORMWORK AND LADDERS | Person can fall down | Person May sustain severe injuries and prove fatal | Provide guard rails for working at height.<br>Face ladder while climbing and use both hands.<br>Ladders shall extend about 1m above landing for easy access and tying up purpose.<br>Do not place ladders against movable objects and maintain base at 1/4 unit of the working length of the ladder.<br>Suspended scaffolds shall not be less than 500 mm wide and tied properly with ropes.<br>No loose planks shall be allowed.<br>Use PPE, like helmets, safety shoes etc. |
| | Failure of scaffolding material | Same as above | Inspect visually all scaffolding materials for stability and anchoring with permanent structures.<br>Design scaffolding for max. load carrying capacity.<br>Scaffolding planks shall not be less than 50X250 mm full thickness lumber or equivalent. These shall be cleated or secured and must extend over the end supports by at least 150mm and not more than 300mm.<br>Don't overload the scaffolds.<br>Do not splice short ladders to make a longer one. Vertical ladders shall not exceed 6m. |
| | Material can fall down | Persons working at lower level gets injured | Remove excess material and scrap immediately.<br>Carry the tools in a tool-kit bag only.<br>Provide safety nets. |



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**APPENDIX-E:(Sheet 12 of 12)**

**CONSTRUCTION HAZARDS, THEIR EFFECTS &PREVENTIVE MEASURES (...Contd.)**

| ACTIVITY | TYPE OF HAZARD | EFFECT OF HAZARD | PREVENTIVE MEASURES |
|---|---|---|---|
| (N) STRUC-TURAL WORKS | Personal negligence and danger of fall | Can cause injury or casualty | Do not take rest inside rooms built for welding machines or electrical distribution system.<br>Avoid walking on beams at height.<br>Wear helmet with chin strap and full body harness while working at height.<br>Use hand gloves and goggles during grinding operations.<br>Cover or mark the sharp and projected edges.<br>Do not stand within the operating radius of cranes. |
| | Lifting/ slipping of material | Same as above | Do not stand under the lifted load.<br>Stack properly all the materials. Avoid slippage during handling.<br>Control longer pieces lifted up by cranes from both ends.<br>Remove loose materials from height.<br>Ensure tightening of all nuts & bolts. |
| (O)PIPELIN E WORKS | Erection/ lowering failure | Can cause injury | Do not stand under the lifted load.<br>Do not allow any person to come within the radii of the side boom handling pipes.<br>Check the load carrying capacity of the lifting tools & tackles.<br>Use safe Load Indicators (SLI).<br>Use appropriate PPEs. |
| | Other | Same as above | Wear gum boots in marshy areas.<br>Allow only one person to perform signaling operations while lowering of pipes.<br>Wedges to be provided below the pipe to prevent spool/pipe roll out.<br>Provide night caps on pipes.<br>Provide end covers on pipes for stoppage of pigs while testing/ cleaning operations. |
| (P) GRIT BLASTING | Pollution in neighboring area, hit by grit sand high pressure air | Can cause personal injury | Ensure the blasting is done in enclosed shed.<br>Keep safe distance while blasting operations.<br>Wear positive pressure blast hood or helmet with view-window, ear-muff/plug, gloves, overall or leather coat /apron, rubber shoes. |



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**APPENDIX-F**

## TRAINING SUBJECTS / TOPICS

(For contractors' personnel)

1. The Law & Safety – Statutory Requirement / Applicable statutes / Duties of employer / employee.
2. Policy & Administration – Why HSE? / Duties & Responsibilities of Safety Personnel at project site / Effect of incentive on accident prevention.
3. HSE & Supervision – Duties of Supervisor / HSE integrated supervision / Who should be held responsible for site accidents?
4. Safety Budget / Cost of Accidents – Direct costs / Indirect costs.
5. Hazard Identification / Type of hazards / HIRAC.
6. Behavioral Safety & Motivation.
7. Housekeeping – Storage / Stacking / Handling of materials / Hydraulic Mobile Crane handling.
8. Occupational Health in Construction sector.
9. Personal Protective Equipment's – Respiratory & Non- respiratory.
10. Electricity & Safety – ELCB / Fuse / Powered tools / Project illumination.
11. Handling of Compressed Gas – Transportation / Storage / FBAs / Fire prevention.
12. Machine Safety – Machine guarding / Maintenance.
13. Transportation – Hazards & risks in transp. of materials / ODC consignments.
14. Cranes & Other Lifting machinery – Legal requirements vis-à-vis essential safety requirements.
15. Communication – HSE Induction / TBTs / Safety Committee / Safety meeting / Safety propaganda / Publicity.
16. Excavation – Risks & Dangers / Safety measures.
17. Working at Heights – Use of ladder / Work on roofs / Scaffolds / Double harness lanyards / Life-line / Fall arrester / Safety Nets / Floor openings.
18. Hazards in Welding & important safety precautions.
19. Gas Cutting – Hazards & safety measures.
20. Fire prevention & fire protection.


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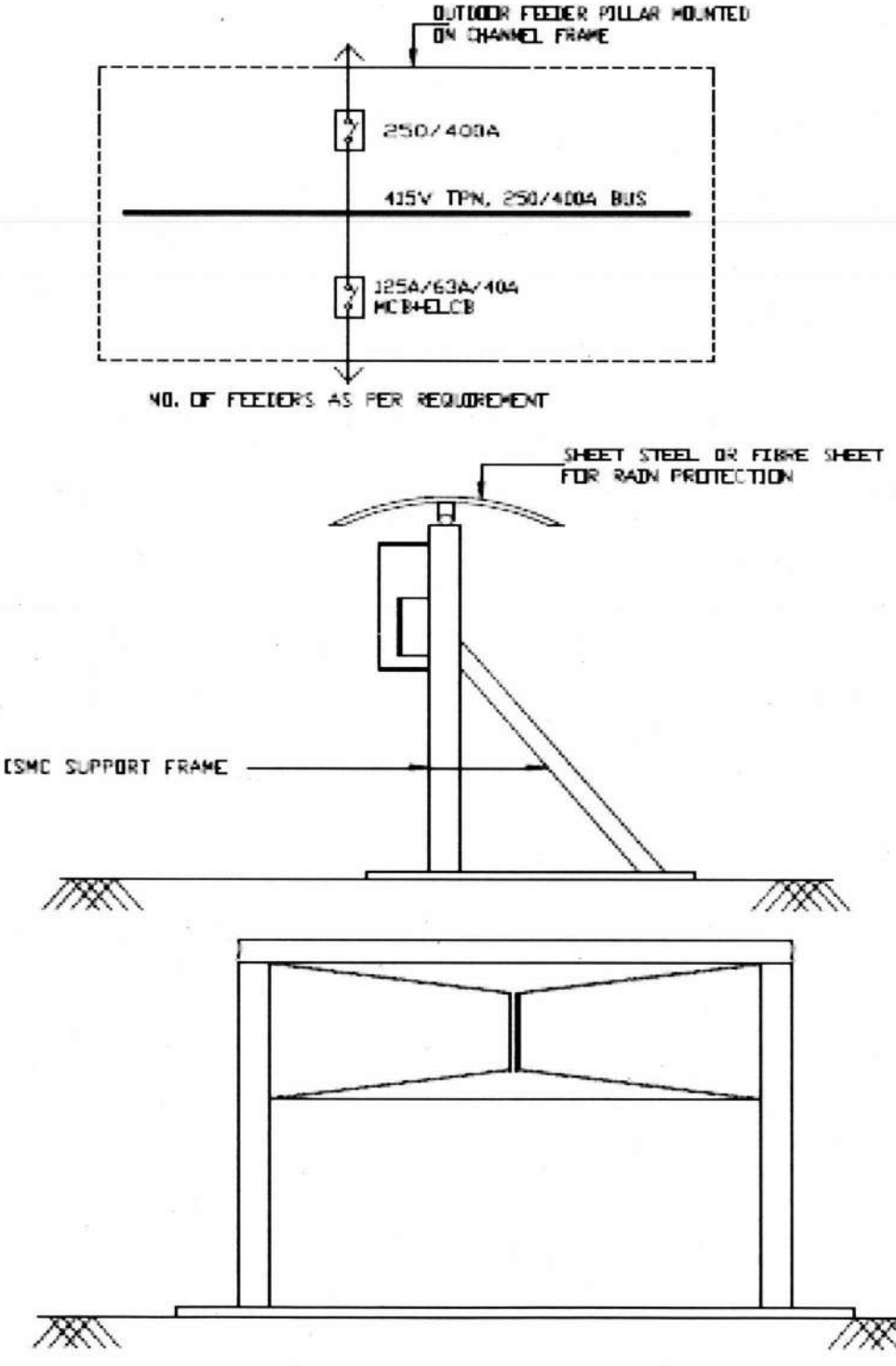
**APPENDIX - G**

## CONSTRUCTION POWER BOARD(typ)




NOTES:-

1. CONTRACTOR TO INSTALL TEMPORARY CONST. POWER BOARD AS SHOWN IN THE DRG. ITS LOCATION SHALL BE EASILY ACCESABALE.
2. POWER DISTRIBUTION BOARD SHALL BE EARTHED AT TWO POINTS BY MINIMUM 40X5MM GI STRIP FROM THE AVILABLE GRID OR DIRECTLY CONNECTED TO TWO DIRECTLY DRIVEN EARTH ELECTRODES.
3. DISTRIBUTION BOARD SHALL BE FABRICATED BY USING 14MM CRCA SHEET STEELWITH HINGED DOORSAND ALL COMPONENT MOUNTED IN IT.
4. ALL INCOMING AND OUTGOING CABLESSHALL HAVE BOTTOM ENTRY.



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**APPENDIX-H**

## LIST OF PROCEDURES (MINIMUM) TO BE FORMING PART OF HSE PLAN:-

A. HSE Management Procedures:

- HSE Risk Management (including HIRA)
- HSE Legal Compliance and Other Requirements
- HSE Objectives & Performance
- HSE Training and Competence (including Induction)
- HSE Motivation &Award Scheme
- HSE Audits
- HSE Sub Contractor Management
- HSE Emergency Management
- HSE Incidents Reporting and Management
- HSE procedure for Behaviour based Safety
- First Aid & Management
- Roles, Responsibility, accountabilities and Authorities

B. Job procedures/Safe Operating procedures

- Setting Up Site &Signages
- Working at Height
- Confined Space Entry
- Permit to Work (including hot works)
- Housekeeping
- Transportation of materials including Manual Handling
- Earthmoving Operations & excavation
- Scaffolding
- Fire Prevention/Protection
- Hazardous Substance handling & Storage
- Personal Protective Equipment


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## APPENDIX-I

## LIFE SAVING RULES

### Bypassing Safety Controls

**Obtain authorisation before overriding or disabling safety controls**

- I understand & use safety-critical equipment and procedure which apply to my task
- I obtain authorization before:
  - disabling or overriding safety equipment
  - deviating from procedures
  - crossing a barrier

### Confined Space

**Obtain authorisation before entering a confined space**

- I confirm energy sources are isolated
- I confirm the atmosphere has been tested and is monitored
- I check and use my breathing apparatus when required
- I confirm there is an attendant standing by
- I confirm rescue plan is in place
- I obtain authorization to enter

### Driving

**Follow safe driving rules**

- I always wear a seatbelt
- I do not exceed the speed limit, and reduce my speed for road conditions
- I do not use phones or operate devices while driving
- I am fit, rested and fully alert while driving
- I follow journey management requirements

### Energy Isolation

**Verify isolation and zero energy before work begins**

- I have identified all energy sources
- I confirm that hazardous energy sources have been isolated, locked and tagged
- I have checked there is zero energy and tested for residual or stored energy

### Hot Work

**Controls flammables and ignition sources**

- I identify and control ignition sources
- Before starting any hot work:
  - I confirm flammable material has been removed or isolated
  - I obtain authorization
- Before starting hot work in a hazardous are I confirm:
  - a gas test has been completed
  - gas will be monitored continually

### Line of Fire

**Keep yourself and others out of the line of fire**

- I position myself to avoid:
  - moving objects
  - vehicles
  - pressure releases
  - dropped objects
- I establish and obey barriers and exclusion zones
- I take action to secure loose objects and report potentialdropped objects

### Safe Mechanical Lifting

**Plan lifting operations and control the area**

- I confirm that the equipment and load have been inspected and are fit for purpose
- I only operate equipment that I am qualified to use
- I establish and obey barriers and exclusion zones
- I never walk under a suspended load

### Work Authorization

**Work with a valid permit when required**

- I am authorised to perform the work
- I understand the permit
- I have confirmed that hazards are controlled and it is safe to start
- I stop and reassess if conditions change

### Work at Height

**Protect yourself against a fall when working at height**

- I inspect my fall protection equipment before use
- I secure tools and work materials to prevent dropped objects
- I tie off 100% to approved anchor points while outside a protected area

### Excavation

**Follow safe excavation procedure**

- Before starting any excavation:
  - I confirm availability of underground utilities
  - I obtain authorization
  - I take adequate precautions to prevent collapse of soil



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**FORMAT NO. : HSE-1 REV 1**

**(Sheet 1 of 6)**

## SAFETY WALK-THROUGH REPORT

(Name & signature of walk through performer to be inserted at the bottom of each page)

Project : _____ Report no. : _____

Date : _____ Ccontractor : _____

Inspection by : _____ Owner : _____

Frequency : Monthly Job no. : _____

Note : Write 'NA' wherever the item is not applicable

| SL. NO. | ITEM | Satisfactory/ Yes | Non satisfactory/ No | Remarks | Action |
|---|---|---|---|---|---|
| 1. | HOUSEKEEPING | | | | |
| a) | Waste containers provided and used | | | | |
| b) | Sanitary facilities adequate and Clean | | | | |
| c) | Passageways and Walkways Clear | | | | |
| d) | General neatness of working areas | | | | |
| e) | Other | | | | |
| 2. | PERSONNEL PROTECTIVE EQUIPMENT | | | | |
| a) | Goggles; Shields | | | | |
| b) | Face protection | | | | |
| c) | Hearing protection | | | | |
| d) | Foot protection | | | | |
| e) | Hand protection | | | | |
| f) | Respiratory Masks etc. | | | | |
| g) | Full body harness conforming to CE, EN 361 | | | | |
| h) | Hard hat (HDPE) | | | | |
| i) | Other | | | | |
| 3. | EXCAVATIONS/OPENINGS | | | | |
| a) | Openings properly covered or barricaded | | | | |
| b) | Excavations shored | | | | |
| c) | Excavations barricaded | | | | |
| d) | Overnight lighting provided | | | | |
| e) | Other | | | | |

Safety walk-through performer (Name & Signature).....



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**FORMAT NO. : HSE-1 REV 1**

**(Sheet 2 of 6)**

| SL. NO. | ITEM | Satisfactory/ Yes | Non satisfactory/ No | Remarks | Action |
|---|---|---|---|---|---|
| 4. | WELDING & GAS CUTTING | | | | |
| a) | Gas cylinders chained upright | | | | |
| b) | Cables and hoses not obstructing | | | | |
| c) | Screens or shields used | | | | |
| d) | Flammable materials protected | | | | |
| e) | Live electrode bits contained properly | | | | |
| f) | Fire extinguisher (s) accessible | | | | |
| g) | Other | | | | |
| 5. | SCAFFOLDING & BARRICADING | | | | |
| a) | Fully decked platforms | | | | |
| b) | Guard and intermediate rails in place | | | | |
| c) | Toe boards in place | | | | |
| d) | Adequate shoring | | | | |
| e) | Adequate access | | | | |
| f) | Positive barricading for critical activities | | | | |
| g) | Installation of warning signs | | | | |
| h) | Other | | | | |
| 6. | LADDERS | | | | |
| a) | Extension side rails 1 m above | | | | |
| b) | Top of landing | | | | |
| c) | Properly secured | | | | |
| d) | Angle + $70^0$ from horizontal | | | | |
| e) | Other | | | | |

Safety walk-through performer (Name &Signature).....



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**FORMAT NO. : HSE-1 REV 1**

**(Sheet 3 of 6)**

| SL. NO. | ITEM | Satisfactory/ Yes | Non satisfactory/ No | Remarks | Action |
|---|---|---|---|---|---|
| 7. | HOISTS, CRANES AND DERRICKS | | | | |
| a) | Condition of cables and sheaves OK | | | | |
| b) | Condition of slings, chains, hooks and eyes O.K. | | | | |
| c) | Inspection and maintenance log-books maintained | | | | |
| d) | Outriggers used | | | | |
| e) | Reverse horn installed / active / coupled with gear | | | | |
| f) | Signs/barricades provided | | | | |
| g) | Signals observed and understood | | | | |
| h) | Qualified operators | | | | |
| i) | Other | | | | |
| 8. | MACHINERY, TOOLS AND EQUIPMENT | | | | |
| a) | Proper instruction | | | | |
| b) | Safety devices | | | | |
| c) | Proper cords | | | | |
| d) | Inspection and maintenance | | | | |
| e) | Other | | | | |
| 9. | VEHICLE AND TRAFFIC | | | | |
| a) | Rules and regulations observed | | | | |
| b) | Inspection and maintenance | | | | |
| c) | Licensed drivers | | | | |
| d) | Other | | | | |

Safety walk-through performer (Name &Signature).....


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**FORMAT NO. : HSE-1 REV 1**

**(Sheet 4 of 6)**

| SL. NO. | ITEM | Satisfactory/ Yes | Non satisfactory/ No | Remarks | Action |
|---|---|---|---|---|---|
| 10. | TEMPORARY FACILITIES | | | | |
| a) | Emergency instructions posted | | | | |
| b) | Fire extinguishers provided | | | | |
| c) | Fire-aid equipment available | | | | |
| d) | Secured against storm damage | | | | |
| e) | General neatness | | | | |
| f) | In accordance with electrical requirements | | | | |
| g) | Other | | | | |
| 11. | FIRE PREVENTION | | | | |
| a) | Personnel trained& instructed to make use of facility | | | | |
| b) | Fire extinguishers checked periodically & record maintained | | | | |
| c) | No smoking in Prohibited areas. | | | | |
| d) | Fire Hydrants not obstructed | | | | |
| e) | Regular fire drill conducted | | | | |
| 12. | ELECTRICAL | | | | |
| a) | Use of 3-core armored cables everywhere | | | | |
| b) | Usage of 'All insulated' or 'double-insulated' electrical tools | | | | |
| c) | All electrical connection are routed through ELCB | | | | |
| d) | Natural Earthing at the source of power (Main DB) | | | | |
| e) | Continuity and tightness of earth conductor | | | | |
| f) | Effective covering of junction boxes, panels and other energized wiring places | | | | |
| g) | Ground fault circuit interrupters provided | | | | |
| h) | Prevention of tripping hazards maintained | | | | |
| f) | DCP extinguishers arranged & licensed electrician engaged at site | | | | |

Safety walk-through performer (Name &Signature).....


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**FORMAT NO. : HSE-1 REV 1**

**(Sheet 5 of 6)**

| SL. NO. | ITEM | Satisfactory/ Yes | Non satisfactory/ No | Remarks | Action |
|---|---|---|---|---|---|
| 13. | HANDLING AND STORAGE OF MATERIALS | | | | |
| a) | Safely stored or stacked | | | | |
| b) | Passageways clear / free from obstructions | | | | |
| c) | Fire fighting facility in place | | | | |
| 14. | FLAMMABLE GASES AND LIQUIDS | | | | |
| a) | Containers clearly identified / protected from fire | | | | |
| b) | Safe storage & transportation arrangement made | | | | |
| c) | Fire extinguishers positioned nearby | | | | |
| d) | Facilities kept away from electric spark, hot spatters & ignition source. | | | | |
| 15. | WORKING AT HEIGHT | | | | |
| a) | Approved Erection plan and work permit in place | | | | |
| b) | Safe access, Safe work platform & Safety nets provided | | | | |
| c) | Life lines, Fall arrester, Full body harness with double lanyards used; | | | | |
| d) | Health Check record available for workers going up? | | | | |
| e) | Protective handrails arranged around floor openings | | | | |
| 16. | CONFINED SPACE | | | | |
| a) | Work Permit obtained from requisite authority | | | | |
| b) | Test for toxic gas and sufficient availability of oxygen conducted & status | | | | |
| c) | Supervisor present at site & at least one person outside the confined space for monitoring deputed | | | | |
| d) | Availability of safe means of entry, exit and ventilation (register for entry & exit maintained) | | | | |
| e) | Fire extinguisher and first-aid facility ensured | | | | |
| f) | Lighting provision made by using 24V Lamp | | | | |
| g) | Proper usage of PPEs ensured | | | | |
| 17. | RADIOGRAPHY | | | | |
| a) | Proper storage and handling of source as per BARC/ AERB guidelines (authorized radiographer available) | | | | |
| b) | Work permit obtained | | | | |

Safety walk-through performer (Name &Signature).....



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**FORMAT NO. : HSE-1 REV 1**

**(Sheet 6 of 6)**

| SL. NO. | ITEM | Satisfactory/ Yes | Non satisfactory/ No | Remarks | Action |
|---|---|---|---|---|---|
| c) | Cordoning of the area done | | | | |
| d) | Use of appropriate PPE's ensured | | | | |
| e) | HSE training to workers/supervisors imparted during the fortnight (indicate topic) | | | | |
| f) | Minimum occupancy of workplace ensured | | | | |
| 18. | HEALTH CHECKS | | | | |
| a) | All Workers medically examined and found be fit for working at heights (slinging, rigging, painting etc.) in confined space in excavation / trenching in shot blasting | | | | |
| b) | Availability of First Aid box with contents | | | | |
| c) | Proper sanitation at site, office and labour camps | | | | |
| d) | Arrangement of medical facilities. | | | | |
| e) | Measures for dealing with illness at site & labour camps. | | | | |
| f) | Availability of Potable drinking water for workmen & staff. | | | | |
| g) | Provision of crèches for children. | | | | |
| h) | Stand by vehicle / ambulance available for evacuation of injured | | | | |
| i) | Adherence to Govt. Guidelines/procedures during epidemic and pandemic (as applicable). | | | | |
| 19. | ENVIRONMENT | | | | |
| a) | Chemical and Other Effluents properly disposed | | | | |
| b) | Cleaning liquid of pipes disposed off properly | | | | |
| c) | Seawater used for hydro-testing disposed off as per agreed procedure | | | | |
| d) | Lubricant Waste/Engine oils properly disposed | | | | |
| e) | Waste from Canteen, offices, sanitation etc. disposed properly | | | | |
| f) | Disposal of surplus earth, stripping materials, Oily rags and combustible materials done properly | | | | |
| g) | Green belt protection | | | | |

Safety walk-through performer (Name &Signature).....



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**FORMAT NO. : HSE-2 REV 0**

**(Sheet 1 of 3)**

## ACCIDENT REPORT

(To be submitted by Contractor after every Accident within 24 hours to EIL/ Owner)

**Report No.:** _____ **Date:** _____

**Project site:** _____ **Name of work:** _____

Contractor's name: _____ Contractor's Job Engineer (name) _____

| | | |
|---|---|---|
| **Non-disabling injury (Non-**LTI) | Hospitalized but resumed duty before end of 48 hrsof accident | |
| **Disabling injury (other** LTI) | Hospitalized & failed to resume duty within next 48 hrs | |
| **Fatal** (LTI): | Death / Expiry | |
| **First Aid case** | Resume duty after first aid | |

Name of the injured:_____ Father's name of victim: _____

Sub Contractor's Name: .....

Gate Pass No.:.....Age: _____Yrs. Victim's medical fitness exam. (Pre-empl.) date: - _____

**Date & time of Accident / Incident:** _____

Names of Witnesses: (1_____ (2)_____ (3) _____

**Profession of victim:**

| | | | | | |
|---|---|---|---|---|---|
| Bar bender | | Carpenter | | Meson | |
| Fitter | | Helper | | Gas cutter | |
| Grinder | | Welder | | Electrician | |
| Driver | | Rigger | | M/c.operator | |
| Engineer | | Manager | | Other/specify | |

**Qualification**

| | | | | | |
|---|---|---|---|---|---|
| No formal education | | Non-Matriculate | | Matriculate | |
| Graduate | | Post- grad | | Other/specify | |

**Job Experience**

| | | | | | |
|---|---|---|---|---|---|
| NIL | | Less than 2 yrs | | 2-5 yrs | |
| 5-10 yrs | | 11-15 yrs | | 15 years and above | |

**Location where the incident happened:** _____

_____



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**FORMAT NO. : HSE-2 REV 0**

**(Sheet 2 of 3)**

**Activity / Works that were continuing during incident / accident: -**

| | | | | | |
|---|---|---|---|---|---|
| Excavation | | Demolition | | Concrete carrying | |
| Concrete pouring | | Transportation of materials (manually) | | Transportation of materials (mechanically) | |
| Work on or adjacent to water | | Work at height (+2.0 mts) | | Scaffold preparation | |
| Scaffold dismantling | | Piling works | | Welding | |
| Grinding | | Gas-cutting | | Pipe fit-ups & fabrication | |
| Structural fabrications | | Machine works | | Hydro-testing works | |
| Electrical works | | Erection activities | | Other/specify | |

**What exactly the victim was doing just before the incident / accident?** .....

.....

.....

**Nature of injury**:

| | | | | | |
|---|---|---|---|---|---|
| Bruise or Contusion | | Abrasion (superficial wound) | | Sprains or strains | |
| Cut or Laceration | | Puncture or Open wound | | Burn | |
| Inhalation of toxic or Poisonous fumes or gases | | Absorption | | Amputation | |
| Fracture | | Other/specify | | | |

**Parts of body involved in incident / accident**

| | | | | | |
|---|---|---|---|---|---|
| Head | | Face | | Eyes | |
| Throat | | Arm (above wrist) | | Hand (including wrist) | |
| Fingers | | Truck (Abdomen / Back / Chest / Shoulder) | | Throat | |
| Leg (above ankle) | | Foot (incl. ankle) | | Toes | |
| Multiple | | | | Other/specify | |

**Accident type**:

| | | | | | |
|---|---|---|---|---|---|
| Struck against | | Struck by | | Fall from Elevation | |
| Fall on same level | | caught in | | caught under | |
| caught in between | | Rubbed or abraded | | Contact with (Electricity) | |
| Contact with (Temp./ extremes) | | Contact with chemicals oroils | | Vehicle accident | |
| Other/specify | | | | | |



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**FORMAT NO. : HSE-2 REV 0**

**(Sheet 3 of 3)**

**Medical Aid provided:-**(indicate specific aids / treatment etc.)-

.....

.....

---

**Actions taken to prevent recurrence of similar incident / accident:**.....

.....

.....

.....

.....

.....

.....

---

**Intimation to local authorities** (Dist. Collector / Local Police Station / ESI authority): Yes / No / NA.

If yes, to whom .....

Safety Officer
(Signature and Name)
Stamp of Contractor

Site Head / Resident Construction Manager
(Signature and Name)

To : Owner
: RCM/Site-in-charge EIL (3 copies)
- Nodal Officer HO through RCM (In case of major accident)
- Divisional Head (Constn) through RCM
- Project Manager, EIL, through RCM



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**FORMAT NO. : HSE-3 REV 0**

**(Sheet 1 of 5)**

## SUPPLEMENTARY ACCIDENT INVESTIGATION REPORT

**TICK THE APPROPRIATE ONEAS APPLICABLE (furnish within 72 hours)**

Supplementary to Incident / Accident Report No: _____ (Copy enclosed)

**Report No.**: _____ **Date**: _____

**Project site**: _____ **Name of work:** _____

Contractor's name: _____ Contractor's Job Engineer (name) _____

| | | |
|---|---|---|
| **Non-disabling injury (Non-**LTI **)** | Hospitalized but resumed duty before end of 48 hrs of accident. | |
| **Disabling injury (other** LTI**)** | Hospitalized & failed to resume duty within next 48 hrs. | |
| **Fatal** (LTI) | Death / Expiry | |
| **First Aid case** | Resume duty after first aid | |

Name of the injured: _____ Father's name of victim: _____

Sub Contractor's Name: .....

Gate Pass No.:..... Age: _____Yrs. Victim's medical fitness exam. (Pre-empl.) date: - _____

**Date & time of Accident / Incident**: _____

Names of Witnesses: (1_____ (2)_____ (3) _____

**Profession of victim:**

| | | | | | |
|---|---|---|---|---|---|
| Bar bender | | Carpenter | | Meson | |
| Fitter | | Helper | | Gas cutter | |
| Grinder | | Welder | | Electrician | |
| Driver | | Rigger | | M/c. operator | |
| Engineer | | Manager | | Other/specify | |

**Qualification**

| | | | | | |
|---|---|---|---|---|---|
| No formal education | | Non-Matriculate | | Matriculate | |
| Graduate | | Post- grad | | Other/specify | |

**Job Experience**

| | | | | | |
|---|---|---|---|---|---|
| NIL | | Less than 2 yrs. | | 2-5 yrs. | |
| 5-10 yrs. | | 11-15 yrs. | | 15 years and above | |

**Location where the incident happened**: _____

_____



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**FORMAT NO. : HSE-3 REV 0**

**(Sheet 2 of 5)**

**Activity / Works that were continuing during incident / accident: -**

| | | | | | |
|---|---|---|---|---|---|
| Excavation | | Demolition | | Concrete carrying | |
| Concrete pouring | | Transportation of materials (manually) | | Transportation of materials (mechanically) | |
| Work on or adjacent to water | | Work at height (+2.0 mts) | | Scaffold preparation | |
| Scaffold dismantling | | Piling works | | Welding | |
| Grinding | | Gas-cutting | | Pipe fit-ups & fabrication | |
| Structural fabrications | | Machine works | | Hydro-testing works | |
| Electrical works | | Erection activities | | Other/specify | |

**What exactly the victim was doing just before the incident / accident?** .....

.....

.....

**Particular of tools & tackles being used and condition of the same after incident/accident:**

.....

.....

**Description of Incident/Accident** (How the incident was caused) : .....

.....

.....

.....

**Nature of injury**:

| | | | | | |
|---|---|---|---|---|---|
| Bruise or Contusion | | Abrasion (superficial wound) | | Sprains or strains | |
| Cut or Laceration | | Puncture or Open wound | | Burn | |
| Inhalation of toxic or Poisonous fumes or gases | | Absorption | | Amputation | |
| Fracture | | Other/specify | | | |

**Parts of body involved in incident / accident**

| | | | | | |
|---|---|---|---|---|---|
| Head | | Face | | Eyes | |
| Throat | | Arm (above wrist) | | Hand (including wrist) | |
| Fingers | | Truck (Abdomen / Back / Chest / Shoulder) | | Throat | |
| Leg (above ankle) | | Foot (incl. ankle) | | Toes | |
| Multiple | | | | Other/specify | |



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**FORMAT NO. : HSE-3 REV 0**

**(Sheet 3 of 5)**

**Accident type**:

| | | | | | |
|---|---|---|---|---|---|
| Struck against | | Struck by | | Fall from Elevation | |
| Fall on same level | | caught in | | caught under | |
| caught in between | | Rubbed or abraded | | Contact with (Electricity) | |
| Contact with (Temp./ extremes) | | Contact with chemicals or oils | | Vehicle accident | |
| Other/specify | | | | | |

Name & Designation of person who provided First-Aid to the victim: _____

Name & Telephone number of Hospital where the victim was treated _____

Mode of transport used for transporting victim – Ambulance / Private car / Tempo / Truck / Others

How much time taken to shift the injured person to Hospital_____

In case of FATAL incident, indicate clearly the BOCW Registration No. of the victim/Company.....
...

Comments of Medical Practitioner, who treated / attended the victim/injured (attached / described here)_____

What actions are taken for investigation of the incident, please indicate clearly – (Video film / Photography / Measurements taken etc. .....)

**Immediate cause** (Please tick the right applicable) –

| | | | | | |
|---|---|---|---|---|---|
| Hazardous methods or procedures inadequately guarded | | Poor housekeeping | | Inadequate or improper PPE | |
| Environmental hazards (excess noise/ space constraint/ inadequate ventilation | | improper illumination/Moving on oval surface | | Working on dangerous equipment | |


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**FORMAT NO.: HSE-3 REV 0**

**(Sheet 4 of 5)**

| | | | | | |
|---|---|---|---|---|---|
| Failure to secure | | Horse-play | | Failure to use PPE | |
| Inattention to surroundings | | Improper use of hands & body-parts | | By-passing safety devices | |
| Unsafe mixing or placement of tools & tackles | | Bypassing standard procedures | | Failure in communication | |
| Operating without authority | | Improper use of equipment or tools & tackles | | drug or alcoholic influence | |
| excessive haste | | Others(specify) | | | |

**Basic cause**

| | | | | | |
|---|---|---|---|---|---|
| Over confidence | | Impulsiveness | | over-exertion | |
| Faulty judgement or poor understanding | | Failing to keep attention constantly | | Nervousness & Fear | |
| Fatigue | | Defective vision | | Ill health or sickness | |
| Slow reaction | | Others(specify) | | | |

**Root cause**

| | | | | | |
|---|---|---|---|---|---|
| Inadequate Engg. | | Improper Design | | Inadequate Planning & organization | |
| Inadequate knowledge | | Inadequate skill | | Inadequate training | |
| Inadequate supervision | | Improper work procedure | | Inadequate compliance with standard | |
| Substandard performance | | Inadequate maintenance | | Improper inspection | |
| Others(specify) | | | | | |

Loss of man days and impact on site works, (if any) –

_____

**Remarks from Contractor's Safety Officer/ Engineer** –

Was the victim performing relevant tasks for which he was engaged /employed? Yes / No
Was the Supervisor present on work-site during the incident? Yes / No
Have the causes of incident rightly identified? Yes / No
Cause of Accident was_____



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**FORMAT NO. : HSE-3 REV 0**

**(Sheet 5 of 5)**

Remedial measures recommended by **Safety Officer of Contractor** for avoiding similar incident in future

: .....

.....

.....

.....

.....

.....

.....

**Intimation to local authorities** (Dist. Collector / Local Police Station / ESI authority): Yes / No / NA.

If yes, to whom .....

---

Safety Officer
(Signature and Name)

Site Head / Resident Construction Manager
(Signature and Name)
Stamp of Contractor

To : Owner
: RCM/ Site-in-charge of EIL (3 copies)
Nodal Officer HO through RCM (In case of major accident)
Divisional Head (Constn.) through RCM
Project Manager EIL, through RCM



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**FORMAT NO. : HSE-4 REV 0**

**NEAR MISS INCIDENT/ DANGEROUS OCCURRENCE REPORTPROFORMA**

(to be submitted within 24 hours)

Report No.: _____

Name of Site: _____ Date: _____

Name of work: _____ Contractor: _____

Incident reported by :

Date & Time of Incident :

Location :

Brief description of incident

Probable cause of incident

Suggested corrective action

Steps taken to avoid recurrence Yes ☐ No ☐

Safety Officer
(Signature and Name)
Stamp of Contractor

Site Head / Resident Construction Manager
(Signature and Name)

Note:

- **Near Miss:** Human injury escaped & no damage to property, equipmentor interruption to work.
- **Dangerous Occurrence**: Occurrences as mentioned below shall be considered as "Dangerous occurrences"

a. collapse or failure of lifting appliances or hoist or conveyors or other similar equipment for handling building or construction material or breakage or failure of rope, chain or loose gears; overturning of cranes used in building or other construction work; falling of objects from height;
b. collapse or subsidence of soil, any wall, floor, gallery, roof or any other part of any structure, platform, staging, scaffolding or any means of access including formwork;
c. collapse of transmission tower;
d. fire and explosion causing damage to property at Construction site.
e. spillage or leakage of hazardous substances and damage to their container;
f. Collapse, capsizing, toppling or collision of transport equipment;
g. Leakage or release of harmful toxic gases at the construction site.

To :Owner
:RCM/Site-in-charge EIL (3 copies)

Divisional Head (Const.) through RCM
Project Manager EIL, through RCM
} (Applicable for Dangerous Occurrence only)


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**FORMAT NO. : HSE-5 REV 0**

**MONTHLY HEALTH, SAFETY &ENVIRONMENTAL (HSE) REPORT**

(To be submitted by each Contractor)

Actual work start Date: _____ For the Month of: _____

Project: _____ Report No: _____

Name of the Contractor: _____ Status as on: _____

Name of Work: _____ Job No : _____

(Contractor in consultation with EIL shall generate the reports through web basedpackage (www3.eil.co.in/eilhse)only.

| ITEM | | UPTO PREVIOUS MONTH | THIS MONTH | CUMULATIVE |
|---|---|---|---|---|
| **1)** Average number of Staff & Workmen (average daily headcount, not man days) | | | | |
| **2)**Total Man-hours worked | | | | |
| **3)** Number of site personnel undergone HSE Induction | | | | |
| **4)** Number of HSE meetings organized at site | | | | |
| **5)** Number of HSE awareness programmes conducted at site | | | | |
| **6)** Number of Tool Box Talks conducted | | | | |
| **7)** Number of Loss Time Injuries (LTI) | Fatalities | | | |
| | Other LTI | | | |
| **8)** Number of Non disabling injury (Non-LTI) | | | | |
| **9)** Number of First Aid Cases | | | | |
| **10)** Number of Near Miss Incidents | | | | |
| **11)** Number of Dangerous Occurrences | | | | |
| **12)** No. of unsafe acts/ practices detected | | | | |
| **13)** No. of disciplinary actions taken against staff/ workmen | | | | |
| **14)** Man-days lost due to injury | | | | |
| **15)** LTI Free man-hours i.e. LTI free man-hours counted from the Last LTI (enter date: .....) | | | | |
| **16)** Frequency Rate (No. of reportable LTI per 10lacs man-hours worked) | | | | |
| **17)** Severity Rate (No. of man days lost due to LTI per 10lacs man-hours worked) | | | | |
| **18)** No. of activities for which HIRAC Completed | | | | |
| **19)** No. of incentives/ awards given | | | | |
| **20)** No. of occasions on which penalty imposed by EIL/ Owner | | | | |
| **21)** No. of Audits conducted | | | | |
| **22)** No. of pending NCs in above Audits | | | | |
| **23)** Compensation cases raised with Insurance | | | | |
| **24)** Compensation cases resolved and paid to workmen | | | | |
| **25)** No of Vehicular Accident cases | | | | |
| **26)** No of fire/Explosion cases | | | | |

| | | | | | |
|---|---|---|---|---|---|
| **27)** Whether workmen compensation policy taken | | | Yes | | No |
| **28)** Whether workmen compensation policy is valid | | | Yes | | No |
| **29)** Whether workmen registered under ESI Act, as applicable | | | Yes | | No |
| **30)** Whether HIRAC Register prepared and updated | | | Yes | | No |
| **31)**Whether Environment Aspect Impact Register prepared and updated | | | Yes | | No |
| **32)** Whether Legal Register prepared and updated | | | Yes | | No |
| Remarks, if any | | | | | |

Date:

Prepared by Safety Officer Approved by Site Head / Resident Construction Manager

(Signature and Name)(Signature and Name)

To: -

- RCM EIL



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**FORMAT NO. : HSE-6 REV 1**

## PERMIT FOR WORKING AT HEIGHTS (ABOVE 2.0 METER)

(In duplicate to be issued daily for site and for office)

Permit No…….. Name of Main Contractor……
Name of work executing agency / sub agency / vendor:……..
Date…… Exact Location of work……
Nature of work ……..Duration of work (from) …… (to) ……..
Number of workers covered within this permit……
(*List enclosed with name & gate pass numbers.*)

| Sl. No. | Items / Subjects | Status of compliance (Yes / No) | |
|---|---|---|---|
| 1 | Work areas / Equipment's inspected | | |
| 2 | Work area cordoned off | | |
| 3 | Adequate lighting is provided | | |
| 4 | Precautions against public traffic taken | | |
| 5 | Concerned persons in & around have been alerted & cautioned | | |
| 6 | Hazards / risks involved in routine / non-routine task assessed and control measures have been implemented at specific task | | |
| 7 | ELCB provided for electrical connection & found working | | |
| 8 | Ladder safely attached / fixed | | |
| 9 | Scaffoldings are checked and TAGs are found used correctly | | |
| 10 | Working platforms are provided and are found sound /safe for use | | |
| 11 | Safe access & egress arrangements (e.g. ladders, fall arresters, life-lines etc.) are satisfactorily incorporated | | |
| 12 | a. Openings on platform / floors are effectively cordoned / covered | | |
| | b. Safety Nets are provided wherever required | | |
| 13 | Use of following safety gadgets by people working at area under this permit, is checked and found satisfactory -<br>Safety helmet<br>Safety harness (full body) with double lanyard<br>Safety Shoes<br>Safety gloves<br>Safety goggles | | |
| 14 | Housekeeping of work area found satisfactorily tidy / clean & clear | | |
| 15 | Adequate measures have been taken for works being continued at the ground level, when simultaneous works are permitted overhead at that very location. | | |
| 16 | Materials are not thrown from heights on to ground | | |
| 17 | Medical examination of workers are made & found satisfactory | | |
| 18 | Responsible job engineer / supervisor found physically present at work spot for overall administration of work as well as safety of people. | | |

Above items have been checked & compliance has been found in place. Hence work is permitted to start / continue at the above-mentioned location. Work shall not start till identified lapses are rectified.

Additional Precautions, if any ……
……..

Work Permit Receiver Verification By Work Permit issuer
Contractor Job Supervisor Contractor Safety Officer Contractor Engineer/RCM

**AT THE END OF THE DAY/WORK:**
All works at height are completed & workmen have returned safely from work location at (time)…….. (date)……

**(Sig.** Contractor Engineer)


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**FORMAT NO. : HSE-7 REV 1**

## CONFINED SPACE ENTRY PERMIT

Project site _____ Sr. No. _____
Name of the work _____ Date _____
Name of Contractor _____ Nature of work _____
Exact location of work _____

**Safety Requirements** POSITIVE ISOLATION OF THE VESSEL IS MANDATORY

**(A) Has the equipment been ?**

| Y | NR | | Y | NR | | Y | NR | |
|---|---|---|---|---|---|---|---|---|
| ☐ | ☐ | Isolated from power/steam/air | ☐ | ☐ | water flushed &/or steamed | ☐ | ☐ | radiation sources removed |
| ☐ | ☐ | isolated from liquid or gases | ☐ | ☐ | Man ways open & ventilated | ☐ | ☐ | proper lighting provided |
| ☐ | ☐ | depressurized &/or drained | ☐ | ☐ | cont. inert gas flow arranged | ☐ | ☐ | |
| ☐ | ☐ | blanked/ blinded/ disconnected | ☐ | ☐ | adequately cooled | ☐ | ☐ | |

**(B) Expected Residual Hazards**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ☐ | ☐ | lack of $O_2$ | ☐ | ☐ | combustible gas/ liquid | ☐ | ☐ | $H_2S$ / toxic gases |
| ☐ | ☐ | corrosive chemicals | ☐ | ☐ | pyrophoric iron / scales | ☐ | ☐ | electricity / static |
| ☐ | ☐ | heat/ steam / frost | ☐ | ☐ | high humidity | ☐ | ☐ | ionizing radiation |
| ☐ | ☐ | | ☐ | ☐ | | ☐ | ☐ | |

**(C) Protection Measures**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ☐ | ☐ | gloves | ☐ | ☐ | ear plug / muff | ☐ | ☐ | goggles / face shield |
| ☐ | ☐ | protective clothing | ☐ | ☐ | dust / gas / air line mask | ☐ | ☐ | personal gas alarm |
| ☐ | ☐ | grounded air duct/blower /AC | ☐ | ☐ | attendant with SCBA/air mask | ☐ | ☐ | rescue equipment/team |
| ☐ | ☐ | Fire fighting arrangements | ☐ | ☐ | safety harness & lifeline | ☐ | ☐ | communication equipment |
| ☐ | ☐ | | ☐ | ☐ | | ☐ | ☐ | |

Authorization / Renewal (It is safe to enter the confined space)

| | No. of persons allowed | Name of persons allowed | Signature | | | Time | | Signature |
|---|---|---|---|---|---|---|---|---|
| | | | Work Permit Receiver(Contractor Supervisor) | Verification by Contractor Safety officer | Work permit issuer Contractor Engineer/RCM | From | To | Workman |
| | | | | | | | | |
| | | | | | | | | |

**Permit Closure :**

**(A)** Entry ☐ was closed ☐ stopped ☐ will continue on ...

**(B)**☐ Site left in a safe condition ☐ Housekeeping done

**(C)**Multi lock☐ removed ☐ key transferred

☐ Ensured all men have come out ☐ Man-ways barricaded

Remarks, if any:



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**FORMAT NO. : HSE-8 REV 0**

## RADIATION WORK PERMIT

Project :
Name of the work :
Name of site contractor :

Sr. No. :
Date :
Job No. :

Location of work :

Source strength :

Cordoned distance (m) :

Name of Radiography agency :

Approved by Owner/EIL ☐

No. of workers engaged :
(*List enclosed with name & gate pass numbers.*)

The following items have been checked &compliance shall be ensured during currency of the permit:

| S. No. | Item description | Done |
|---|---|---|
| | Safety regulations as per BARC/AERB ensured while source in use/in transit & during storage | |
| | Area cordoned off / safe working platform provided | |
| | Lighting arrangements for working during nights ensured | |
| | Warning signs/ flash lights installed | |
| | Cold work permit taken (if applicable) | |
| | PPEs like film badges, dosimeters used | |

Additional precautions, if any _____

(Radiography Agency's BARC/AERB authorized Supervisor)

Permission is granted.

Permit is valid from _____ AM/PM _____ Date to _____ AM/PM _____ Date

(Signature of permit issuing authority-RCM of contractor)
Name : Designation: Date:

Permit renewal:

| Permit extended up to | | Additional precautions required, if any | Sign of issuing authority with date (of site contractor) | |
|---|---|---|---|---|
| Date | Time | | | |
| | | | | |
| | | | | |

Work completed/ stopped/ area cleared at _____ Hrs of Date _____
(Sign. of permit issuing authority)
Name& Signature of site contractor:


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**FORMAT NO. : HSE-9 REV 1**

**DEMOLISHING/DISMANTLING WORK PERMIT**

Project : Sr.No. :
Name of the work : Date :
Name of contractor : Job No. :

Name of sub-contractor : No. of workers to be engaged:
(*List enclosed with name & gate pass numbers.*)

Line No./ Equipment No./ Structure to be dismantled :

Location details of dismantling/ demolition with sketch : (clearly indicate the area)

The following items have been checked &compliance shall be ensured during currency of the permit:

| S. No. | Item description | Done | Not Applicable |
|---|---|---|---|
| | Services like power, gas supply, water, etc. disconnected | ☐ | ☐ |
| | Dismantling/ Demolishing method reviewed & approved | ☐ | ☐ |
| | Usage of appropriate PPEs ensured | ☐ | ☐ |
| | Precautions taken for neighboring structures | ☐ | ☐ |
| | First-Aid arrangements made | ☐ | ☐ |
| | Fire fighting arrangements ensured | ☐ | ☐ |
| | Precautions taken for blasting | ☐ | ☐ |

Work Permit Receiver
(Contractor's Supervisor/Engineer)

Verification by Contractor
(Contractor's Safety Officer)

Permission is granted.

(Work Permit issuer-Client)

Name :
Date :

Completion report:

Dismantling/ Demolishing is completed on _____ Date at _____ Hrs.

Materials/ debris transported to identified location ☐ Tagging completed (as applicable) ☐

Services like power, gas supply, water, etc. restored ☐

(Permit issuing authority-Client)

CONTRACTOR's NAME

**FORMAT NO. : HSE-10 REV 0**

## DAILY SAFETY CHECKLIST

(To make use of before start of day's work)

Project :
Name of the work :
Name of contractor :

Sr.No. :
Date :
Job No. :

**Description of Job decided to perform : -**

- **Use of PPE / Safety Gadgets**

| Sl. No | PPEs | Compliance (Yes / No) | Sl. No | PPEs | Compliance (Yes / No) |
|---|---|---|---|---|---|
| 1 | Safety Helmets | | 6 | Face Shield | |
| 2 | Safety Shoes | | 7 | Full body harness | |
| 3 | Hand Gloves | | 8 | Fall Arrest System | |
| 4 | Dust Musk | | 9 | Safety net | |
| 5 | Safety Goggles | | 10 | Horizontal life-line made of steel wire, (dia not less than 8.0 mm.) | |

**(Serial No. 1 & 2 are compulsory for everyone. Specify & ensure use of other safety gadgets as required for the job)**

- **Identify following important unsafe conditions: -**

| Sl. No | Conditions | Yes / No |
|---|---|---|
| 1 | Access to work site / emergency escape clear | |
| 2 | Soil / Loose earth kept away from excavated pit / slope / ladder provided | |
| 3 | Electrical wire / welding lead lying entangled on ground / welding m/c. booth accessible | |
| 4 | Elevated work platform / open ends are protected | |
| 5 | Ground area cordoned off before lifting works or erection at height / ground area checked & cordoned-off before start of height works | |
| 6 | Structural members / erected pipes / wooden boards/pieces etc. are safely anchored at heights and are not likely to fall down on people when working beneath | |
| 7 | Ladders tied-up on tall steel structures, long before are removed to get rid of their use | |
| 8 | Any Other | |

- **Indicate actions taken, if status of any of the above items is found "No"**
  .....
  .....
- **Specific Safety guidelines / precautions, if any** (communicated thro' TBT)
  .....
  .....
- **Above conditions and PPE compliances are checked by undersigned and correct status are indicated after verification**

Prepared by
Contractor Site Engineer

Verification By
Contractor Safety Officer


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**FORMAT NO. : HSE-11 REV 0**

**(Sheet 1 of 2)**

## HOUSEKEEPING ASSESSMENT& COMPLIANCE

Project :
Name of the work :
Name of contractor :
Name of contractor : Fortnightly

Sr.No. :
Date :
Job No. :

| Sl. No. | Subjects of Review | Satisfactory/ Yes | Non satisfactory/No | Remarks | Action |
|---|---|---|---|---|---|
| 1. | Cleanliness at the Main entry / access of site | | | | |
| 2. | Ground condition / floor areas free from water-logging / oil spillage | | | | |
| 3. | Ground & elevated floors free from rubbish / wastes / accumulated debris / scraps. | | | | |
| 4. | Manholes / openings are covered / fenced | | | | |
| 5. | Trenches are barricaded / walkways are in place | | | | |
| 6. | Drains are cleaned / not choked / not occupied by dumped materials | | | | |
| 7. | Sufficient CAUTION boards / instructions displayed | | | | |
| 8. | Construction machinery are maintained & parked in orderly manner. | | | | |
| 9. | Movement of site people are not obstructed because of dumping / storing of construction materials | | | | |
| 10. | Access / egress to Electrical Distribution Boards / Panels clear from wires / cables / earth-strips etc. | | | | |
| 11. | Electrical panel rooms / sheds / MCC / Control rooms / Substations etc. are clean & tidy and not used for storing dress / clothes, tiffin-box or bicycles. | | | | |
| 12. | Passage behind Elec. panels are free for access | | | | |
| 13. | Fire extinguishers / fire-buckets are accessible without any difficulty. | | | | |
| 14. | Stair-steps, platforms & landings are clear & tidy | | | | |
| 15. | Sheds / rooms & work areas have got sufficient illumination as well as ventilation | | | | |
| 16. | Cables / Wires / welding leads are routed / hanged appropriately & are not creating unsafe condition. | | | | |
| 17. | Stacking / storing of insulation materials or their packing. | | | | |
| 18. | Removal or cleanliness of left-over sand, concrete, brick-bats, insulation-materials, excess earth, wastes etc. | | | | |
| 19. | Storing / stacking of sand, metal chips, re-bars, steel pipes, valves, fittings etc. | | | | |
| 20. | One escape route at ground & minimum two escape routes at elevation available, | | | | |



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**FORMAT NO. : HSE-11 REV 0**

**(Sheet 2 of 2)**

| Sl. No. | Subjects of Review | Satisfactory/ Yes | Non satisfactory/No | Remarks | Action |
|---|---|---|---|---|---|
| 21. | Captions / Posters / Slogans on various safety instructions are displayed legibly in local language | | | | |
| 22. | Cable trenches are water-free or regular arrangement for taking out accumulated water exists. | | | | |
| 23. | Windows of rooms / offices are regularly cleaned | | | | |
| 24. | Facilities for cycle sheds, drinking water, washing, rest-rooms etc. are maintained in tidy manner. | | | | |
| 25. | Toilet, Urinals, Canteen / kitchen / pantry etc. are maintained & free from obnoxious smell. | | | | |
| 26. | Construction tools / tackles are stored systematically - the items are tagged / tested / certified by competent third party. | | | | |
| 27. | Sufficient numbers of Dust-bins / Waste-bins found at site and are regularly emptied. | | | | |

Additional remarks, if any -

.....

.....

.....

Inspected by
Contractor Engineer

Verification By
Contractor Safety Officer



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**FORMAT NO. : HSE-12 REV 0**

## INSPECTION OF TEMPORARY ELECTRICAL BOOTH / INSTALLATION

Project :
Name of the work :
Name of contractor :
Sub Station No:/Booth No

Sr.No. :
Date :
Job No. :
Location:

| SL NO | SUBJECTS | OBSERVATION (YES /NO) | ACTION TAKEN |
|---|---|---|---|
| 1 | Switchboards installed properly are in order and protected from rain & water-logging. | | |
| 2 | Adequate illumination provided for switchboard operation during night hours & the lamps are protected from direct human contact. | | |
| 3 | Voltage ratings, DANGER signs, Shock-Treatment-Chart displayed in the installation / booth | | |
| 4 | Fire extinguisher (DCP or $CO_2$) & Sand Bucket kept in close vicinity of Switchboards | | |
| 5 | Valid License & Competent Electrician / Wireman available & name/ license no. displayed at booth / installation. | | |
| 6 | General housekeeping in & around booth / installation found in order. | | |
| 7 | Cable-route-markers for U/G cables provided. | | |
| 8 | Monthly inspection report of Electrical hand tools available in booth / installation. | | |
| 9 | Electrical Panel door to be in closed condition and Insulated Mat to be provided in front of panel. | | |
| 10 | Rubber hand gloves available/ used by Electricians | | |
| 11 | Availability of CAUTION boards for shutdown & / or repairing works. | | |
| 12 | All incoming & outgoing feeders have proper MCCB / HRC fuses / Switches. | | |
| 13 | Switchboards "earthed" at two distinctly isolated locations. | | |
| 14 | Switchboards have adequate operating space at the front face & at the rear face too. | | |
| 15 | All connections provided through 30mA ELCB. | | |
| 16 | Testing records of all ELCBs available at site | | |
| 17 | Only industrial type plugs & sockets are used. | | |
| 18 | Temporary connections are 3-core double insulated & free from cuts & joints and 3rd core is earthed at both ends | | |
| 19 | Socket boards are properly mounted on stand & protected from water ingress. | | |
| 20 | Electrical equipments operating above 250V have two earthing / double earthing. | | |
| 21 | All incoming / outgoing cables are properly glanded& terminated with "lugs". | | |
| 22 | Switch-boards are of industrial variety / type. | | |
| 23 | Sketch for installation / connection (SLD) made & pasted& other safety labels/display boards | | |
| 24 | Labeling of incoming / outgoing feeders made. | | |
| 25 | All hand lamps are protected from direct contact. | | |
| 26 | All electrical cable / joints are in safe condition | | |

Inspected by
Contractor Engineer

Verification By
Contractor Safety Officer


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**FORMAT NO. : HSE-13 REV 0**

**(Sheet 1 of 2)**

## INSPECTION FOR SCAFFOLDING

Project : Sr.No. :
Name of the work : Date :
Name of contractor : Job No. :

| Sl. No | Description | Yes | No | N.A. | Actions taken |
|---|---|---|---|---|---|
| 1 | Whether work permit is obtained to take up work at height above 1.5 Mts? | | | | |
| 2 | Whether atmospheric condition is "stormy" or "raining" and works at heights have been permitted? | | | | |
| 3 | Whether steel pipes scaffoldings are used for units /off-site areas? | | | | |
| 4 | Whether scaffolding has been erected on rigid/firm/leveled surfaces / ground? Whether "foot-seals" or "base-plates" are used beneath the up-rights (vertical steel pipes) | | | | |
| 5 | Whether scaffold construction is as per IS specification with toe-board and hand-rails (top-rail as well as mid-rail)? | | | | |
| 6 | Whether distance between two successive up-rights are less than 2.5 Mts (height of scaffold & load carrying capacity governs the distance between two uprights) | | | | |
| 7 | Whether all uprights are extended at least 900 mm above the top most working platform (to enable fitting of handrails)? | | | | |
| 8 | Whether vertical distance of two successive ledgers is satisfactory? (*varying between 1.3 Mts. To 2.1 Mts)* | | | | |
| 9 | Whether the peripheral areas of working at height are cordoned-off? (for avoiding accident to people arising out of dropped / deflected materials) | | | | |
| 10 | Whether platform is provided? Is it safely approachable? | | | | |
| 11 | Whether end of scaffold platform / board are extended beyond transoms? (125mm to 150 mm) | | | | |
| 12 | Whether CE / IS approved quality and worthy conditioned full-body safety harness (with double lanyard & karabiners) are used while working at heights? | | | | |
| 13 | Whether life-line of safety harness is anchored to an independent secured support capable of withstanding load of a falling person? | | | | |
| 14 | Whether the area around the scaffold is cordoned off to prohibit the entry of unauthorized person / vehicle? | | | | |
| 15 | Whether clamps used are of good condition, of adequate strength and free from defects? | | | | |
| 16 | Whether ladder is placed at secured and leveled surface? | | | | |
| 17 | Whether water-pass and oil-spills are avoided around the scaffold structure? | | | | |
| 18 | Whether ladder is extended 1.5mts. above the landing point at height? | | | | |
| 19 | Whether more than one access/egress provided to the scaffold? | | | | |
| 20 | Whether ladder used are of adequate length and overlapping of short ladders avoided? | | | | |
| 21 | Whether metallic ladders are placed much away from near-by electrical transmission line? | | | | |
| 22 | Whether rungs of ladder are inspected and found in good order? | | | | |
| 23 | Whether fall-arresters provided on both the access/egress routes? | | | | |
| 24 | Whether diagonal (cross) bracings are provided at regular interval on the scaffold? | | | | |
| 25 | Whether working platform on the scaffold has been made free from "jolt" or "gap"? | | | | |
| 26 | Whether tools or materials are removed after completion of the day's job at heights? | | | | |
| 27 | Whether a valid Permit for Work (PFW) is obtained before taking up work over asbestos or fragile roof? | | | | |
| 28 | Whether sufficient precaution is taken while working on fragile roof? | | | | |


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**FORMAT NO. : HSE-13 REV 0**

**(Sheet 2 of 2)**

| Sl. No | Description | Yes | No | N. A | Actions taken |
|---|---|---|---|---|---|
| 29 | Whether provision is made to arrange duck ladder, crawling board for working on fragile roof? | | | | |
| 30 | Whether scaffold has been inspected by qualified civil engineers prior to their use? | | | | |
| 31 | Whether the scaffolding has been designed for the load to be borne by the same? | | | | |
| 32 | Whether the erection and dismantling of the scaffolding is being done by trained persons and under adequate supervision? | | | | |
| 33 | Whether safety net with proper working arrangement and life-line has been provided? | | | | |
| 34 | Whether TAGS (Green for acceptable and Red for incomplete/unsafe scaffolds) are used on scaffolds? | | | | |
| 35 | Whether sufficient illumination is provided in and around the scaffold and access? | | | | |
| 36 | Whether emergency rescue / response arrangements are made in place | | | | |

Inspected by
Contractor Engineer

Verification By
Contractor Safety Officer



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**FORMAT NO. : HSE-14 REV 1**

**(sheet 1 of 2)**

## PERMIT FOR ERECTION / MODIFICATION & DISMANTLING OFSCAFFOLDING

Project :
Name of the work :
Name of contractor :
Nature of activities :

Sr.No. :
Date :
Job No. :
Duration: From.....To.....

| SL. No. | SUBJECTS / ITEMS | DONE | NOT DONE | REMARKS |
|---|---|---|---|---|
| 1 | Specific task of Erection / Modification / Dismantling of scaffolds, identified & TAGGED accordingly (before as well as after carrying-out jobs). | | | |
| 2 | People engaged in doing the job are identified & are certified by Job Engineer of Main Contractor as experienced / trained. | | | Names to be noted |
| 3 | Concerned persons are alerted by the Job Engineer of Main Contractor in connection with possible hazards & what the workmen MUST do / MUST not do. | | | |
| 4 | Verification by Job Engineer of Main Contractor made for confirming that all persons permitted to carry-out the jobs are making use of Helmet, Safety Shoes, Goggles, Gloves & Double lanyard safety harness and other relevant PPEs. | | | |
| 5 | Area of work is effectively cordoned-off / barricaded / illuminated. | | | |
| 6 | For taking-up / lowering down Scaffolding members / clamps / couplings etc. appropriate ropes / pulleys/ chains etc. have been arranged for use (not to throw any item) & the same have been verified as "fit for purpose". | | | |
| 7 | Items / members of scaffold, being lowered are removed from the area & stacked correctly. | | | |
| 8 | Ropes, chains, pulley blocks etc. being used for lifting or lowering scaffold items, are inspected by the Job Engineer & their certifications as well as physical conditions have been found O.K. before signing this PERMIT. | | | |
| 9 | Safety Net / Life-line / Fall Arresters etc. are arranged in position and Job Engineer has found working conditions favorable for activities to start. | | | |
| 10 | Scaffold erection or dismantling tasks are being supervised by Experienced Engineer / Competent person. | | | |
| 11 | Only competent & experienced people have been selected / engaged in Scaffolding erection, modification or dismantling tasks. | | | |
| 12 | Adequate & effective actions for traffic and movement of people around the cordoned-off area taken to avoid inadvertent incident | | | |
| 13 | Working platforms are protected with handrails & toe-boards. | | | |
| 14 | Access & Exit (for reach & escape) are safe for use by people. | | | |
| 15 | Tools, tackles to be used for above jobs are verified by job Engineers of Main contractor as genuinely good and tied-up at height (to prevent their fall). | | | |
| 16 | Site important Telephone Nos. are made known to everyone | | | |
| 17 | SOP (Safe Operating Procedure) for the specific task is made & followed too. | | | |
| 18 | Emergency vehicle has been arranged at work locations. | | | |

- This permit for work shall be available at specific work location all the time.
- After completion of work, permit shall be returned to safety cell of main contractor, without fail.
- This Permit shall be issued maximum upto (Monday to Sunday).
- Additional Precautions, if any

  .....
- **ACCORD OF PERMISSION** (to be ticked) - **YES** ( )/ NO ( )

  Work Permit Receiver Verification By Work Permit issuer Contractor Job Supervisor
  Contractor Safety Officer Contractor Engineer/RCM


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**FORMAT NO. : HSE-14 REV 1**

**(sheet 2of 2)**

Everyday Site working conditions & performance of workmen shall be assessed / checked by Contractor Site Engr. and Safety Officer shall verify the same.

| | Name / Sign. | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY | SUNDAY |
|---|---|---|---|---|---|---|---|---|
| Site Engr. | | | | | | | | |
| Safety Off. | | | | | | | | |



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**FORMAT NO. : HSE-15 REV 1**

## PERMIT FOR HEAVY LIFT/CRITICAL ERECTION

Project :
Name of the work :
Name of contractor :
Nature of activities :
Location of work :
Equipment/Structure to be erected:

Sr. No. :
Date :
Job No. :
Duration: From.....To.....
Name /Type of crane :
Wt. of equipment/ structure to be erected

| SL. NO. | Description of Item | COMPLIANCE STATUS | | | Remarks |
|---|---|---|---|---|---|
| | | Yes | No | Not applicable | |
| 1) | Is the crane type suitable for lift or as per erection procedure? | | | | |
| 2) | Is the crane have the correct number of counterweights fitted? | | | | |
| 3) | Availability of Load Certification of crane from authorized agency. | | | | |
| 4) | Is the load chart of crane available in carne cabin/or with Crane operator? | | | | |
| 5) | Is the device to check the Wind speed in crane is working? Is the safety features in crane are working? | | | | |
| 6) | Availability of Load certification of slings and other accessories from authorized agency | | | | |
| 7) | Availability of Licensee/certificate for crane operator from authorized agency. | | | | |
| 8) | Availability of approved HIRAC for the subject activities. | | | | |
| 9) | Availability of approved erection/rigging procedures. | | | | |
| 10) | Availability of temporary gratings/ platforms for critical lifting(as applicable) | | | | |
| 11) | Tool Box conducted before erection? | | | | |
| 12) | Has the area been cordoned off? | | | | |
| 13) | Are the authorized persons during erection are identified? | | | | |
| 14) | Does each person identified for erection understand their roles and responsibilities? | | | | |
| 15) | Is the ground on which crane will rest or outrigger support are correct? | | | | |
| 16) | Is hard stand requirement (if any) complied? | | | | |
| 17) | Is the communication system (viz walkie-talkies, etc. are working properly? | | | | |
| 18) | If more than one crane is lifting the load, is an Intermediate rigger will supervise the lift? | | | | |
| 19) | If there is other obstruction within the operating radius of the crane, have correct precautions been taken to prevent collision? | | | | |
| 20) | All the persons are wearing the requisite PPE? | | | | |

Work Permit Receiver Verification By Work Permit issuer Contractor Job Supervisor
Contractor Safety Officer Contractor Engineer/RCM


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**FORMAT NO. : HSE-16 REV 1**

## PERMIT FOR ENERGY ISOLATION & DE-ISOLATION

Project :
Name of the work :
Name of contractor :

Sr.No. :
Date :
Job No. :

### ENERGY ISOLATION PERMIT

- Clearance required from:.....Hrs .....Date To .....Hrs ....Date
- Name of equipment/ energy source etc. .....
- Nature of job to be done: .....
- Area.....Location:.....

| PERMIT VALIDATION | PERFORMING AUTHORITY |
|---|---|
| I hereby authorize the .....personnel(performer) to isolate the above equipment/energy source from all sources of power and handover the equipment/energy source for maintenance/repair.<br><br>Issuing authority<br>Client/Contractor RCM (as applicable)<br>Signature: Date:<br>Name: | The work and precautions will be carried out under my overall responsibility.(Testing/execution engineer)<br><br>Signature: Date:<br>Name: |

| SAFETY PRECAUTIONS FOR CLEARANCE | NORMALISING AFTER CLEARANCE |
|---|---|
| 1. Notify workers of intent to de- energize ☐<br>2. Obtain lock, tag or locking/tagging devices ☐<br>3. Shut down, de-energize, dissipate any residual energies. ☐<br>4. Apply lock ,tag and locking and/or tagging devices ☐<br>5. *Any other job specific precautions ☐<br>6. Verify effectiveness of lockout by attempting to restart. ☐<br>7. Proper PPE is ensured ☐<br><br>I certify that the energy source mentioned above is isolated from all sources and is safe to start the work.<br><br>Tag No:..... Lock No:.....<br><br>Issuing authority<br>Client/Contractor RCM (as applicable)<br>Signature: Date:<br>Name:<br>**(*to be included by contractor in consultation with issuing authority)** | 1. Notify workers of intent to re- energize ☐<br>2. Conduct visual inspection to confirm that the danger zone is clear of workers ☐<br>3. Conduct visual inspection to confirm that tools ,equipment's danger zone is clear of workers ☐<br>4. Reposition the safety devices(interlocks, valves, guards, covers ,sensors, as applicable, etc.) ☐<br>5. *Any other job specific normalizing details ☐<br>6. Remove lock, tag and locking and/or tagging devices. ☐<br>7. Re-energize. ☐<br>8. Confirm system is operating properly& safely<br>I certify that the energy source mentioned above is isolated from all sources and is safe to start the work.<br><br>Tag No:..... Lock No:.....<br>Issuing authority<br>Client/Contractor RCM (as applicable)<br>Signature: Date:<br>Name:<br>**(*to be included by contractor in consultation with issuing authority)** |

### ENERGY DE-ISOLATION PERMIT

| PERMIT VALIDATION | PERFORMING AUTHORITY |
|---|---|
| I hereby authorize the .....personnel(performer) to de- isolate the above equipment/energy source from all sources of power and handover the equipment/energy source for normal operation..<br><br>Issuing authority<br>Client/Contractor RCM (as applicable)<br>Signature: Date:<br>Name: | I hereby certify that the equipment/energy source mentioned above has been de-isolated and is ready for normal operation.(Testing/execution engineer)<br><br>Signature: Date:<br>Name:<br><br>Countersigned by Issuing authority |


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**FORMAT NO. : HSE-17 REV 1**

**PERMIT FOR EXCAVATION** (depth 2m and above)

**(Sheet 1of 2)**

Project :
Name of the work :
Name of contractor :
Job Description :
Size of excavation :

Sr.No. :
Date :
Job No. :
Location:

| SL. NO. | Description of Item | COMPLIANCE STATUS | | | Remarks |
|---|---|---|---|---|---|
| | | Yes | No | Not applicable | |
| 1) | Suitable and sufficient risk assessments and method statements has been carried to ensure that the work shall be undertaken in accordance with specification and standard. | | | | |
| 2) | Are plans/details of underground services available and the same has been reviewed? | | | | |
| 3) | Has survey done to locate the services/obstacles etc. | | | | |
| 4) | Has the live services (electrical, water line, air line, telephone line, etc)has been disabled for carrying out the job. | | | | |
| 5) | Is adequate barriers/fences to protect the excavation are in place? | | | | |
| 6) | Is Adequate warning signs are in place? | | | | |
| 7) | Is Assessment of ground conditions done and remedial action(if any) taken? | | | | |
| 8) | Safe access / egress (e.g. ramp / steps / ladders etc.) provided for site workmen & supervisors. | | | | |
| 9) | Is the excavation work being undertaken in proximity of structure, etc. ?If Yes, it's effect is considered? | | | | |
| 10) | Availability of competent person for supervising the excavation work? | | | | |
| 11) | Adequate safe arrangement to prevent collapse of edges (e.g. shoring / strutting / benching / sloping etc.) made at site. | | | | |
| 12) | Hard barricades (at least 1.0M away from edge & for excavation near site access roads) with warning signs/caution boards are provided | | | | |
| 13) | Accumulation / passage-ways of water at periphery of excavation / trench stopped/ restricted. | | | | |
| 14) | Is the equipment being used for excavation has been checked for adequacy and is in good working condition having all the safety features? | | | | |
| 15) | Age & fitness of workmen ensured by medical test before engagement in job ? | | | | |
| 16) | Arrangement of Monitoring of possible oxygen deficiency or obnoxious gases done & action taken? | | | | |

**PERMIT GRANTED -** Yes / No

(*List enclosed with name & gate pass numbers.*)

Name & Signature of Site Engr. Name & Signature of Area – In charge/RCM of Contractor (Receiver) Contractor (Issuer)

Verification by Contractor Safety Officer


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**FORMAT NO. : HSE-17 REV 1**

## PERMIT FOR EXCAVATION

**(Sheet 2of 2)**

**NOTES: -**

1. Slopes or benches for excavation beyond 2.0M depth shall be designed & approved by Contractor's site head.
2. Excavated earth to be kept at least 1.5M away from edges
3. Safety helmets, Safety shoes or gum-boots, gloves, goggles, Face shield, Safety Harness shall be essential PPEs.
4. Permit shall be made in **duplicate** and original shall be available at site of work.
5. Permit shall be issued for maximum **one week** only (Monday to Sunday)
6. After completion of works, permit shall be closed & preserved for record purpose

### GRANT OF PERMIT AND EXTENSIONS

| Sl. No. | Validity period From ____To ____ | Working Time From _____To _____ | Receiver (site Engr. of Main Contractor) | Issuer(Area In charge/RCM of Main Contractor) | Review by EIL / Owner (Remarks with date |
|---|---|---|---|---|---|
| 1. | | | | | |
| 2. | | | | | |
| 3. | | | | | |
| 4. | | | | | |
| 5. | | | | | |
| 6. | | | | | |
| 7. | | | | | |

Additional safety instructions if any: -

1.

2.

3.



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**FORMAT NO. : HSE-18 REV 0** **(Sheet 1of 2)**

## IDENTIFICATION OF ENVIRONMENTAL ASPECTS, IMPACT ASSESSMENT AND CONTROL MEASURES

| S.No | Activity | Environmental Aspect | N/A/E | Environment Impact | Control Measures | Consequences | | | | | | Risk Level | Significant | Gaps/ Recommendations |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | A | B | C | D | E | F | G | Yes/No | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |



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**(Sheet 2 of 2)**

## INITIAL ENVIRONMENT REVIEW TECHNIQUE

| **Environmental Impacts** | AP = Air Pollution | WP = Water Pollution | LC = Land Contamination | DNR = Depletion of Natural Resources | NP = Noise Pollution |
|---|---|---|---|---|---|

| Scale | Quantity (A) | Occurrence (B) | Severity of Impact (C) | Detection (D) | Control (E) | Legal and other requirements (F) |
|---|---|---|---|---|---|---|
| 1 | Negligible | Very Rare | Negligible visual impact | Immediately | Available & effective at place | In compliance or not applicable |
| 2 | Low | Once a month or less | Causes Discomfort or Nuisance | Within 1 hour | Has in-built Secondary control | |
| 3 | Moderate | Once a day | Resource Depletion | Within 8 hours | Needs human Intervention | |
| 4 | High | Several times a Day | Affects Aquatic Life, flora, fauna or global issue | Within 24 hours | Mechanism in place but not reliable | |
| 5 | Excessive | Continuous | Human health effect | More than 24 hours | Absent or no effective control | Not in compliance |

**Risk Level - G : A x B x C x D x Ex F**

Aspects with score of **100 and above** are considered as significant.
Also, Irrespective of the score, all legal noncompliance's to be considered as significant

| Condition | |
|---|---|
| N | NORMAL |
| A | ABNORMAL |
| E | EMERGENCY |



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**FORMAT NO. : HSE-19 REV 0 HIRAC**

| Risk Identification | | | | | | Desired Controls & Existing Gaps, If Any | | Risk Assessment | | | | Recommended Control Actions To Reduce The Risk Level | Action By | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SN | Activity | Activity Type (R/NR) | Hazards | Condition( N/AN/E) | Associated Risk | Desired Control Measures | Gaps If Any | Probability(P) | Impact (I) | Risk R= P*I | Risk Classification | | | |
| | | | | | | | | | | | | | | |

**Likelihood** – Possibility of occurrence of risks based on present gaps (technological / operational / competence / measurement and monitoring);

**UL:** Unlikely, **L:** Likely, **VL:** Very Likely, **FR:** Frequent, **C**: Continuous

**Impact** –

**SI:** Slight Injury, **MI:** Minor Injury, **MJ:** Major Injury, **SF:** Single Fatality, **MF:** Multiple Fatalities

**Level of consequence** – Refer Guidance criteria for this i.e. possible degree of damage;

**Condition- N**: Normal, **AN**: Abnormal, **E**-Emergency

**Activity Type:** R- Routine, NR- Non Routine

**RISK** –

**L**: Low Risk, **M:** Moderate Risk, **H:** High Risk



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**FORMAT NO.:** **HSE-20 REV 0**

## Inspection of Tower Crane

**Name of Contractor:** **Project:**

**Name of Work:** **Job No:**

**Vehicle Identification/Registration No:** **Date:**

| Sr. No. | Description | Observation | Remarks & Suggestions |
|---|---|---|---|
| 1 | Serial number plate &SWL marking | | |
| 2 | Valid TPI Certificate | | |
| 3 | Valid Insurance | | |
| 4 | Safe access and egress are provided to the crane operator. | | |
| 5 | Front glass of Operator cabin | | |
| 6 | Operator crane cabin is provided with a locking mechanism so as to prevent unauthorised entry. | | |
| 7 | A safety bar is fitted across the operator's cabin window where there is likelihood of the operator falling through it. | | |
| 8 | Manufacturer Operating Manual and Maintenance Manual are made available. | | |
| 9 | An updated Operation and Maintenance log book is available in the operator cabin. | | |
| 10 | All mounting bolts are in good condition. | | |
| 11 | Load chart provided | | |
| 12 | SLI available | | |
| 13 | Crane hooks have got smooth surface and no dent | | |
| 14 | Hook-latch / Dog-clamp in hook is effective | | |
| 15 | Over hoist limit switch | | |
| 16 | Double body earthing of Tower Crane | | |
| 17 | Jib angle indicator is provided (For Luffing Jib Tower Crane). | | |
| 18 | Emergency stop button, which will terminate the operation of the crane engine, is installed in the operator cabin and correctly identified. | | |
| 19 | Effective braking mechanisms for Hoisting, Derricking, Slewing, Trolley Travelling maintained: | | |
| 20 | Trolley Travelling limiter to prevent over-travelling of trolley is functional. | | |
| 21 | Limit switches to prevent over-derricking and over-lowering of jib (For Luffing Jib Tower Crane) is functional. | | |
| 22 | Slewing limiter to restrict slewing of crane is functional. | | |
| 23 | Over load Limiter to prevent overloading of crane is functional. | | |
| 24 | Load Moment Limiter to prevent over-turning moment is functional. | | |
| 25 | Anti-collision devices are tested to stop the tower crane's operation such that the crane-to-crane interference must be maintained at not less than 3 m. | | |
| 26 | Condition of boom | | |
| 27 | Counter weight placement and pins | | |
| 28 | Winches, pulleys and wire ropes are in good working condition. | | |
| 29 | Colour coding | | |
| 30 | Leakage in hydraulic cylinder | | |



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| | | | |
|---|---|---|---|
| 31 | Fire Extinguisher | | |
| 32 | Tower crane is adequately grounded or protected against lightning. | | |
| 33 | Wind anemometer is installed and is in good working condition. | | |
| 34 | Aviation lamp is functional (Reqd. for 30mt and above) | | |
| 35 | Pre Medical Check-up& Periodic Medical check-up (every 6 months) including vision test for Operator | | |
| 36 | Safety Induction for Operator | | |
| 37 | Others | | |

**Signature & Name of Operator:**

**Signature and name of Job Engineer**

**Signature & Name of Contractor's Safety Officer**



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**FORMAT NO. : HSE-21 REV 0**

## Crane Inspection Checklist

**Name of Contractor:** **Project:**

**Name of Work:** **Job No:**

**Vehicle Identification/Registration No:** **Date:**

| Sr. No. | Description | Observation | Remarks & Suggestions |
|---|---|---|---|
| 1 | Crane hooks have got smooth surface and no dent | | |
| 2 | Hook-latch / Dog-clamp in hook is effective | | |
| 3 | Over hoist limit switch | | |
| 4 | Over Load Indicator | | |
| 5 | Over Boom limit switch | | |
| 6 | Boom angle indicator | | |
| 7 | Colour coding | | |
| 8 | Condition of boom | | |
| 9 | Condition of wire rope | | |
| 10 | Rope drum / sheaves are in good working condition | | |
| 11 | Swing break & lock | | |
| 12 | Swing Alarm | | |
| 13 | Over hoist break & lock | | |
| 14 | Boom break & lock (For Telescopic Boom) | | |
| 15 | Leakage in hydraulic cylinder | | |
| 16 | Condition of Outrigger (For Tyre Mounted Crane) | | |
| 17 | Outrigger fully extended Marking (For Tyre Mounted Crane) | | |
| 18 | Condition of Tyre (For Tyre Mounted Crane) | | |
| 19 | Wheel chokes are present and are used whenever required (For Tyre mounted) | | |
| 20 | Battery & lamps | | |
| 21 | Moving & rotating parts guarded | | |
| 22 | Load chart provided | | |
| 23 | Reverse horn (For Tyre Mounted Crane) | | |
| 24 | Body Condition of crane | | |
| 25 | Front glass of Operator cabin | | |
| 26 | Both side Mirror | | |
| 27 | Number Plate (For Tyre Mounted Crane) | | |
| 28 | Fire Extinguisher | | |
| 29 | Horn | | |
| 30 | Windshield and wipers | | |
| 31 | Working of light & Indicator | | |
| 32 | SLI | | |
| 33 | Spark Arrestor( For Running Refinery/ Petrochemical/Chemical Plant) | | |



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| | | | |
|---|---|---|---|
| 34 | Foot-steps and hand-holds are in good working condition for exit /enter in to cabin | | |
| 35 | TPI Certificate | | |
| 36 | RC Document (For Tyre Mounted Crane) | | |
| 37 | Fitness Certificate of Vehicle by authority | | |
| 38 | Insurance | | |
| 39 | PUC | | |
| 40 | HMV License for Operator | | |
| 41 | Pre Medical Check-up& Periodic Medical check-up (every 6 months) including vision test for Operator | | |
| 42 | Safety Induction for Operator | | |
| 43 | Others | | |

**Signature & Name of Operator:**

**Signature & Name of Contractor's Concern Engineer**

**Signature & Name of Contractor's Safety Officer**



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**FORMAT NO. : HSE-22 REV 0**

**Hydraulic Mobile Crane- Inspection Checklist**

**Name of Contractor:** **Project:**

**Name of Work:** **Job No:**

**Vehicle Identification/Registration No:** **Date:**

| Sr. No. | Description | Observation | Remarks & Suggestions |
|---|---|---|---|
| 1 | Identification number of Hydraulic Mobile crane boldly scribed in front and rear end of machine | | |
| 2 | Operator has got adequate document in support of his competency (i.e. HMV driving license, knowledge & training) | | |
| 3 | Marking of SWL on hook position is clearly visible | | |
| 4 | Test & examination of Hydraulic Mobile crane by statutory / competent authority is carried out & document is valid | | |
| 5 | Colour Coding | | |
| 6 | RC Document | | |
| 7 | Fitness Certificate of Vehicle by authority | | |
| 8 | Valid Insurance | | |
| 9 | Valid PUC | | |
| 10 | Pre Medical Check-up& Periodic Medical check-up (every 6 months) including vision test for Operator | | |
| 11 | Safety Induction for Operator | | |
| 12 | Crane hooks have got smooth surface and no dent | | |
| 13 | Hook-latch / Dog-clamp in hook is effective | | |
| 14 | Over hoist limit switch | | |
| 15 | Over Load Indicator | | |
| 16 | SLI | | |
| 17 | Condition of boom | | |
| 18 | Condition of wire rope | | |
| 19 | Rope drum / sheaves are in good working condition | | |
| 20 | Leakage in hydraulic cylinder | | |
| 21 | Tyre condition | | |



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| | | | |
|---|---|---|---|
| 22 | Battery | | |
| 23 | Moving & rotating parts guarded | | |
| 24 | Break | | |
| 25 | Parking Break | | |
| 26 | Front horn | | |
| 27 | Reverse horn | | |
| 28 | Hydraulic Mobile Crane cabin body and frame of machine is in good order | | |
| 29 | Both side Mirror | | |
| 30 | Fire Extinguisher | | |
| 31 | Front glass pane of the Hydraulic Mobile operator's cabin is clean & clear (i.e. not cracked / damaged / broken) | | |
| 32 | Windshield and wipers condition | | |
| 33 | Working of front & back lights, turn Indicators, parking lights & fog lamps | | |
| 34 | Spark Arrestor( For Running Refinery/ Petrochemical/Chemical Plant) | | |
| 35 | Wheel chokes are present and are used whenever required | | |
| 36 | Foot-steps and hand-holds are in good working condition for exit /enter in to cabin | | |
| 37 | Others | | |

**Signature & Name of Operator**

**Signature & Name of Contractor's Concern Engineer**

**Signature & Name of Contractor's Safety Officer**



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**FORMAT NO. : HSE-23 REV 0**

## Hydraulic Rig Inspection Checklist

**Name of Contractor:** **Project:**

**Name of Work:** **Job No:**

**Vehicle Identification/Registration No:** **Date:**

| Sr. No. | Description | Observation | Remarks & Suggestions |
|---|---|---|---|
| 1 | Control panel is clean & all buttons/switches are clearly visible (no paint over spray, etc.) | | |
| 2 | All switch & mechanical guards are in good condition and properly installed | | |
| 3 | All Safety Indicator lights work | | |
| 4 | Drive controls function properly & accurately labelled (up, down, right, left, forward, back) | | |
| 5 | Motion alarms are functional | | |
| 6 | Safety decals are in place and readable | | |
| 7 | Any defects such as cracked welds, fuel leaks, hydraulic leaks, damaged control cables or wire harness, etc. | | |
| 8 | Braking devices are operating properly | | |
| 9 | Winches, pulleys and wire ropes are in good working condition. | | |
| 10 | Function of interlocks and limit switch | | |
| 11 | The manufacturer's operations manual (in all languages of the operators) | | |
| 12 | Oil level, Hydraulic Oil Level, Fuel Level, Coolant Level | | |
| 13 | Battery Charge | | |
| 14 | Outriggers in place or functioning. Associated alarms working | | |
| 15 | Moving & rotating parts guarded | | |


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| | | | |
|---|---|---|---|
| 16 | Load chart provided | | |
| 17 | Fire Extinguisher | | |
| 18 | Spark Arrestor, if operated by using fuel( For Running Refinery/ Petrochemical/Chemical Plant) | | |
| 19 | Serial number plate | | |
| 20 | SLI | | |
| 21 | TPI Certificate | | |
| 22 | Colour Coding | | |
| 23 | Insurance | | |
| 24 | Pre Medical Check-up& Periodic Medical check-up (every 6 months) including vision test for Operator | | |
| 25 | Safety Induction for Operator | | |
| 26 | Others | | |

**Signature & Name of Operator:**

**Signature & Name of Contractor's Concern Engineer**

**Signature & Name of Contractor's Safety Officer**



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**FORMAT NO. : HSE-24 REV 0**

**Boom Lift Inspection Checklist**

**Name of Contractor:** **Project:**

**Name of Work:** **Job No:**

**Vehicle Identification/Registration No:** **Date:**

| Sr. No. | Description | Observation | Remarks & Suggestions |
|---|---|---|---|
| 1 | Operating and emergency controls are in proper working condition, EMO button or Emergency Stop Device | | |
| 2 | Functional upper drive control interlock (i.e. foot pedal, spring lock, or two hand controls) | | |
| 3 | Emergency Lowering function operates properly | | |
| 4 | Lower operating controls successfully override the upper controls | | |
| 5 | Both upper and lower controls are adequately protected from inadvertent operation. | | |
| 6 | Control panel is clean & all buttons/switches are clearly visible (no paint over spray, etc.) | | |
| 7 | All switch & mechanical guards are in good condition and properly installed | | |
| 8 | All Safety Indicator lights work | | |
| 9 | Drive controls function properly & accurately labelled (up, down, right, left, forward, back) | | |
| 10 | Motion alarms are functional | | |
| 11 | Safety decals are in place and readable | | |
| 12 | Guardrails and anchor points are in place, and in good condition | | |
| 13 | Work platform & extension slides are clean, dry, & clear of debris | | |
| 14 | Work platform extension slides in and out freely with safety locking pins in place to lock setting on models with extension platforms. | | |
| 15 | Any defects such as cracked welds, fuel leaks, hydraulic leaks, damaged control cables or wire harness, etc. | | |
| 16 | Braking devices are operating properly | | |
| 17 | The manufacturer's operations manual is stored on AWP (in all languages of the operators) | | |
| 18 | Oil level, Hydraulic Oil Level, Fuel Level, Coolant Level | | |



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| | | | |
|---|---|---|---|
| 19 | Battery Charge | | |
| 20 | Outriggers in place or functioning. Associated alarms working | | |
| 21 | Tyres and wheels are in good condition, with adequate air pressure if pneumatic | | |
| 22 | Wheel chokes are present and are used whenever required | | |
| 23 | Moving & rotating parts guarded | | |
| 24 | Load chart provided | | |
| 25 | Fire Extinguisher | | |
| 26 | Spark Arrestor, if operated by using fuel( For Running Refinery/ Petrochemical/Chemical Plant) | | |
| 27 | Serial number plate with Load capacity | | |
| 28 | TPI Certificate | | |
| 29 | Colour Coding | | |
| 30 | Insurance | | |
| 31 | Pre Medical Check-up& Periodic Medical check-up (every 6 months) including vision test for Operator | | |
| 32 | Safety Induction for Operator | | |
| 33 | Others | | |

**Signature & Name of Operator:**

**Signature & Name of Contractor's Concern Engineer**

**Signature & Name of Contractor's Safety Officer**



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| Index<br>(Client HSE Specifitions) | | |
|---|---|---|
| **Sl.No** | **Description** | **Total Pages** |
| 1 | EO 21-CAPEX(A)/TNT/23-24/EO dt 9/5/2024 | 2 |
| 2 | Format for seeking clearance for forigners vising MIL group of ordnance factory | 1 |
| 3 | Details of vechile entring at HEF | 1 |
| 4 | Standard work permit | 4 |
| 5 | Permission for ignition/use of fire/flame inside the factory | 1 |
| 6 | Standing instructions for electrical safety in ordnance factory | 188 |
| 7 | High Explosive factory safety manual 2019(Part I,II and III) | 141 |
| 8 | Standing Instruction | 1 |

**SECURITY ESTABLISHMENT: HEF**

**(NO 6111/SE/MISC/HEF DT 09/05/2024)**

**SUB:- TURNKEY EXECUTION OF TNT PLANT AT HEF ON OBE BASIS**

**Ref :- EO Office letter No 21-CAPEX(A)/TNT/23-24/EO dt 09/05/2024.**

1. With reference to the above subject, the comments sought for SL. No 38 (c) and Sl No- 74 are as below.:

2. **Point No - 38 (c)** :-

(a) Though the detail of equipment that will be utilized is not available with this section, it is recommended that any equipment with GPS tracking / requiring internet connectivity may not be permitted for eg Quadcopter (drone), Smart Phones and Laptops etc.

(b) Further, our letter No 6111/SE/MISC/HEF dt 29/04/2024 may also be referred to in this regard.

3. **Point No - 74** :-

(a) Latest format of seeking permission for visit of Foreign National has been forwarded vide MIL letter MILCO/CSO/Gen/2024 dt 07/05/2024 (copy attached).

(b) Permission of MIL & copies of documents as mentioned below be provided to this office min 48hrs in advance:-

(i) Copy of Passport incl validity
(ii) Details of visa
(iii) Address of stay in India
(iv) Details of accompanying staff (Indian)
(v) Date & duration of visit to the fy with specific purpose
(vi) Permission of CGM HEF

4. For info and necessary action please.

**Security Officer** **OIC/SE**

**To** :-

**WM/EO**

50

Appendix

## FORMAT FOR SEEKING CLEARANCE FOR FOREGINERS VISITING MIL GROUP OF ORDNANCE FACTORY

| S.No | Details | |
|---|---|---|
| 1. | Full name and Sex of Visitor | |
| 2. | Nationality of Visitor | |
| 3. | Date of Birth | |
| 4. | Parentage of Visitor | |
| 5. | Permanent and Present Address of Visitor | |
| 6. | Passport No and Date & Place of Issue | |
| 7. | Validity of Passport | |
| 8. | Occupation & Name of Firm/Organisation which the Visitor is representing | |
| 9. | Specific Purpose of Visit | |
| 10. | If Visitor has Visited the Establishment earlier, full details of same to be furnished | |
| 11. | Details of Escort being provided for conducting the visit of the Visitor- | |
| 12. | Address of Hotel/Accomodation where the Visitor is staying in India during the Visit | |
| 13. | Address of Indian Company with which the Visitor is having Partnership/Alliance. | |
| 14. | Date & Time of Visit | |
| 15. | Area to be Visited. | |
| 16. | Certificate that No Classified Document will be Shared with the Visitor. | |

Recommended for Security Clearance
Chief General Manager :
Name of Ordnance Factory:

## SECURITY ESTABLISHMENT: HEF

## (NO 6111/SE/MISC/HEF DT 29/04/2024)

**SUB:- TURNKEY EXECUTION OF TNT PLANT AT HEF ON OBE BASIS**

1. Ref your letter No 8355/21-CAPEX(A)/TNT/23-24/EO dt 25/04/2024.

2. The following is recommended to be included :-

   (a) Mobile phones with cameras will not be permitted inside the company.

   (b) Details of vehicles (Trucks) including Register No & driver details etc and material being dumped to be provided in 48 Hrs in advance.

   (c) Details of Aadhaar & PVR be provided to SE office in hard & soft copy both.

   (d) One PC with printer be provided by contractor for preparing passes of the persons hired employed by the contractor, at the Main Gate.

3. Further, it is strongly recommended a separate Entry / Exit point (incl a separate gate) be made available for the employees of the firm. Suggested location for the same will be intimated on approval of competent authority.

29/04/24
Security Officer

29.4
OIC/SE

To :-

DO/EO

Copy to :-

DETAILS OF VEHICLES ENTERING AT HEF

DATE:-.....

| Sl NO. | Vehicle Reg. No. with Validity | Permit with validity | Driver Name | Licence No with Validity & Issuing Authority | Driver PVR | REMAR |
|---|---|---|---|---|---|---|
| | | | | | | |

Stamp/Seal of Comp.

Contractorn Name & Sign.

Note:- All above documents to be produce at the HEF gate for Security purpose.

WM/ED

# Standard Work Permit Format

Part - I

(Before Commencement of the Work)

**Ordinance Factory/Unit Name : HIGH EXPLOSIVES FACTORY**

**Work Permit No.: .....** **Date & Time of Issue: .....**

**Permit Duration : from .....** **to .....**

1. Detail of the Work: .....
2. Exact Location of Work Site: .....
3. Name of Contractor / Firm: .....
4. Name & Designation and Signature of Site In Charge:
   .....
5. Name, Designation & Signature of Work Site Nominated Person:
   .....
6. Name & Signature of Contractor's Supervisor / Supervisors
   .....
7. Assessment of general requirements before issue of Permit

| SI. NO | Required | Condition | Remark of safety officer where not Specified |
|---|---|---|---|
| 1 | Electrical Shut down | YES/NO | Name Designation and signature of Concerned EM Staff |
| 2 | Ladder | YES/NO | |
| 3 | Full Body Harness Double lanyard ad per IS 1531 | YES/NO | |
| 4 | Safety helmet as per IS 2925 | YES/NO | |
| 5 | Hand Gloves | YES/NO | |
| 6 | Safety shoes | YES/NO | |
| 7 | Safety net as per IS 11057 | YES/NO | |
| 8 | Safe walk/Crawling ladder | YES/NO | |
| 9 | Oxygen cylinder and other emergency arrangements | YES/NO | Please Specify |
| 10 | Safe Working Instructions are Known to Contractor's Supervisor | YES/NO | |
| 11 | Medical certificate of Worker | YES/NO | |
| 12 | Others | YES/NO | |

8 Workers Authorized to Work Requiring Permit:

| SI NO | Name of Workers | Age in completed years | Medical Certificate Date | Signature |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

This work permit will be considered valid only if the associated part II and III are adhered to

| Permit Raised By | Site clearance Given By HOS/Concerned Section | Permit Issued By Safety Officer | Permit Received By Contractor |
|---|---|---|---|
| (Name & Designation) | (Name & Designation) | (Name & Designation) | (Name & Designation) |

Part - II

(Report on daily basis before start of work during the Permit Period)

Work Permit No. :……..…. Permit Issue Date: ……..

Date of Work. :……

A. Daily Safety / Safe Practice Checklist:

| SI No. | Items | Yes /No | Remarks of site in charge if any |
|---|---|---|---|
| 1 | Site is cleared for working with compliance off all safety instructions. If roof working is involved then there is no rain, thundershowers or excessive heat. | | |
| 2 | Electrical shut down required | | |
| 3 | Ladder is sound and being used safely (single ladder up to 30 feet) | | |
| 4 | Body harness double lanyard is being and tied properly | | |
| 5 | Safety Helmet is being used | | |
| 6 | Hand gloves are being used | | |
| 7 | Safety belt is being used | | |
| 8 | Safety net is being used and fixed properly | | |
| 9 | Safe walk ladder is placed and fixed properly | | |
| 10 | Contractor's supervisor is available and well aware about the safety instructions (OFB instructions for working at height ) | | |
| 11 | Safe working instructions are given to the workmen in the local language by Contractor's supervisor before commencement of work | | |

B. Workers actually engaged from the list authorized in part -1:

| SI No. | Name of workers | Age in Completed years | Medical Certificate Date | Insurance Certificate No. | Signature |
|---|---|---|---|---|---|
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |

It is hereby ensured that the contract men are wearing safety gadgets and following safety norms.

Contractor Supervisor (Name & Seal)

Section Nominated staff (Name & Designation)

Site in Charge (Name & Designation)

Part-III

( Monitoring of work during permit duration)

Work Permit No: .....

Permit Issue Date: .....

Surprise Visit Details

| SI. NO. | Visit Date & Time | Visit Conducted By (SO/CSO) | Action taken details ( in case deviation if any) |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| | | | |

Work Permit Closure Date & Time: .....

Safety Officer
(Name & Designation)

Chief Safety Officer
( Name & Designation)

**ANNEXURE - I**

***SAFETY SECTION***
*NO.5/SF/ESO/HEF/2013*
*DATE:-*

***SUB:- TEMPORARY ELECTRICAL CONNECTION PERMISSION FOR***

*Ref:- Your letter No/HEF -18 No.*
*Location :-*

*Period :-*

*Nature of work:-*

*Name of contractor/Action by (section name) :-*

*The following conditions / guidelines to be followed while giving the temporary Electrical connection .*

1. *Connection must be given as per IE RULES / SI for Electrical Safety of OFB Directives*
2. *Four-core Armored stranded conductor cable of suitable size/capacity must be connected. One end of armoured of cable must be connected to earthing of, switch / MCB/MCCB & other end of same armoured connected to welding machine/portable pump motor, metal cutter ---etc.*
3. *Double earthing of suitable size/capacity of earth wire must be connected/ provided to Welding Machine/ Portable pump motor/ Cutter/Rock drill machine/concrete breaker, metal cutter --- etc.*
4. *Temp. Electrical connection supply must be disconnect at the end of days work / exhaust of work.*
5. *Supply cable & welding machine/ portable pump motor/cutter/Rock Drill machine/ concrete breaker/ Dewatering Pump , must be protected from Vehicle / Tress passers / Rain water. Welding/ Concrete breaker ---etc (out door ) work should be stopped during rain water/ thunderstorm / lightning .*
6. *Separate switch/MCCB/MCB of suitable size / capacity with double earthing of suitable size/capacity should be connected for electrical supply/connection.*
7. *Welding machine/ portable pump motor/cutter/Drill machine/ Dewatering Pump ,---etc. kept away from the process building / Acid tanks/ Acid pipe line, Steam line, water pipe line.*
8. *Separate MCCB/MCB of suitable size / capacity with double earthing of suitable size / capacity should be connected for the welding machine/ portable pump motor/cutter/Rock Drill machine/ concrete breaker, Dewatering Pump , metal cutter ---etc.*
9. *The flexible cables of suitable size/ capacity used with the portable appliances should have thick insulation /heavily insulated and adequately protected from mechanical injury. The cable must have an additional core of earth connection (Double earthing required).*
10. *Water and foam type fire extinguishers should not be used for electrical fire.*
11. *Dry sand , Dry powder , $CO_2$ (gas) fire extinguisher should be used for electrical fire.*
12. *Work/Job to be supervised/n the presence of the staff of ME/EM/EO/CW/FB & Concern section's staff & fire brigade men to be present at the time of work/works spot along with fire fighting extinguishers / arrangements.*
13. *Work/Job to be done by the consents of JWM/HOS of ME/EM/EO/CW/FB & Concern section's JWM / HOS.*
14. *Permission is valid from 8.00 A.M. TO 4.30 P.M. Except Sunday & holidays.*
15. *Personal protective equipments like, insulated safety shoes, hand gloves, ladder safety goggles Safety Glasses, helmet, Safety belt face shield , welding helmet , nose ( gas) masks , apron etc. to be used by the personals.*
16. *Electrical Switch/ the insulation of wire / cable/ earthing wire, to be checked at every time while changing the position/Area of the, welding/ grinding/Drilling/Concrete breaking. etc*
17. *Only one work like ,welding/grinding/drilling or concrete breaking & etc. may be done on same spot at a time.*
18. *All portable appliances ( Drill Machine...etc.) should be connected through a plug socket of appropriate capacity with an earth connection & controlled by appropriate capacity of switch/ M.C.B..*

***ESO / SAFETY***

## *PERMISSION FOR IGNITION / USE OF FIRE / FLAME INSIDE THE FACTORY.*

| | | | | |
|---|---|---|---|---|
| 1 | *Name of the firm / Contractor* | | | |
| 2 | *Supply Order No. / CPO No.* | | | |
| 3 | *Section / Bldg. No. / location where use of Fire / flame* | | | |
| 4 | *Period/Time for use of Fire/ Flame* | | *From* | *To* |
| | | *Date* | | |
| | | *Time* | | |
| 5 | *Whether Permission required including Sunday / Holiday* | | | |
| 6 | *Reason for use of fire / Flame* | | | |

*Permitted / Not permitted*

**AGM / E** **GPO / Dy. GPO** **DVO / HOS /**

*To*

*Section Safety*
*Fire Brigade* } *For necessary action*

*Remarks of Safety Staff :*

***CHIEF SAFETY OFFICER*** ***HOS / SF***

*To*

*M/s*

*Copy to :*

**DVO / FB , CO , EO** :- *For information and necessary co- ordination.*

MASTER COPY

# STANDING INSTRUCTIONS

# FOR

# ELECTRICAL SAFETY

# IN

# ORDNANCE FACTORIES

*2019*

# FOREWORD

As per CEA Regulations, all electrical installations shall be designed, erected, installed, operated and maintained in such a way as to prevent danger to human being, animal and property. The Central Electricity Authority, as mandated by the Electricity Act' 2003, has framed different regulations in the field of generation, transmission, distribution and use of electricity. These are further supplemented by other governmental rules and departmental safety instructions of OFB issued from time to time.

2. The departmental instructions on Electrical Safety issued in 1978 were superseded in 1985 and subsequently amended in 1993 and lastly in 2000. These earlier instructions were mainly based on The IE Rules' 1956 and The Electricity (Supply) Act' 1948. Since then several instructions were issued by Ordnance Factory Board regarding various aspects of Electrical Safety. Large scale increase in generation, transmission and use of electricity necessitated major changes in the Electricity Act and hence the Indian Electricity Act' 2003 was promulgated. Section 177 of this Act authorised the Central Electricity Authority to make regulations consistent with this Act to carry out the provisions of the Act. This Standing Instruction is mainly based on the CEA regulations-2010 (amended in 2015 & 2018). The comparative chart of the IE Rules' 1956 and the CEA Regulations-2010 is available at the end of this compilation.

3. The enclosed Standing Instructions supersede the old Standing Instructions-2000. Provision of Chartered Electrical Safety Officer, certain changes in experience, qualification and nomination criteria of ESO and HOS/EM have been incorporated. Reference numbers of the CEA Regulations and OFB letters have been given wherever found feasible. Terms low, medium, high and extra high voltage have been replaced with 250V, 650V, 11kV & 33 kV voltage and above.

4. With the increase in use of electrical equipments and gadgets in our daily life, both professional and personal, the importance of the knowledge of safety precautions and DOs and DON'Ts during use of electricity has increased many folds. The impression created in the minds of persons working in the factories that electrical safety is the responsibility of electrical section alone, which is not correct. Investigations into electrical accidents have revealed that accidents occur by wrong handling of equipments, improper up-keep of shop floor particularly the cable trenches and control rooms / panels. It is the responsibility of the user sections to ensure that all equipments in the area are maintained / worked properly and that cable trenches and shop floor electrical control kiosks are kept clean and not misused.

5. It is needless to emphasize the role of RCS, REI and ESO to assist the Sr. GMs / GMs in operating and maintaining the electrical installations in the factory in a safe manner. The inspecting officers shall check the system thoroughly and critically and bring out the non-conformities / defects to the notice of the factory. The factory shall take the observations seriously and all efforts should be made to rectify the defects pointed out by them on priority basis.

6. Periodical inspection and maintenance should be given due importance. Shut downs necessary for carrying out inspection / testing / maintenance should not generally be refused or postponed.

7. All officers and staff with electrical background must go through these instructions and those who are responsible for electrical maintenance must become thorough with these instructions and implement the same. Effective measures should also be taken by Sr. GMs / GMs to curb any tendency on the part of their staff / workers to disregard / neglect compliance with this Standing Instructions.

V. S. Verma
Member / M&C, TS & Engg.

Ordnance Factory Board,
10-A, S. K. Bose Marg, Kolkata – 700 001
Date: 23.05.2019

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**( STANDING INSTRUCTIONS TO BE REVIEWED EVERY 5 YEARS)**

# CHAPTER-I

## General Instructions

1.1 All electrical installations shall be constructed, installed, protected, worked and maintained in such a manner as to ensure safety of human beings, animals and property.{the CEA Reg. 12(1)}

1.2 All installations, lines and apparatus shall be of sufficient rating for power, insulation and estimated fault current and of sufficient mechanical strength for the duty cycle which they may be required to perform.

1.3 Save as otherwise provided in the CEA Regulations (CEA Regulations-2010 & its amendments), the relevant code of practice of BIS or National Electricity Code (NEC), if any,are to be followed. In the event of any inconsistency, the provisions of the CEA Regulations shall prevail.

1.4 Certain safety measures have been prescribed by *Storage & Transportation of Explosive committee* (STEC- latest issue in 2017) for electrical installations connected with explosive handling process and specific type of installations, these should be followed.

1.5 Where some equipmentsare to be installed in any basement, it shall be ensured that the design of the basement should be such that there is no seepage or leakage or logging of water in the basement. [CEA Reg. 12(4)]

1.6 These standing instructions shall be read by all the Staff of electrical section and electrical staff attached to production and maintenance sections (at least once in a year and at the time of induction of a staff) who should sign after each reading. A register shall be maintained by the HOS of the Ordnance Factory /Unit for the purpose.

1.7 Ignorance of the contents of the Standing Instructions will not be accepted as an excuse and any person violating the provisions of the Standing Instructions will render himself liable for disciplinary action (under wilful negligence of duties).

1.8 Relevant extracts of Para No. 6.21.1, 6.21.2, 6.21.3, 6.21.4, 6.21.9& 6.21.10 from the S.I. should also be given wide publicity in Factory and Estate through periodical circulars minimum once in a year to ensure

Safety of all Electrical Installations & personnel in factory and factory estate (if any).

1.9 Relevant parts of these instructions should also be explained and read once in three months to industrial employees of the electrical section by respective Electrical Maintenance Group In-charge and they shall render a certificate in this regard to the D.O. of the Electrical section through Head of Section.

1.10 It should be ensured that all future planning for new erections, extensions and projects comply with the CEA Regulations and other Govt. rules/regulations / codes of practice and DGOF Standing Instructions.

1.11 In case of ambiguity, recommendations/approval of REI shall be sought.

1.12 Electrical installations in factories and estate area (if any) will be inspected periodicallyfrom Electrical Safety point of view by the following:-

a) Electrical Safety Staff, ESO (Monthly)

b) Regional Electrical Inspector, REI (half yearly)

Besides that, RCS of the region & COS of OFB headquarters may also visit the factories from time to time.

1.13 Each of the visits mentioned above will generate a report bringing to the notice of the General Manager the various unsafe electrical features and their locations as noticed by them during the visit.

1.14 It is the responsibility of the General Manager to take steps to rectify these unsafe features on priority basis in the shortest time and within the period given for rectification in the inspection report and forward a rectification report to the Inspecting Officer with copy to RCS & COS/OFB.

1.15 The unsafe features can be of two kinds:-

A. Those which can be rectified easily within the resources of the factory (like temporary wiring, loose wiring, live parts exposed etc.).

B. Defects for which certain procurement action and long term planning is involved.

1.16 (a) Defects of category ‘A’ above:–

These defects should be rectified immediately. If defects of the same type are existing elsewhere in the factory & estate, those should also be rectified. Suitable steps / directives should be given to prevent recurrence of such defect in future.

(b) Defect of category ‘B’ above.

PDCs for all the defects noticed will be given by REI.

(c) In case factory is not able to rectify any defect within PDC, action plan should be clearly defined and progress in each month to be intimated to REI and COS through format 1A (summarised Position), Format 1B (Completion Report for the month of …….) and Format 1C (List of pending observations / Objections).

(As per OFB letter No. 411/CEI//COS, Dated: 20/08/2014 – Different annexures, Formats and forms applicable are given in the last.)

(d) Meanwhile steps must be taken to guard the personnel & installation against the unsafe features in consultation with Regional Electrical Inspection, RCS & COS.

(e) The details of defects, their location and date of rectification should be recorded. A monthly review should be carried out by the General Manager / AGM (Electrical Maintenance) to monitor the progress.

(f) Rectification done by the factory of each & every defect and with its location should be recorded & reported to the REI and COS / OFB through their monthly reports.

1.17 In case of defects of serious nature e.g. non-operation or non-functioning of protective devices / Tripping batteries, live parts exposed etc. not rectified within the specific time intimated to them, the REI, Officers of COS / RCS may order immediate disconnection of the portions of the installations till rectifications are completed.

1.18 General Manager should initiate action against persons indulging in unsafe practices.

1.19 ESO should ensure observance of Safety provisions laid down under the Electricity Act, 2003 and the CEA Regulations made there under and shall periodically inspect electrical installations and keep a record thereof which shall be made available to the REI, Officers of COS / RCS during their visit.

# CHAPTER-II

## Responsibilities

**2.1 General Manager:-**

It is the statutory responsibility of the General Manager of the Factory as the administrative head to ensure the statutory compliance of the Electricity Act and the CEA Regulations in regard to Electrical installations under his jurisdiction. It shall be ensured that the installations are installed, operated and maintained in such a way as to ensure safety of human beings, animals and property.

**2.2 Divisional Officer of Electrical Section:-**

(i) As an execution officer he/she is responsible to the General Manager to see that Rules/Regulations/departmental instructions pertaining to safety and other statutory compliances are followed and complied with.

(ii) In a factory having more than one Electrical JWM or electrical group functioning independent of each other, it is the responsibility of Divisional / Group Officer controlling all these groups to effect co-ordination between the different groups to ensure that there are no loop holes in implementation of the instructions in regard to electrical safety and the instructions contained in this S.I. are complied.

**2.3 HOS Electrical Section:-**

(i) An officer from Electrical stream and with reasonable experience in operation and maintenance of electric plants shall be made HOS of the Electrical Section.

(ii) Ensure compliance of the instructions contained in this S.I. by all persons under his control and working under him and bring to the notice of production / maintenance / other section any lapses (in the compliance of this SI) on their part.

(iii) The electrical installations in the factory and estate are installed, maintained and repaired in such a way as to be free from danger. Any unsafe act detected or noticed by him should be brought to the notice of the head of the section / occupant through the officer of the concerned department for rectification.

(iv) Hewill be answerable to the Divisional Officer and the General Manager of the factory for any lapse in the compliance of any of

the provisions of the S.I. or Rules of Central / State Government or the CEA regulations etc.

(v) To report Electrical accidents to the Regional Electrical Inspector and COS/OFB, in terms of CEA Regulations.

(vi) He will ensure that every person working on an electric supply line or apparatus or both shall be provided with tools and devices such as gloves, rubber shoes, safety belts, ladder, earthing device, helmets, line tester, test lamps and the like for protecting him from mechanical or electrical injury. Such tools and devices shall always be maintained in sound and efficient working condition.

(vii) He will submit progress of compliance of electrical safety observations raised by the Electrical Safety Officer (ESO) to concerned RCS forwarding a copy to ESO in **Proforma 20B.**

## 2.4 Electrical Safety Officer (ESO):-

General Manager of the factory will nominate an Electrical Safety Officer for ensuring observance for ensuring safety measures with respect to use of electricity, under intimation to RCS & COS/OFB.The ESO shall be an Electrical Engineer degree holder with at least 5 years of experience in operation and maintenance of electrical installations or an Electric Engineering Diploma holder with at least 10 years of experience in operation and maintenance of Electric installations. [CEA Reg. 5(2) with Amendment in 2018].

The ESO shall:-

(i) function independent of Electrical Maintenance Section.

(ii) Inspect the installations from time to time and point out unsafe features noticed, to the General Manager and watch the rectification.

(iii) Submit a monthly inspection report of the factory and estate in **Proforma 20A**to the Sr. General Manager/General Manager and shall forward a copy of this report to the concerned RCS.

(iv) Assist Regional Electrical Inspector, RCS & COS/OFB during their inspection visits.

(v) Visit the accident spot immediately (after an electrical accident and advice the GM regarding the evidences to be preserved / photographed).

(vi) ESO will function under the technical guidance of the REI and may seek clarification on any point from him.

(vii) ESO will inspect that all tools and devices used by persons such as gloves, rubber shoes, safety belts, ladders, earthing devices, helmet, line testers, test lamps and the like for protecting persons are in sound and efficient working condition, once in three months and send a report to REI.

(viii) All rectifications carried out by the factory of deviations pointed out by REI / RCS / COS are to be checked by ESO and countersigned for the correctness.

(ix) Changes in nomination of ESO will be intimated to RCS & COS / OFB.

**** Sr. General Manager / General Manager / HOD may get assistance of any Chartered Electrical Inspector if found extremely necessary for any specific electrical installation testing job.***

(the CEA Reg. 5A, 30 & 43)

**2.5 Electrical Section:-**

2.5.1 Electrical Section shall at all times be solely responsible for the maintenance and upkeep (at the required level) of all the electrical installations in the factory and estate in such a condition as to be free from danger.

2.5.2 Proper and safe operation of power supply equipment and installation in the factory and estate.

2.5.3 The Staff and IEs executing any electrical work would ensure that the work is done in the manner prescribed in the S.I.

2.5.4 They should bring to the notice of the JWM In-charge, Electrical Section & in his absence Divisional Officer / Electrical or any person acting on his behalf any unsafe features likely to expose persons to the risk of electrical shock, mechanical injury or fire, noticed by him and it is the responsibility of the officer or JWM to whom the matter is reported to take steps to eliminate the danger involved in it.

**2.6 Maintenance Sections:-**

The In-charge of the Maintenance Section should ensure that,

2.6.1 No connection for their electrical appliances is taken from other than from a plug socket outlet or standard accessory outlet.

2.6.2 Tampering or making any alteration or adjustment of setting or replacement of fuses of any electrical apparatus or machinery or wiring installation is not carried out by persons working under him. All such

connections, reconnections, additions or alterations etc. shall be done by Electrical Staff and workmen deputed by them.

2.6.3 Portable appliances are to be connected only with proper plug tops to plug sockets.

2.6.4 Apparatus are never connected by inserting wires into the plug sockets.

2.6.5 The flexible cable is provided with an earth wire and is connected to earth point in the plug at one end and the body of the portable appliances at the other end.

2.6.6 All portable appliances and Inspection Lamps under their custody are in sound working order. They should be got checked by the Electrical Section periodically and records maintained for them having been inspected and found satisfactory. No unauthorised / improvised portable apparatus should be permitted to be utilised in their section.

2.6.7 Malfunctioning of the plug point or any abnormal features (like sparking, heating up of plug point or wire, apparatus) are reported to electrical section and the apparatus is not used till the fault is cleared by them.

2.6.8 The cable trenches are kept clean, covered and free from oil / water or shop sweepings.

2.6.9 They are not used for laying or running pipes or process lines or for any other purposes.

2.6.10 Electrical Section should be consulted before any excavation is done for water / sewage line in the area where cables are passing or suspected to be passing and their written clearance obtained before starting the work.

2.6.11 New works pertaining to water and sewage line should not be planned close to electric cable. Where such passing or crossing is unavoidable, the power lines should be protected by cast iron or Hume pipes. Electrical section should always be involved in such planning.

2.6.12 Water / air / steam lines should not be erected over / close to an electrical installation. Electrical section should be consulted before laying these lines so that leakage of water / steam does not affect the electrical installation or its accessories.

2.6.13 It should be ensured that water leaking through roofs of the buildings or leakage from any pipe like (steam / water / process line) does not fall on the electrical installation. They should also ensure that pipelines do not cause any obstruction to the operation & maintenance of any part of the electrical installation.

2.6.14 The space in front and rear of electrical controls are kept clear upto 1 meter distance and be easily approachable. No heater or sundry stores should be kept in these areas.

2.6.15 Space near power panels should not be used as a rest shed, store room or site workshop / shift office.

2.6.16 Enclosures to control panel are kept closed properly with screws intact.

2.6.17 Metallic scrap is not allowed to go into the power / control panel or fall on or near it.

2.6.18 It should be ensured that extensions / new constructions (buildings / roads) do not come over earth pits or over a cable route.

2.6.19 Apparatus / machinery and its controls are used in the manner prescribed by the machinery manufacturer.

2.6.20 He should obtain written clearance of Electrical Section in the following cases:-

(i) Whenever work has to be done on an EOT Crane or any other crane where live wires are within accessible distance and the person is required to go up to attend to it.

(ii) Work has to be done on the roof top of a bldg. or walls (inside or outside) with O.H. lines going over or passing close to the building.

(iii) Work has to be done on a structure (metallic)close to O.H. line.

(iv) Work on any machinery with bare live wires within accessible distance.

**2.7 User Sections and Users in Residential Areas:-**

2.7.1 Instructions listed under paragraphs 2.5 and 2.6 shall also apply to the extent relevant.

2.7.2 Switching Stations, power control panels, control rooms of plants, sub-distribution panels etc. should have a clear passage free from obstacles for ready approach, easy operation in the event of any emergency. Articles should not be dumped on its passage.

2.7.3 A space of 1 meter all around powder control panel, sub-power panel and control panels should be kept free from encroachment and nothing should be kept inside the area. This space should not be utilised as storeroom, site workshop, shift room, resting place or for any other purpose.

## 2.8 Cables and cable trenches:-

2.8.1 Cable trenches inside the production buildings should be kept free from cotton waste, oil, water any other articles (production material and scrap, shop sweeping etc.). The trenches should be kept closed and no gaps should be allowed to exist in the trench covering.

2.8.2 No rainwater should be allowed to collect in the cable trench. The source of flow of rainwater into the cable trench should be located and rectified. Any water accumulated in the trench should be pumped out.

2.8.2 Pipelines (water, steam, air etc.) should not run along with cables in cable trenches.

2.8.4 No digging in places where cables have been laid should be commenced without intimating electrical section and obtaining their clearance in writing.

2.8.5 Digging should be stopped at the stage where cables are seen and should be commenced only after the electrical section representative visits the spot and gives the clearance to go ahead or stands there to supervise the work.

2.8.6 While planning new construction, suitable clauses should be incorporated in the siting board stage itself to ensure that (1) cables do not come under a bldg. and (2) cables crossing proposed roads / drains are adequately protected from mechanical damage or suitably diverted.

## 2.9 O. H. lines:-

2.9.1 As far as possible no buildings or sheds should be planned or constructed below an O. H. line. If the construction is unavoidable, following precaution should be taken. The portion of O.H. line crossing the building should be changed over to insulated wire or A clearance as per the para 6.2 shall be maintained over the top most part of the building and close cradle guarding should be provided below the line.

2.9.2 Laying of pipelines / structures in the vicinity of O. H. lines should be avoided. If laying is inescapable A clearance as per the para 6.2 shall be maintained over the top most part of the building and close cradle guarding should be provided below the line. Alternatively the portion of the line should be replaced with insulated wire or cable.

2.9.3 Work on a building or pipe lines or structures with overhead lines running above or nearby within the minimum vertical and horizontal clearance distances given at para 6.2 is permitted for lines of voltages up

to 650 V only. No work within the minimum vertical and horizontal clearance distances of live lines of voltage more than 650 V is permitted.

2.9.4 Planting of trees below the overhead lines should not be permitted.

2.9.5 The space around the terminal poles of overhead lines and shackle points should be kept clear of wild growth below.

2.9.6 Cables should not be allowed to run on floor without proper metallic protection.

2.9.7 Flexible cable connections to portable appliances should be free from joints and should not be in contact with swarf and sharp metallic objects.

2.9.8 Any abnormal behaviour like sparking seen on O. H. conductor should be reported to the electrical section immediately by anyone who sees it.

2.9.9 A snapped O. H. conductor or an O. H. conductor hanging loose, should be reported to the electrical section and security section immediately. A Durwan should be posted to warn any person going near the fallen line till the electrical section takes over the situation.

## 2.10 Works on or near Electrical Installation:-

2.10.1 Work on any live electrical installation should be carried out only with the prior permission and clearance of electrical maintenance section under their supervision and safety guidance.

2.10.2 Dismantling / shifting of any electrically operated apparatus should be done with prior intimation to electrical section and with their clearance. The objective is to ensure that cabling / wiring are protected and the lines are isolated.

2.10.3 Fuses / setting of relays etc. should not be tampered. Any alteration in the size of fuse, setting of relays of electrical apparatus should be done only by the authorised electrical persons.

2.10.4 No tampering of wiring is permitted.

2.10.5 Alteration, modification, temporary / permanent extension should be done only by authorised electrical persons.

2.10.6 Work on or near live bus-bars / O. H. line or exposed live parts (gantry, bus-bar for shop lighting or machinery, bare wire O. H. lines running on or near walls) should not be commenced without obtaining permit and clearance from electrical maintenance section.

2.10.7 Enclosures of the control panel should be kept closed properly and with all screws in-tact. Metallic swarf should not be allowed to get into or fall on or near it. A space of minimum 1 m all around should be kept free from swarf and metallic objects.

2.10.8 They should ensure that all portable appliances (with metallic body) used by them have a third wire connection to earth.

2.10.9 Earth pits should be kept clear, maintained and accessible.

2.10.10 Plantation of trees should not be done below O. H. lines.

2.10.11 Any abnormal behaviour (smoke, sparking, abnormally hot etc.) in switchgears should be reported to the electrical section immediately. No one other than authorised electrical persons should be allowed to go near it.

2.10.12 Any serious violation of this S. I. likely to endanger personnel or machinery should be reported to the officer controlling the section for rectification within a specified time (reasonable). In the event of non-rectification within the specified time the area / machinery involved in the violation of S.I. be disconnected. It will not be reconnected till the violation is removed.

**2.11 It is the responsibility of the user section / user to ensure the safety of personnel / machinery under his control.**

2.11.1 The instruction contained in para 2.6 and 2.7 will apply to the extent relevant.

2.11.2 Any abnormal feature / features such as heating up of an electrical accessory, sparking, electric shock or being O. H. lines loose / dangling / ruptured should be reported to the electrical section for rectification.

2.11.3 In the case hanging, loose or dangling conductors of an O. H. line system seen during non-working hours, the matter should be reported to the I/C electrical shift and I/C main gate who will contact the Electrical Officer / JWM / incharge of concerned EM Group and arrange to cordon off the place of fault if advised by them to do so.

2.11.4 The Electrical Officer / JWM / incharge of concerned EM Group shall, on receipt of such a message, take immediate steps to isolate power supply if considered necessary.

# CHAPTER – III

# AUTHORISATION

3.1 The CEA Regulation 2010 prescribe that a supplier or consumer to carry out duties accidental to the generation, transformation, transmission, conversion, distribution or use of electricity shall designate persons for the purpose to operate and carry out the work on electrical lines and apparatus. {the CEA Reg. 2010 3(1)}

3.2 HOS/EM shall maintain a register wherein the names of the designated persons and the purpose for which they are engaged, shall be entered. {the CEA Reg. 2010, 3(2)}

3.3 No person shall be designated under Para 3.1 above, unless:-

(i) he possesses a certificate of competency or electrical work permit, issued by the appropriate Government OR certificate of competency issued by DGOF for the purpose.

(ii) his name is entered in the register referred to in Para 3.2 above. {the CEA Reg.3(3)}

3.4 For the purposes detailed in Para 3.2 and 3.3(ii) the HOS/EM shall maintain the following records:-

(i) A record of qualification in **Proforma-1** for staff and IEs.

(ii) An authorisationregister in **Proforma-2** with the authorising and authorised persons signing it. Signature should be with date.

3.5 The authorisation register should be checked by the Divisional Officer once in a month.

3.6 The register maintained under Para 3.2 shall be produced before the Regional Electrical Inspector during his visits.

3.7 If on inspection, the Regional Electrical Inspector finds that the designated person does not fulfill the required qualification, he shall recommend the removal of the name of such persons from the register.

3.8 It is the responsibility of the HOS/EM to ensure that no work whether new work, repairs/alterations, adjustments and additions in the factory or factory estate is carried out except by an authorised person under the personal and direct supervision of a responsible competent electrical staff assigned for the work.

3.9 Works involving replacements of lamps, fans, fluorescent tubes, fuses, switches, cleaning of slip rings and commutators of motors and generators in the factory or estate shall be carried out by authorised persons under the general supervision / directives of a technical staff assigned for the purpose.

3.10 The HOS/EM will ensure that the person deputed for any work is authorised by him, in writing, is in possession of necessary competency certificates issued by the DGOF or license issued by State or Central Govt. covering the technical requirements of the work assigned to him and is competent to execute the work.

3.11 Staff assigned to technically supervise and execute / guide the work should have been cleared by the Electrical Supervisory competency board at DGOF Hqrs.

3.12 Staff and IEs cleared by the competency board at DGOF Hqrs., in the special trade can be authorised to supervise and execute works falling in that category only.

3.13 Normally and as far as possible working on live lines or in close proximity of live lines, or with live parts in an accessible condition or handling live parts of equipments should be avoided and it should normally be done after rendering dead the line or installations where the work is to be carried out and obtaining a shut-down permit under the permit system described in Chapter-IV.

3.14 Every person who is working on an electric supply line or apparatus or both shall be provided with tools and devices such as gloves, rubber shoes, safety belts, ladders, earthing devices, helmets, line testers, testing lamps and other safety gadgets required for protecting him from mechanical and electrical injury and such tools and devices shall always be maintained in sound and efficient working condition. {the CEA Reg. chapter III/19./(2)}

3.15 No person shall work on any live (hot) electric supply line or apparatus and no person shall assist such person on such work, unless he is designated in that behalf and takes the safety precautions given in **Schedule-III**. {the CEA Reg. 19(3)}

3.16 Except in the case of works referred to in Para 3.17 below, it is not necessary to make an entry in the register to authorise a person for each and every work. A general description of the scope of the work an individual is expected to perform and area of machinery to function may

be entered in columns 4 & 5 respectively of the Proforma. Any change in the authorisation of duties shall be recorded as a fresh authorisation.

3.17 Particulars of work and person detailed for each & every work of the following category should be recorded in the **Proforma-3** (Record of Special works) and should be executed under strict supervision of a technically competent staff, which will remain at the work spot till the completion of the work:-

(i) Works involving any person to ascend a pole or structure supporting un-insulated live conductors, closer than 1.5 m. from live conductors (for lines up to 650 V only). Ascending on pole supporting 11kV and more is not permitted under live condition.

(ii) Works on OH line system other than operation of AB switches.

(iii) Works requiring opening of enclosures containing the live conductors of any apparatus including switchgear and panel or entering an area where live wires / bus bars are exposed and not fully protected.

(iv) Work on control circuit of any machinery having multiple controls located at different places without taking a total shut down of the apparatus or taking only a partial shut-down.

(v) Works involving going up an EOT crane or a manually operated crane located near an EOT crane, without taking a shut-down of the power supply to the bus bars on the rail of the crane.

(vi) Major breakdown and repair works.

(vii) Works involving special consideration of safety.

(viii) Works involving handling of power supply cables which are carrying current and are not de-energised & discharged.

(ix) Works involving working on dead O.H. line (dead and isolated) but in a close proximity (less than 2 meters for voltage up to 650 V & 4 meters for 11kV or above lines) of another O.H. line which is live and for which shut-down permit is not taken.

(x) Works involving entry into enclosures / enclosed area contained live parts or conductors which are not totally insulated (e.g. control panel room of a plant wherein the conductors are not totally insulated / isolated.

**3.18 Safety precautions to be taken by the authorised person:-**

(i) All electrical works except these of routine nature like replacement of lamps, fans, fuses, tubes, switches, low voltage domestic appliances and cleaning of slip rings and commutators of motors and generators shall be done under the directions and technical supervision of competent electrical staff.

(ii) The work should be done by a competent and trained person who is aware of the danger that exists when working on or near the live mains or apparatus.

(iii) Proper safety gadgets and devices should be used by the persons involved in the process.

(iv) Proper tools, equipments, safety gadgets like rubber gloves, mats, rubber shoes, ladders, earthing devices, helmets, line testers, operating rods, safety belts etc., and any other devices recommended by the manufacturer as in practice to ensure safety should be provided and used.

(v) The persons in charge of work should examine the tools / equipments and safety gadgets / devices before use to ensure that they are in sound and efficient working condition.

(vi) The persons should be accompanied by another person preferably trained in the technique of artificial respiration, be capable of rendering first aid in the event of injury and be capable of putting off supply to the area where the work is being carried out in the event of an elec. accident involving flash over or leakage or shock.

(vii) Details of safety precautions required to be followed for different types of jobs required to be handled should be made by the factory in consultation with / approval of the REI, be appended along with authorisation register and got signed by all the staff and workmen as a token of having read and understood the instructions.

3.19 Working on live 11 KV and above lines/mains or apparatus except operation of VCB, AB switches and testing with instruments intended to be so used, shall not be carried out under any circumstances.

# CHAPTER – IV

# PERMIT SYSTEM

**4.1 The following types of work shall not be commenced unless instructions contained in point No. 4.2 of this chapter are completely complied with:-**

4.1.1 Works involving construction, erection, rectification of an electric installation or apparatus which is live or not fully dead / isolated & electrically discharged.

4.1.2 Work on an installation which although dead is capable of being energised by the operation (accidentally or otherwise) of switches, link / fuses or by any means or through accidental contact with electric system during the course of work.

4.1.3 Work in close proximity of a live installation within the accessible range.

4.1.4 Work on electric installations of 11KV and above of which a section is live.

4.1.5 All electrical installation work, including additions, alterations, repairs and adjustments to existing installations, except such replacement of lamps, fans, fuses, switches, domestic appliances of voltage not exceeding 250 V and fittings as in no way alters its' capacity or character, shall be carried out by the person licensed in this behalf by the Central Government, State Government or possessing DGOF competency in electrical field and under the direct supervision of a person holding a certificate of supervisory competency issued by DGOF or by a person holding a permit issued or recognized by the State Government. {CEA Reg. 29(1)}

**4.2 Safety instructions while commencing work on mains / apparatus:-**

4.2.1 The person entrusted with the work on mains or apparatus shall obtain a permit certificate as per **Proforma-5** after making the apparatus, installation, feeder or section of electric system dead and completely isolating the area where he will be working. This is particularly applicable for working on installations containing voltage 11KV and above, overhead lines of up to 650V, cables & installations, where there is a risk of back feed. Proper permit procedure as detailed in this chapter shall be followed.

**Or**

The person entrusted with the work, who takes a shutdown himself after putting 'Off' the switch removing the fuses. This is particularly applicable only in cases involving domestic installations working on the voltage below 650V, portions of the installations located in a small area having only one control point for supply, with no back feed in places where the area of work is close to control switch and is visible to the person (or where this is not visible he shall detail a man near the switch to ensure that the switch is not made 'ON' inadvertently).

**Or**

Any person takes a shutdown after informing his group In-charge, puts OFF the switch, removes the fuses, locks the switch room or switchgear to prevent any one switching it 'ON' without his knowledge (This is applicable in the case of Street light & places where there is no risk of back feed & feeders controlled by a single switching station).

4.2.2 The work shall be carried out by a person possessing requisite competency for the type of work.{CEA Reg. 3(3)}

4.2.3 Before any conductor or apparatus is handled, adequate precautions shall be taken, by earthing or other suitable means, to discharge electrically such conductor or apparatus, and any adjacent conductor or apparatus, if there is danger there from, and to prevent any conductor or apparatus from being accidentally or inadvertently electrically charged when persons are working thereon.{CEA Reg. 19(1)}

4.2.4 The person is authorised to do the work. {CEA Reg. 3(3)}

4.2.5 He is aware of the risks involved in the work and takes appropriate precautions.

4.2.6 Every person who is working on an electric supply line or apparatus or both shall be provided with tools and devices such as gloves, rubber shoes, safety belts, ladders, earthing devices, helmets, line testers, testing lamps and other safety gadgets required for protecting him from mechanical and electrical injury and such tools and devices shall always be maintained in sound and efficient working condition. {CEA Reg. 19(2)}

4.2.7 All safety gadgets mentioned under Para 4.2.6 shall be checked quarterly in general and every time before commencing the work, by a responsible person i.e. the group In-charge of concerned electrical maintenance group. He, after checking, shall render a report to HOS/EM. On the basis of these reports, HOS/EM then shall take necessary steps to ensure availability of the tools / safety gadgets and safety devices.

4.2.8 No person shall work on any live electric supply line or apparatus and no person shall assist such person on such work, unless he is designated in that behalf and takes the safety precautions given in Schedule-III. {CEA Reg. 19(3)}

4.2.9 He is accompanied by another person who is conversant with artificial respiration procedure & has enough knowledge to isolate the appropriate switch in the event of electric shock, electric flash over or burn injury due to any reason.

4.2.10 Every telecommunication line on supports carrying a line of voltage exceeding 650V but not exceeding 33 kV shall, for the purpose of working thereon, be deemed to be a line of voltage exceeding 650V. {CEA Reg. 19(4)}

## 4.3 Permit to Work procedure for electric maintenance:-

4.3.1 A Proforma of permit to work **(Proforma-5)** given in the annexure shall be used while issuing any permit to work.

4.3.2 The permit to work certificate from the person (in-charge operation) to the person (in-charge for any particular work) ensures that the portion of the installation where the work is to be carried out is rendered dead and safe for working. If more than one section or departments are working on the same apparatus or line, one permit to work certificate shall be issued to in-charge of each department / section. Restoration of the supply shall be done when all permit to work certificates are returned by concerned in-charges.

4.3.3 In a manned substation, electrician on duty as switch board attendant, is responsible for switching off / isolation of control switches prior to the issue of permit for a work and to ensure that these switches may not put 'ON' or part of the installation where the work under permit certificate is being carried out is not energised until the return of the permit duly cancelled by the permit receiving authority.

4.3.4 Permit to work certificate can be issued by the group in-charge of the concerned electrical maintenance, HOS/EM or staff / responsible persons authorised by him. In all cases the issue of a permit shall be recorded by the HOS/EM in a register maintained for the purpose in the **Proforma-4** in the annexure. Where the permit is issued by the group in-charge of the concerned electrical maintenance group or a person authorised by HOS/EM, the particulars of the permit issued shall be intimated to HOS/EM immediately after issue and shall be followed by clearance and

normalcy report as soon as normal power supply in the affected area is restored.

4.3.5 Permit books shall be treated as an important record. All sheets in the permit books and permit books themselves shall be serially numbered. No page out of the permit book shall be detached or used for any other purpose. If any sheet is detached, a dated and initialed statement shall then and there be recorded in the book by the person responsible for it.

4.3.6 A permit book can be issued to each person authorised by HOS/EM, who shall keep it in safe custody.

4.3.7 Generally a permit to work certificate will be issued to any factory employee working in EM section and authorised to do the electrical repair and maintenance work but it may be issued to any other section, firm or agency also for the work such as underground water line laying, ground leveling work, laying of sewage / drainage lines etc. While issuing permit to work for all type of excavation work in factory and factory estate, EM section shall also ensure in the permit that the work area being excavated is not having any underground cable. However, if permit to work is issued to any outer agency, firm or contractor, an electrician / staff well conversant with the supply system of that particular area shall be deputed for proper guidance regarding safety.

4.3.8 The counterfoil and the Permit to work certificate shall be prepared at the same time. The person issuing permit to work or SBA on duty (in the case of manned substation) shall carry out the operation of switching OFF / isolation, earthing etc. of the section, hand-over the keys of the controlling switch to the person receiving permit to work (if considered necessary) by issuing authority, before issuing the permit. The issuance and return of keys will also be recorded in the key register / logbook. The details of switches / links operated shall be recorded in the counterfoil and the certificate. He shall also fix a board on the switches put 'OFF', mentioning instruction that **"Men working on line, Do not switch ON"**. The issuing person and the SBA on duty (in the case of manned substation) and the person receiving the certificate shall sign at appropriate places in the permit and in the counterfoil. The issue of permit will be recorded in the log book and the details shall be intimated to HOS/EM for endorsing the details in **Proforma-4.**

4.3.9 Permit receiving person shall keep the permit certificate with him till the work is completed. In case he has to transfer the permit to another person, he shall fill in "Box 3" of the certificate and sign it and get the

signature of the person to whom the permit is transferred before handing it over to him.

4.3.10 After completion of the work, the receiving person of the permit / the person to whom the permit is transferred will cancel the permit by filling and signing in “PART-IV” of the certificate, “PART-III” of the counterfoil and hand over the keys of the control switches (if any) handed over to him at the time of issue to ensure additional safety. The issuing person or electrician on duty as switch board attendant (in the case of manned substation) shall fill in and sign the “PART-V” of the permit certificate and “PART-IV” of the counterfoil. He shall switch ‘ON’ the control switches, restore normalcy, record in log book the cancellation and intimate the HOS/EM the return of permit and normalcy. The counterfoil and the cancelled certificate shall be pinned / pasted together in the book. Later, all these permit certificates shall be placed in a file for record and further tripping system analysis. In case more than one permit has been issued for the same area, the return of all the permit certificates issued shall be awaited before switching ‘ON’ & restoring supply to the affected area.

4.3.11 The original permit shall be issued to the person actually doing the work or in-charge of the work and the counterfoil will be retained in the permit book, for further allocation of work to the workers authorising them individually to carry out the prescribed work. On completion of the work mentioned in the permit, it shall be returned to the issuing officer for cancellation.

4.3.12 Issue / return of permit shall also be entered in the logbook or log-sheet either in red ink or this endorsement shall be underlined. When change of shift occurs during the pendency of a permit, the outgoing officer issuing permit / SBA / Electrician shall inform about all the permits to his reliever verbally and by entering in the logbook or log-sheet before handing over the control to next incumbent. The incoming officer authorised to issue a permit / SBA / Electrician shall also sign the permit book or log sheet while taking over as a token of his acknowledgement having noted the pendency of the permits.

4.3.13 Allofficers issuingpermit and persons / in-charges concerned with the permit shall adopt similar logging procedure to avoid any confusion / discrepancy.

**4.4 The instructions given below shall strictly be complied with at all times by the person in-charge and his staff working on any job with a permit to work:-**

4.4.1 The person in-charge shall explain the nature and duration of work to be carried out to the permit issuing authority and obtain from him a permit to work before commencing work. This nature and duration of work shall be endorsed in permit also.

4.4.2 The permit issuing authority shall not issue a permit unless

a) Concerned switches / switchgears have been made "OFF" and contact making/breaking trolley has been withdrawn and are completely isolated on both sides, links and fuses opened, mains and apparatus discharged and earthed (to the extent feasible) adjacent live parts adequately protected. Where possible, the switches shall be locked, keys handed over to the permit receiving authority (if considered necessary) and the permit receiving authority will not return them until completion of the work. Switches and fuses of all control panel connected with the works covered in the permit shall also be made 'OFF' or rendered inoperative.

b) **"Men working on line DO not switch ON**" boards are attached in conspicuous places on the switch / MCCB / VCB / switchgear and apparatus and at all other control points under the permit to work.

c) An entry is made in the logbook / log-sheet to the effect that the switch / MCCB / VCB / switchgear and apparatus under permit have been made OFF / dead. On no account shall they again be made live until the permit is returned by the person in-charge who has done the work, removed earthings to the system provided for safety and returned the keys (if any), which were given to him at the time of issue of the permit.

4.4.3 The person (In-charge of work to be carried out) before allowing any workman to commence work on the mains / apparatus shall take the following precautions:-

a) He shall explain the nature and purpose of the work and precautions taken by the permit issuing authority to ensure safety of the workmen and shall also explain the precautions to be taken by them during the progress of work.

b) He shall ensure that if the work is being carried out at a height of more than 3.0 meters, the persons actually working at the height are free from (i) Epilepsy, (ii) High BP, (iii) Vertigo and (iv) Obesity. It shall also be ensured that their eye sight is also good.

**{Reference OFB letter No. 104/SF/GEN/COS, Dated: 17/06/2016 & 9/06/2017 and letter No. 211/GEN/COS, Dated: 12/02/2018}**

c) Satisfy himself that the switches controlling the mains and apparatus have been isolated, discharged properly, earthed, where possible, shorted with a discharge rod and ***"Men working on line, do not switch ON"*** caution boards have been placed at conspicuous places.

d) Warn the workmen and the public about the danger that exist in the vicinity of the area covered by the permit.

4.4.4 On completion of the work, ensure removal of all earthing devices so that the mains and apparatus are fit in all respects for charging, withdraw all workmen and warn them that it is no longer safe to touch or approach the mains and apparatus and thereafter return the keys and the permit to the permit issuing authority for cancellation.

**4.5** Works of the following types may not warrant issue of a permit, provided all the condition stated in point No. 4.2 are complied with and the shutdown procedure detailed in the point No. 4.6 hereunder is followed:-

4.5.1 Works involving simple domestic installations such as replacement of lamps, fans, fuses, switches, domestic appliances of voltage not exceeding 250 V and fittings which in no way alters electrical system's capacity or character. {CEA Reg. 29(1)}

4.5.2 Simple apparatus with all controls located close to the person attending to it.

4.5.3 Machinery having only one point of entry of power supply and the switch installed close to the machinery.

4.5.4 Any other type of work permitted by the D.O. in writing.

**4.6** The person detailed for the work shall put 'OFF' the switch, remove the fuse, neutral link if any, lock the switch (if possible) and lock the room (if possible), keep the fuses, keys etc. under his custody till the work is completed, and he shall:

(i) warn the persons in the area not to operate the switch.

(ii) put a board **"Men working on line. Do not switch ON"** (where work is being done in a substation or switching station).

(iii) The operation of the switchgear shall also be logged in the shift logbook and in **Proforma-6** (register).

**4.7** Under no circumstances, one shall do repair / maintenance work on the installation, system or apparatus working on 11KV and above when they are live or energised with electric power. Only those works, which involve general switching "ON / OFF" operation of any switchgear, AB switches, VCB, OCBs (if any), testing with instruments / gadgets intended to be used under live line conditions may be carried out.

**4.8** *No person or agency shall be allowed to work on wall or roof of a building or a metallic structure, perimeter wall or any part of an electrical installation which is close to an overhead line or installation, unless the electric section is informed and their permission is obtained in writing before commencing the work. Same shall be applicable to the work involving excavation, digging or leveling the land manually or using any type of earth moving machine. The electric section shall see the place & examine the scope of work, give shut down / permit and prescribe in writing the requirements to ensure safety. EM section shall also ensure on Work Permit that* ***"There is no underground cable laid at the place of excavation, digging or leveling the land".***

# CHAPTER – V

# SUBSTATIONS

**5.0** The instructions in this chapter will apply to all substations, receiving stations, generating stations & switching stations to the extent relevant.

## 5.1 General safety requirements relating to installation, operation and maintenance of substations:-

5.1.1 Substations, receiving stations, generating stations, switching stations and the transformer rooms should have an independent approach connected to road of sufficient load bearing capacity to withstand movement of heavy equipments e.g. transformers, ACBs, VCBs etc. This approach shall be over and above any other approaches from production sections to switching rooms as may be considered necessary to meet the operational requirements.

5.1.2 Its location in the factories handling explosives should conform to STEC regulations (Latest issue 2017).

5.1.3 The floor of the substation building shall preferably be above the road level outside. Where necessarily constructed underground, due provisions for ventilation and drainage shall be made. [CEA Reg. 49{1(i)}]

5.1.4 Any space housing switchgears, transformers etc. shall not be used for storage of any materials especially inflammable and combustible materials or refuse. [CEA Reg. 49{1(i)}]

5.1.5 The drains outside the building shall be so constructed that water from outside does not seep in or get into the cable trenches.

5.1.6 Outdoor sub-stations (excluding pole type substations) and outdoor switching station shall be efficiently protected by fencing not less than 1.8 meters in height or other means. [CEA Reg. 49{1(ii)}]

5.1.7 The fencing of such area shall be earthed efficiently. [CEA Reg. 49{1(ii)}]

5.1.8 Where platform type construction is used for a pole type sub-station and sufficient space for a person to stand on the platform is provided, a substantial hand rail shall be built around the said platform and if the hand rail is of metal it shall be connected with earth. However, in the case of wooden supports and wooden platform the metal hand-rail shall not be connected with earth. {CEA Reg. 50}

5.1.9 A danger board with a sign of skull and bones (as per IS - 2551), showing the voltage (highest) handled in the substation in Hindi/English and local language, shall be affixed in a conspicuous position.

5.1.10 Danger boards of approved quality with correct voltage marked shall be placed on all equipment & control switchgears.

5.1.11 Substation Buildings shall not be used as shift room, site workshop, store room etc.

5.1.12 Substation buildings shall be kept neat and clean and free from dust.

5.1.13 All generating stations, substations, junction-boxes or pillars, in which there are many circuits or apparatus, shall be marked by means of indication of a permanent nature that the respective circuits or apparatus are readily distinguishable from one another. These circuits or apparatus may be working on different voltages or at the same voltage. (CEA Reg. 24)

5.1.14 HOS/EM shall arrange to prepare a schematic diagram/plan of the area of supply and on this diagram route and the alignment of the overhead/underground cables shall be marked. In case of underground works, the approximate depth of all the existing electric supply cables below the surface, number of cores and sizes of the feeding cables, location of street distributing/junction boxes and other electrical works also shall be marked. {CEA Reg. 11(1)}

5.1.15 Once in every year, the Schematic diagram/plan mentioned above shall be duly corrected so as to show the updated electric supply lines incorporating fresh changes (if any), street distributing boxes and other works for the time being in position. {CEA Reg. 11(1)}

5.1.16 Schematic diagram/plan mentioned under point No. 5.1.14 and 5.1.15above, shall also be prepared and maintained up dated in electronic / digital form. {CEA Reg. 11(3)}

5.1.17 Normally, readings of different parameters such as voltage, current, power factor etc. of the transformers and different feeders shall be endorsed in the log book on hourly basis, but if load on the transformer/feeder is going beyond the full load rating, more frequent readings i.e. half-hourly or readings at every fifteen minutes may also be taken. If critical condition of load persists beyond the rated capacity of transformer/feeder cable, immediate steps shall be taken to reduce the load and the SBA/technician on duty shall inform the in-charge concerned.

5.1.18 While changing shift duty, the outgoing SBA/technician shall brief about the abnormal condition (if any) such as any shutdown, tripping, critically loaded transformer/feeder etc. to the coming SBA/technician.

5.1.19 Substation buildings shall not be used as a general shift room or a place for keeping personal items and dresses etc., only authorised items (i.e. items listed in 5.2 below) shall be kept in the Substation. [CEA Reg. 49{1 (i)}]

5.1.20 A list of authorised persons shall be displayed in the substation. This list may be changed from time to time depending upon the duty allocated. Persons other than the above authorised persons shall not be permitted to enter in the substation. {CEA Reg. 3(2) & 3(3)}

5.1.21 The equipments at the substations shall not be operated by persons other than authorised persons. All operations carried out in all manned substations shall be endorsed in logbook **(Proforma 6)** and all type of operations carried out in any unmanned Substation shall be recorded in the concerned register. However, external cleaning of the switch gear, trenches, transformers (indoor type only) can be carried out by any person but under the direct supervision of the authorised persons.

5.1.22 All care shall be taken to ensure that the elec. installations and equipment are well protected from the entry of water or chemical dust by leakage or seepage or any other cause. Any seepage / leakage / entry of water into the substations, equipments and cable trenches shall be attended immediately.

5.1.23 If the substation feeds electric power to overhead lines and take off poles are located just outside the Substation building, the fencing shall cover the takeoff poles also to prevent unauthorised operation and damage to the pole & its accessories due to any reason.

5.1.24 One set of tools for emergency operation shall be kept available in the substation at all times, in addition to tools/gadgets required for normal operation of substation. Tool boxes pertaining to individual workmen not on duty shall be kept in a separate and specific room / place.

5.1.25 It shall be ensured that unless the conditions are such that all the conductors and apparatus may be made dead at the same time for the purpose of cleaning or for other work, the said conductors and apparatus shall be so arranged that these may be made dead in sections, and that work on any such section may be carried on by a designated person without danger. [CEA Reg. 44{ 2(xiii)}]

5.1.26 Only designated / authorised persons shall carry out the work on live lines, switchgears and apparatus. [CEA Reg. 44{ 2(xiv)}]

5.1.27 For works involving voltage exceeding 650 V, common work as to take readings of voltmeter, ammeter, to ON & OFF the circuits, operating gang operation switch etc. are permitted on live system and that also with using hand gloves, rubber boots and such other gadgets/PPEs of good quality and suitable voltage rating required to ensure safety.

5.1.28 Before any conductor or apparatus is handled, adequate precautions shall be taken, by earthing or by discharging electrically such conductor or apparatus, and any adjacent conductor or apparatus (if there is danger from it) and to prevent any conductor or apparatus from being accidentally or inadvertently electrically charged when persons are working thereon. {CEA Reg. 19(1)}

5.1.29 Every person who is working on an electric supply line or apparatus shall be provided with tools and devices such as gloves, rubber shoes, safety belts, ladders, earthing devices, helmets, line testers, testing lamps and other safety gadgets required for protecting him from mechanical and electrical injury. Such tools and devices shall always be maintained in good and efficient working condition. {CEA Reg. 19(2)}

5.1.30 No person shall work on any live electric supply line or apparatus and no person shall assist such person on such work, unless he is designated in that behalf and takes the safety precautions given in Schedule-III. {CEA Reg. 19(3)}

5.1.31 Insulating floors or mats (as per IS – 15652:2006) of appropriate voltage level shall be placed in front of the panels. {CEA Reg. 19(5)}

*5.1.32 The individuals working in HT maintenance and having knowledge and experience in the field, need not be shifted to other areas frequently. {OFB letter No. 411/CEI/COS, Dated:- 05/10/2016}*

5.1.33 (A) The work must be done by an authorised person in possession of requisite competency for the type of work involved.

(B) Authorised person / Persons must be in possession of:-

a) Requisite permit certificate (refer Chapter-IV).

b) Must have taken shut down in the manner detailed in Chapter-IV.

c) Authorisation to do repairing / maintenance works under live line condition (for voltage up to 650V only) is permitted and this shall be recorded under special works and the work being

done under the direct supervision of a competent and authorised staff.

**5.2 The following shall be available in every S.S.:-**

5.2.1 Fire (Sand) buckets filled with clean dry sand shall be conspicuously marked and kept in a readily accessible position for extinguishing fires in addition to fire extinguishers suitable for dealing with fires. {CEA Reg. 2010 - 27(1)}

5.2.2 There shall be minimum four sand buckets in each substation and fire extinguishers as per scale prescribed in the Annexure-A.

5.2.3 The fire extinguishers shall be tested for satisfactory operation as per relevant Indian Standard at least once a year and record of such tests shall be maintained. {CEA Reg. 27(2)}

5.2.4 A first aid box/cupboard conspicuously marked and equipped with such contents as specified by the State Government, shall be provided and maintained. {CEA Reg. 27(3)}

5.2.5 Two or more gas masks shall be provided conspicuously and installed and maintained at accessible place, in every generating station with capacity of 5 MW and above and enclosed sub-station, with transformation capacity of 5 MVA and above for use in the event of fire or smoke. {CEA Reg. 27(4)}

5.2.6 Adequate number of gas masks shall be provided at every generating station and enclosed sub-station with capacity less than 5 MW and 5 MVA respectively.

5.2.7 A set of instructions in Hindi/English and the regional language with action chart for the artificial respiration / resuscitation of persons suffering from electric shock shall be affixed in a conspicuous place in each substation, generating station and switching station. {CEA Reg. 28(1)}

5.2.8 Address/Telephone No. of the nearest doctor available shall also be arranged.

5.2.9 An artificial respirator in good and working condition. {CEA Reg. 28(3)}

5.2.10 Key board/boxes with pegs should be marked to indicate the particulars of the key hung on it. Each key should have a tag to indicate the lock operated by it. The particulars of the peg should match with that indicated on the key tags.

5.2.11 Hand gloves in good condition of approved quality (IS- 4770:1991 & IS - 13774:1993 for 11kV and IEC-60903:2002 for maximum working voltage 33kV), with the voltage upto which it can be used stamped on it, suitable for the highest voltage of the system in the substation.

5.2.12 Minimum one pair of rubber boots and other protective clothing as considered necessary.

5.2.13 Essential gadgets required for operation of switch gears, drawing–IN/OUT of fuses, operating rods, handles etc.

5.2.14 Hydro meter (If conventional batteries are used), cell tester, multi-meter/voltmeter for testing/checking the condition of the batteries.

5.2.15 Minimum one torch in working condition.

5.2.16 Emergency lighting units / system to provide general illumination.

5.2.17 A tool box containing all essential tools and safety gadgets for emergency operation in the S.S.

5.2.18 Adequate number of caution boards mentioned "**Men working on line" or "Do not 'ON' the switch"**.

5.2.19 A drawing of the power supply scheme of the factory and factory estate and a detailed schematic diagram of the equipments in the substation indicating the ratings of equipments & cables of incoming & outgoing supplies.

5.2.20 A logbook for manned Substations:- The logbook, apart from load details, shall record the condition of the tripping & emergency batteries (voltage, specific gravity daily).

## 5.3 Minimum Clearances:-

### (a) For panels and switchgears:-

5.3.1 A clear space of not less than **one meter** in width shall be provided in front of the panels. [CEA Reg. 37{(iii)a}]

5.3.2 Space behind the switch board shall be either less than 20 cm. or more than 75 cm. [CEA Reg. 37{(iii)b}]

5.3.3 If the space behind the switchboard exceeds 75 cm. in width, there shall be a passage way from either end, clear to a height of 1.8 meters. [CEA Reg. 37{(iii)c}]

### (b) For Transformers:-

5.3.4 The minimum clearance required from wall shall be as under:

1.25 m : from each wall for transformers bounded by walls on all sides.
1.0 m : from each wall for transformers bounded by walls on 3 sides.
0.75 m : from each wall for transformers bounded by walls on 2 sides.
0.50m : from the wall for transformers bounded by wall on one side.

5.3.5 Besides above, there should be enough space around transformer to facilitate inspection, testing and maintenance.

## 5.4 Safety requirements for installation and operation of switchgears at substations:-

5.4.1 The enclosures of all switchgears and bus-bars shall be kept free from holes or crevices and shall be vermin proof. Spare holes for cable entry or holes left out after taking out any instrument/relay etc. from the panel for repairs; shall be closed properly to make the panel insect and vermin proof. The doors of the switchgears shall be kept closed properly without leaving any crevices. All new / replacements of switchgear panels, pillar boxes and DBs shall be of factory fabricated and of reputed make only. {CEA Reg. 37(i)}

5.4.2 Contact making / breaking trolley of switchgears not intended to be operated for longer time may be lowered or racked out and locked. A board **"Men working on line"** or **"Danger - Do not switch ON"** may be displayed on such switchgears. The lowered or racked out switchgear shall be checked before taking it 'UP' or racking it 'IN', particularly if it has been kept in lowered or racked out condition for a long time.

5.4.3 When two or more switchgears feeding power to a common load either from two or more different power sources or from the same power source, these shall be provided with electrical interlocking system to keep the rest switchgears in 'OFF' position when one of them is in 'ON' position. When switchgears intended to be used for such type and to be procured/purchased new, interlocking having electrical as well as mechanical system shall be preferred.

5.4.4 The keys of the switchgears and the substation should be suitably tagged to identify the equipment or substation controlled by it and placed on appropriate peg in the key board suitably marked for ready identification. All removal & return of keys shall be recorded in a logbook and key register in **Proforma-9**.

5.4.5 All transformers, ACBs, VCBs and Switches etc. shall be at true level to the floor, and stand vertical.

5.4.6 Individual switchgear of any combined panel shall be provided metallic partitions on the sides to segregate it from the adjoining switchgear.

5.4.7 The cubicles, housing measuring instruments and protection relays connected with the circuit breaker/switchgear, shall also be so arranged that any flashover in the circuit breaker/switchgear does not damage the instrument / relay.

5.4.8 The correctness and proper functioning of 'ON' & 'OFF' indication on switchgears shall be maintained and checked regularly.

5.4.9 Instruments and protective relays, CTs and PTs shall be kept in functioning order at all times. The switchgears shall never be allowed to function with protective devices inoperative. (i.e. due to any Electrical/mechanical fault in the tripping mechanism or non-availability of power supply for tripping). Batteries (from tripping circuit) shall never be disconnected, when power supply system is "ON".

5.4.10 The setting of relays and choice of C.T. Ratio shall be such as to ensure correct degree of protection to the equipment controlled by it.

5.4.11 The tripping system / Batteries / relays shall also be checked regularly for their proper functioning. A regular log book shall be maintained in in the **Proforma-7** for the condition of batteries.

5.4.12 Switchgears shall be correctly and clearly marked to indicate the area or circuit controlled by it.

5.4.13 All live bare parts shall be adequately protected and made inaccessible under normal conditions. Arrangement shall be made to provide in readily accessible position switches for rendering them dead whenever necessary. Other suitable safety measures shall be taken as are specified in the relevant IS. (theCEA Reg. 17)

5.4.14 However, where this is not possible, suitable caution board mentioning "LIVE PARTS EXPOSED"" in Hindi/English and local language shall be provided at a safe distance to warn persons about these live parts.

5.4.15 In case live conductors pertain to supply voltage more than 650V and are exposed out of any panel, the panel room shall be kept locked and authorisation to receive the keys and open the room shall be made in written and one copy of this authorisation shall be made available at the place where the key is placed. Issue and return of such keys shall be made for specific purpose only and be recorded in **Proforma 3**.

5.4.16 In case of use of electricity at voltage exceeding 650 Volts, suitable interlocks shall be provided in the following cases:-

(i) Isolators and the controlling circuit breakers shall be interlocked so that the isolators cannot be operated unless the corresponding breaker is in open position. [CEA Reg. 45{1(i)}]

(ii) Isolators and corresponding earthing switches shall be inter-locked so that no earthing switch can be closed unless and until the corresponding isolator is in open position. [CEA Reg. 45{1(ii)}]

(iii) Where two or more supplies are not intended to be operated in parallel, the respective circuit breakers or linked switches controlling the supplies shall be inter-locked to prevent possibility of any inadvertent paralleling or feedback. If not interlocked, switchgears in OFF position shall be provided with a board ***"Back Feed" DO NOT OPERATE WITHOUT PROPER INSTRUCTIONS FROM CONCERNED STAFF"*** to avoid inadvertent / unsafe operations. [CEA Reg. 45{1(iii)}]

(iv) When two or more transformers are operated in parallel, the system shall be so arranged as to trip the secondary breaker of a transformer in case the primary breaker of that transformer trips. [CEA Reg. 45{1(iv)}]

(v) All gates or doors which give access to live parts of an installation shall be inter-locked in such a way that these cannot be opened unless the live parts are made dead and proper discharging and earthing of these parts should be ensured before any person comes in the close proximity of such parts. [CEA Reg. 45{1(v)}]

(vi) Where two or more generators operated in parallel and neutral switching is adopted, inter-lock shall be provided to ensure that circuit breaker provided to generator cannot be closed unless one of the neutrals is connected to the earthing system. [CEA Reg. 45{1(i) to 1(vi)}]

5.4.17 In case of use of electricity at voltage exceeding 650 Volts, following protection shall be provided in all systems and circuits to automatically disconnect the supply under abnormal conditions:-

(i) Over current protection to disconnect the supply automatically, if the rated current of the equipment, cable or supply line is exceeded for a time which the equipment, cable or supply line is not designed to withstand. [CEA Reg. 45{2(i)}]

(ii) Earth fault or earth leakage protection to disconnect the supply automatically, if the earth fault current exceeds the limit of

current for keeping the contact potential within the reasonable values. [CEA Reg. 45{2(ii)}]

(iii) Gas pressure type and winding and oil temperature protection (Buchholz relay) to give alarm and tripping shall be provided on all transformers of rating 1000 KVA and above or fitted with conservator. [CEA Reg. 45{2(iii)}]

(iv) Transformers of capacity 10 MVA and above shall be protected against incipient faults by differential protection; [CEA Reg. 45{2(iv)}]

(v) All generators with rating of 100 KVA and above shall be protected against earth fault or earth leakage. [CEA Reg. 45{2(v)}]

(vi) All generators with rating of 1000 KVA and above shall be protected against faults within the generator winding using restricted earth fault protection or differential protection or by both. [CEA Reg. 45{2(vi)}]

(vii) High speed bus-bar differential protection along with local breaker back up protection shall be commissioned and shall always be available at all 132 KV and above voltage sub-stations and switching stations and generating stations connected with the grid. [CEA Reg. 45{2(vii)}]

5.4.18 In cases, where a switchgear or transformer is suspected to have developed fault or where fire is seen inside, the following action shall be taken immediately:-

(i) The incoming supply / supplies controlling the supply to the switchgear under fault shall be put OFF immediately.

(ii) No one shall be permitted to go near the faulty switchgear or cross the path of flame / gushing hot oil (if any), unless the supply to the faulty switchgear is disconnected and the flames / gushing of oil has subsided.

(iii) Standing from a safe distance, attempts shall be made to prevent spread of fire to other areas in the substation & control the situation using sand buckets, fire extinguishers / shifting of inflammable items (if any), creating barriers in the paths of flame, etc.

(iv) While switching “ON” any switchgear before or after repairs, the operator shall keep himself as far away as practicable with his face turned away, so that in the event of any flashing over, burn injuries to the operator could be minimised. No person, other than person carrying out the switching ‘ON’ operation of the

switchgear shall stand very close to the switchgear at the time of its operation. Other staff and employees may stand at a safe distance.

(v) All tripping of OCBs (if any) due to suspected fault / fault condition shall be recorded in **Proforma 8**.

5.4.19 A linked switch with fuse or a circuit breaker of requisite capacity to carry and break the current for the voltage system not exceeding 650V, shall be placed as near as possible after the point of commencement of supply so as to be readily accessible and capable of being easily operated to completely isolate the supply to the installation. This equipment shall be in addition to any equipment installed for controlling other individual circuits, feeders or apparatus. {CEA Reg. 35(2)}

5.4.20 A circuit breaker of requisite capacity to carry and break the current for the voltage exceeding 33 kV shall be placed as near as possible after the point of commencement of supply. {CEA Reg. 35(2)}

5.4.21 Each distinct circuit shall be protected against excess energy by means of suitable cut-out or a circuit breaker of adequate breaking capacity suitably located and so constructed as to prevent danger from overheating, arcing or scattering of hot metal when it comes into operation and to permit for ready renewal of the fusible metal of the cut-out without danger. {CEA Reg. 35(4)}

5.4.22 All insulating materials shall be chosen with special regard to the circumstances of their proposed use and their mechanical strength shall be sufficient for their purpose and so far as is practicable of such a character or so protected as to maintain adequately their insulating property under all working conditions in respect of temperature and moisture. {CEA Reg. 35(6)}

5.4.23 Adequate precautions shall be taken to ensure that no live parts are so exposed as to cause danger. {CEA Reg. 35(7)}

## 5.5 Safety requirements for installation and operation of transformers at substations:-

5.5.1 Any apparatus having more than 2000 liters of oil shall not be located in the basement, where proper oil draining arrangement cannot be provided. [CEA Reg. 44{2(vi)}]

5.5.2 Where transformers having more than 2000 liters of oil are installed, whether indoor or outdoor, following safety measures shall be provided:-

(a) The baffle walls of four hours fire rating shall be provided between the transformers / apparatus to prevent damage and spreading of fire, due to any fault/explosion/fire in the transformer apparatus.

(b) Provisions shall be made for suitable oil soak pit and where use of more than 9000 liters of oil is involved, provision shall be made for the draining away or removal of any oil which may leak or escape from the tank/receptacle. Special precautions shall be taken to prevent the spread of any fire.

(c) Any type of spare oil (Diesel, lubrication or insulating) shall not be stored in the vicinity of any oil filled equipment in any sub-station or switching station.

(d) All the transformers and switchgears shall be maintained as per the schedule provided by the manufacturer or in accordance with the maintenance schedules prepared in accordance with the relevant codes of practice of BIS.

(e) Only dry type of transformers shall be used for installations inside the residential and commercial buildings.

[CEA Reg. 44{2(vi) & 2(vii)}]

*Note:- point No. 5.5.1 & 5.5.2 are also applicable to OCBs or any other oil containing apparatus.*

5.5.3 The transformers shall preferably be installed each in a separate room.

5.5.4 Adequate fire protection arrangement for quenching the fire in all the apparatus shall be made. [CEA Reg. 44{ 2(viii)}]

5.5.5 It shall be ensured that the transformers of 10 MVA and above rating or in case of oil filled transformers with oil capacity of more than 2000 liters are provided with fire-fighting system as per IS – 3034:1993 or with Nitrogen Injection Fire Protection System. [CEA Reg. 44{ 2(ix)}]

5.5.6 Where it is necessary to locate the transformers, sub-station or switching station in the basement, the CEA Regulation 44{2(x)} shall be followed.

5.5.7 It shall be ensured that oil filled transformers installed indoors in other than residential or commercial buildings are placed at the ground floor or not below the first basement. [CEA Reg. 44{ 2(xi)}]

5.5.8 All transformers shall be provided with temperature indicator, oil level indicator, ON/Off Load Tap Changer along with other standard accessories.

5.5.9 Off Load Tap Changer on transformer shall always be kept locked and be operated only after de-energising the transformer. If there is provision of ON Load tap Changer on any transformer, its operation at loaded transformer should be avoided.

5.5.10 When temperature indicators with electrical contacts provided, use of these contacts shall be for tripping the transformers at unmanned substations and for giving alarm at lower degree of risk and for tripping the transformer at serious fault, when the substation is manned.

5.5.11 The neutral point of any transformer/Generator shall be provided with two distinct and independent earthing connections terminating in its own earth pits. Earthing wires / strips for earthing the neutral of the transformers shall not be in contact with or close to the body of the transformer. [CEA Reg. 41(xiii) & 48{ 2(i)}]

5.5.12 The condition of silica gel and oil level in the conservator tank shall be checked periodically. Any abnormality / abnormalities like leakage of oil, heating/charring of cable terminals or uncommon noise and any deviation from normal parameters shall be attended immediately.

5.5.13 In case of every transformer the following shall be provided; namely:-

(i) On primary side for transformers a link switch with fuse or circuit breaker of adequate capacity. This link switch shall be capable to OFF supply to the transformer when it is at “No Load”.

(ii) All transformers shall be provided a circuit breaker on primary side, (a) having a capacity of 5000 kVA and above installed before the year 2000 and (b) having a capacity of 1000 kVA and above installed in or after the year 2000. [CEA Reg. 35{3(i)}]

5.5.14 In respect of all transformers installed in or after the year 2000, on the secondary side of all transformers a circuit breaker of adequate rating shall be installed. However, for transformers of capacity below 1000 KVA, on secondary side a linked switch with fuse or circuit breaker of adequate rating shall be installed. [CEA Reg. 35{3(ii)}]

## 5.6 Safety precautions while installation and operation of the electrical power generating sets:-

5.6.1 D.G. sets installed or proposed to be installed shall match the load requirement and characteristics.

5.6.2 Following minimum protective devices/system shall be arranged with any generator:-

a) Prevention of back feed from the main supply to the generator.

b) Prevention against overloading of the DG Set.

c) Adequate synchronizing system, if two or more generators are intended to operate in parallel.

5.6.3 D.G. Sets shall be installed as far away as possible from the power panel of the regular supply system. These shall preferably be installed in well ventilated separate room.

5.6.4 Often D.G. Sets of small capacities meant for specific loads are connected to the panel containing switchgears meant for several other loads besides the specific load. In such cases adequate fool proof precautions shall be taken to ensure that the entire load is not connected to the generator causing over loading to the generator.

5.6.5 Any kind of oil (diesel, lubricating or insulating) shall not be stored in D.G. set rooms.

5.6.6 Place where D.G. Sets are installed shall be treated as a generating station. All the instructions applicable to a generating station in the CEA Regulations' 2010, the Electricity Act' 2003 and general safety rules applicable to substations and any other electrical installation, shall apply to the extent they are relevant.

## 5.7 Safety precautions while installation and operation of the batteries:-

5.7.1 Batteries may be required to be provided for energising the tripping circuit and emergency lighting for the substation. The same batteries shall not be used for both the purposes.

5.7.2 The batteries if not enclosed in an enclosure with its own charging unit, shall be installed in a separate room fitted with an exhaust fan.

5.7.3 Periodic checking/testing and maintenance of batteries shall be as under:-

**A. Daily:-**

a) Indication of leakage, swelling or body deformation in any battery.

b) Voltage of any one battery (selected randomly).

c) Specific gravity of electrolyte of all cells of any one battery, selected randomly (applicable to the conventional batteries only).

d) In case power supply fails the switchgear indication light shall glow for at least about five minutes. If it goes off immediately, it indicates that the battery requires replacement.

**B. Fortnightly:-**

a) Checking of total voltage of the combined battery units under test conditions of 15 minutes loading, having minimum load equivalent to all tripping coils' resistances.

b) Checking the condition of all terminals of batteries and connecting leads for carbonization and pitting.

c) All nuts and bolts connecting the leads with the battery terminals shall be tightened.

d) Petroleum jelly shall be applied after tightening the nuts and bolts as mentioned above.

5.7.4 The results of tests/checks mentioned above shall be recorded in **Proforma-7** and the results shall be signed by HOS/EM and DO/EM once in three months.

5.7.5 Abnormalities noticed and remedial action taken shall be recorded and reported to the HOS/EM & DO/EM immediately.

5.7.6 The voltmeter, indication lamp, ammeter in the charging unit shall always be maintained in working condition.

## 5.8 Safety precautions for Cable Trenches and Cables.

5.8.1 Cable Trenches shall be designed, constructed & maintained in such a manner that there is no possibility of accumulation of water or oil in it.

5.8.2 Trenches should be covered by chequered plate or RCC slabs installed in flush with the floor of the substation so that there are no projections. (Projections can cause accident due to the stumbling during operations). Alternatively it can be filled with sand up to floor level. There should not be any protrusion on the trench covers.

5.8.3 Cotton waste, oil, waste materials, swarf & metallic articles, shop sweeping, etc. shall not be thrown in the cable trenches.

5.8.4 Cables should be laid on racks or trays with adequate clearance and shall not cris-cross or rest on one another. Cables should be clamped rigidly.

5.8.5 Power cables shall not be laid along with control cables. Control cables shall run independently preferably in separate trenches.

5.8.6 There should not be any cable joint in the trenches located inside the substation.

5.8.7 The armour of the cable shall bear continuity with the enclosure of the switchgear or the equipment into which it terminates.

5.8.8 A compression gland always shall be used at cable ends to keep the system dust, damp and vermin proof.

5.8.9 No other service pipelines or process line (Air, water etc.) shall be laid along with cables in cable trenches. All ducts provided for power cables and other services shall be provided with fire barriers at each floor crossing. {CEA Reg. 36(5)}

5.8.10 Cable boxes should not be fixed in between two circuit breakers, unless the clearance between the two is sufficient to prevent damage to circuit breaker or cable box, due to fault in the cable terminal box or circuit breaker. As far as possible, cable boxes shall be fixed on the rear side of the circuit breakers.

5.8.11 It shall be ensured that cable trenches inside the sub-stations and switching stations containing cables are filled with sand, pebbles or similar non-inflammable materials or completely covered with non-inflammable slabs. [CEA Reg. 44{2(xii)}]

## 5.9 Condensers / Capacitors:-

5.9.1 Condensers / Capacitors shall be controlled by an independent switch.

5.9.2 Suitable ammeters and power factor meters shall be provided to know the functioning of the unit.

5.9.3 Where APFC (Automatic Power Factor Controlling) devices are installed, suitable arrangement shall be made for manual operation also.

5.9.4 Suitable arrangement shall be made for immediately and automatic or manual discharge of every static condenser on disconnection of supply. Even after disconnecting the supply to capacitors, unless discharged completely, no one shall touch or come in contact with condenser terminals. {CEA Reg. 51}

## 5.10 Earthing:-

5.10.1 All earthing shall conform to BIS Code of practice (IS-3043- 1987) and shall be as per all the provisions made under the CEA Regulations 2010

No. 41 (for installations and apparatus not exceeding 650 V) & CEA Reg. 48(1) to 48(8) {for installations and apparatus including and exceeding 650 V).

5.10.2 Size of the earth plate / electrode and number of electrodes, their spacing, the earth resistance etc. shall fulfill the requirements of load condition and fault current likely to develop. It shall be ensured that operation of earth leakage relay or over current relay or fuse of highest capacity in the circuit, under earth fault condition. (For design of earth electrode refer IS – 3043 : 1987)

5.10.3 The size of the earth conductor shall be such as to ensure that under maximum earth fault condition:-

i) It is capable to take full fault current without burning off or causing a voltage drop not exceeding 32 V between earth and any point on the earth system.

ii) The resistance between any two points in the system does not exceed 1 ohm (0.5 ohm for buildings dealing with explosives).

iii) It shall be mechanically strong enough to resist any strain / mechanical injury likely to be put upon it.

iv) The minimum cross-section of earth conductor shall be as follows:-

(I) For large installations:-

(a) Main connections:- cross–section area of earth shall be 0.25 Sq. inch (i.e. 161 Sq. mm) for copper wire.

(b) Branch connections:- cross–section should be 0.1 Sq. inch (i.e. 64.5 Sq. mm ) for copper wire.

(II) For sub-stations:– copper strip of 1 inch x 1/8 inch (i.e. 25.4 mm X 3.17 mm) as a ring main to which all apparatus are connected.

(III) For smaller installations:– copper wire of 8 SWG i.e. 4.0 mm square.

(IV) For domestic installations:– copper wire of 0.0045 Sq. in (7/22) i.e. 1.0 mm. square.

Note:- For aluminium conductors, corresponding size considering equal to the copper conductor shall be used.

5.10.4 Aluminium wires/ strips shall not be used as earth conductor below earth (Only copper / GI can be used). Where aluminium wires / strips is

being used in contact with lime cement, suitable spacer shall be provided.

5.10.5 Joint between Aluminium and Copper / GI shall be anti-corrosive type with lead packing in between.

5.10.6 Earth pits for all buildings shall be provided with proper earth pit chambers and shall be properly maintained.

5.10.7 No debris shall be thrown or wild growth be allowed near the earth pits.

5.10.8 The frame of every generator, stationary motor, portable motor, and the metallic parts, not intended as conductors, of all transformers and any other apparatus used for regulating or controlling electricity, and all electricity consuming apparatus, of voltage exceeding 250 V but not exceeding 650 V shall be earthed by two separate and distinct connections with earth. {CEA Reg. 41(xii)}

5.10.9 Neutral point of every generator and transformer shall be earthed by connecting it to the earthing system by not less than two separate and distinct connections. This is over and above the earthings required for body/frame. [CEA Reg. {41(xiii) & 48{2(i)}]

5.10.10 Every overhead line, sub-station or generating station which is exposed to lightening shall have efficient means for diverting to earth any electrical surges due to lightening which may result into injuries. {CEA Reg. 74(1)}

5.10.11 The earthing lead for any lightening arrester shall not pass through any iron or steel pipe, but shall be taken as directly as possible from the lightening arrester “without touching any metal part to a separate-vertical ground electrode or junction of the earth mat already provided. {CEA Reg. 74(2)}

5.10.12 It shall be ensured that the earth pit is always in an open area and not inside any building. No civil construction shall be carried out on any earth pit.

5.10.13 Earth system shall be maintained properly to ensure that it is able to provide adequate protection at all times.

5.10.14 All the earth pits of the different system may be inter-connected below earth.

**Records of earthing system and its test results:-**

5.10.15 A sketch showing the earthing system, location of earth pits (with serial number marked for identification) shall be prepared for all substations,

production buildings, block of residential quarters, amenity buildings & shall be available in ER test register. Location of all the earthing pits shall also be marked on the nearby wall.

5.10.16 Whenever, new earth pits are provided / added in the supply system, necessary sketch shall be prepared and recording of ER tests results shall be started right from the time of taking over.

5.10.17 The Earthings mentioned above shall be tested for its Earth Resistance on a dry day during dry season at least once a year and records of such tests results shall be maintained in **Proforma 10** (for LP earthing), **Proforma 11 A** (for buildings other than substation), **Proforma 11B** (for substation buildings) and **Proforma 11C** (for overhead lines) and shall be produced, to the Regional Electrical Inspector (if so required by him). [CEA Reg. 41(xvi) & 48(8)]

## 5.11 Safety before testing, maintenance and repairs of Switchgears, Transformers, Reactors, condensers & cables:-

5.11.1 Dismantling, testing or repairs of transformer, switchgear, cables or any other apparatus shall not be commenced unless the following actions are complied:-

i) A shut down is taken and proper permit to work certificate **(Proforma 5)** is obtained.

ii) All switches, (including those controlling the back feeds) which may keep involving a part of the switchgear and its circuits live are put off / isolated.

iii) The outgoing of feeder / bus bars is discharged and kept earthed till the completion of work.

iv) The work done by a competent and authorised person and is planned and to be executed under direct supervision of competent and authorised staff.

v) Use of inflammable liquids like petrol for cleaning any equipment at plant/site is a hazard. If however use of inflammable liquids is unavoidable, it shall be ensured that no flame or electrical apparatus prone to sparking is worked near it.

vi) Proper tools and safety gadgets shall be used by the workers and details of tools to be used are listed before starting the work and after completion of the work.

vii) All above instructions supplemented by the manufacturer's instructions shall always be followed at the time of maintenance

& repairs. In case the manufacturer's instructions are not available they should be obtained and be kept safely for future. Based on the above, the factory shall compile detailed instructions for maintenance, repairs & safety of each type of equipments for guidance.

5.11.2 In the event of a fault in the transformer / switchgear / apparatus involving gushing out of oil / smoke / fire, following additional steps shall be taken:-

(a) No one shall go near it.

(b) The transformer shall be put OFF from both the sides i.e. primary and secondary.

(c) If the fire is still continuing, attempts shall be made:-

i) to control the fire to the extent possible.

ii) Prevent spread of the fire.

5.11.3 After completion of the Repairing, maintenance or rectification work, following checks shall be made positively:-

(A) **Switch gear**.

i) The work has been done correctly and all the alignments are correct.

ii) All the insulations / bushings are free from cracks and there are no signs of current leakage or flash over.

iii) The ACBs / VCBs / Switchgears shall be tested for IR Value, Contact resistance, Dielectric strength for oil (if there is still any OCB left for replacement with ACB or VCB). The results shall be compared with the values obtained for similar healthy functioning Switchgears or the values recommended by the manufacture.

iv) Tripping mechanism of the switchgear is functioning properly and all the protective devices / interlocking etc. are in order.

v) Tripping batteries where provided are in healthy condition.

vi) Any fault in the circuit associated with the fault in circuit breaker is cleared before making it ON, alternately it shall be isolated.

vii) List of tools / spares / accessories, used for the purpose of repair, maintenance or adjustments etc. are to be tallied to confirm that nothing is left unaccounted.

viii) Work / operation such as repair, maintenance or adjustments etc. are to be recorded in the log sheet. All results of check & tests carried out after the work shall be recorded in a register.

ix) The permit (issued if any) for working on the circuit controlled by it is returned duly cancelled.

5.11.4 Only after the completion of the above formalities the switchgear must be made 'ON'.

5.11.5 For the purpose of assessing the functioning of protective devices or the switchgear a record of tripping under fault shall be maintained in **Proforma 8**.

5.11.6 Number of persons in the area shall be limited to the barest minimum, at the time of switching ON the switchgear after repair, maintenance or adjustments etc.

5.11.7 After the completion of rectification the following must be checked / followed before energising any equipment:-

**(B) Transformer:-**

i) The rectification has been done correctly, all the connections are tight, and all the jumpers are insulated and that there are no loose hanging live parts / connections, earthing wire or chain connected for safety has been removed.

ii) The bushings are in good conditions.

iii) The IR values, ratio tests, voltage tests, Dielectric strength of oil tests etc. are taken and found to be satisfactory. These final values should be recorded.

iv) Tap changer is in healthy condition at all positions.

v) Any faulty circuit associated with the fault in the transformer is cleared / isolated.

vi) List of tools / spares / accessories drawn for the purpose of repairs is checked to confirm that nothing is left in contact with conductor.

vii) Air lock in Buchholz relay, if provided, is removed.

viii) Oil level in the conservator tank is correct & there is no oil leakage from anywhere.

ix) Temp. Relay contacts are wired and are in functioning order.

x) Buchholz relay is wired and is in functioning order.

xi) No person is detailed in the transformer room at the time of energising. In case the transformer is in the same hall as the switchgear it should be ensured that no one remain near the transformer.

xii) Silica gel should be re-activated at $150^0$ to $200^0$ C.

xiii) Number of persons near the transformer are limited to the barest minimum at the time of switching 'ON'.

**(C) Reactor.**

i) The rectification has been done correctly and all connections are tight. The equipment is tested and found satisfactory.

ii) Any faults associated with the fault in the equipment is cleared / isolated and a certificate to that effect obtained from the maintenance authority.

iii) Sub paragraph number vi), xi) and xiii) of para (B) above will also apply.

**(D) Condensers, Capacitors or APFCs:-**

Point No. vi), xi) and xiii) of para (B), point No. (i) & (ii) of Para (C) above shall apply.

**(E) Batteries.**

(i) Manufacturer's instructions shall be followed for carrying out any repairs on the batteries.

(ii) Never apply heat (for soldering or brazing or sealing) with the stoppers closed and electrolyte filled in the cells. The stoppers and electrolyte shall be removed before such working.

(iii) Charging, discharging and maintenance of specific gravity of the electrolyte etc. should be done according to the manufacturer's instructions.

(iv) Alkaline batteries (if in use) shall not be kept in the same bay of acid batteries. It is preferable to charge the two types of batteries in different rooms.

(v) Exhaust fan shall be provided in the charging bay / room for the batteries.

(vi) Acid resistant tiles shall be provided for the flooring of battery room.

(vii) For new installations, Sealed Maintenance Free batteries should be preferred.

5.11.9 Testing of installation, apparatus, switchgear or supply system only up to and including 650V, under live line condition may be permitted, provided all steps mentioned as under are taken to ensure safety:-

i) Use of hand gloves of good quality and appropriate voltage rating.

ii) Use of proper tools (insulated pliers, screw driver, fuse puller, test lamp with exposed lead not exceeding 3 mm etc.)

iii) The gadgets required to be used for such live line working (checked and found in healthy condition) are used.

iv) No connections or disconnections are made under live line condition.

v) No attempt is made to inject any voltage into any part of the line /circuit by external connection or by passing / altering the connection while the switch is ON.

vi) Work shall be done under the direct supervision and directives of a qualified and experienced electrical engineer.

**5.12 Maintenance schedule of Dry TypeTransformers**:-

5.12.1 Before entering or working on the transformer, always de-energise transformer and ground the case and connect the ground to all terminals of the transformer. Remove these terminal earthing connections before re-energising the transformer.

5.12.2 All installation and inspection test results shall be recorded and filed for future reference and inspection.

5.12.3 Log books should be provided to record all switching operations, isolations and trip occurrence.

5.12.4 **(A) Daily Inspection:-**

(i) Inspect the transformer visually.

(ii) Note down winding temperature.

(iii) Ensure the surrounding of the transformer clean and dry.

(iv) Ensure adequate clearance / passage.

(v) Ensure winding and core temperature meters are functional and readings are regularly being recorded.

(vi) All covers are properly closed and locked.

**(B) Quarterly Inspection:-**

(i) Ensure that the transformer is free from obstructions. There is no accumulation of dust, dirt, seepage or water.

(ii) Ensure that all earth connections are properly connected and rigid.

(iii) Check the condition of incoming and outgoing cables.

(iv) Ensure all inspection covers, access, doors, plug and socket fastening bolts are in position and tight.

(v) Ensure tap changer cover is secure.

(vi) Ensure the integrity of the neutral earthing system.

**(C) Yearly Maintenance / Scheduled Major Maintenance:-**

(i) In order to facilitate major overhaul, de-energise the transformer and ground / earth its case and all terminals of the transformer.

(ii) The windings may be cleaned with a vacuum cleaner, a blower or with dry compressed air (Pressure should not be over 25 lbs/In.$^2$). The use of a vacuum cleaner should be preferred.

(iii) Remove any dust and rust from the core and windings.

(iv) Supports to cables, tap changer, terminal boards, bushings and other major insulating surfaces should be brushed or wiped out with a dry lint free cloth.

(v) All nut and bolt connections are to be tightened properly.

(vi) Winding insulation test should be checked and the test results should be recorded.

(vii) Minimum values of the insulations must be according to the recommendations of manufacturer of the transformer or as per the table given below:-

| MINIMUM INSULATION RESISTANCE TABLE | | |
|---|---|---|
| S. No. | Winding Class (KV) | Insulation Resistance (MΩ) |
| 1 | 1.2 | 600 |
| 2 | 2.5 | 1000 |
| 3 | 5.0 | 1500 |
| 4 | 8.7 | 2000 |
| 5 | 15.0 | 3000 |

# CHAPTER – VI

# OVERHEAD LINES

## 6.1 General Introduction:-

Some of the safety points applicable to overhead lines in general are given here under:-

6.1.1 For the purpose of this SI, the term Overhead lines include all aerial lines (insulated or bare) used for transmitting /distributing electric power including service lines.

6.1.2 The lines shall be constructed keeping in view the prime factors of safety as well as electrical and mechanical design considerations.
{theCEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Reg. 2010 No. 90(1)}

6.1.3 **For Chemical Factories,** the installation shall in addition be governed by STEC regulations (chapter X) / safety instructions for explosives factories / buildings.

6.1.4 CEA Regulations, BIS Standards / Specifications & Code of practices, international IEC standards and Standing Instructions for Overhead lines in general and given below are required to be complied with at the time of installation, testing, maintenance and repairing of overhead lines. However, if there are some contradiction in international IEC standards and BIS Standards /Specifications, latter shall be followed.

6.1.5 The overhead line system shall be constructed so as to ensure:-

(a) Voltage conditions are within permissible levels.

(b) Improvement of reliability and security of power supply.

(c) Improvement in quality of supply.

(d) Adequate capacity for load growth for next 5 years.
{CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Reg. 2010 No. 92}

6.1.6 Overhead lines shall be routed preferably through an open area, (where there is not much movement of persons) as far away from buildings as possible. It shall terminate as close to perimeter or boundaries to the estate as possible. The objective is to ensure its rout through the factory and the estate to keep minimum. {CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Reg. 2010 No. 93}

6.1.7 An overhead line shall not cross over an existing building as far as possible and no building shall be constructed under an existing overhead line. {CEA Reg. 60(1) & 61(1)}

6.1.8 Where an overhead line of voltage exceeding 650 volt passes above or adjacent to any building or part of a building or structure, it shall have on basis of maximum sag a vertical clearance above the highest part of the building immediately under such line, as given in **table 6.2.1**. {CEA Reg. 61(2)}

6.1.9 Electric overhead lines shall be designed and constructed complying with the requirements mentioned in applicable Indian Standards as well as other rules and regulations as per latest amendments. The design and construction of the electric lines shall be such that they perform their intended functions. {CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Reg. 2010 No. 94(1)}

6.1.10 Extension of existing lines shall be carried out after ensuring that the limits of voltage variations on the lines are not exceeded.
{CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Reg. 2010 No. 94(2)}

6.1.11 Reliability and security of supply shall be improved by sectionalizing the overhead lines, auto re-closers, ring main units (RMUs) and fault passage indicators as per techno-economic considerations.
{CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Reg. 2010 No. 94(3)}

## 6.2 Clearances:-

6.2.1 Minimum vertical and horizontal clearance from the ground, buildings, any structure, tree branches etc. shall be not less than:-

**Table 6.2.1**

<table>
<tr><th rowspan="2">Minimum Clearance from the Ground</th><th colspan="4">VOLTAGE RANGE</th></tr>
<tr><th>When Voltage exceeds 33KV</th><th>Voltage not exceeding 33 KV</th><th>Voltage not exceeding 11KV</th><th>Voltage Not Exceeding 650 V</th></tr>
<tr><td>Lines erected elsewhere other than along or across or any street.</td><td>5.2 m + 0.3 m for every addl. 33 KV or part thereof by which the voltage of the line exceeds 33KV</td><td>5.2 m,<br>(For voltage Exceeding 11 KV but not exceeding to 33 KV)</td><td colspan="2">4.6 m if conductor is bare, 4.0 m if conductor is insulated.<br>(For voltage up to and including 11 KV)</td></tr>
<tr><td>Along a street</td><td rowspan="2">6.1 m+ 0.3 m for every addl. 33 KV or part thereof</td><td colspan="2">5.8 m (For voltage Exceeding 650 KV but not exceeding to 33 KV)</td><td>5.5 m</td></tr>
<tr><td>At road Crossing (across a street)</td><td>6.1 m</td><td>6.1 m</td><td>5.8 m</td></tr>
<tr><td>When an overhead</td><td>3.7 m + 0.3 m for</td><td colspan="2">3.7 m</td><td>2.5 m (When the line passes</td></tr>
</table>

| | | | |
|---|---|---|---|
| line passes above or adjacent to any building or part of a building or metallic structure.<br>(For any flat roof, open balcony, verandah roof and lean-to-roof and on the basis of maximum sag in the line) | every addl. 33 KV or part thereof<br>(When roof is flat then from the highest point of building) | (When roof is flat then from the highest point ofbuilding)<br><br>(For voltage Exceeding 650 KV but not exceeding to 33 KV) | above the building a vertical clearance from the highest point ofbuilding) |
| | | | 2.5 M<br>(For pitched roof, when the line passes above the building a vertical clearance immediately under the line) |
| The horizontal clearancebetween thenearest conductor and any part of such building or metallic structure.(on the basis of maximum deflection due to wind pressure) | 2.0 m + 0.3 m for every addl. 33 KV or part thereof<br>(When line passes adjacent to the building) | 2.0 m<br>(For lines of voltage exceeding 11kV up to and including 33 kV)<br><br>(When line passes adjacent to the building) | 1.2 m<br>(For lines of voltage exceeding 650 volt up to and including 11 kV)<br><br>(When line passes adjacent to the building) |

{CEA Reg. 58, 60(2) & 61(2)}

6.2.2 Where an overhead line crosses another overhead power line, clearances shall be as under:-
(Minimum clearances in meters between lines crossing each other)

| S. No. | Nominal System Voltage | 11-66 kV | 110-132 kV |
|---|---|---|---|
| 1 | Up to 650 V | 2.44 | 3.05 |
| 2 | 11-66 kV | 2.44 | 3.05 |
| 3 | 110-132 kV | 3.05 | 3.05 |

6.2.3 No rods, pipes, or similar materials shall be taken below or in the vicinity of any bare overhead conductor or lines if these contravene the provisions for clearances under CEA Regulations 58, 60 and 61.

6.2.4 No materials or earth work or agricultural produce shall be dumped or stored.

6.2.5 No trees shall be grown below or in the vicinity ofbare overhead conductors, lines or underground cables to contravene the provisions of the CEA Regulation [No. 58, 60 and 61].

6.2.6 No flammable material shall be stored under the electric supply line.

6.2.7 No fire shall be allowed above underground cables. Firing of any material below electric lines shall be prohibited. {CEA Reg. 64}

6.2.8 For new installations, it is recommended to go for underground cables for communication purposes. However, no underground telecommunication cable shall be laid without a minimum separation distance of 0.6 meters to the underground power cable of voltage exceeding 33 kV. {CEA Reg. 76(2)}

6.2.9 Where conductors forming parts of systems at different voltages are erected on the same supports, adequate provision to guard against danger to linemen and others, shall be made from the lower voltage system being charged above its normal working voltage, by leakage from or contact with the higher voltage system and the methods of construction and the applicable minimum clearances between the conductors of the two systems shall be as specified in Point No.6.2.2 for lines crossing each other. {CEA Reg. 62}

6.2.10 Phase separators should be provided in the overhead lines for maintaining adequate clearance under condition of wind, storm, rain etc., wherever required.

## 6.3 Guarding.

6.3.1 Guarding is a must at the following instances:-

(a) Where overhead line cross streets, buildings, any structures, barbed wire fencing, perimeter wall / fencing.

(b) Where lines of different systems or voltages cross each other or are carried on same support.

(c) On all power lines above 650 V up to and including 33 KV erected along or crossing street.

(d) Where an overhead line crosses or is in proximity to another overhead line, guarding arrangement shall be provided so as to guard against the possibility of their coming into contact with each other. {CEA Reg. 69 (iii)}

6.3.2 Where guarding is required, the following shall be observed:-

(i) Every guard-wire shall be connected with earth at each point at which its electrical continuity is broken.

(ii) Every guard-wire shall have an actual breaking strength of not less than 635 kg and, if made of iron or steel, shall be galvanized.

(iii) Every guard-wire or cross-connected systems of guard-wires shall have sufficient current-carrying capacity to ensure them

rendering dead, without risk of fusing of the guard-wire or wires, till the contact of any live wire has been removed.
{CEA Reg. 70}

6.3.3 Guarding must include cross piece / cradles / catch guards as per scale given below:-

(i) At all street / road crossings:- One cradle piece per running meter of the line.

(ii) Crossing of power lines of different systems, crossing of overhead pipelines, supports, roofs of buildings, earthed structures, fencing, metallic objects:- One cradle piece every 0.5 m run on the portion above the pipe line etc. plus 1.0 m on either side.

6.3.4 By road side:-

Where the space below is frequented by persons walking across, one cradle piece 0.5m away from the pole on either side & one cradle piece at every 2.0 m length of span.

6.3.5 Open country & at other places:-

One cradle piece or catch guard on both side of the pole (if pole is not end pole).

6.3.6 Where line up to and including 650 V and telephone lines supported on the same poles:-

(a) One cradle piece every at 0.5 m length of the line span, when the clearance between the lines of the two systems is less than 1.5 m.

(b) One cradle piece at every 1.5 m length of the line when clearance of the two systems is more than 1.5 m.

6.3.7 The object of guarding is to ensure disconnection of power supply in the event of a conductor breaking. To achieve this effectively, the guarding should be connected to earth and the protective system tuned effectively to function in the manner stated above. While guarding is a must at places indicated under 6.3.1, at other places other protective devices like catch guard, ring guard etc. can be used, provided the fuses / protective devices are correctly set to trip/off the supply in the event of fault (Snapping / excessive sagging leading to short circuit).

6.3.8 Earthing shall be provided to all metallic poles, any metallic fitting attached thereto and guarding at minimum three (3) equidistant places

at the span of 1.0 km and it shall be continuous over the entire length of the line. {CEA Reg. 72 (1)}

6.3.9 Metallic bearer wire used for supporting insulated wire of overhead service lines of voltage not exceeding 650 V shall be efficiently earthed or insulated. {CEA Reg. 72(2)}

## 6.4 Stay Arrangements:-

6.4.1

(i) To prevent tilting of a pole from its normal position due to abnormal wind pressure and deviation of alignment, the pole shall be kept in position by stays. The stays shall be provided where the overhead lines are at:-

(a) angle locations;

(b) dead end locations;

(c) tee off points;

(d) steep gradient locations;

(e) cut- point;

(f) along the straight run at minimum two locations in one (1) km.

(ii) Galvanized iron stay wires and stay rods of adequate size shall be used. The individual wire used to form "stranded stay-wire" shall have a minimum tensile strength complying with relevant IS. For double pole structure, four stays along the line, two in each direction and two stays along the bisection of the angle of deviation or as required depending on the angle of deviation shall be provided.

(iii) When two or more stays are provided on the same pole, each stay shall be grouted entirely separate from the other.

(iv) The angle between the pole and stay wire shall be about 45 degrees and in no case it shall be less than 30 degrees. ·

(v) Stays shall be anchored either by providing base plates, angle ironor rail.

(vi) Stays shall either be connected to earth or shall be insulated using a stay insulator. If insulated, stay wires shall be connected to the pole with a porcelain guy strain insulator as per relevant IS. The Porcelain insulator shall be inserted in the stay wire at a height of minimum 3.0 m vertically above the ground level. The strain

insulators shall be free from defects, thoroughly vitrified and smoothly glazed.

(vii) Wooden insulators shall not be used for providing insulation to stay/guy wire.

{All above are as per {CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Reg. No. 100(1) to (7)}

6.4.2 Stays shall be always in tension and not remain loose at any time.

6.4.3 Direction of stay shall be such as to neutralise any strain on the poles due to tension of conductor/s.

6.4.4 Parts of a building or structure should not be used to anchor or support a stay or overhead line.

**6.5 Earthing arrangements:-**

6.5.1 Earthing of Poles:-

(i) All metallic supports shall be permanently and effectively earthed. The earthing arrangement shall conform to relevant IS.

(ii) Metal cross arms and insulator pins for PCC and PSCC poles shall be bonded together and normally earthed at every pole for 33 kV or 22 kV or 11 kV lines and at every 5th pole for lines below 500 volts.

(iii) The support on each side of a road crossing, railway crossing or river crossing shall be earthed.

(iv) All steel poles on which switches, transformers, fuses etc. are mounted shall be earthed.

(v) All poles above 650 volts, irrespective of inhabited areas, shall be earthed. For poles below 650 V guarding with continuous earth-wire shall be provided invariably, connected to earth at three equidistant points in one km.

{All above are as per {CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Reg. 2010 No. 99(1) to 99(6)}

6.5.2 All metallic cross-arms/supports of insulators, clamps, guarding wires shall be connected to earth through an earth wire running all along the overhead line, and earthed at 3 nearly equidistant places in one km. {CEA Reg. 72(1)}

6.5.3 The earth wire shall be connected (in addition) to an earth pit at terminal poles and shackle points. The earth wire on either side of a shackle point should have continuity.

6.5.4 The earthing system of the overhead lines shall be checked initially after completion of the installation before commencing supply. Subsequently, every year checking shall be done on the earthing system before the onset of monsoon and results of earth resistance test at each earth point shall be recorded in **Proforma 11C**.

6.5.5 The earth resistance of surge absorber should also be checked once a year. The functioning of a surge absorber shall be checked after each lightening stroke, for its effectiveness, involving functioning of the surge absorber. {CEA Reg. 41 & 48}

## 6.6 Supports (Poles and Towers):-

6.6.1 The supports shall be poles or narrow based lattice towers with fully galvanised structure as per site requirement.

6.6.2 Poles may be used for 33 kV, 22 kV, 11 kV and lines below 650 V as per requirement. The poles shall be pre-cast concrete (PCC) pole, pre-stressed cement concrete (PSCC) pole, rolled-steel joist, rail pole or steel tubular pole as required, provided PCC and PSCC poles shall not be used at cut-points and as end poles.

6.6.3 Concrete poles shall be preferred in plain areas.

6.6.4 For locations involving long spans or higher clearances on account of crossing of power or communication lines or a railway line, specially designed poles / lattice towers may be used.

6.6.5 For angles of deviation of more than 10 degree, double pole structure shall be used.

{All above are as per {the CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Reg. 2010 No. 95(1) to 95(8)}

6.6.6 All poles supporting overhead lines shall be properly numbered. The number should also indicate the feeding substation, system and maximum voltage of conductors carried.

6.6.7 Supports carrying conductors involving back feed etc. should be specially marked in red. Switches controlling back feed or alternate supply should be provided with some locking device to prevent inadvertent operation, painted in red and carry suitable marking to indicate the back feed/alternate supply.

6.6.8 Supports of overhead lines pertaining to different agencies (controlled/operated) installed in the same area shall be marked and painted in different colours to enable easy identification of the system.

6.6.9 AB switches / TPMO switches where provided shall be kept locked.

6.6.10 The area below surge absorbers, AB switches, D.O. fuses, shackle and tapping points shall be kept clear of wild growth and be easily approachable.

6.6.11 Trees and metallic structures (not forming a part of the electric installation) shall not be used to support any overhead line / service line.

## 6.7 Danger Notices Boards / Plates:-

Every pole/structure of voltage exceeding 250V shall be affixed with permanently in a conspicuous position, a danger notice in Hindi or English and the local language of the district, with a sign of skull and bones of a design as per IS-2551.[theCEA Reg. 18]

## 6.8 Anti-Climbing Devices-

Anti-climbing devices shall be provided on the supports. For this purpose barbed wire conforming to relevant IS for a vertical distance of 30 to 40 cm. at a height of 3.5 to 4meters from ground level or clamps with protruding spikes at a height of 3 to 4meter shall be used.

{CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Reg. No. 102}

## 6.9 Line Span:-

(i) Line span shall be decided taking into consideration topography, wind pressure, type of support, conductor configuration and ultimate tensile strength of conductor.

(ii) The span shall be within the range specified by IS.

(iii) Uniform span shall be maintained as far as possible between consecutive pole structures.

(iv) While constructing a line, if a road crossing occurs at mid span, then a pole shall be placed on one side of the road so as to avoid mid span at the road crossing.

(v) While crossing another power line, the lower voltage line shall be underneath. The lower line shall normally not cross at mid span of the upper line.

(vi) While placing poles on high ground, shorter poles can be used while maintaining proper ground clearance at the middle of the span.

(vii) Poles shall normally not be placed along the edges or cuts or embankments of creeks and streams.

(viii) At all the places where the new line crosses over roads or another existing line, adequately earthed guard wire mesh below the line shall be provided to avoid the conductor of the new line falling over the areas below, in case of any break. In cases where the line passes below an existing line, the guard wire mesh shall be provided above the new line under construction.

{All above as per CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Reg. No. 96(1) to 96(8)}

## 6.10 Erection of Poles and factor of safety:-

Erection of poles shall be carried out in accordance with the provisions of relevant IS. For factor of safety in overhead lines CEA Reg. 57 shall be followed.

## 6.11 Insulators, Insulator Strings and Hardware Fittings:-

(i) Pin insulators shall generally be used on the straight stretch of a line. The pin insulators shall conform to relevant IS. These may be used on lines up to 33 kV.

(ii) Shackle insulators shall be used in lines below 500 volts and these shall conform to IS. Strap type fittings shall be used for a dead end location, while U-clamp fittings shall be used at tangent locations.

(iii) Requisite type of suspension and tension insulator strings with disc insulators or long rod insulators offering equivalent performance shall be used on 33 kV or 22 kV or 11 kV lines. The number of insulators and creeping distance shall be selected based on electrical system parameters taking into account altitude of site, expected environmental and pollution conditions etc. For critical locations with high pollution level, anti-fog type insulators or polymer insulators may be used for better performance. The special coating on the insulators may be used as per requirement.

(iv) Disc Porcelain insulators shall conform to relevant IS. Polymer / composite insulators conforming to relevant IEC / other international Standards may also be used.

(v) Disc type insulators shall be of Ball and Socket type or Tongue and Clevis type.

(vi) Insulator strings shall be complete with all required hardware fittings. The fittings shall conform to relevant IS.

{the CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Reg. No. 104}

## 6.12 Cross-Arms:-

Cross arms shall be provided in accordance with the requirement. In case, they are made of mild steel, the cross-arms and the clamps shall be hot dipped galvanized conforming to relevant IS, after completion of fabrication. Welding at site should be avoided as far as possible, in case welding becomes necessary, the joint shall be covered with cold galvanizing paint.{the CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Reg. No. 105}

## 6.13 Conductor:-

6.13.1

(i) The size of the conductor shall depend upon the voltage regulation, factor of safety, power to be transmitted, length of line, future load requirement consideration, line voltage and mechanical strength desired.

(ii) Aluminum conductor steel reinforced (ACSR) or equivalent all aluminum alloy conductors (AAAC), all aluminum conductor (AAC), aluminum alloy conductor steel reinforced (AACSR) complying with relevant IS shall be used according to requirement.

(iii) Required accessories for conductor and earth wire viz. mid-span compression joints, repair sleeve, T-connector, flexible copper bond, vibration dampers, spacer / spacer-dampers, earth wire clamps etc. shall conform to relevant IS.

(iv) The configuration of conductors on the line can be triangular, horizontal or vertical depending upon the voltage level of the lines, terrain, right of way and clearances to be maintained. In case horizontal clearance from a building is difficult to secure, vertical arrangements of the conductor shall be adopted.

{the CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Reg. No. 106(1) to 106(5)}

6.13.2 No conductor of an overhead line shall have more than one joint in a span and joints between conductors of overhead lines shall be mechanically and electrically secure under the conditions of operation.

6.13.3 The ultimate strength and the electrical conductivity of the joint shall be as per relevant Indian Standards.{the CEA Reg. No. 56}

## 6.14 LTSpacers:-

To avoid clashing and accidental mutual touching of bare overhead conductors on LT lines, spacers, which can be either spiral or composite shall be provided in between conductors at appropriate locations in different spans (particularly for lines having longer spans or lines having large sags encountering high winds).

{the CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Reg. No. 107}

## 6.15 Cables:-

6.15.1

(i) Underground cables or Aerial Bunched Cables (ABC) of adequate rating can also be used for supplying power. Cables shall conform to relevant Indian Standards.

(ii) PVC cables shall not be used in systems working exceeding 650V.

(iii) AB Cables shall be used in the theft and accident-prone areas.

(iv) Direct burying of underground cables shall not be adopted except where cables enter and take off from a trench.

(v) The underground cables shall be segregated by running in separate trenches or on separate racks.

(vi) The cable trenches shall be properly sloped so as to, drain freely any water, which may enter.

(vii) Cable trenches shall not be run through oil rooms.

(viii) Adequate number of spare cores shall be included in all control cables.

{the CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Reg. No. 108(1) to 108(9)}

6.15.2 Underground power cable shall be laid as per the table given below:-

| S. No. | Voltage (V) | Minimum Depth Required |
|---|---|---|
| 1 | Up to 650 V | 0.75 m |
| 2 | 650 to 11 kV | 1.00 m |
| 3 | More than 11 kV | 1.20 m |

6.15.3 No underground telecommunication cable shall be laid without a minimum separation distance of 0.6 meters to the underground power cable of voltage exceeding 33 kV. {CEA Reg. 76(2)}

6.15.4 Cable laid under road crossings, drainage/sewage line or subject to heavy load etc. shall be drawn through “Class C GI pipe” of sufficient

size (to house the cable comfortably) and single length (i.e. without any in line joint) and in rest of the complete length it shall be covered with Class A bricks on it and at least 6 inch deep bedding of clean and dry sand (3 inch under and 3 inch above the cable).

6.15.5 When any cable is to be laid under road crossing, road digging/cutting shall be avoided. Preference shall be given to lay the cable through horizontal boring method through the conduit/pipe housing the cable.

**6.16 Service Lines-**

6.16.1 No service line of tapping shall be taken off an overhead line except at a point of support.

6.16.2 Provided that the number of tapping per conductor shall not be more than four in case of connections at voltage not exceeding 650 V.{the CEA Reg. No. 71}

6.16.3 No. of service lines emanating from a pole shall be limited to four. If more number of service lines are required to be taken this can be done through a Kiosk or Pillar box or distribution board mounted on the pole in a weather proof enclosure.

6.16.4 All insulated wire service lines should be adequately supported by a G. I. catenary wire.

6.16.5 Person assigned to work on overhead line must be provided with the following:-

(i) A suitable strong ladder.

(ii) A piece of rope for lashing the ladder to the pole.

(iii) Safety belt.

(iv) A pair of hand gloves of approved quality.

(v) A helmet of insulating material.

(vi) Rubber boots.

(vii) A line tester.

(viii) A torch in working condition (if night working is involved).

(ix) Discharge rod.

(x) Shorting chains.

(xi) Tools required for the use on overhead lines (pulley draw use ropes, blocks etc.) for the type of work.

(xii) Any other equipment / gadgets to ensure safety as necessary.

(xiii) A test lamp having following specifications:-

(a) Lamp holders shall be of bakelite pendent type.

(b) Always two test lamps (230 V types) of equal wattage connected in series shall be used for testing MV installations. These test lamps can be fitted on a bakelite sheet. Shorting of one test lamp with a coin is not permitted.

(c) Test leads shall be adequately insulated and be of stiff wire. The bare ends shall not be more than 5 mm. They can be connected to test probes.

(d) The test lamps shall be checked before use to ensure that it is in working order.

(e) As far as possible neon testers should be used to check the live points before using the test lamps.

(f) The testing shall be done by only one person. Any other person / helper shall not remain close to the unit being tested. While testing, the person testing it shall keep his head as far away from the apparatus being tested, as possible.

(g) Use of test lamp in an area where explosives are handled shall be done with the permission of the concerned safety / production staff.

6.16.6 Person/Employee actually working at more than 3.0 meter height shall be free from (a) High BP, (b) Vertigo, (c) obesity & (d) Epilepsy. He should have good eye sight also. {OFB letter No. 104/SF/GEN/COS, Dated: 09/06/17}

## 6.17 Lightning Protection:-

6.17.1 The surge arresters (SAs) shall be placed at the terminal points of the lines and also at the junction points of cables and bare overhead conductor lines.

6.17.2 For 33 kV, 22 kV and 11 kV lines, surge arresters having rated voltage of 30 kVrms, 20 kVrms and 9 kVrms and discharge current rating of 10 kA, 7.5 kA and 5 kA, complying with relevant IS, shall be used respectively.

6.17.3 The earth wire of appropriate size to take care of predicted/design fault currents and lightning complying with relevant IS shall be used. The earth wire shall be either of Galvanized Stranded Steel (GSS) or alternatively ACSR/ AACSR conductor.

6.17.4 The earthing lead for the surge arrester shall not pass through any iron or steel pipe, but shall be taken directly to a separate earth electrode.

{the CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Reg. No. 110}

## 6.18 Protection of 33 kV, 22 kV, 11 kV and LT System:-

6.18.1

(i) The protection scheme shall be finalized based on prudent utility practice.

(ii) An earth leakage protective device shall be provided as per requirement of Central Electricity Authority (Measures Relating to Safety and Electricity Supply), Regulations as and when these are notified by the Authority.

{the CEA (Technical Standards for Construction of Electrical Plants and Electric Lines) Reg. No. 111}

6.18.2 It is the responsibility of In-charge/EM of concerned group to check and ensure that the tools and safety gadgets used by the workers are in good & safe working condition. This shall be done on a monthly basis by the Staff / in-charge for the work and every time before commencing the work by in-chargeof the gang. Under no circumstances should a person be allowed to use unsafe tools / safety gadgets.

6.18.3 Warning boards should be fixed at either end of the zone of work and at the controlling switch. The warning board bearing an inscription “MEN WORKING ON LINE. DO NOT SWITCH ON.” This should be in English / Hindi and local language.

6.18.4 Line should be discharged to earth. Lines should be shorted by shorting chain at either end of the work zone.

6.18.5 No person shall apply test voltage to any mains unless he has received a permit to work and has warned all persons working in the mains of the proposed application of test voltage. If any part which will become alive, is likely to be exposed, as a result of application of test voltage the person in-charge of the test shall take precautions to ensure that the exposed live portion does not constitute any danger to any person. It should also be ensured by the person in-charge before application of test voltage that no other permit to work has been issued for working on these mains.

6.18.6 No person shall work within the minimum safe distance from the exposed live mains or apparatus. The minimum distance depends upon the actual voltage. This does not apply to operations carried out on mains and apparatus which are so constructed as to permit safe operation.

6.18.7 No person after receiving of permit to work shall work or any way interfere with any high voltage mains or conductors or conduits carrying voltage exceeding 650V, except under the personal instructions and supervision at site of work by a competent person.

6.18.8 Except for the purpose of testing, phasing etc. the earthing and short circuiting device shall remain connected for the duration of work.

6.18.9 Earthing devices shall be connected only after verification that the circuit is rendered dead. It should be done in such a manner that the persons doing the job are protected by earth connection on both the sides of the working zone. All the three phases should be effectively earthed and shot circuited, though work may be proceeding only for one phase.

6.18.10 The earthing and short circuits of lines specified in the permit to work shall be removed or interfered only with the authority of the person In-charge for the work.

6.18.11 When the mains to be worked upon are to be divided into two or more sections; isolation & earthing etc. shall be carried out on each section.

6.18.12 It shall be ensured that the control switches controlling different feeders or circuits are correctly marked. This shall also be confirmed before commencing the work that the line is really dead.

6.18.13 Work on overhead lines and apparatus should, as far as possible, be planned in such a way that it would be possible to return the permit and energise the installation on the same day. Where this is not possible and work has to be continued on the same permit, the next day or after few days, the In-charge of the repair team should before commencement of work, check that the switches, DO fuses, Gang operating switches etc. controlling the line are in the 'OFF' position and the line is discharged.

6.18.14 Adequate care should be taken during rectifications of the breakdowns of overhead lines that continuity of earth wire between its different sections, earth pit guard, iron mongery on the poles, stays (where un-insulted) are not impaired. Any rectification necessary should be done before energising the system. Testing of earth continuity and earth resistance should be checked after each major line repair.

6.18.15 When dead mains are to be connected to live mains, all connections to live parts shall be made at last and in all cases phase sequence shall be checked to ensure that only like phases are connected together. Before inserting fuses or links in a feeder of distribution pillar controlling the

cable / O. H. distribution lines on which a fault has been cleared, each phase shall be connected through a test switch / fuse.

6.18.16 No work shall be done on any overhead line during the period of thunder and lightning.

6.18.17 The above precautions are applicable even in cases where work has to be done on overhead line conductor of a feeder / circuit / system / Street lights / Telephone system / P.A. system supported on the same pole or supports. If the work is being done on the lower most conductor and the work does not involve stringing or drawl / renewal of lines or jumpers and there is a clearance of more than 6 ft. between it and the next vertical conductor above, permit / shut down need not be taken. Shut down will however be taken for the lines below.

## 6.19 ADDITIONAL PRECAUTIONS WHILE WORKING ON LINES HAVING VOLTAGE EXCEEDING 650 V:-

6.19.1 All lines shall be regarded as live and a source of danger and treated accordingly unless it is positively known to be dead, discharged and earthed.

6.19.2 No person shall work, or test or earth line without a permit to work except in cases where the work involved is connecting and testing apparatus etc. specially designed for connecting to live parts and work is done with equipments and safety gadgets / devices by the authorised person under the supervision of a competent person.

6.19.3 The operations of proving dead, earthing and short circuiting of any mains shall be carried out only by an authorised person under the instructions of the person in-charge of maintenance.

6.19.4 The electrical circuit shall be broken only by authorised persons by disconnecting switches, isolating links, unbolting connections or switches which are racked out. Where possible, the isolation should be checkedvisually.

6.19.5 Where the means of isolation, are provided with a device to prevent their operation by un-authorised persons, the device (lock) shall be used.

6.19.6 All earthing devices should be checked periodically and always prior to their use. Earthing devices should be connected only after verification that the circuit is rendered dead. It should be done in such a manner that the persons doing the job are protected by earth connections on both sides of the working zone. All the three phases should be effectively

earthed and short circuited though work may be proceeding on one phase only.

6.19.7 When the mains to be worked upon are to be divided into two or more sections, isolation & earthing etc. should be carried out on each section.

6.19.8 After completion of the work on O. H. line, all the earthing / shorting to earth shall be removed. The line shall be inspected visually and with the help of instrument to confirm that (a) no tools or (b) wire / earthing chain are left on the O. H. line (c) the line is in safe condition for charging (d) the readings of IR & ER are satisfactory. (e) the test result shall be recorded. (f) surge absorbers are O.K.

6.19.9 After testing the high voltage cables with DC voltage (megger) the cable shall be discharged through a 2 Mega-ohms resistance and not directly; owing to dielectric absorption, which is particularly prominent in the DC voltage testing of HV cables. The cables shall be discharged for a sufficiently long period to prevent rebuilding of voltage.

6.19.10 After completion of rectification & check-up detailed in 6.20.8 & 6.20.9; check should be made on the tripping batteries, protective devices of the switch gears and confirm that they are in healthy working order. This should be done before restoring the supply. Under no case should a switch be made 'ON' without confirming that the protective / tripping devices are satisfactorily functioning.

## 6.20 OTHER INSTRUCTIONS TO ENSURE SAFETY IN RESPECT OF OVERHEAD LINES:-

6.20.1 Whenever an arcing jumper, a snapped O.H. line conductor or a pole bent / broken and standing tilted in a precarious position is seen by anybody, the person seeing it shall report it immediately giving exact location to (a) security office and (b) electrical shift person.

6.20.2 He shall if possible also request the nearest available estate / security durwan or if durwan is not available, any responsible person to stand at the place, to warn the passing persons of the danger and remain there till relieved by a durwan or Security Staff or electrical personnel.

6.20.3 The in-charge gate office on receipt of the message shall:-

(A) pass it on to (a) JWM/ Electrical (in his absence D.O. Elec.) (b) Shift I/C (c) Electrical Section and (d) Orderly officer.

(B) arrange immediately to post one or two darwans at the spot to warn the persons passing that way of the danger. The durwan /

darwans will remain there till the situation is cleared by Elect. Section.

(C) obtain a confirmation in writing from the Elect. Sec. that the snapped wire has been isolated / made dead and that there is no danger.

(D) Record the time and date of the confirmation.

6.20.4 Orderly officer shall ensure that the above instructions are being complied without any delay.

6.20.5 Once the Electrical Staff reports at the place, it is their responsibility to rectify / isolate the snapped line. Till this is done the durwan shall not leave the place.

6.20.6 Tree branches shall be regularly cut to ensure the clearance as per para 6.2 above.

6.20.7 Vines and shrubs shall not be allowed to grow on any part of the overhead line system.

6.20.8 The area below overhead line shall be free from accumulation of debris, metallic scrap etc.

6.20.9 No material should be stacked below any overhead line; where it is unavoidable the following shall be complied:-

(A) Clearance as indicated in para 6.2 of this chapter.

(B) Close cradle guarding.

6.20.10 No building / structure should be constructed below overhead lines of 11kV and above.

6.20.11 No person or agency shall be allowed to work on wall or roof of a building or a metallic structure, perimeter wall or any part of an electrical installation which is close to an overhead lineor installation, unless the electric section is informed and their permission is obtained in writing before commencing the work. Same rule shall be applicable to the work involving excavation, digging or leveling the land manually or using any type of earth moving machine. The electric section shall see the place & examine the scope of work, give shut down / permit and prescribe in writing the requirements to ensure safety. EM section shall also ensure on Work Permit that **"There is no underground cable laid at the place of excavation, digging or leveling the land".**

# CHAPTER – VII

# ELECTRICAL INSTALLATION IN BUILDINGS

**7.1**

7.1.1 It is the requirement under CEA Regulations-2010 that all electrical installations shall be installed, operated and maintained in such a way as to prevent danger to human being, animal and property. {CEA Reg. 12(1)}

7.1.2 All electric supply lines and apparatus shall be of sufficient rating for power, insulation and estimated fault current and mechanical strength for the duty cycle required to be performed.{CEA Reg. 12(1)}

**7.2 Service lines:-**

**(A) General Conditions:-**

7.2.1 It shall be ensured that all electric supply lines, wires, fittings and apparatus are in a safe condition and in all respects fit for supplying electricity and all precautions shall be taken to avoid danger arising from such supply lines, wires, fittings and apparatus etc.

7.2.2 All service lines, either for any production building, office or residential quarters or block, which are underground or which are accessible shall be so insulated and protected as to be secured under all ordinary conditions against electrical, mechanical, chemical or any other injury to the insulation.

7.2.3 Every consumer using electric supply, supplied by the factory, shall take all possible precautions for the safe custody of the equipment belonging to the factory but installed at the premises under their control and shall also ensure that the installation under their control is maintained in a safe condition.

{CEA Reg. 13 (1) to 13(4)}

**(B) Service lines for buildings handling essentially lighting load:-**

7.2.4 Service lines in non-explosive factories can be of bare wire / insulated wire, through overhead line or underground cable.

7.2.5 If insulated wires or cables are used aerially, they shall be supported on a catenary wire connected to earth at the overhead line end and with building earth at building end.

7.2.6 Any metallic structures not forming part of overhead line system and trees shall not be used for supporting the overhead lines.

7.2.7 The entry of the service line into a building shall be through a G.I. pipe bend (outside opening shall be bent down wards).

7.2.8 Service lines shall be free from joints.

7.2.9 A service line shall be taken off only from a point of support. The number of tapping per conductor shall not be more than four.

**(C) Service lines for explosive buildings:-**

7.2.10 In addition to above, these shall conform to the safety regulations prescribed by STEC (See Chapter-X).

**(D) Service lines for buildings having predominantly power load:-**

7.2.11 Service lines for buildings having power load shall generally be fed from sub-station switch or Kiosks (Distribution box), through cables or overhead lines.

7.2.12 Entry of power supply line into the building shall be through a cable connected to the overhead line or the switchgear in the substation.

7.2.13 Feeding cables shall terminate into a switch panel through a fuse switch / ACB / MCB / MCCB according to the load involved and level of protection required. Under no condition this shall be connected to a bus bar directly.

7.2.14 Earth wire of adequate size connected to the earth wire of overhead line or earth system in the substation (in case the cable is not metal covered and armoured) shall also run along the cable.

7.2.15 Buildings with heavy loads may have more than one service line or cable from the same voltage or different voltage systems. Adequate care shall be taken to ensure that no harm results to the installation or the person if the circuits get inter connected. In case this is not possible all steps should be taken to keep the two circuits physically isolated and distinctly separate.

7.2.16 Every generating station, sub-station, junction-box or pillar in which there are any circuits or apparatus, whether intended for operation at different voltages or at the same voltage, shall be ensured by the means of indication of a permanent nature that the respective circuits are readily distinguishable from one another.
{CEA Reg. 24}

7.2.17 The pole number at which supply from the substation or main switch is entering up to the pole and the source to which these are connected shall be marked on the switchgear.

7.2.18 Cables of different voltage systems, type of voltage such as DC / AC or cables meant for lighting circuits should terminate into switchgears physically isolated and separated apart from each other.

7.2.19 Cables used at voltage exceeding 650V shall terminate into switchgear having adequate voltage rating and protection system for earth fault and overcurrent/short circuit fault. Ends of such cables shall be sealed with suitable type of cable termination boxes.

## 7.3 KIOSKS:-

7.3.1 Service lines may emanate from a kiosk feeding a number of buildings in the area. The kiosk may be fed electricity through a cable from a substation or overhead line.

7.3.2 Each individual service line emanating from the kiosk shall be protected by a fuse, MCB or MCCB having appropriate O/Load rating.

7.3.3 The kiosk must be totally enclosed type i.e. insect & vermin proof and be easily accessible for maintenance. All screws, panels or doors opened for repairing, testing, maintenance etc. shall be re-fixed / closed completely, after job completion.

7.3.4 All kiosks shall be kept locked with key available in the shift room or manned substation.

7.3.5 The outgoing feeders & incoming feeders from and to the kiosk shall be clearly marked.

7.3.6 Danger board shall be provided on the enclosure of kiosks.

7.3.7 The enclosure of all kiosks containing voltage system of normally exceeding 250 V but not exceeding 650 volts shall be earthed as per the Indian Standards in this regard and the provisions in the CEA Regulation No. 41 and the kiosks containing voltage exceeding 650V shall be earthed as per the Indian Standards in this regard and the provisions in the CEA Regulation No. 48. {CEA Reg. 37(ii)}

## 7.4 Control switches and panels:-

7.4.1 The service lines shall be according to type of load terminating into any of the following:-

i) Iron clad switch/MCB of appropriate poles (i.e. Double Pole / Triple Pole) and current capacity and type for buildings involving lighting / small load.

ii) MCCB/ACB/SFU(Switch Fuse Unit)/Switchgear controlling supply to one or more power panels (for buildings involving heavy loads).

7.4.2 The iron clad switches / MCCBs / ACBs / SFUs(Switch Fuse Unit)/ Switchgears shall be easily accessible and be installed at the minimum height of 1.25 m to maximum 1.70 m for easy access, operation and maintenance.

7.4.3 Isolating switches / MCBs / MCCBs and switchgears shall be installed in an easily accessible position on each floor (in case of a multistoried building) and separate for each building i.e. for industrial / domestic buildings.

7.4.4 The spacing of the switches / MCBs / switchgears shall be such as to facilitate easy operation and maintenance.

7.4.5 The space housing the switches / switchgears shall be kept clean and dry. The space housing the switches / switchgears shall not be used for storage of any materials especially inflammable or combustible material or refuse. [CEA Reg. 49{1(i)}]

7.4.6 The space in front of switch boards / switchgears shall be kept clear up to a minimum distance of 1.0 meter width. [CEA Reg. 37{iii(a)}]

7.4.7 The space behind / front of the switch / switchgear panel and the switch room (if housed in a room) shall not be used as a rest room / office / store room / workshop etc. or for any purpose and shall be left free.

7.4.8 Fuses, protective relays shall be of appropriate rating commensurate with the load and proper settings with respect to other relays in the circuit.

7.4.9 Neutral links shall be provided in residential quarters/ offices where lighting & fan loads are involved.

7.4.10 Switch panels / switch rooms controlling power supply to heavy industrial loads shall be treated as a switching station and shall be provided with :-

(a) sand buckets and fire extinguishers suitable for extinguishing electric fire as per the recommendations of CFEES, and

(b) artificial respiration chart in Hindi, English and local language of the district.

[CEA Reg. 27(1) and 28(1)]

7.4.10 The instructions given in Chapter-V (Substations) shall also apply to the extent relevant.

7.4.11 On every switchgear / panel or main controlling switches / switchgears shall be affixed permanently in a conspicuous position a danger notice board in Hindi, English and the local language of the district, with a sign of skull and bones of a design as per IS-2551. [CEA Reg. 18]

7.4.12 Armour of the cable shall be connected to enclosure of the switch / switchgears with the help of a compression gland to ensure the earthing of the armour also.

7.4.13 All switches / switchgears shall be clearly marked to indicate the load controlled by it. Incoming switches / switchgears shall be marked indicating the source of supply i.e. from and to indications of supply connected with the switch / switchgear.

7.4.14 Switches in explosive buildings shall in addition be governed by the safety regulation mentioned in STEC (see chapter X).

## 7.5 Safety Regarding Cable Trenches in buildings other than substations:-

7.5.1 It shall be ensured that cable trenches containing cables are filled with sand, pebbles or similar non-inflammable materials or completely covered with non-inflammable slabs. [CEA Reg. 44{2(xii)}]

7.5.2 Cable trenches shall be kept clean and free from water / oil seepage. Shop sweepings, metallic swarf / articles shall not be dumped into the cable trenches. Cable trenches shall not be used for running pipe line, water line or any other type of process line.

7.5.3 Cables shall be properly supported on rack / trays / wall and not multiply-crossed or jumbled with each other in the cable trench.

7.5.4 No joint shall be made in a cable trench inside a building.

7.5.5 No machinery shall be installed on or above any cable trench.

7.5.6 Control and power, cables shall run separately laid on separate racks & trenches.

7.5.7 Cables of different voltage systems shall be segregated & run on independent trays / racks / supports.

7.5.8 Cables shall not be allowed to run on floors without any mechanical protection.

**7.6 Safety regarding Wiring installations:-**

7.6.1 All accessories used for wiring shall be of appropriate design to suit the load conditions. These shall conform to the CEA Regulations relevant and specification of the BIS code of practice (IS – 732:1989) to ensure safety.

7.6.2 All parts, spares and accessories used for the wiring in buildings handling explosives; their selection & installation, shall confirm to the regulations mentioned in STEC recommendations; in addition to the CEA Regulations relevant / ISCP etc. (Ref. Chapter X).

7.6.3 Apart from danger boards, outgoing circuit name and supply from the feeder/substation; no other stickers or notice shall be fixed on electrical equipment & controls.

7.6.4 All switches, distribution board, sub switches etc. shall be installed in an easily accessible position and be approachable.

7.6.5 The space in front of switch / DBs shall be kept clear for easy approach and operation. It shall not be used as storage space /dumping ground for production materials or scrap, shift room, workshop, testing bay or office. Cotton waste, heater, inflammable material shall not be kept on the switches.

7.6.6 No fuses or switches shall be provided on neutral unless it is a specific requirement under explosive regulations. However, there may be made a provision of a neutral link in neutral wire for testing purpose.

7.6.7 Every electrical installation other than voltage not exceeding 250 V, below 2 kW and those installations of voltage not exceeding 250 V, shall be controlled by an earth leakage protective device whose maximum earth leakage threshold for tripping should not exceed 30 milliamperes for domestic connections and 100 milliamperes for all other installations, so as to disconnect the supply instantly on the occurrence of earth fault or leakage of current. [CEA Reg. 42]

7.6.8 ACB/MCCB/Switchgear of every power panel and sub-panel controlling heavy load (exceeding 200 Amps) shall be provided with voltmeter, ammeter with selector switches, to indicate the availability of

the supply and the loading on the circuit. In case of heavy loads indicating lamps may also be provided on each phase.

7.6.9 The enclosures of the switchgear, electrical accessories and wiring of power panels shall not be used for hanging/keeping/supporting or dumping personal clothes or other articles.

7.6.10 Ceiling fans shall be hanging at a minimum clearance of 2.4 meters from the floor. It shall be installed above the height of a light fitting. The ceiling fan shall never be installed close to a hanging light.

7.6.11 General light and power wiring shall either run on walls at a height of 3.0 meters from the floor (if the ceiling of the building is more than 3.5 meter high) or at 0.5 meter below the ceiling (if the ceiling of the building is less than 3.5 meter high).

7.6.12 Wiring in residential quarters and office buildings may be in plastic conduits, conforming the relevant IS; but in industrial building wiring shall be done in metallic conduit pipes or on trays supported on walls, pillars or brackets or on trays in trenches. It should not run on the floor without a mechanical protection fixed permanently. If the mechanical support for the cable/wiring is metallic, it shall be connected to earth.

7.6.13 Electrical accessories shall be fixed rigidly & permanently and shall not be tied by rope or wires.

7.6.14 Wiring of different systems shall run independently with their accessories located separate from each other. Such wiring shall be marked/painted clearly to distinguish them and to prevent inter connection between them. {CEA Reg. 24}

7.6.15 No light or power shall be provided in cupboard or drawers of the work benches or workman’s cupboard.

7.6.16 All metallic enclosures of switchgears carrying live parts (such as bus - trunk) of voltage up to 250V, metallic support to switchgears, panels, shall be efficiently connected to earth. Where the supply voltage is not exceeding 250 V and where the installations are either new or renovated, all plug sockets shall be of the three pin type, and the third pin shall be permanently and efficiently earthed. All metallic enclosures of switchgears, panels, conduits carrying live parts of voltage exceeding 250V and up to 650 V, metallic support to switchgears, panels, shall be efficiently connected with two distinct and independent earth pits.
{CEA Reg. 41}

7.6.17 X-ray and other machines involving high voltage/frequency shall be provided with an additional independent earth connection.

7.6.18 All type of safety regulations pertaining to electrical energy meters shall be followed as per the provisions made under the CEA (Installation and Operation of Meters) Regulations' 2006 and latest amendments therein.

## 7.7 Safety Provisions Regarding Portable appliances:-

7.7.1 All portable appliances shall be connected only through a plug socket of appropriate capacity and design and controlled by a switch i.e. no portable appliance shall be used without a plug top connected.

7.7.2 Portable appliances shall not be used inside the buildings handling explosives without the written permission of the Safety Section.

7.7.3 It is better and safer to have a few additional plug points at different places to avoid a long length of cable running haphazardly on the shop floor.

7.7.4 The cable type shall be of three-core for single phase appliance having metallic body or any metallic part exposed and working at voltage not exceeding 250V and the third wire shall be used as earth connection. However, if the outer body of any portable appliance is made of any insulating material and no metallic part of the appliance or apparatus is exposed and working voltage of the appliance or apparatus does not exceeding 250V, double insulated twin core cable may be used to supply power to such appliance or apparatus.

7.7.5 Flexible wires/cables shall not be used for portable or transportable motors, generators, transformers, rectifiers, electric drills, electric sprayers, welding sets or any other portable or transportable apparatus unless they are heavily insulated and adequately protected from mechanical injury. {CEA Reg. 21}

7.7.6 Where the protection is by means of metallic covering, the covering shall be in metallic connection with the frame of any such apparatus and earthed. {CEA Reg. 21}

7.7.7 The cables shall be three core type and four core type for portable and transportable apparatus working on single phase and three phase supply respectively and the wire meant to be used for ground connection shall be easily identifiable. {CEA Reg. 21}

## 7.8 Safety Regarding Inspection Lamps:-

7.8.1 Inspection lamps used in process buildings shall preferably be of 50 Volts or lower unless required otherwise.

7.8.2 For inspection lamps working at 230V, if unavoidable, supply shall be handled carefully to avoid wear-out of insulation or connection becoming loose or coming out.

7.8.3 Replacement of lamps/repairs to inspection lamps shall be done by the authorised electrical person only. Employees of production section shall never be allowed to repair the test lamp/replace lamps. No repairs to inspection lamp including replacement of lamp should be done with the lamp connected to plug point.

7.8.4 Portable lamps shall always be used with a mesh guard to protect it from any damage while handling it.

7.8.5 No joints are permitted in the inspection lamp leads.

7.8.6 The leads shall as far as possible be taken overhead & not allowed to run on shop floor or on any machinery / stores.

## 7.9 Earthing System:-

### (A) General:-

7.9.1 All buildings using electric power for lighting or for power at different voltage levels shall have earthing system as per relevant Indian Standards and CEA Reg. 2010 No. 16, 37 (ii), 41 & 48.

7.9.2 All non-current carrying metal parts associated with an installation of voltage exceeding 650 V shall be effectively earthed to a grounding system or mat which shall:-

(i) Limit the touch and step potential to tolerable values;

(ii) Limit the ground potential rise to tolerable values so as to prevent danger due to transfer of potential through ground, earth wires, cable sheath, fences, pipe lines, etc.;

(iii) Maintain the resistance of the earth connection to such a value as to make operation of the protective devices effective.
{CEA Reg. 48(1)}

7.9.3 The work and design, number of earth pits, size of the earth conductor, type of earthing shall conform to IS - 3043:1987, concerned provisions of CEA Regulations-2010 and STEC regulations (for explosive buildings).

### (B) Size of the earth conductor:-

7.9.4 the size of earth conductor shall be so taken as to be able to carry the maximum fault current of the circuit without fail.

7.9.5 Under faulty current condition, earthing conductor should not be rupturing or causing deterioration in the insulation of the system.

7.9.6 The resistance between any point of earthing system in the installation to earth terminal at the test point of earthing terminal shall not exceed 1.0 ohm.

**(C) Earth pits:-**

7.9.7 Resistance of the earth pit shall be such as to develop a fault current of twice the current required to operate the Earth Leakage Relay or three times the highest rating of the fuse in the circuit

7.9.8 Earth pits shall be located outside the buildings. No civil construction shall be made on/over an earth pit.

7.9.9 Number of earth pits shall depend upon the load used in the circuit. The number of pits will be designed in such a way as to meet the parameters stated above. However, actual numbers of earth pits may be more to achieve the required earth resistance or level of protection for the circuit.

7.9.10 For domestic buildings using electric power at the voltage not exceeding 250 V one or two earth pits may be adequate. For industrial buildings this will have to be carefully worked out considering the relevant IS specifications and provisions of the CEA Regulations-2010.

7.9.11 Each building supplied at the voltage not exceeding 250V shall have minimum two earth connections, one through the power supply feeder and the other through the building earth pit. However, these two earth connections may be inter-connected. {CEA Reg. 16}

**(D) Testing / Inspection of Earth System:-**

7.9.12 Earth system shall be tested once in a year in summer and dry season *{CEA Reg. 48(8)}*, and record of such testing shall be maintained properly in **Proforma 11A** for the buildings other than substation and in **Proforma 10** for the LP earthing system of the buildings (If provided).

7.9.13 While testing the earth pit, each earth electrode should be isolated from the system. If ER value of any earth electrode is found to be abnormally high immediate steps shall be taken to bring the ER value to the level specified.

7.9.14 Combined resistance of earth electrodes (where inter-connected) shall also be checked.

7.9.15 Details of rectification done & final reading shall also be recorded.

7.9.16 For testing of earthing of the buildings processing explosives, the frequency prescribed in STEC shall strictly be followed.

7.9.17 Before commencing testing/repairs of earth system in explosives buildings, clearance of production section & Safety section shall be obtained positively.

7.9.18 Depth and location of earth pit shall be so chosen that as far as possible there is moisture around it round the year.

7.9.19 Rails of overhead Cranes, hoists, lifts and walking beams etc. shall be electrically continuous and bear continuity to earth.

7.9.20 No pipe line carrying water, fuel, sewage, drainage, chemical or anything else shall be used as earth terminal or earth conductor. {CEA Reg. 41(x)}

7.9.21

(A) All metal casing or metallic coverings containing or protecting any electric supply line or apparatus shall be connected with earth and shall be so joined and connected across all junction boxes and other openings as to make good mechanical and electrical connection through their whole length.

(B) Conditions mentioned in 7.9.21(A) shall not apply where, the supply voltage does not exceed 250 V and the apparatus consists of wall tubes or brackets, electroliers, switches, ceiling fans or transportable apparatus, unless provided with earth terminal and to class-II apparatus and appliances.

*Explanation:- The expression "Class-II apparatus and appliances" shall have the same meaning as is assigned to it in the relevant Indian Standards.* {CEA Reg. 41(xiv)}

(C) For electrical installations and apparatus of voltage not exceeding 650V, all earthing systems shall:-

(a) consist of equipotential bonding conductors capable of carrying the prospective earth fault current and a group of pipes, rods and plate electrodes for dissipating the current to the general mass of earth without exceeding the allowable temperature limits as per relevant Indian Standards in order to maintain all non-current carrying metal works reasonably at earth potential and to avoid dangerous contact potentials being developed on such metal works.

(b) limit earth resistance sufficiently low to permit adequate fault current for the operation of protective devices in time and to reduce neutral shifting.

(c) be mechanically strong, withstand corrosion and retaining electrical continuity during the life of the installation and all earthing systems shall be tested to ensure efficient earthing, before the electric supply lines or apparatus are energized. {CEA Reg. 41(xv)}

7.9.22 The earthing lead for any lightening arrester shall not pass through any iron or steel pipe, but shall be taken as directly as possible from the lightening arrester without touching any metal part to a separate-vertical ground electrode or junction of the earth mat already provided for the building. {CEA Reg. 74(2)}

# CHAPTER – VIII

# ELECTRICAL INSTALLATIONS (MACHINERY) IN BUILDINGS

**8.1** All electrically driven/operated machines must be provided with the following:-

8.1.1 The supply of electricity to each motor/a group of motors/other apparatus meant for operating one particular machine shall be controlled by a suitable linked switch/a circuit breaker/an emergency tripping device with manual reset of requisite capacity placed in such a position as to be adjacent to the motor/a group of motors/other apparatus readily accessible to and easily operated by the person in-charge and so connected in the circuit that by its means all supply of electricity can be cut-off therewith. {CEA Reg. 35(5)}

8.1.2 Where control gear is not accessible easily, at least a stop push button (for putting off the machinery) shall be provided on the machinery or close to it.

8.1.3 Adequate protective devices.

8.1.4 A power control switch (back up protection).

8.1.5 A danger notice in Hindi or English and the local language of the district, with a sign of skull and bones of a design as per IS-2551 shall be affixed permanently in a conspicuous position a on every motor, generator, transformer, machine and other electrical plant and equipment together with apparatus used for controlling or regulating the same, working at voltage exceeding 250V. {CEA Reg. 18}

8.1.6 Two separate and distinct connections with earth (when machine is operated at more than 250V or at three phase).{CEA Reg. 41(xii)}

8.1.7 In places where the switch is not located on the machine or its vicinity to show the ON/OFF position of supply.

**8.2** The enclosures to the live parts/control panels must be closed, with no crevices or holes. There should be no exposed live part.

**8.3** Holes left over due to removal of instrument should be covered to prevent accessibility of live parts or any foreign matter going.

**8.4** The armour of the cables or conduit carrying the wires shall be effectively connected to earth and shall bear continuity with the

enclosure of the control switchgear / control box into which it terminates.

**8.5** Swarf shall not be allowed to fall on control cubicles. The control cubicle shall be easily accessible. No production items or scrap shall be thrown / heaped on or around it.

**8.6** Control box, bus trunks and electrical accessories shall not be allowed to be used for supporting or keeping any article.

**8.7** For heavy /sophisticated machinery, controls may be kept away from the machines or housed in a separate room and following shall be observed:-

8.7.1 The room/area around the control switchgears shall be kept clean.

8.7.2 Nothing shall be kept on the control unit.

8.7.3 The room / places must not be used as a shift room /office or site workshop.

8.7.4 Maximum man limit for the room/area shall be prescribed. Only authorised persons shall be permitted in the room/area.

**8.8** Men shall not be allowed to sit close to the control panel.

**8.9** Cables connecting the machine shall be laid in a trench or run overhead on cable tray or run in conduits. In no case it shall be allowed to run on the floor without mechanical protection.

**8.10 Selection of Cables:-**

8.10.1 Cables shall be of adequate current carrying capacity and cater for the starting current requirement of the machine/installation without causing heavy voltage drop or heating during continuous use.

8.10.2 The choice of cable (type) shall depend upon the working voltage, phases, electrical load condition of the machine and the weather conditions of surrounding area, where machine is installed.

8.10.3 Cables of different systems (power cables, control cables and power cables of different voltage systems) shall run separately. Control / instrument cables shall preferably run in separate trays.

8.10.4 Cables shall adequately be supported on racks or clamps. They shall not be laid cris-cross.

## 8.11 Bus trunks:-

8.11.1 Where bus-trunking is used for connections to machines, it shall comply the following:-

(i) It shall be enclosed.

(ii) It shall be installed at minimum height of 2.5 m from the ground.

(iii) Danger notice shall be provided.

8.11.2 The body of the enclosure & supports should be efficiently connected with earth by two separate and distinct connections *(For working voltage exceeding 250 V).*

8.11.3 It should not be used for supporting or keeping any other articles or things.

8.11.4 The cable connections, with the bus trunks should be adequately supported.

8.11.5 All cable connections, conduits to machines emanating from the bus trunk should be rigidly supported.

## 8.12 Safety measures for Travelling Cranes:-

8.12.1 Every electrical travelling crane, hoist, walking beam or installation like these, to which electricity is supplied from an external source shall ensure that these are efficiently controlled by a suitable switch enabling all voltage to be cutoff in one operation. {CEA Reg. 20}

8.12.2 Where such vehicles, travelling cranes or the like runs on metal rails, it shall be ensured that the rails are electrically continuous and connected to earth at its ends. {CEA Reg. 20}

8.12.3 Indication lamps must be provided on the bus bar at its two ends.

8.12.4 The bus bar supply switchgear shall be located on a nearby wall/structure in an easily accessible position.

8.12.5 An earth leakage relay may be provided where it is operated from a cabin installed at a height.

8.12.6 Adequate space shall be available in front of the control unit for maintenance.

8.12.7 The live bus bars shall not be easily approachable. They should be protected by guarding.

8.12.8 Where two or more gantry cranes run on the same rails, a suitable alarm system shall be incorporated to warn the approach of a gantry crane too close to another gantry crane.

8.12.9 The ladder to the operating cabin shall be provided on the side where there is no bus bar and connected to the control cabin by a cat walk with rail supports to prevent falling or slips.

8.12.10 Lights and fans, in the shop shall be so located that any person going up for maintenance does not come in contact with live bus bars.

8.12.11 Operator sitting in the cabin shall be well protected from falling during operation. He shall not be allowed to operate, sitting on a plank or portable stool.

## 8.13 Overhead bus bars:-

8.13.1 Bus bars shall normally be enclosed in a metallic enclosure.

8.13.2 All bus bars must be controlled by a switch located in a readily accessible position in the shop.

8.13.3 Overhead bus bars when used in a shop, it shall be provided with adequate guarding to prevent its falling on its metallic supports.

8.13.4 The guarding shall be earthed effectively.

8.13.5 The bus-bar shall be supported on metallic frame work and supports.

## 8.14 L.P. system:-

8.14.1 The need for providing Lightening Protection to any building shall be decided in accordance with the relevant BIS and once it is provided it shall be maintained.

8.14.2 The portion of earth conductors preferably shall be of copper, GI or MS and not of Aluminium (Specially underground).

8.14.3 Joints between aluminium, copper and GI (dissimilar metals) shall be anti-corrosive with a lead packing in between. Inspection joints shall also be provided to facilitate testing.

8.14.4 Earth pits for LP system shall be independent. They may be connected with earth pits of power system underground.

8.14.5 LP system shall be checked / tested regularly and proper records shall be maintained in **Proforma 10**.

## 8.15 Static earth system:-

The requirements, design, testing etc. shall be governed by regulations / recommendations issued by STEC (Ref. Chapter X).

## 8.16 Maintenance & repairs to wiring & machine installation in bldg.

8.16.1 Works under the above category shall be commenced only after compliance of one of the following:-

(a) A permit to work is obtained in accordance with the permit **Proforma-5** (Chapter IV.) covering the location of the installation where work is to be carried out.

(b) Special works authorisation for working on installation involving intricate controls or controls located over a wide area or a part of whole of the installation, major break downs on overhead line system, live installation etc. Such works will be done in accordance with procedure laid out under chapter-III (Authorisation).

(c) Isolating supply to the equipment and control in case of minor works (electrical meter, lights / fans etc.). Work will be done only by an authorised person.

8.16.2 Working on installation which is fully or partly live may be permitted subject to the following conditions:-

(i) The person is competent to execute the works.

(ii) He is aware of the installation being partially / fully live and the risk involved in executing the work.

(iii) He takes all precautions necessary and follows procedure laid down to ensure safety.

(iv) He uses proper tools / gadgets / PPEs to ensure safety.

(v) He is authorised to do the type of the work.

(vi) In case of installation of voltage 650 V and more, the work is done under the supervision of a competent person.

(vii) The point number (vi) shall not apply for works like ON/Off operations of a switchgear, replacement of fuses, or works to be done with the help of safety gadgets intended to be used for the purpose.

## 8.17 Additional points to ensure safety in installations working at 650V and more:-

8.17.1 All works, except those like operation of switchgears or controls, and those intended to be worked under live line condition, shall be commenced only after switching off the power supply to the equipment on which work is to be carried out and discharging the conductors of power input terminal to earth.

8.17.2 The installation shall be checked and tested by a competent person before switching on.

8.17.3 Number of persons in the area where the work is being carried out and those near the switchgear shall be restricted to minimum at the first time switching 'ON' after repair/maintenance.

8.17.4 Other points to be borne in mind while doing rectification:-

(i) Identify the machine under repair, location of its controls, remote controls and control of incoming supply to the machine.

(ii) Visually check for any apparent damage. Arrange to rectify it before proceeding further.

(iii) Testing should be commenced after completely isolating the supply.

(iv) Switching "ON" after repair/maintenance shall be done only after results of 8.17.2 are found satisfactory.

(v) Always use the correctly rated fuses and relays. Do not use ordinary wire to replace HRC fuses. Do not run any machine after by-passing any protective device connected in the circuit.

(vi) Before switching on after repairs/maintenance, ensure that earthing system has been connected properly at specified places, short circuiting chain/conductors has been removed and all live parts are properly covered.

(vii) Check the operational characteristic and confirm that they are in order.

(viii) Avoid temporary works / connections.

(ix) Details of all major repairs / maintenance are recorded.

## 8.18 Periodic inspection & testing of elec. installation.

8.18.1 Periodic inspection and testing of all electrical installation shall be followed as per specified schedules.

8.18.2 Checking and testing results shall be recorded as per the Proforma/Formats.

**8.19 Periodical inspection and testing shall include the following:-**

8.19.1 Inspection, checking and tests recommended by manufacturer, as per BIS specifications, DGOF Standing Instructions and other directives issued by OFB from time to time.

8.19.2 Insulation Resistance test – once a year (minimum) **(Proforma-14)**.

8.19.3 Earth test – once a year (minimum)

8.19.4 Testing of protective devices i.e. tripping relays and circuit breakers once a year (minimum). Testing date, and due date should be displayed on the power panel nearby the tested relays.

8.19.5 Tests on tripping batteries as prescribed in this SI.

8.19.6 Power supply equipment as prescribed.

8.19.7 Checking of ceiling fans for fastening arrangement (split pins, rubber reels, check/lock nuts etc.) once in five years (minimum). Record of such checking should be maintained in **Proforma-19**.

8.19.8 The testing of meters shall be done at site or at EM section at least once in five years **(Proforma-13A & Proforma-13B**). [The CEA (Installation and Operation of Meters) Regulation-2006 No. 18(2)].

8.19.9 IR and ER values of Machines as per manufacturers' recommendations.

8.19.10 Visual inspection of all installations once in 6 months.

# CHAPTER IX

# TEMPORARY WORKS, WIRING AND CONNECTION

**9.1** Temporary service connections are given normally for 240 Volts / 415 volt system. Occasionally it may be given at voltage higher than 415 Volt also. They may be of three types:-

9.1.1 **To Contractor/Firm:-** To facilitate any firm/contractor for his construction / erection work in the factory or estate. These may be for any specific period depending upon the contract.

9.1.2 **To religious / social functions:-** These are given for a specific period generally not exceeding 15 days. These may be given to employees or organisations for religious / social functions.

9.1.3 **To buildings in the factory or estate to maintain continuity of power supply during the repairing/rectification period of permanent service connections.**

**9.2** Besides the above, the factory may have to carry out temporary wiring works to commission or test machinery or provide illumination to work spots.

**9.3** Proper records are required to be maintained to meet the contractual / Finance / Audit obligations in regard to temporary connections of the type mentioned in point Number 9.1.1 and 9.1.2.

**9.4** Temporary connections of the type mentioned in point number 9.1.3 above and all temporary wiring works in Para 9.2 shall be authorised by a responsible officer nominated by the General Manager for the purpose and the authorisation for connection and disconnection recorded in a register **(Proforma 12)** maintained by the EM section. The installation provided shall comply with the following:-

**9.5 For Contractor's service connections:-**

9.5.1 Work shall conform to the CEA Regulations, IS Standards and code of practice as and where applicable.

9.5.2 The service connection will be done in a permanent manner with overhead bare conductors/cables supported rigidly on mechanically strong supports with provision of earth wire and guarding.

9.5.3 The meter and the power control switch / DB with fuses of proper capacity shall be installed in a weather proof enclosure or under a shed for protection from rain water or other climatic effects.

9.5.4 Double earthing is to be connected to the panels, metallic structures i.e. the power control switch / DB etc. shall be provided with its own earth pits in addition to running earth (depending upon quantum of load / compliance with the CEA Regulations & STEC recommendations.

9.5.5 The Firm/contractor shall get this installation tested and certified by an electrical engineer / supervisor holding the requisite competency prescribed under the CEA Regulations 5A. The tests shall be performed as per the CEA Regulation number 33 (i) to (iii) or the CEA Reg. 43 (as the case may be) and this test certificate shall be presented to the factory before asking the factory management for energising the line.

9.5.6 The installation will also be visited by the factory ESO and connection will only be given after the factory ESO concludes that the installation is satisfactory. For this purpose he may carry out IR, ER and such other tests as he considers necessary.

9.5.7 The contractor shall intimate the name of the person responsible for care and custody and safety of the installation who can be contacted by the factory to bring to the notice any unsafe features or violations noticed in the installation.

9.5.8 Once the connection is given no addition / alteration in the capacity and number of points in the installation will be permitted without the prior consent of the factory and certificate from the competent person referred in point 9.5.5 for the fitness of the installation (after the addition / alteration) and approval of the factory ESO.

9.5.9 The installation will also be visited periodically by the Electrical staff of the factory, ESO of the factory / Regional or Asst. Elect. Inspector / RCS during their inspection visits and defects / deviations from the CEA Regulations, Standing Instructions regarding electrical safety, if any, will be brought to the notice of the contractor or the person nominated by him under Para 9.5.7 in writing for rectification within a reasonable time depending upon the nature of the defect.

9.5.10 In the event of non-rectification of the defect within the period specified above, the supply will be disconnected and will be reconnected only after the ESO of the factory or REI or RCS are satisfied with the rectification of the defect/ deviation pointed out.

9.5.11 In the event of any serious defect (likely to endanger persons, factory installation or properly) noticed, the supply will be disconnected immediately and the contractor or his representative stated in Para 9.5.7 shall be intimated after the disconnection. The reconnection will be made only after the contractor rectifies the defect to the satisfaction of the factory ESO.

9.5.12 The firm/contractor will perform IR tests as per the CEA Reg. 33 and Earth Resistance tests in accordance with the CEA Reg. 41 or CEA Reg. 48 (as the case may be) for his installation and the records of such tests shall be prepared and maintained as per the CEA Reg. 41 (xvii) and 48(8). {the CEA Reg. 33, 41 & 48}

9.5.13 The inspection by Electrical Safety Staff /Asst. Elect. Inspector / Regional Electrical Inspector, RCS etc. initially and from time to time does not absolve the responsibility of the contractor for the safety in his installation and compliance with the CEA Regulations.

**9.6 Temporary connections for religious / social functions:-**

The service line with the earth wire shall be installed by the user in a manner approved by the factory and the final connection will be done by the factory after having satisfied that the party have complied all the safety rules and regulations applicable and the following:-

9.6.1 The work complies with the CEA Regulations, DGOF SI and any other instruction issued by the Central or State Government.

9.6.2 The power control switch, DB with fuses is of proper capacity. Energy meter installed in a weather proof enclosure protected from rain. {CEA Reg. 12}

9.6.3 The power control switch / DB etc., when installed outside a building or in an open area is provided with its own independent earth pits.

9.6.4 In the case the function is in an open area/stage, at least two suitable fire extinguishers capable of fighting electrical fire shall be provided. These may be maintained by the factory.

9.6.5 For the above purposes the installation should be checked and cleared by ESO or a person holding Supervisory Competency Certificate issued by the Central Government/State Government or DGOF before providing electrical supply connection.

**9.7** The applicant getting the temporary connection will be personally held responsible for care of the installation, safe operations and compliance

with these instructions. He should ensure that his installation is free from danger to the personnel and property/ installation belonging to the factory.

**9.8** No addition / alteration in the capacity and number of points in the installation is permitted without the prior consent of the factory and certificate from the competent person referred in Para 9.6.5 for the fitness of the installation after the addition / alteration. {CEA Reg. 29}

**9.9** The installation shall also be visited and inspected by the ESO of the factory at the time of initial connection and may also be inspected by REI or RCS during their inspection visits.

9.9.1 Any defects / deviations noticed during the above visits will be brought to the notice of the applicant of the temporary connection for rectification within a reasonable time depending upon the nature of the defect. In the event of non-rectification of the defect within the specified time, the supply will be disconnected. {the CEA Reg. 31(3)}

9.9.2 In the event of any serious defect noticed (which is likely to endanger persons, factory installations or property), the connection will be immediately disconnected and the party may be intimated afterwards.

9.9.3 Records of IR and Earth Resistance tests will be maintained by the factory and shall be shown to the REI / RCS during their visits.

9.9.4 It is the responsibility of the person taking the temporary connection, as far as circumstances permit, to take precautions for the safe custody of the equipment on his premises belonging to the factory. He will be responsible for the consequences of any unsafe features and loss of property due to theft / pilferage. {CEA Reg. 13(3)}

**9.10 Temporary works / wiring / service connection to buildings in the factory / estate area:-**

9.10.1 Temporary service connection and wiring shall not be permitted in normal conditions. However, cases may arise when these may become unavoidable due to extreme urgency.

9.10.2 In such cases, written authorisation as laid down in point number 9.4 should be taken first & records of such temporary connections shall be maintained in **Proforma 12**.

9.10.3 The work will be done under the supervision of a Staff member whose name will be recorded in the register.

9.10.4 The installation where temporary connection is to be provided shall be inspected by an officer not less than a ***JWM*** and unless he is satisfied about the soundness of the installation, safety aspect and compliance with the CEA Regulations, it will not be energised.

9.10.5 The disconnection / changeover to permanent connection of such temporary connection/wiring will be watched by HOS/EM and the DO/EM. They will also sign the records of such temporary connections **(Proforma 12)** periodically, once in a month.

9.10.6 No other temporary works other than those stated in this chapter will be permitted. Any temporary work done un-authorisedly shall be disconnected immediately after coming to notice and person responsible shall be issued a warning letter.

9.10.7 Occupants of houses shall be advised twice a year through circulars not to carry out any temporary works / extensions in their government quarters/houses.

9.10.8 The instructions given in this chapter are made mainly from safety point of view, which are applicable to all temporary works and connections, in addition to various administrative instructions of the OF Board on the subject from time to time.

## 9.11 Testing:-

9.11.1 Resistance of earth continuity conductor i.e. the resistance between the main switch & any part of the earth continuity conductor should not exceed 0.5 ohm.

9.11.2 IR value between conductor and earth terminal should be:-

(i) On application of 500 V DC between each live conductor and earth for a period of one minute the insulation resistance of installation and equipment of voltage not exceeding 650V shall be at least 1 MEGA OHM or as specified in the relevant Indian Standard.

(ii) On application of 2.5 kV-DC between each live conductor and earth for a period of one minute, the insulation resistance of installation and equipment of voltage exceeding 650V but not exceeding 33kV shall be at least 5 MEGA OHM or as specified in the relevant Indian Standard.

[CEA Reg.33{1(ii) & (iii)}]

9.11.3 Resistance between the surface of a conducting floor & earth tested with 500 V megger using a wetted electrode should not exceed 50 x $10^3$ ohm.

9.11.4 Resistance between the surface of antistatic floor and earth when tested by this method should be between 50 x $10^3$ and 2 x $10^6$ ohms.

## 9.12 LP System

9.12.1 The testing of LP installation requires initial testing as well as after any modification.

9.12.2 Resistance to earth of each individual earth termination shall not exceed 10 ohms X No. of earth terminations.

9.12.3 Resistance to earth of the installation with all earth electrodes & bonding of other services measured at accessible random points approximately equidistant from all earth electrodes shall not exceed 10 ohms.

## 9.13 Frequency of testing and Inspection

9.13.1 IR and ER tests:-

All fixed electrical installations within the enclosed explosives area are to be electrically tested not less frequently than recommended in the following schedule :- ( STEC No. 7)

| Category | IR | Earth continuity | Other test as per CEA Regulations 2010 |
|---|---|---|---|
| A | Min. 6 months<br>Max. 1 yr. | 6 months<br>1 yr. | 6 months<br>1 yr. |
| B | Min. 6 months.<br>Max. 2 yrs. | 1 yr.<br>2 yrs. | 1 yr.<br>2 yrs. |
| C | Min. 1 yr.<br>Max. 3 yrs. | 1 yr.<br>4 yrs. | 2 yrs.<br>4 yrs. |
| Other buildings within the explosives area | Min. 2 yrs.<br>Max. 5 yrs. | 2 yrs.<br>5yrs. | 4 yrs.<br>5yrs. |

9.13.2 Flexible cables used with electric appliances in building containing explosives should be inspected/ tested once in a month.

9.13.3 All electrical installations in explosive buildings should be inspected for any visible signs of damage or depreciation at least annually.

9.13.4 New installations of conducting floor / antistatic floor should be tested at intervals of 3 & 9 months. Thereafter the tests should be made at interval not exceeding 12 months.

9.13.5 Inspection & testing records should be maintained in a register and this should be seen by an audit officer / REI.

# CHAPTER X

# SAFETY IN ELECTRICAL INSTALLATIONS DEALING WITH EXPLOSIVES.

**10.0** The existing electrical installations in buildings dealing with explosives are governed by STEC regulations {Pamphlet No. 7 (1982)}. These regulations are amended and updated in 1998, 2011 and latest in 2017 issue. These amended and updated regulations are applicable only to new installations and replacements over and above the CEA Regulations. These regulations do not apply to administrative buildings, or other personal accommodations, workshops not containing explosives within an explosive area. Some of the common provisions are given herewith.

**10.1 Definitions:-**

Explosive buildings are categorized into A, B and C type as detailed below:-

10.1.1 **Category A:–** This category comprises explosives Store-houses, Laboratories or process buildings in which explosives may give rise to flammable vapour in the building but not explosive dust. Category A is further sub-divided into Zones 0, 1 & 2.

**(i)** ***Zone 0***:- Zone in which the flammable atmosphere is continuously present or is present for long periods. In such situations, no electrical fittings / equipments should be installed. Zone O areas are generally encountered in petro-chemical industries. If installation of electrical equipments is considered absolutely essential, the recommendations laid down in IS/IEC 60079: Part 11:2006 (Reaffirmed 2013) should be used. For explosives like nitro-glycerin which has the property to sublime, it is recommended that either Dust-Tight or pressurised electrical equipment may be used.

**(ii)** ***Zone 1***:- Zone in which the flammable atmosphere is likely to occur in normal operation. Electrical equipment which is certified as flame-proof (FLP) with type of protection ‘d’{IS/IEC 60079 : Part 1 :2007 (reaffirmed 2012)} is recommended.

**(iii)** ***Zone 2***:- Zone in which the flammable atmosphere is not likely to occur in normal operation and if occurs it will exist only for a short time. Electrical fittings/equipment, which are suitable for category A Zone 1 are permitted. Alternatively, increased safety

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