



# NTPC Safety Rules

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CORPORATE SAFETY DEPARTMENT,  
NTPC Ltd.,

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## **1.0 GENERAL**

1. There are mainly two following Acts and Rules (hereinafter referred to as Rules) that specifically provide for Safety, Health and Welfare Measures, which are specifically applicable for the building and construction workers, namely:
  - 1.1 Building and other construction workers (regulation of employment and conditions of service) Act, 1996 (briefly referred to as Building & Construction Act),
  - 1.2 Building and other construction workers (regulation of employment and conditions of service) Central Rules, 1998 (briefly referred to as Building & Construction Rules) as adopted by the various State Governments,
  - 1.3 Factories Act, 1948, and
  - 1.4 State Factories Rules, (briefly referred to as Factories Rules) as adopted by the various State Governments.
2. While these legislations set out the minimum standards of compliance, the Management of the NTPC Ltd. had formulated additional and more stringent norms for the contractors to be referred as NTPC Safety Rules (Also mentioned as Safety Rules for Construction and Erection), wherever felt necessary, for compliance by the Contractors, to whom it shall award contracts for building construction and/ or erection work within their existing Plants or at sites in a green field, or wherever it has control and where new construction and building activities are to be undertaken.
3. Wherever there are contradictions in Statutory Provisions, Technical Specifications or NTPC Safety Rules, the provisions- which are more stringent shall be applicable for compliance by the Contractor.
4. Any expansion, modification, alteration and, or construction activity within an existing Plant operating as per approved site plan under the Factories Act, shall attract the provisions of this Act/ Rules also, and the Contractor shall implement all required provisions thereof. For any construction within the premises of NTPC premises covered under the Factories Act, the norms of Building and other construction workers (regulation of employment and conditions of service) Central Act/ Rules, or Factories Act/ Rules- which ever are stringent shall be complied by the Contractor.
5. The NTPC Rules primarily highlights a set of safety requirements derived from both the Building & Construction Act/ Rules and Factories Act/ Rules, Indian Standards- as applicable, and other NTPC requirements. These norms shall be deemed to be the NTPC Safety Rules for Construction and Erection, as mentioned in general conditions of contract. The Contractor shall also implement Permit systems for various activities of Construction and Erection as framed for implementation at local level.

6. The Contractor shall indemnify NTPC from all the liabilities that may arise out of any failure to comply with the above mentioned Acts/Rules or any contravention thereof by the contractor or any other agency on his behalf.
7. It is also mandated that the Engineer-in-charge or NTPC Project Safety Officials, may, on their convenience, exercise such superintendence, supervision and/ or control, as may be deemed necessary, but this shall not absolve the contractor of his basic responsibility for strict compliance with the norms, standards and, or legal provisions as applicable under the Factories Act/Rules and the Building and other construction (regulation of employment and conditions of service) Act/Rules.
8. The Safety Rules for Construction & Erection, as outlined hereunder, while setting out a broad parameter of safety norms, are not exhaustive. The Contractor is advised to refer to other statutory provisions, as applicable, for details and strict compliance thereof.
9. The contractor is also required to ensure compliance with provisions of all the Acts/Rules that provide for safety measures such as:
  - i. Electricity Act/Rules
  - ii. Boiler Act/Rules/Regulations
  - iii. Explosives Act/Rules
  - iv. Petroleum Act/Rules
  - v. Motor Vehicles Act/Rules
  - vi. Dangerous Machines (Regulation) Act
  - vii. Environment (Protection) Act/Rules
  - viii. Mines Act/Rules, etc.

## 2.0 Definitions

1. **Building or other construction work:** means the construction, alteration, repairs, maintenance or demolition, of or, in relation to, power plants and its related activities, buildings, streets, roads, railways, tramways, airfields, generation, transmission and distribution of power, water works, oil and gas installations, electric lines, tunnels, bridges, viaducts, pipelines, towers, cooling towers and such other work as may be specified.
2. **Building worker:** means a person who is employed by a contractor or his subcontractor to do any skilled, semi-skilled or manual, supervisory, technical or clerical work for hire or reward, whether the terms of employment be expressed or implied, in connection with any building or other construction work;
3. **Establishment:** means an establishment who or which employs building workers in any building or other construction work, and includes an establishment belonging to a contractor;
4. **Contractor:** means a person who undertakes a contract, to produce a given result for any establishment, other than a mere supply of goods or articles of manufacture by the employment of building workers or who supplies building workers for any work of the establishment, and includes a sub-contractor or any other agency engaged on his behalf;
5. **Employer:** in relation to an establishment, means the owner thereof that is the contractor himself.
6. **Competent Person:** means a person so approved by the Central Government who belongs to a testing establishment in India possessing adequate qualification, experience and skill for the purpose of testing, examination or annealing and certification of lifting appliances, lifting gears, wire ropes or pressure plant or equipment;
7. **Responsible Person:** means a person appointed by the employer to be responsible for the performance of specific duty or duties and who has sufficient knowledge and experience and the requisite authority for the proper performance of such duties;
8. **Danger:** means danger of accident or of injury or danger to health;
9. **Hazard:** means danger or potential danger;
10. **Hazardous substance:** means any substance, which due to its explosiveness, inflammability, radioactivity, toxic or corrosive properties and similar hazardous characteristics may Cause injury; or Affect adversely the human system; or Cause loss of life or damage to property or environment;

11. **Hazardous Process:** comprises roof work, steel erection, and work under and over water, demolition and work in confined space;
12. **National Standard:** means standards as approved by the Bureau of Indian Standards (BIS) and in the absence of such standards, the standards approved by the Central Government for a specific purpose;
13. **Lifting Appliance:** means a crane, hoist, derrick, winch, jack, pulley block or other equipment used for lifting materials, objects or building workers;
14. **Lifting gear:** means ropes, chains, hooks, slings and other accessories of a lifting appliance;
15. **Safe Operating Practice:** Means the practice followed in building and construction activities for the safety of workers and for safe operation of machinery and equipment used in such activities. Such practices shall conform to all or any of the following:
  - (a) Relevant Standards approved by BIS;
  - (b) National Building Codes;
  - (c) Manufacturer's instruction on safe use of equipment and machinery;
  - (d) Code of practice on safety in construction industry published by International Labour Organization (ILO).
16. **Safe working load:** in relation to an article of lifting gear or lifting appliance, means the load which is the maximum load that may be imposed on such article or appliance with safety in the normal conditions as assessed and certified by a competent person;
17. **Workplace:** means all places where building workers are required to be present or to go for work and which are under the control of an employer;
18. **Personal Protective Equipment (PPE):** are the protective devices made available for individual or collective use of the workers likely to be affected by the hazards of the workplace or process;
19. **Construction & Erection (E&C) Rules:** all references to E&C Manual shall mean the Construction & Erection Rules that are detailed hereunder;
20. **Engineer in-charge:** All references to the Engineer in-charge shall mean the person in-charge of a building and construction of the NTPC.
21. **Interpretation of words not defined:** words and expressions not defined or used in this Manual shall have the same meaning as generally assigned in common engineering practices.

## **1.0 Responsibilities of the contractor**

- 1.1 Before commencing the work, the contractor shall prepare and obtain the approval of the Engineer-in-charge, NTPC in respect of the following:
- 1.2 The Contractor shall have a Safety Plan detailing the safety norms that he shall evolve through a Job Safety Analysis (JSA) and Hazard Assessment & Risk Management Process (HARMP) and constitute a Safety Organization. A sample format detailing the **Safety Plan** is enclosed as Annexure –II- in the schedule;
- 1.3 The contractor must also have a well-defined Safety & Health Policy as prescribed under the Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act 1996 and its Central Rules, 1998.
- 1.4 The contractor shall be responsible for providing constant and adequate supervision of any building or construction work under his control to ensure compliance with the legal provisions and/or standards specified by NTPC. He shall take all the necessary measures to prevent accidents. It is the responsibility of the contractor not to allow any worker to work in an unsafe condition, nor with unsafe equipment;
- 1.5 The contractor shall provide adequate and suitable Personal Protective Equipments (PPEs), wherever they are required, to all concerned personnel. The quality of these equipment shall conform to National (BIS) or International Standards, where the National standards are not available, However there quality shall not be inferior to that, which are supplied by NTPC. A register bearing signature or thumb impression of the worker issued with such PPE will be maintained by the Contractor, as the proof of the receipt by the worker, and the same will be made available for verification of the Engineer-in-charge on demand. Fall Arrestors shall also be provided by him, wherever required or as directed by Engineer in-charge or NTPC project Safety Officials.;
- 1.6 Further, it shall be the responsibility of the contractor to ensure that the safe conditions and suitable supervision as prescribed in the specifications & NTPC Safety Rules (Also referred here as NTPC Safety Rules for Construction and Erection); and for this purpose sufficient number of Supervisors shall be appointed for adequate and constant supervision at all times and in all workplaces;
- 1.7 It shall be responsibility of the Contractor that all workers are protected from the hazards, arising out of their work or due to the work carried out by others, in the vicinity;
- 1.8 PPE shall be treated as the last line of protection and in no case they will be taken as the substitute of safe work conditions like safe scaffolds, safe platforms, safe access and egress, planned walkways/aisles, well laid-out approach roads, properly designed/engineered work methods etc.;
- 1.9 Necessary license/consents shall be obtained by the Contractor, as required under various statutory provisions and all conditions as laid down in the said license/consent are fulfilled;
- 1.10 The Contractor shall get Safety Audit of his construction/ erection work, once every 6 months for contract value exceeding Rs 25 Crores, and once every 12 months for contract value less than 25 Crores, with an accredited safety auditor, accredited by Ministry of Labour, Government of India, who must be having experience of minimum 7 years in safety in construction at power plant site. The recommendations of Auditor shall be promptly complied with.
- 1.11 The Contractor shall provide Safety Training to all his workers, at least once every 6 months through a faculty, having a qualification of Safety Officer, as prescribed in Building and other construction workers (regulation of employment and conditions of service) Rules, and having an experience of not less than 7 years of working in Power Plants.



## **2.0 Construction Cess**

**2.1** It shall be the responsibility of the contractor, to whom the work is awarded by NTPC, as the employer of the building and construction workers, to ensure that the requirements relating to Building and other construction workers (regulation of employment and conditions of service) Cess Act/ Rules- framed by competent authority, are fully complied with by him. Thus the onus of compliance of the norms so prescribed shall rest with the contractor concerned, indemnifying NTPC from all the liabilities that may arise out of any failure to comply with the above mentioned Acts/Rules or any contravention thereof by the contractor or any other agency on his behalf.

## **3.0 Safety Organization**

### **3.1 Safety Officer:**

3.1.1 In every establishment, wherein one hundred and fifty or more workers are ordinarily employed, the Contractor shall appoint a Safety Officers with the qualifications and experience in the Building and other construction workers (regulation of employment and conditions of service) Act, 1996 and Rules made there under. For each additional 300 or a part thereof one additional Safety officer with the qualifications as mentioned above in this para, shall be appointed by the Contractor.

3.1.2 Wherever the number of workers employed by a single employer is less than one hundred and fifty, such employers may form a group and appoint common Safety Officer who may be assisted by suitable and adequate staff, with prior approval of the Engineer-in-charge;

### **3.1 Safety Promotional activities**

- i) The contractors are required to celebrate the National Safety Day falling due on 4<sup>th</sup> march each year and follow the circulars that may be issued by the Engineer in-charge from time to time in this regard. It is also provided that he will allocate funds for organizing Safety week/month to elicit participation of workers in the promotion of safety as a shared concern and activity;
- ii) Safety posters, slogan competition, special meetings and talks shall be organized during such celebrations, besides safety badges etc. by the workers in appreciation of their involvement in the promotional activities.

## **4.0 Safety Training:**

Safety training shall be provided by the Contractor to all his workers as well as those appointed by his sub-contractors etc, at least once every 6 months, through a faculty which possess the minimum qualification of Safety Officer as mentioned in Building and other construction workers (regulation of employment and conditions of service) Act, 1996 **and** rules made their under along with minimum experience of seven years in Construction area

in Power Industry. The contractor required to work out a calendar of training programmes detailing the skill development modules and reinforcement of safety measures relating to the on-going jobs. The calendar of training programmes shall be made available to the Engineer in-charge for his information and follow up;

**i) Safety inspections:**

Besides the requirement of inspection, which is incorporated under various clauses of the NTPC Safety Rules, the contractor shall schedule regular inspection of various job sites and activities by developing a check list appropriate to the task and the hazards involved therein and implement the findings of the inspection forthwith;

## **5.0 Reporting of accidents**

### **5.1 Reporting of accidents:**

- 5.1.1 Notice of any accident (the prescribed format is annexed to the manual) to a worker at the building or construction site that
- (a) Causes loss of life; or
  - (b) Disables a worker from working for a period of 48 hours or more immediately following the accident;
  - (c) Shall forthwith be sent by Telegram, Telephone, Fax, or similar other means including special Messenger within four hours in case of fatal accidents and 72 hours in case of other accidents, besides the Engineer-in-charge, to:
    - i. The Regional Labour Commissioner (Central);
    - ii. The Board with which the worker involved was registered as a beneficiary;
    - iii. Director General of Building and other construction (regulation of employment and conditions of service) Act/Rules; and
    - iv. The next of kin or other relative of the worker involved in the accident;
- 5.1.2 Further, notice of accident shall be sent in respect of an accident which
- (a) Causes loss of life; or
  - (b) Disables the injured worker from work for more than 10 days to
    - (1) The Officer-in-charge of the nearest Police Station;
    - (2) The District Magistrate or, if the District Magistrate by order so desires, to
    - (3) The Sub-Divisional Magistrate;
- 5.1.3 Where any accident causing disablement that subsequently results in death, notice thereof in writing of such death, shall be sent by the Contractor to the Authorities mentioned above, within the time frame of rules.
- 5.1.4 In case of an accident causing minor injury, first-aid shall be administered and that resulting in disability of 48 hours or more, the injured worker shall be given first-aid and immediately transferred to a Hospital or other place for medical treatment, and shall be informed to the authorities as per rules.
- 5.1.5 All near-miss accidents and Fires shall be reported to NTPC Engineer In-charge and Plant NTPC Safety Officer.

### **5.2 Reporting of dangerous occurrences:**

- 5.2.1 The following classes of dangerous occurrences shall be reported to the Inspector having jurisdiction, whether or not any disablement or death caused to the worker, namely:

- (a) Collapse or failure of lifting appliances, or hoist, or conveyors, or similar equipment for handling of building or construction material or breakage or failure of rope, chain or loose gears; or overturning of cranes used in construction work;
- (b) Falling of objects from height;
- (c) Collapse or subsidence of soil, any wall, floor, gallery, roof or any other part of any structure, platform, staging, scaffolding or means of access including formwork;
- (d) Contract work, excavation, collapse of transmission;
- (e) Explosion of receiver or vessel used for storage at pa pressure than atmospheric pressure, of any gase(s) or any liquid or solid used as building material;
- (f) Fire and explosion causing damage to any place on construction site where building workers are employed;
- (g) Spillage or leakage of any hazardous substance and damage to their container;
- (h) Collapse, capsizing, toppling or collision of transport equipment;
- (i) Leakage or release of harmful toxic gases at the construction site;
- (j) In case of failure of a lifting appliance, loose gear, hoist or building and other construction work, machinery and transport equipment at a construction site, such appliances, gear, hoist, machinery or equipment and the site of such occurrence shall, as far as practicable, be kept undisturbed until inspected by the Authorities;

5.2.2 Every notice given for fatal accidents shall be followed by a written report to the concerned Statutory Authorities and the Engineer In-charge in the specified Form annexed as Schedule, under acknowledgement.

### **5. 3 Investigation of accidents and dangerous occurrences**

5.3.1 Besides reporting, it shall be the responsibility of the contractor to assign a responsible person to thoroughly investigate all incidents involving near-miss accidents, lost-time and reportable accidents and dangerous occurrences with a view to finding out the causative factor, taking remedial measures and fixing responsibility, and make a copy of the investigation report along with action-plan, specifying a definite time-frame for implementation of the findings, available to the Engineer in-charge forthwith;

5.3.2 In the establishments in which a Safety officer has been appointed in compliance with the requirements of the clause 2.0 provided under the head: Safety Organization, the responsibility for investigation shall be assigned to him.

## **6.0 Emergency Action Plan**

6.1 The contractor shall ensure that an **Emergency Action Plan** is prepared to deal with emergencies arising out of:

6.2 Fire and explosion;

6.3 Collapse of lifting appliances and transport equipment;

6.4 Collapse of building, sheds or structure etc.;

6.5 Gas leakage or spillage of dangerous goods or chemicals;

6.6 Drowning of workers, sinking vessels, and

6.7 Landslides getting workers buried; floods, storms and other natural calamities.

6.8 While arrangements shall be made for emergency medical treatment and evacuation of the victim in the event of an accident or dangerous incident occurring, the chain of command and the responsible persons of the contractor with their telephone numbers and addresses for quick communication shall be adequately publicized and conspicuously displayed in the workplace.

- 6.9 It is also required that there is a tie-up with the hospitals and fire stations located in the neighbourhood for attending to the casualties promptly and emergency vehicle kept on standby duty during the working hours for the purpose.
- 6.10 It shall be the responsibility of the contractor to keep the Local Law & Order Authorities informed and seek urgent help, as the case may be, so as to mitigate the consequences of an emergency. Prompt communication to NTPC, telephonically initially and followed by a written report, shall be made by the contractor.

## **7.0 Safety in the workplace**

### **7.1 Housekeeping:**

- 7.1.1 The contractor shall be primarily responsible for maintaining Good housekeeping and safety standards in the workplace;
- 7.1.2 Loose materials that are not required for use shall not be placed or left behind so dangerously as to obstruct workplaces or passageways;
- 7.1.3 All projecting nails shall be removed or bent to prevent injury;
- 7.1.4 Equipment, tools and small objects shall not be left lying unattended or unsecured from where they could fall or cause a person to trip;
- 7.1.5 Scrap, waste or rubbish shall not be allowed to accumulate in the site as these combustibles can create serious fire hazards and affect safe working;
- 7.1.6 Workplaces and passageways that become slippery owing to spillage of oil or other causes shall be cleaned up or strewn with sand, ash or the like;
- 7.1.7 Portable equipment shall be returned after use to their designated storage place.

### **7.2 Means of access and egress shall consist of**

- 7.2.1 Adequate and safe means of access and egress shall be provided in all workplaces;
- 7.2.2 The means of access and egress shall be maintained in a safe condition;

### **7.3 Lighting and ventilation**

- 7.3.1 All practical measures shall be taken to prevent smoke, fumes etc. from obscuring any workplace or equipment at which any worker is engaged;
- 7.3.2 Adequate and suitable artificial lighting shall be provided where natural lighting is not sufficient as per IS 3646 (Part II). The artificial lighting so provided shall not cause any incidental any danger, including that of producing glare or disturbing shadows;
- 7.3.3 To prevent danger to health from air contamination by dust generated during grinding, cleaning, spraying or manipulation of materials as also to provide protection against dangerous gases, fumes, vapours, mist, etc. effective arrangements shall be made for ventilation;
- 7.3.4 Workers shall be provided with suitable respiratory protective equipment, if it is not technically possible to have uncontaminated air. To this end, a study by a competent person shall be made to decide on the due protection. Sufficient illumination at all times for maintaining safe working conditions shall be provided where building workers are required to work or pass, and for passageways, stairways and landings such illuminations shall not be less a than 0.5 foot candles at the floor level;
- 7.3.5 Where natural lighting is not adequate to prevent danger, adequate and suitable lighting shall be provided as per IS: 3646 – Part II;
- 7.3.6 Artificial lighting shall not cause any danger due to a brightness greater than 10 foot candles per square inch, except where the angle of inclination from the eye to the source or the part pf the fitting as the case may be exceeds 20<sup>0</sup>, including that of producing glare or disturbing shadows;

- 7.3.7 Where necessary to prevent danger to health from air contamination by dust from the grinding, cleaning, spraying, or manipulating of materials or objects, arrangements shall be made to limit the concentration of the pollutants by thorough ventilation, and dust generated due to movement of earthmoving machinery and other construction equipment, by spray of water in the area from time to time;
- 7.3.8 Adequate ventilation by the circulation of fresh air shall be maintained in such places where the concentration of pollutants is likely to affect the health of the workers;
- 7.3.9 Special care shall be taken to ventilate the workplace where gas cutting, welding or other operations involving generation of dangerous fumes, vapours, mists, gases etc is likely;
- 7.3.10 Where it is technically not possible to eliminate dust or noxious or harmful fumes or gases sufficiently to prevent injury to the health of the workers, the contractor shall provide suitable respiratory equipment like dust mask or gas/fume mask or breathing apparatus or other suitable respiratory equipment.

#### **7.4 Dangerous and harmful environment:**

- 7.4.1 When an internal combustion engine exhausts into confined space or excavation or tunnel or any other workplace where neither natural ventilation nor artificial ventilation system is adequate to keep the carbon monoxide content of the atmosphere below fifty parts per million, adequate and suitable measures shall be taken at such workplace in order to avoid exposure of building workers to health hazards;
- 7.4.2 No building worker shall be allowed to enter any confined space or tank or trench or excavation wherein there is given off any dust fumes or other impurities of such nature and to such extent as is likely to be injurious or offensive to the building worker or in which explosives, poisonous, noxious or gaseous material or other harmful articles have been carried or stored or in which dry ice has been used as a refrigerant, or which has been fumigated or in which there is a possibility of oxygen deficiency, unless all practical steps have been taken to remove such dust, fumes or other impurities and dangers which may be present and to prevent any further ingress thereof, from such workplace or tank or trench or excavation;
- 7.4.3 No worker shall be allowed to enter any such space unless a responsible person has certified it to be safe and fit for the entry of such building workers.
- 7.5 Fumes/gases due to Welding and gas-cutting operations:** When welding or cutting operations are carried out in a confined space:
  - 7.5.1 Adequate ventilation, by means of exhaust fans or forced draught, as the condition may require, shall be constantly provided; otherwise enough quantity of air shall be circulated by means of air compressors to dilute the contaminant within permissible limits;
  - 7.5.2 Workers shall take necessary precautions to prevent unburned combustible gas or oxygen from escaping inside a tank or vessel or other confined space;
  - 7.5.3 Welding or cutting operations on any container that has held explosives or where inflammable gases may have been generated, shall be undertaken after the container has been thoroughly cleaned by steam or other effective means; and
  - 7.5.4 Gas-test shall be carried out ensure that the confined space is completely free from combustible gases and vapours.

## **7.6 Dust, gases, fumes**

- 7.6.1 Concentration of dust, gases or fumes shall be prevented by providing suitable means to control their concentration within the permissible limit so that they may not cause injury or create health hazard to a building worker;
- 7.6.1 For protection against such hazardous substances, besides efficient and effective means of control, personal protective equipment like dust masks, breathing apparatus, other respiratory appliances, goggles, as the case may be, shall be provided.

## **7.7 Excessive noise:**

- 7.7.1 Adequate measures shall be taken against the harmful effects of an excessive noise;
- 7.7.2 Use of earplugs/muffs and anti-vibration gloves shall be ensured to protect the workers from the impact of exposure to such dangers;
- 7.7.3 The noise level in no case shall exceed as prescribed in the concerned Rules and exposure in excess of 115 dBA over the period of a quarter of an hour cannot be permitted:

## **7.8 Corrosive substances:**

- 7.8.1 All corrosive substances, including alkalis and acids, shall be stored and used by a person dealing with such substances at a building or other construction work in such a manner that it does not endanger the building worker and suitable protective equipment shall be provided by the employer to a building worker during handling or use of such substances at a building or other construction work and in case of spillage of such substances on the building worker, immediate remedial measures shall be taken;
- 7.8.2 While protection of the body could be ensured by use of corrosion resistant apparel/overalls, suitable goggles, gloves, apron, gum boots etc. shall be made available to all concerned personnel;
- 7.8.3 To deal with an accidental spillage of a corrosive substance on the body of a worker, the facility of eyewash fountain or water shower, as the case may be, shall be installed, within the easy reach of the workplace.

## **7.9 Eye protection:**

- 7.9.1 Suitable personal protective equipment for the protection of eyes shall be provided and used by the building worker engaged in operations like welding, cutting, chipping, grinding or similar operations which may cause hazard to his eyes;
- 7.9.2 Goggles or face shield or welding screen with suitable shade of glass/filters etc shall be provided for the protection of the eyes.

## **7.10 Overhead protection:**



- 7.10.1 It shall be ensured that at the building or other construction site, overhead protection is erected along the periphery of every building under construction that shall be of fifteen meters or more in height when completed;
- 7.10.2 Overhead protection shall not be less than two meters wide and shall be erected at a height not more than five meters above the base of the building and the outer edge of such overhead protection shall be one hundred fifty millimeters higher than the inner edge thereof or shall be erected at an angle of not more than twenty degrees to its horizontal sloping into the building;
- 7.10.3 It shall be also ensured that at the building and other construction work that any area exposed to risk of falling material, articles or objects is roped or cordoned off or otherwise suitably guarded from inadvertent entry of persons other than building workers at work in such area.

### **7.11 Lifting and carrying of excessive weight:**

- 7.11.1 No building worker lifts by hand or carries overhead or over his back or shoulders any materials, articles, tools or appliances exceeding in weight the maximum limits as set out in the following table unless aided by any other building worker or a mechanical device;
- 7.11.2 No worker aided by other workers, lift by hand or carry overhead or over their back or shoulders any materials, articles, tools or other appliances exceeding in weight the sum total of the maximum limits as prescribed in the concerned Rules, unless aided by a mechanical devices:

### **7.12 Protections against fall of persons –**

- 7.12.1 All scaffolds/working platforms at height of two metres or more shall be fenced;
- 7.12.2 All guard-rails for the fencing of floor openings, gangways, elevated workplaces shall be made of sound material, good construction and possess adequate strength and be between 1 m and 1.5 m above platform level, consist of two rails (two ropes or chains may be used if they are sufficiently taut) and supporting stanchions;
- 7.12.3 Intermediate rails, ropes or chains shall be midway between the top and lower of edges of the top rail;
- 7.12.4 Sufficient number of stanchions or standard poles or uprights shall be maintained to ensure the required stability and resistance;
- 7.12.5 Guard-rails shall be free from sharp edges and be maintained in good repair;
- 7.12.6 Floor openings through which persons could fall, shall be guarded by covering or fencing;
- 7.12.7 If the means of protection is removed to allow the passage of persons or goods or other purpose, the same shall be replaced as soon as possible, while making temporary arrangements for reasonable degree of safety in the meanwhile;
- 7.12.8 Covers for floor opening shall be safe to walk on and if vehicles operate thereon it shall be safe for the same. This will require the contractor to have prior assessment of expected loads;
- 7.12.9 Cover for floor opening shall be secured by hinges, grooves, stops or other effective means against sliding, falling down or lifting out or any other inadvertent displacement;

- 7.12.10 Covers for any openings shall not constitute any hindrance to traffic and, as far as practicable, be flush with the floor;
- 7.12.11 If covers constitute as grids, the bars shall be spread not more than 5 cm apart;
- 7.12.12 Elevated workplaces at more than 2 m above the floor or ground shall be protected on all open sides by guardrails. It is commonly observed that fragile barricade tapes are used as a substitute of a strong and dependable fencing. This practice is prohibited. The barricade tapes can be used as markers/route guide only;
- 7.12.13 Elevated workplaces shall be provided with safe means of access and egress such as stairs, ramps or ladders according to suitability;
- 7.12.14 Persons employed at elevated workplaces or other situations at more than 2m from which they may fall, shall be protected by means of adequate safety nets, or platforms, or be secured by safety belts with the lanyard properly anchored above the head level of the user. All possible effort shall be made to have strong and dependable mechanical arrangement.

### **7.13 Protection against fall of objects and materials:**

- 7.13.1 Materials and objects such as scaffolding materials, waste materials or tools shall not be thrown up or down from heights, as they are liable to cause injury;
- 7.13.2 If materials and other objects cannot be safely lowered from heights, adequate precautions such as the provision of fencing, lookout men or barriers shall be provided to protect any person from injury.

### **7.14 Protection against entry of unauthorized persons:**

- 7.14.1 Construction zones in the site and built up areas alongside main traffic routes shall be barricaded;
- 7.14.2 Unauthorized persons shall not be allowed access to construction sites and visitors shall be provided with the required protective equipment and it be ensured that they use them effectively.

### **7.15 Head protection and other protection apparel:**

- 7.15.1 Every building worker who is required to –
- 7.15.2 Pass through or working within the areas where there is hazard of his being struck by falling objects or materials, shall be provided with safety helmets of the type approved and tested in accordance with the national standards;
- 7.15.3 Work in water or in wet concrete or in other similar work, shall be provided with suitable waterproof;
- 7.15.4 Work in rain or in similar wet condition, shall be provided with waterproof coat with hat;
- 7.15.5 Workers using or handling of alkalis, acid or other similar corrosive substances shall be provided with appropriate protective equipment in accordance with the approved standards;
- 7.15.6 Every building worker engaged in handling sharp objects or materials at a building or other construction work, which may cause hand injury, shall be provided with suitable hand gloves in accordance with the approved standards.



**7.16 Stability of structures:** No wall, chimney or other structure or part of a structure shall be left unsupported in such condition that it may fall, collapse or weaken due to wind pressure, vibration or due to any other reason. Entry of persons into such locations where tall structures are being built shall be regulated without a let up.

**7.17.0 Safety of Structures and equipment and other safety concerns**

7.17.1 Safety of structures like scaffoldings, platforms, gangways/walkways, towers, stairs, ladders, ramps, safety in excavation, formwork, falsework, demolition work, storage, handling and use of explosives, inflammable substances and hazardous materials, gas cutting and welding, use of electricity etc.; and equipment viz. construction machinery, crushers and batching plant, boiler and other pressure vessels, transport and material handling equipment, lifting appliances, vehicles etc., shall be operated and maintained as per approved norms and –

- i. They shall be made of sound material and of good construction, free from patent defects, provided with adequate safe guards, properly maintained, periodically inspected and strong enough to withstand safely the loads and stresses to which they may be subjected;
- ii. They shall carry enough factor of safety bearing in mind that the possibility of their abuse, which otherwise shall be prevented by constant and adequate supervision, cannot be ruled out altogether;
- iii. It is incumbent on the contractor to ensure that only competent and authorized persons operate the equipment or attend to electrical and mechanical systems and repair of faults or breakdowns etc.

7.17.2 Working in the confined space may involve certain serious hazards. Strict adherence to the conditions of Permit-to-work issued for the purpose is required;

7.17.3 Control of energy sources shall be ensured through Log-out/Tag-out practices.

**7.18 Slipping, tripping, cutting, drowning and falling hazards:**

7.18.1 The contractor shall keep all passageways, platforms and other places free from accumulations of dust, debris or similar material and from other obstructions that may cause tripping;

7.18.2 Any sharp projections or protruding nails or similar projections which may cause any cutting hazard to a building workers shall be removed or otherwise made safe by taking suitable measures;

7.18.3 No contractor shall allow any building worker at construction work to use the passageway, or a scaffold, platform or any other elevated working surface which is in slippery and dangerous condition and shall ensure that water, grease, oil or other similar substances which may cause the surface slippery, be removed or sanded/saw-dusted or covered with suitable material to make it safe from slipping hazard;

7.18.4 Wherever building workers are exposed to the hazarded of falling into water, they shall be provided with rescuing arrangement from such hazard and if it is considered necessary, well equipped boat or launch manned with trained personnel shall be provided by the contractor at the site of such work;

7.18.5 Every open side or opening into or through which a building worker, vehicle or lifting appliance or other equipments may fall at a building or other construction work shall be

covered or guarded suitably to prevent such fall except where free access is necessary by reasons of their nature of the work;

7.18.6 Wherever building workers are exposed to the hazards of falling from height while employed on such work they shall be provided by the employer with adequate equipment or means for saving them from such hazards, Such equipments or means shall be in accordance with the standards as laid down;

7.18.7 Whenever there is a possibility of falling of any martial, equipment or building worker at a construction site relating to a building or other construction work, adequate and suitable safety net shall be provided in accordance with the above stipulation;

## **8.0 Safety in material handling**

### **8.1 General provisions:**

8.1.1 All building materials stored in tiers shall be stacked, racked, blocked, interlocked or otherwise secured safely to prevent sliding, falling or collapse and in an orderly manner to avoid obstruction of any passageway at the place of work. Piles of materials shall be stored or stacked in such a manner as to ensure their stability;

8.1.2 Maximum safe load limits of floors within buildings and structures in kg/cm<sup>2</sup> shall be conspicuously posted in all storage areas, except for floor or slab on gradient. Maximum safe load shall not be exceeded. Material or equipment shall not be stored upon any floor or platform in such quantity as to exceed its safe carrying capacity;

8.1.3 Ailes and passageways shall be kept clear to provide for the free and safe movement of material handling equipment or persons. Such areas shall be kept in good repair;

8.1.4 When a difference in road or working levels exist, means such as ramps, blocking or grading shall be used to ensure the safe movement of vehicles between two levels;

8.1.5 Material stored inside buildings under construction shall not be placed within 2 m of any hoist way or inside floor openings nor within 3.2 m of exterior wall which does not extend above the top of material stored;

8.1.6 Persons employed required to work on stored material in silos, hoppers and similar storage areas shall be equipped with lifelines and safety belts;

8.1.7 Non-compatible materials shall be segregated in storage;

8.1.8 Bagged materials shall be stacked by stepping back the layers and cross-keeping the bags at least every 10 bags high;

8.1.9 Materials shall not be stored on scaffolds or runways in excess of supplies needed for immediate operations;

8.1.10 Bricks stacks shall not be more than 2.2 m in height. When a loose brick stack reaches a height of 1.3 m it shall be tampered back 5 cm in every foot of height above the 1.25 m level;

8.1.11 When masonry blocks are stacked higher than 2 m, the stack shall be tapered back on half block per tier above the 2 m level;

8.1.12 Material or equipment shall not be stored or placed so close to any edge of a floor or platform as to endanger the safety of persons below or working in the vicinity. Where stacking, unshackling, stowing or unstarving of construction material or article, or

handling in connection therewith cannot be safely carried out unaided, reasonable measures to guard against accident or dangerous occurrences shall be taken by shoring or otherwise to prevent any danger likely to be caused by such handling;

- 8.1.13 Stacking of material or article shall be made on firm foundation not liable to settle and such material or article and shall not overload the floor on which such stacking is made;
- 8.1.14 The material or articles shall not be stacked against partition or walls of a warehouse or stores unless it is known that such partition or the wall is of sufficient strength to withstand the pressure of such materials or articles;
- 8.1.15 The materials or articles shall not be stacked to such a height and in such a manner as would render the pile of such stack unstable and cause hazards to the building workers or the public in general;
- 8.1.16 Where the building workers are on stack exceeding one point five meters in height, safe means of access to the stack shall be provided;
- 8.1.17 All stacking or unshackling operations shall be performed under the supervision of a responsible person for such stacking or unstacking;
- 8.1.18 The stacking of construction materials or articles shall not be made near the site of excavation, shaft, pit or any other such opening;
- 8.1.19 Stacks that may lean heavily or become unstable or collapse are barricaded shall be avoided;
- 8.1.20 Structural steel, poles, pipe, bar stock and other cylindrical materials, unless racked, shall be stacked and blocked so as to prevent sliding, spreading or tilting.

## **8.2. Lumber:**

- 8.2.1 Used lumber shall have all nails withdrawn before stacking;
- 8.2.2 Lumber shall be stacked on level and solidly supported sills;
- 8.2.3 Lumber piles shall not exceed 6 m in height provided that lumber is handled manually, shall not be stacked more than 5 m height;
- 8.2.4 Lumber shall be so stacked as to be stable and self-supporting.

## **8.3 Stacking of cement and bags containing other materials:**

- 8.3.1 The cement or other material in bags shall be stacked in a header and stature-wise in rows alternately in not more than 10 numbers and there will be circulation of space of at least 600 mm in between two such rows;
- 8.3.2 While removing bags from the stack pile the stability of such stack pile shall be ensured;
- 8.3.3 Bags containing cement or lime shall be stored on a firm ground;
- 8.3.4 The materials like bricks, tiles or blocks shall also be stored on a firm ground;
- 8.3.5 Reinforcing steel shall be stored according to its shape, size and length and stack of reinforcing steel kept as low as possible;
- 8.3.6 No pipe shall be stored on rack or in stack where such pipe is likely to fall by rolling;

8.3.7 The angle of repose shall be maintained where loose materials are stacked;

8.3.8 When dust laden material is to be stored or handled, measures shall be taken to suppress the dust produced by such storing or handling and suitable personal protective equipment supplied to and used by the building workers working for such storing or handling.

#### **8.4 Disposal of debris and waste material:**

8.4.1 It shall be ensured that debris is

- i) Handled and disposed of by a method, which does not cause danger to the safety of a person and not allowed to accumulate so as to constitute a hazard;
- ii) Kept sufficiently moist to bring down the dust under control;
- iii) Not thrown inside or outside from any height of such building or other construction work;

8.4.2 Brought down by suitable means/chutes provided for the purpose and on completion of work, leftover building material, article or other substance or debris shall be disposed off as soon as possible to avoid any hazard to any traffic or person;

8.4.3 Whenever materials are dropped more than 6 m to any point lying outside the exterior walls of the building an enclosed chute of wood, or equivalent material shall be used;

8.4.4 When debris is dropped through holes in the floor without the use of chutes, the area where the material is dropped shall be completely enclosed with barricades not less than 1.1 m high and not less than 1.9 m back from the edge of the opening above. Signs warning of the hazard of falling material shall be posted at each level;

8.4.5 All scrap lumber, waste material and rubbish shall be removed from the immediate work area as the work progresses;

8.4.6 Disposal of waste material or debris by burning shall be done under guidance of the Engineer in-charge;

8.4.7 All solvent wastes, oil rags and flammable liquids shall be kept in fire resistant covered containers until removed from the work site.

**8.5 Handling gas cylinders:** Gas cylinders shall not be lifted on bare slings. For lifting the cylinders, cage of suitable size shall be used and all cylinders shall be horizontally positioned in it. Such cage shall have fencing in such a way that there is no possibility of fall of cylinders from this cage.

#### **8.6 Rigging equipment for material handling:**

8.6.1 Rigging equipment for material handling shall be inspected prior to use in each shift as necessary during its use to ensure that it is safe. Defective rigging equipment shall be removed from service;

8.6.2 Rigging equipment shall not be loaded in excess of its recommended safe working load, as prescribed in the Indian standards;

- 8.6.3 Rigging equipment, when not in use, shall be removed from the immediate work area so as not to present a hazard to persons engaged in the area;
- 8.6.4 Special custom designed grabs, hooks, clamps, or other lifting accessories, for such units as modular panels, prefabricated structures and similar materials, shall be marked to indicate the safe working loads shall be proof tested prior to use 125% of their rated load;
- 8.6.5 Welded alloy steel chain slings shall have permanently affixed-durable identification standing size, grade, rated capacity and manufacturer.

### **8.7 Fencing of motors etc**

- 8.7.1 All motors, cogwheels, chains and friction gearings, flywheels, shafting and the other dangerous and moving parts of machinery (whether or not driven by mechanical power) and steam pipes shall be securely fenced and the fencing of dangerous parts of machinery not removed while such machinery is in motion or in use;
- 8.7.2 No part of any machinery which is in motion and which is not securely fenced, shall be examined, lubricated, adjusted or repaired except by a person skilled and trained for such examination, lubrication, adjustment or repairs and machine parts cleaned only when such machine is stopped;
- 8.7.3 When a machine is stopped for servicing or repairs, adequate measures shall be taken to ensure that such machine does not restart inadvertently and not only tag-out sign is required; it is also essential that an active system of isolating the power be applied.

### **8.8 Protection against lightning**

- 8.8.1 Where necessary, installations shall be protected against lightning, provided further that;
- 8.8.2 No bare conductors or bare current-carrying parts of equipment be permitted to be installed unless adequate precautions are taken to prevent direct or indirect contact;
- 8.8.3 Only flame-proof equipment and conductors shall be installed at places where explosives or inflammable substances are stored, handled or used or where explosive atmosphere exists;
- 8.8.4 Persons competent and authorized only shall attend to electrical breakdowns and other operational faults and give or restore power to an equipment and such persons shall be easily identifiable by their dress or special helmet worn;
- 8.8.5 It will constitute a standard practice to switch off portable tools while shifting from one place to another or while leaving them behind unattended;
- 8.8.6 The contractor shall ensure that a system is in place to always keep tools well maintained.

### **8.9 Vehicular Traffic**

8.9.1 Whenever any building or other construction work is being carried on, or is located in close proximity to a road or any other place where any vehicular traffic may cause danger to building workers, it shall be ensured that such building or other construction work is barricaded and suitable warning signs and lights displayed or erected to prevent such danger and if necessary, a request in writing made to the concerned authorities to control such traffic;

8.9.2 All vehicles used at construction site shall comply with the requirements of the Motor Vehicles Act, 1988 (59 of 1988) and the Rules made hereunder;

(a) The driver of a vehicle of any class or description operating at a construction site shall hold a valid driving license under the Motor Vehicles Act. 1988 (59 of 1988).

**8.10 Use of safety belt or other fall arrest systems:** Wherever any work at a height of 2 m or more is carried out, use of a suitable fall arrest system is mandatory if the workplace has already not been provided with an otherwise reliable means of protection for preventing the fall of persons from that height, provided further that:

8.10.1 Safety belt, lanyard, life lines and devices for the attachment of such life lines shall conform to the approved standards;

8.10.2 Every building worker shall be supplied with safety belt and safety life lines for his protection and such building worker shall use such belts and life lines during the performance of his work;

8.10.3 All building workers using safety belt and safety life lines shall have the knowledge of safe use and maintenance of such belts and life lines and shall be supplied with necessary instructions for its use;

8.10.4 The responsible person for supervising the use of safety belts and safety lifelines shall inspect and ensure that such safety belts and lifelines are fit for use before taking them into use.

### **8.11 Safety net and its use**

8.11.1 Every safety net shall be of adequate strength, made of sound material and suitable for use and conform to the approved standards;

8.11.2 The responsible person for maintenance of safety nets and their use shall ensure safe fixing of such safety nets and provide such safety nets with suitable and sufficient anchorage so that the purposes for which such safety net is intended for use is served;

**8.12 Storage of safety belts and nets, etc:** Proper arrangement shall be made for the safe storage of safety belts, safety lifelines and safety nets when they are not in use and are protected against mechanical damage, damages from chemicals and damages from biological agents.

### **8.13 Safety Helmets and Safety footwear**

8.13.1 The Engineer in-charge may declare whole or part of a site as the hardhat area and in such an eventuality it shall be the responsibility of the contractor to provide safety helmet



of the approved quality to all personnel engaged in construction and erection work, including the visitors to the site;

8.13.2 Accordingly, wherever safety footwear is required for the safety of the personnel, the contractor shall provide the same of the approved type free of charge.

## **9.0 Safety in Welding and gas cutting**

### **9.1 Gas welding:**

#### **9.1.1 General provisions:**

9.1.1.1 All welders shall be provided with fire resistant protective clothing and equipment, such as fire resistant gauntlets and aprons, helmets and goggles with suitable filter lenses and its usage shall be ensured;

9.1.1.2 The welders shall not be allowed to wear clothing that is not free from grease, oil and other flammable material;

9.1.1.3 Adequate precautions shall be taken to protect persons working or passing near welding operations from dangerous sparks and radiation;

9.1.1.4 When welding or cutting is being done on materials containing toxic or harmful substances or liable to produce toxic or harmful fumes, adequate precautions shall be taken to protect workers from the fumes, either by

- i) Exhaust ventilation, or
- ii) Respiratory protective equipment;
- iii) Arrangement shall be made so that welding sparks do not fall down on the persons working below or material, which are combustible in nature and may be damaged with such sparks.

9.1.1.5 The oxygen pressure for welding shall always be high enough to prevent acetylene flowing back into the oxygen cylinder;

9.1.1.6 Acetylene shall not be used for welding at a pressure exceeding 1 atmosphere gauge;

9.1.1.7 Adequate precautions shall be taken to prevent:

- i) Fire being started by sparks,
- ii) Slag or hot metal; and
- iii) Damage to fibre ropes from heat, sparks, slag or hot metal;

9.1.1.8 Precautions shall be taken to prevent flammable vapours and substances from entering the working area;

### **9.2. Welding at places with fire risks:**

9.2.1 Unless adequate precautions are taken, no welding or cutting operations shall be allowed near the place where combustible materials are stored, or near materials or plant where explosive or flammable dusts, gases or vapours are likely to be present or given off. If hot work permit system exists at the site, the same shall be followed;

9.2.2 Combustible materials and structures that cannot be removed from the vicinity of welding operations shall be shielded by asbestos or protected by other suitable means.

### **9.3 Welding in confined space:**

9.3.1 When welding or cutting operations are being carried out in a confined space;

- i) Adequate ventilation, by means of exhaust fans or forced draught as the condition may require, shall be constantly provided; otherwise enough quantity of air shall be blown in by means of compressors to dilute the pollutants;

- ii) No blow pipe shall be left unattended inside a tank or vessel or other confined space during meal break or other interruption of the work;
- iii) The worker shall take all necessary precautions to prevent unburned combustible gas or oxygen from escaping inside a tank or vessel or other confined space; and
- iv) When necessary to prevent danger, an attendant shall watch the welders from outside.

#### **9.4 Welding on containers for explosive or flammable substances:**

- 9.4.1 Welding or cutting operations on containers in which they are explosives or flammable substances shall not be allowed;
- i) Welding or cutting operations on any container that has held explosive or where flammable gases may have been generated, shall only be undertaken,
  - ii) After the container has been thoroughly cleansed by steam or other effective means; and
  - iii) Found by air tests to be completely free from combustible gases and vapours; or
  - iv) After the combustible gas in the container has been completely replaced by an inert gas or by water;
  - v) If an inert gas is used as laid down in clause 4.2.3, after the vessel has been filled with gas, the gas shall continue to flow slowly into it thorough out the welding or cutting operations;
  - vi) Before starting any welding operations on, or otherwise applying heat to, closed or jacketed containers or other hollow parts, such containers or parts shall be adequately vented in suitable manner.

#### **9.5 Gas cylinders**

- 9.5.1 Gas cylinders shall be inspected, stored, handled and transported in conformity with the requirements of Gas Cylinders Rules, 1981;
- 9.5.2 When in use, cylinders shall be held in upright positions by straps, collars or chains;
- 9.5.3 Devices referred to in clause 8.6.2 shall be such that the cylinders can be rapidly removed in an emergency;
- 9.5.4 Welders shall not temper with or attempt to repair safety devices and valves on gas cylinders;
- 9.5.5 When acetylene cylinders are coupled, flash back arrestor shall be inserted between the cylinder and the coupler block, or between the coupler block and the regulator;
- 9.5.6 Only acetylene cylinders or approximately equal pressure shall be coupled;
- 9.5.7 No gas shall be taken from a cylinder unless a pressure reducing regulator has been attached to the valve;
- 9.5.8 Only the right pressure reducing regulator shall be used for the gas in the cylinder;
- 9.5.9 Cylinder valves shall be kept free from gases, grease, oil, dusts and dirt;
- 9.5.10 Leaky cylinders charged with acetylene or liquefied fuel gas shall be taken into the open air at a safe distance from any open flame or sparks.

#### **9.6 Hose**

- 9.6.1 Only hose especially designed for welding and cutting operations shall be used to connect an oxy-acetylene torch to gas outlet;
- 9.6.2 Hose lines for oxygen and for oxy-acetylene shall be of different colours and preferably of different size;
- 9.6.3 Hose connections shall be sufficiently light to withstand without leakage a pressure twice the maximum delivery pressure of the pressure regulators in the system;



- 9.6.4 Care shall be taken that hose does not become kinked or tangled, stepped on or run-over or otherwise damaged;
- 9.6.5 Any length of hose in which a flashback has burned, shall be discarded;
- 9.6.6 No hose with more than one gas passage shall be used;
- 9.6.7 Only soapy water shall be used for testing hose for leaks.

## **9.7 Torches**

- 9.7.1 When torches are being changed, the gases shall be shut off at the pressure reducing regulators and not by crimping hose;
- 9.7.2 Torches shall be lit with friction lighters or other safe source but not with matches.
- 9.7.3 Electric welding equipment:
- 9.7.4 Welding machines shall be controlled by a switch mounted on or near the machine framework that, when opened, immediately cuts off the power from all conductors supplying the machine;
- 9.7.5 Welding circuit shall be so designed as to prevent the transmission of high potential from the source of supply to the welding electrodes;
- 9.7.6 The maximum open circuit voltage shall be in accordance with Indian Standards;
- 9.7.7 Electrode conductors or cables shall not be excessive in length and shall not be longer than necessary to perform the work;
- 9.7.8 Return conductors shall be taken directly to work and securely connected mechanically and electrically to it or to the work bench, floor etc. and to an adjacent metallic object;
- 9.7.9 Cable shall be supported so as not to create dangerous obstruction;
- 9.7.10 Motors, generators, rectifiers and transformers in arc welding or cutting machines, and all current carrying parts, shall be protected against accidental contact with uninsulated live parts;
- 9.7.11 Ventilating slots in transformer enclosures shall be so designed that no live part is accessible through any slot;
- 9.7.12 Frames of arc welding machines shall be effectively earthed;
- 9.7.13 In hand-operated arc welding machines, cables and cable connectors used in arc welding circuits shall be effectively insulated on the supply side;
- 9.7.14 The outer surface electrode holders of hand-operated arc welding machines, including the jaw so far as practicable, shall be effectively insulated;
- 9.7.15 Electrode holders of hand-operated arc-welding machines shall, if practicable, be provided with discs or shields to protect the operator's hands from the heat of the arcs;
- 9.7.16 Only heavy-duty cable with unbroken insulation shall be used;
- 9.7.17 Circuit connections shall be waterproof;
- 9.7.18 When lengths of cable have to be joined, only insulated connectors shall be used on the earth line and the electrode holder line;
- 9.7.19 Connections to welding terminals shall be made at distribution boxes, socket outlets, etc. by bolted joints;
- 9.7.20 Welding terminals shall be adequately protected against accidental contact by enclosures, covers or other effective means;
- 9.7.21 Electrode holder shall
  - i) Have adequate current capacity;
  - ii) Be adequately insulated to prevent shock, short-circuiting or flashovers.

## **9.8 Operations**

- 9.8.1 Arc welding and cutting operations that are carried on at places where persons other than the welders are working or passing shall be enclosed by means of suitable stationary or mobile screens;
- 9.8.2 Walls and screens of both permanent and temporary protective enclosures shall be provided to absorb harmful rays from the welding equipment and prevent reflection, and if necessary, be painted or otherwise treated for the purpose;
- 9.8.3 When arc welding is done in damp confined spaces;
- i) Electrode holders shall be completely insulated; and
  - ii) The welding machines shall be outside the confined space;
- 9.8.4 Welders shall take adequate precautions
- i) To prevent any part of their body from completing an electric circuit
  - ii) To prevent contact between any part of the body and the exposed part of the electrode, or electrode when in contact with metal; and
  - iii) To prevent wet or damaged clothing, gloves and boots from touching any live part;
- 9.8.5 Welding circuits shall be switched off when not in use;
- 9.8.6 Electrodes shall only be inserted in the holder with insulating means such as insulating gloves;
- 9.8.7 Electrode and return leads shall be adequately protected against damage;
- 9.8.8 Live parts of electrode holders shall be inaccessible when they are not in use;
- 9.8.9 Electric arc-welding equipment shall not be left unattended with current switched on.

## **10.0 Safety in the use of Electricity**

### **10.1 General**

- 10.1.1 Only Authorized, trained and experience electricians shall be appointed to do any work on electrical equipments and installations. No Electrician without ITI in Electrician trade or those who have not passed Wireman's certificate shall be allowed for electrical work.
- 10.1.2 Before commencement of any building or other construction work, adequate measures shall be taken to prevent any worker from coming into physical contact with any electrical equipment or apparatus, machines or live electrical circuit which may cause electrical hazard during the course of his employment and suitable warning signs shall be displayed and maintained at conspicuous places in Hindi and in local language understood by the majority of the building workers;
- 10.1.3 In workplaces where the exact location of underground electric power line is not known, the building workers using jack hammers, crow bars or other hand tools which may come in contact with a live electrical line shall be provided with approved insulated protective gloves and footwear;
- 10.1.4 As far as practicable, no wiring or cable, which may come in contact with water or which may be mechanically damaged or which may result in electric shock shall be left on ground or;
- 10.1.5 All electrical appliances and current carrying equipment used shall be made of sound material and adequately earthed;

- 10.1.6 All temporary electrical installations shall be provided with earth leakage circuit breakers;
- 10.1.7 It is required that all portable power-driven hand tools are provided with double insulation to secure a high degree of protection from electrical hazards;
- 10.1.8 Electrical installations shall comply with the requirements of any law for the time being in force, especially the Indian Electricity Act/Rules in particular with specific reference to the following:
- i) All parts of installations shall be of standard construction not lower, from the safety point of view, than the national standards, as applicable. All parts of electrical installations shall be so constructed, installed and maintained so as to prevent electrical fires, explosion and shock;
  - ii) Earthing of metal work of electrical equipment, other than the parts which carry current, shall be provided and will conform to Electricity Act and IS: 3042 – 198.68.6 (code of practice for earthing);
- 10.1.9 All parts of electrical installation shall be adequate size and characteristics for the work they may be called upon to do and in particular they shall:
- i) Be of adequate mechanical strength to withstand working conditions in construction operations; and
  - ii) Be not liable to damage by water, dust or electrical, thermal or chemical action to which they are subjected to in construction operations;
- 10.1.10 All parts of electrical installations shall be so constructed, installed and maintained as to prevent the danger of electric shock; fire and external explosion;
- 10.1.11 It shall be made impossible for circuit breakers to be opened or closed inadvertently, by gravity or by mechanical impact;
- 10.1.12 Before operation of OCBs, oil level must be checked and the event of short, extra quantity must be filled;
- 10.1.13 Use of rubber gloves and rubber gum boots of tested quality where electric shock is likely to occur shall be provided, but these shall not be considered as providing adequate protection against the risk of electric shock in lieu of inbuilt safety arrangement in the system;
- 10.1.14 First-aid boxes, instruction for restoration of persons affected by electric shock shall be made;
- 10.1.15 Arrangement shall be made for sufficient number of CO<sub>2</sub>/chemical powder type fire extinguishers/sand buckets etc.;
- 10.1.16 No electrical circuits shall ever be overloaded to the dangerous extent or beyond the rated capacity;
- 10.1.17 In confined areas, only 24 volt supply shall be used for every equipment, including hand-held portable tools and hand lamps;
- 10.1.18 All electrical appliances and outlets shall be clearly marked to indicate their purpose and voltage.

## 10.2 Fuses

- 10.2.1** Fuses shall bear markings indicating their rated current, whether they are of the fast or slow-breaking type and, as far as practicable, and their rated breaking capacity. Fuses as per need and of correct rating shall be used in the circuit;
- 10.2.2** Effective measures shall be taken to ensure that persons removing or inserting fuses will not be endangered, in particular by any adjacent live parts;
- 10.2.3** In case of blow of fuses only after finding out and correcting of the fault, new fuses shall be provided in the circuit.

### **10.3 Switches**

- 10.3.1** All switches shall be of enclosed type and so installed and earthed as to prevent danger in their operation;
- 10.3.2** Use of switches, which may connect or disconnect circuit through gravity, shall not be used.

### **10.4 Motors**

- 10.4.1** All motors shall be equipped with a switch;
- 10.4.2** When a motor can be cut off from more than one place, where practicable, a stopping device shall be installed in the immediate vicinity of the motor;
- 10.4.3** Motors shall be so installed as to ensure that they can be adequately cooled;
- 10.4.4** Motors shall be effectively protected against over current;
- 10.4.5** Whenever the motors installed are in the open area where there is the possibility of fall of liquid corrosives or otherwise, it shall be suitably protected with covering;
- 10.4.6** Earthing shall be connected to all motors, generators etc. as prescribed in the Indian Electricity Rules, amended from time to time.

### **10.5 Connections**

- 10.5.1** At points where conductors are joined, branched or led into apparatus, they shall be:
- i) Mechanically protected, and
  - ii) Properly maintained;
- 10.5.2** Conductors shall be joined, branched or led into an apparatus through junction boxes, bushings, glands or equivalent connecting devices;
- 10.5.3** Junction boxes or plug-out-socket couplings shall be used for joining cables wherever practicable;
- 10.5.4** When parts of conductors are joined together, or conductors are joined to one another or to an apparatus, the attachment shall be made by screwing, clamping, soldering, riveting, brazing, crimping, or equivalent means. Loose connections shall not be provided in any case;

10.5.5 Cable joints, junction boxes and connectors shall be protected as far as practicable, against traffic, fall of ground, water and other sources of damage;

10.5.6 Whenever armoured cables are joined, the junction boxes shall be bridged by a suitably conductive bond between the armouring of the cables.

## **10.6 Transportable and portable electrical equipment:**

**10.6.1** The supply of electricity to portable apparatus shall not exceed 250v;

10.6.2 Hand-held and portable machines shall be equipped with a built-in switch to switch off power in case of emergency;

10.6.3 Hand-held electrically operated tools shall be provided with built-in switch to disconnect the circuit when the tool is not being used;

10.6.4 Portable electrical tools, unless flameproof, shall not be used in flammable or explosive atmosphere;

10.6.5 Only three-core cable shall be used for single-phase operated tools with the third core connected to earth.

## **10.7 Hand lamps**

**10.7.1** Hand lamps shall be equipped with strong cover of glass or other transparent material;

10.7.2 Portable lamp holders shall have:

- i) All current –carrying parts enclosed;
- ii) Insulated handle; and
- iii) They shall operate at 24 v;

## **10.8 Inspection, maintenance**

**10.8.1** All electrical equipment shall be inspected before it is taken into use to ensure that it is suitable for its purpose of use;

10.8.2 At the beginning of every shift every person using electrical equipment shall make a careful external examination of the equipment and conductors for which he is responsible, especially flexible cables;

10.8.3 Periodic inspections, testing, maintenance of all electrical equipment is to be made and record of test of transformer oil and pit earthing shall be maintained;

10.8.4 Electrical conductors and equipment shall be repaired by the electrician only as far as practicable, no work shall be done live conductors or equipment;

10.8.5 Before any work is begun on conductors or equipment that does not have to remain live;

- i) The current shall be switched off;
- ii) Adequate precautions shall be taken to prevent the current from being switched on again;
- iii) The conductors or the equipment shall be tested to ascertain that they are dead;
- iv) The conductor and equipment shall be earthed and short-circuited; and
- v) Neighbouring live parts shall be adequately protected against accidental contact;

10.8.6 After work on conductors and equipment, the current shall only be switched on again on the orders of a competent person;

10.8.7 Electricians shall be provided with adequate tools, and person protective equipment, such as rubber gloves, mats etc.;

10.8.8 All conductors and equipment shall be considered to live unless there is certain proof to the contrary.

## **10.9 Work in the vicinity of electrical installations**

10.9.1 When work is to be done in the neighbourhood of electrical conductors or installations, the contractor shall ascertain the voltage carried and the works shall not be allowed to reach to unsafe distance from them;

10.9.2 When any excavation is to be made or any bore-holed sunk, the contractor shall ascertain whether there are any underground conductors, in or in dangerous proximity to, the zone of operations;

10.9.3 No work shall be done in dangerous proximity to a conductor or an installation until it has been made dead;

10.9.4 Before work begins, work permit shall be obtained from the Engineer in-charge if live electricity lines/circuit are passing in close vicinity;

10.9.5 Before the current is restored, the contractor shall ensure that no work remain on the work site;

10.9.6 If conductor or an installation in the neighbourhood of which work is to be done can not be made dead, special precautions shall be taken and special instructions given to the workers so as to prevent danger by adequately enclosing or fencing;

10.9.7 If mobile equipment has to be employed in the neighbourhood of conductors or installations that cannot be made dead, its movement shall be so controlled as to keep it as a safe distance from them.

## **11 Safety in the use of hand tools and power-operated tools**

### **11.1 General provisions**

11.1.1 All hand and power tools and similar equipment, shall be maintained in safe condition.

11.1.2 When power operated tools are designed to accommodate guards, they shall be equipped with such guards, when in use;

11.1.3 Belts, gears, shafts, pulleys, sprockets, spindles, drums, fly wheels, chains and other reciprocating, rotating or moving parts of the equipment shall be similarly guarded;

11.1.4 Personnel using hand and power tools and exposed to the hazard of falling, flying, abrasive, and splashing objects, or exposed to harmful dusts, fumes, mists, vapours, or gases shall be provided with the particular personal protective equipment necessary to protect them from the hazards;

11.1.5 All hand-held powered platen sanders, grinders, grinders with wheels of 5 cm or less, routers, planers, laminate trimmers, nibblers, shears, scroll saws and jigsaws with blade shanks of 0.5 cm wide or less shall be equipped with only a positive on-off control.

11.1.6 All hand-held powered drills, tappers, fastener drivers, horizontal, vertical or angle grinders with wheels greater than 5 cm in diameter, disc sanders, belt sanders, reciprocating saws, saber saws and other operating powered tools shall be equipped with a momentary contact on control provided that turnoff can be accomplished by a single motion of the same finger or fingers that turn it on.

### **11.2 Hand Tools**

11.2.1 The contractor shall not issue or permit the use of unsafe hand tools;

11.2.2 Wrenches including adjustable pipe end and socket wrenches shall not be used when jaws are sprung to the point that slippage occurs;

11.2.3 Impact tools such as drift pins, wedges and chisels shall be kept free of mushroomed heads;

11.2.4 The wooden handles of tools shall be kept free of splinters or cracks and shall be kept tight on the tools.

### **11.3 Power operated tools**

11.3.1 Electric power operated tools shall be either of the approved double-insulated type or shall be grounded;

11.3.2 The use of electric cords for hoisting or lowering loads shall not be permitted;

11.3.3 Pneumatic power tools shall be secured to the hose or whip by some positive means to prevent the tool from becoming accidentally disconnected;



- 11.3.4 Safety clips or retainers shall be securely installed or maintained on pneumatic impact (percussion) tools to prevent attachments from being accidentally expelled;
- 11.3.5 All pneumatically riveting machine staplers and other similar equipment provided with automatic fastener feed, which operate at more than 7 kg/cm<sup>2</sup> pressure at the tool a safety device on the muzzle to prevent the tool from ejecting the fasteners unless the muzzle is in contact with the work surface;
- 11.3.6 Compressed air shall not be used for cleaning purposes except when the pressure is reduced to less than 2 kg/cm<sup>2</sup> and that too with effective chip guarding. The 2 kg/cm<sup>2</sup> pressure requirement does not apply to concrete form, mill scale and similar cleaning purposes;
- 11.3.7 The manufacturer's safe operating for hoses, pipes, valves, filters and other fittings shall not be exceeded;
- 11.3.8 Only personnel who has been trained in the operation of the particular tool shall be allowed to operate power-actuated tools;
- 11.3.9 The tool shall be tested each day before loading to see that the safety devices are in proper working condition. The method of testing shall be accordance with the manufacturer's recommended procedure;
- 11.3.10 Any tool found not in proper working order, or that which develops a defect during use, shall be immediately removed from service and not used until properly repaired;
- 11.3.11 Tools shall not be loaded until just prior to the intended firing time. Neither loaded nor empty tools are to be pointed at any other person. Hands shall be kept clear of the open barrel end;
- 11.3.12 Loaded tools shall not be left unattended;
- 11.3.13 Fasteners shall not be driven into very hard or brittle materials including, but not limited to, cast iron, glazed tiles, surface hardened steel, glass block, live rock, face brick or hollow tiles;
- 11.3.14 Driving into materials that can be easily penetrated shall be avoided unless backed by a substance that will prevent the pin or fastener from passing completely through and creating a flying missile hazard on the other side;
- 11.3.15 No fastener shall be driven into a palled area caused by an unsatisfactory fastening;
- 11.3.16 Only non-sparking tools shall be used in an explosive or flammable atmosphere;
- 11.3.17 All tools shall be used with the correct shield, guard or attachment as recommended by thee manufacturer.

#### **11.4 Abrasive wheels and tools**

- 11.4.1 All grinding machines shall be supplied with sufficient power to maintain the spindle speed at safe levels under all conditions of normal operation;
- 11.4.2 Grinding machines shall be equipped with suitable safety guards;
- 11.4.3 The maximum angular exposure of the grinding wheel periphery and sides shall not be more than 90<sup>0</sup>, except that when the work requires contact with the wheel below the horizontal plane of the spindle, the angular exposure shall not exceed 120<sup>0</sup>. In either



case, the exposure shall begin not more than  $8.65^{\circ}$  above the horizontal plane of the spindle. Safety guards shall be strong enough to withstand the bursting of the wheel;

- 11.4.4 Floor and bench-mounted grinders shall be work-rests, which shall be rigidly supported and readily adjustable. Such work-rests shall be kept at a distance not to exceed 5 mm from the surface of the wheel;
- 11.4.5 Cup type wheels used for external grinding shall be protected by either revolving cup guard or a band type guard;
- 11.4.6 When safety guards are required, they shall be mounted as to maintain proper alignment with the wheel and the guard and the guard and its fastening shall be adequate strength to retain the fragments of the wheel in case of accidental breakage. The maximum angular exposure of the grinding wheel periphery and sides shall not exceed  $180^{\circ}$ ;
- 11.4.7 Portable abrasive wheel used for internal grinding shall be provided with suitable safety flanges;
- 11.4.8 When safety flanges are required, they shall be used only with wheels designed to fit the flanges. Only safety flanges, of a type and design and properly assembled so as to ensure that the pieces of the wheel will be retained in case of accidental breakage, shall be used;
- 11.4.9 All abrasive wheels shall be closely inspected and ring tested before mounting to ensure that they are free from cracks or defects;
- 11.4.10 Grinding wheels shall fit freely on the spindle and shall not be forced on. The spindle nut shall be tightened only enough to hold the wheel in place;
- 11.4.11 All employees using abrasive wheels shall be protected by suitable eye protection equipment.

## **11.5 Woodworking tools**

- 11.5.1 All fixed power driven woodworking tools shall be provided with a disconnect switch that can either be locked or tagged in the **off-position**;
- 11.5.2 The operating speed shall be attached or otherwise permanently marked on all circular saws over 0.5 m in diameter or operating at over 3000 peripheral rpm. Any saw so marked shall not be operated at a speed other than that marked on the blade. When a marked saw is retensioned for a different speed, the marking shall be corrected to show the new speed;
- 11.5.3 Automatic feeding devices shall be installed on machines wherever the nature of the work will permit. Feeder attachments shall have the feed rolls or other moving parts covered or guarded so as to protect the operator from hazardous points;
- 11.5.4 All portable power driven circular saws shall be equipped with guards above and below the base plate or shoe. The upper guard shall cover the saw to the depth of the teeth, except for the minimum arc required to permit the base to be tilted for bevel cuts. The lower guard shall cover the saw to the depth of the teeth, except for the minimum arc required to allow proper retraction and contact with the work. When the tool is withdrawn from the work, the lower guard shall automatically and instantly return to the covering position.

## **12.0 Safety in the use of ladders and stairs**

### **12.1 General aspects of safety related to use of ladders**

- 12.1.1 Every ladder or step-ladder used in building or other construction work shall be of good construction, made of sound material and of adequate strength for the purpose for which such ladder or step-ladder is used;
- 12.1.2 When a ladder is used as a means of communication, such ladder shall be lashed to a fixed structure so that while working on such ladder it does not slip;
- 12.1.3 A ladder or step ladder shall not stand on loose bricks or other loose packing and have a level and firm footing;
- 12.1.4 No ladder shall be used which has a missing or defective rungs or rungs, which depend for support solely on nails, spikes or other similar fixing.

### **12.2 Materials for ladders**

- 12.2.1 Shall be constructed with upright of adequate strength and are made of straight-grained wood, free from defects and having the grain of such wood running length wise;
- 12.2.2 Shall have rungs made of straight-grained wood free for defects and mortised or securely notched into the upright, reinforcing metal ties, if wedges shall not secure the tenors of such ladders;
- 12.2.3 Where it is required, in case of use of fixed ladders, sufficient foot-hold and hand-hold shall be provided for use by the building worker;
- 12.2.4 Every ladder shall be -
  - (I) Secured so as to prevent undue swaying;
  - (II) Equally and properly supported on each of its upright;
  - (III) So used as not to cause undue sagging; and
  - (IV) Placed as nearly as possible at an inclination of four in one;
- 12.2.5 The use of all ladders and stepladders shall conform to the approved standards;
- 12.2.6 Wooden ladders shall be constructed with uprights of adequate strength as well as rungs made of wood free from visible defects and having the grains of the wood in the ladders running lengthwise and rungs mortised or rebuted into the uprights;
- 12.2.7 Uprights and rungs of metal ladders shall have a cross-section adequate to prevent dangerous deflection, shall be equal and not less than 25 cm or more than 35 cm;
- 12.2.8 Rungs of metal ladders shall be kept clean so as to prevent them from becoming slippery;
- 12.2.9 Portable ladders shall not exceed 9 m in length;
- 12.2.10 Every ladder or run of ladders rising to a height exceeding 9 m shall be provided with an intermediate landing, providing further that the intervals between landings shall not exceed 9 m. The landings shall be of suitable size and protected by railings;
- 12.2.11 Defective ladders that cannot be satisfactorily repaired shall be tagged Not Fit For Use and destroyed;
- 12.2.12 Wooden ladders shall not be painted, but oiled or covered with clean varnish or other transparent preservatives;
- 12.2.13 Metal ladders shall be protected against corrosion by being coated with rust-proof paint or by other means unless they are made of non-corrosive metals;
- 12.2.14 Every ladder shall rise at least 1 m above the highest point to be reached and have one of the uprights continued to that height to serve as a hand-rail at the top;

- 12.2.15 Ladders shall not stand on loose bricks or other loose packing but have a level and firm footing so that they are equally supported on each upright;
- 12.2.16 Every ladder shall be securely fixed so that it cannot move from its top and bottom points of rest and if it cannot be secured at the top, it shall be securely fastened at the base and if fastening at the top is also impracticable, it shall have a man stationed at the foot holding the end to prevent it from slipping;
- 12.2.17 Where a run of two or more ladders connects different floors, the ladders shall be staggered and a protective landing with the smallest practicable opening shall be provided at each floor;
- 12.2.18 A ladder having only one upright or a missing or dangerously defective rung shall not be used;
- 12.2.19 When a ladder is placed in position, the distance between the foot of a ladder and the base of the structure against which it rests shall be about one-quarter of its length;
- 12.2.20 Workers using ladders shall leave at least one hand free for climbing up and down, face the ladder, avoid wearing slippery footwear and avoid carrying heavy or bulky loads;
- 12.2.21 A ladder shall not be placed in front of a door that opens towards it unless the door is fastened or locked or guarded;
- 12.2.22 A ladder shall not be placed against a window frame unless the ladder is fitted with a board at the top so that the applied load is safely distributed over the frame;
- 12.2.23 Metal ladders shall not be used in the vicinity of live electrical equipment;
- 12.2.24 Adequate means shall be provided to prevent displacement of the ladder set up in public thoroughfare or where persons, vehicles etc. may accidentally collide with it.

### **12.3 Portable stepladders**

- 12.3.1 The length of portable stepladders shall not exceed 8.6 m and their back legs shall be adequately braced;
- 12.3.2 Stepladders exceeding 1.5 m in length shall have two or more cross-ties;
- 12.3.3 The spread between the front and back legs shall be restricted by means of hinged metal flat bars or high-grade fibre or other effective means;
- 12.3.4 When in the open position, treads of stepladders shall be horizontal.

### **12.4 Portable trestle ladders**

- 12.4.1 The height of the trestle ladders shall not exceed 5.5 m;
- 12.4.2 The spread between the front and back legs shall be restricted by means of hinged metal flat bars or high-grade fibre or other effective means;
- 12.4.3 The front and back legs shall be joined at the top by bolted steel hinges of adequate dimensions or other effective means;
- 12.4.4 Both legs of trestle ladders shall be equipped with sufficient number of steel crossties.

### **12.5 Extension ladders**

- 12.5.1 The length of extension ladders shall not exceed 15 m;
- 12.5.2 Extension ladders shall be equipped with an effective lock and guide brackets by which the ladder can be extended, retracted or locked in any position;
- 12.5.3 The rungs of overlapping sections shall coincide so as to form double treads and shall be equipped with one or more extension ropes;
- 12.5.4 Extension ropes shall be securely anchored and run over suitable pulleys.

## **12.6 Mechanical ladders**

- 12.6.1 Mechanical ladder is that ladder, which is a mechanically extendable ladder, mounted on a wheeled frame;
- 12.6.2 Mechanical ladder shall be equipped with guard-rails and toe-boards and a cage of heavy-gauge steel mesh;
- 12.6.3 If mechanical ladder has no railed platform or cage, workers using it shall be secured by suitable safety belt;
- 12.6.4 Mechanical ladders shall not be moved, while a person is on them, unless they have specially designed to ensure that perfect stability is maintained during movement.

## **12.7 Fixed ladders**

- 12.7.1 Uprights of fixed ladders shall be at least 40 cm and shall be set an angle of  $15^0$  to the vertical;
- 12.7.2 Clearance at the back of the rungs shall be at least 15 cm and no obstruction within 75 cm of the face of the ladder;
- 12.7.3 There shall be at least 7.5 cm clearance between the ladder and the nearest fixed object;
- 12.7.4 When it is necessary for a ladder to pass closely through a hole in a platform or a floor, the edges of the hole shall be padded so as to prevent injury to the users;
- 12.7.5 The length of the runs of fixed ladder shall not exceed 9 m;
- 12.7.6 Landing platform shall be provided for each 9 m or fraction thereof;
- 12.7.7 As far as practicable, runs shall be staggered;
- 12.7.8 Runs from which a person could fall from more than 8.6 m shall be enclosed in a cage of heavy-gauge mesh or hoops;
- 12.7.9 Fixed ladders shall be firmly bolted or welded in position.

## **12.8 Stairs**

- 12.8.1 Stairs shall be of adequate strength to withstand safely the loads that they will have to carry;
- 12.8.2 Stairs used for the purpose of construction work shall have a clear width of at least 8.60 cm;
- 12.8.3 Stairs made of perforated material shall not have openings exceeding 1.2 cm in width;
- 12.8.4 No step of a stairway shall depend for its support solely on nails, spikes, screws or other similar fixing;
- 12.8.5 No stairway with missing or dangerously defective steps shall be used;
- 12.8.6 Every stairway that is at an angle of less than  $30^0$  from the vertical shall be provided with a secure handhold at the top landing place, either by extending one upright for at least 1 m or by other effective means;
- 12.8.7 Movable and removable stairs shall be adequately secured in the position of use;
- 12.8.8 In all building structures permanent stairs shall be constructed as soon as practicable;
- 12.8.9 When work on a building has progressed to a height of more than 18 m above the ground and it has not been practical to construct the permanent stairs, sufficient number of stairs shall be provided to ensure safe access to the working levels.

## **13.0            Safety in the use of lifting appliances**

**13.1 Construction and maintenance of lifting appliances:** All lifting appliances, including their parts and working gear, whether fixed or movable, and any plant or gear used in anchoring or fixing of such appliances -

13.1.1 Shall be of sound construction, sound material, and of adequate strength to serve the purpose for which these are to be used and all such appliances shall be free from patent defects, and

13.1.2 Maintained in good repair and working condition;

13.1.3 Every drum or pulley around which the rope of any lifting appliance is carried, shall be of adequate diameter and sound construction in relation to such rope;

(I) Any rope that terminates at the winding drum of lifting appliance shall be securely attached to such drum and at least three dead turns of such rope remain on such drum in every operating position of such lifting appliance;

(II) The flange of a drum projects twice the rope diameter beyond the last layer of such rope and if such rope and if such projection is not available, other measures like anti-slackness guards shall be provided to prevent such rope from coming off such drum;

13.1.4 Every lifting appliance shall be provided with adequate and efficient brakes which shall be:

i) Capable of preventing fall of suspended load (including any test load),

ii) Effectively controlling such load while it is being lowered, acting without shock and shall be attached with shoes that can be easily removed for running and which shall be simple and have easily accessible means of adjustment;

13.1.5 Provided that nothing contained above shall apply to **steam-winch** that can be operated as safely as with brakes.

### **13.2 Controls of every lifting appliance shall be so**

13.2.1 Situated that the driver of such appliance at his stand or seat has ample room for operating and has an unrestricted view of building or other construction work, as far as practicable, and that he remains clear of the load and the ropes, and that no load passes over him;

13.2.2 Positioned with due regard to ergonomic considerations for proper operation of such appliance;

13.2.3 Located that the driver of such appliance remains above the appliance and shall have upon them or adjacent to them clear markings to indicate their purpose and mode of operations;

13.2.4 Provided, where necessary, with a suitable locking device to prevent accidental movement or displacement and shall move, as far as practicable, in the direction of the resultant load movement;

13.2.5 Wherever automatic brakes are provided, they shall automatically come to the neutral position in case of power failure.

### **13.3 Test and periodical examination**

**13.3.1 Test:** All lifting appliances including all parts and gears thereof, whether fixed or movable, shall be tested and examined by a competent person before being taken into

use for the first time or after it has undergone any alteration or repairs liable to affect its strength or stability or after erection on a site and also once at least in every five years, in the manner as specified;

13.3.2 **Examination:** all lifting appliances shall be thoroughly examined by a competent person at least in every twelve months and where the competent person making such examination forms the opinion that the lifting appliance cannot continue to function safely, he shall forthwith give notice in writing of his opinion to the contractor.

### **13.4 Automatic load indicator**

13.4.1 Cut-out shall be provided which automatically arrests the movement of the lifting parts of every crane if the load exceeds the safe working load, wherever possible;

13.4.2 Wherever the above provisions cannot be applied and if it is not possible to install an automatic safe load indicator, in that case, provision of a table showing the safe working loads at the corresponding inclinations or radii of the jib on the crane shall be considered sufficient.

13.5 **Installation:** Fixed lifting appliances shall be installed by a competent person in a manner that

13.5.1 Such appliances cannot be displaced by the load, vibration or other influences;

13.5.2 The operator of such appliance is not exposed to danger from loads, ropes or drums;

13.5.3 The operator can either see over the zone of operation or communicate with all loading and unloading points by signal, or other communication system;

13.5.4 Adequate clearance is provided between parts or loads of lifting appliances and between the fixed objects such as walls and posts, or electrical conductors;

13.5.5 The lifting appliances; when exposed to wind loading, are given sufficient additional strength, stability and rigidity to withstand such loading safely;

13.5.6 No structural alterations or repairs are made on any part of the lifting appliances that affect the safety of such appliances without obtaining the opinion of the competent person to this effect.

### **13.6 Winches**

13.6.1 Winches shall not be used if their control levers operate with excessive friction or play;

13.6.2 Double gear winches shall not be used unless a positive means of locking the gearshift is provided;

13.6.3 There shall be no load other than the fall and the hook assembly on the winch while changing gears on a two-gear winch;

13.6.4 Adequate protection shall be provided to the winch operator against abnormal weather;

13.6.5 Temporary seats or shelters for winch operators that may pose hazard to the winch operator or any other building workers shall not be allowed to be used;



13.6.6 Control levers shall be secured in the neutral position and, whenever possible, the power shall shut off if the winch is left unattended.

### **13.7 In use of every steam-winch**

**13.7.1** Measures shall be taken to prevent escaping steam from obscuring any part of the construction site or other workplace or from otherwise hindering or injuring any building worker;

**13.7.2** Extension control levers which tend to fall off their own weight shall be counter-balanced;

**13.7.3** Winch operators shall not be permitted to use the which control extension levers except for short handles on wheel type controls and that such levers shall be of adequate strength, secure and fastened with metal connections at the fulcrum and at the permanent control lever;

**13.7.4** In use of every electric winch, no building worker shall be permitted to transfer, alter or adjust electric control circuits in case of any defect in such winch;

### **13.8 Electric winches shall not be used for building work where**

13.8.1 The electromagnetic brake is unable to hold the load; or

13.8.2 One or more control points either hoisting or lowering are not operating properly.

**13.9 Buckets:** It shall be ensured that tip-up buckets are equipped with a device that effectively prevents accidental tipping.

### **13.10 Identification and marking of safe working load:**

13.10.1 Every lifting appliance and loose gear shall be clearly marked for its safe working load and identification by stamping or other suitable means;

13.10.2 Every derrick (**other than derrick crane**) shall be clearly marked for its safe working load when such derrick is used either in single purchase with lower block or in union purchases in all possible block positions;

13.10.3 The lowest angle to the horizontal, to which the derrick may be used, shall be legibly marked;

13.10.4 Every lifting appliance having more than one working load shall be fitted with effective means to enable the operator to determine safe working load at each point under all conditions of use;

13.10.5 Means to ascertain the safe working load for lifting gears under such conditions in which such gears may be used shall be provided to enable a worker using such gears and such means safely, which shall comprise:

- iii) Marking of the safe working load in plain figures or letters upon the sling or upon a tablet or ring of durable material attached securely thereto in case of chain slings; and

- iv) The means specified or notices so exhibited as can be easily read by any concerned building worker stating the safe working load for the various sizes of the wire rope slings used.

### **13.11 Loading of lifting appliances and lifting gears**

- 13.11.1 No lifting appliance, lifting gear or wire rope shall be used in an unsafe way and in such a manner as to involve risk to life of building workers and they are not loaded beyond their safe working load except for testing purposes under the direction of a **competent person** in the manner as specified in schedule;
- 13.11.2 No lifting appliance and lifting gear, or any other material-handling appliance shall be used if the Inspector having jurisdiction under the Building and Other construction (regulation of employment and conditions of service) Act/Rules is not satisfied with reference to a certificate of test or examination or to an authenticated record maintained as provided under the Rules or if in his view the lifting appliance, lifting gear or any other material handling appliance is not safe for use in building or other construction work;
- 13.11.3 No pulley block shall be used unless the safe working load and its identification are clearly marked on such block.

### **13.12 Operator's cab or cabin shall**

- 13.12.1 Be made of fire resistant material;
- 13.12.2 Have a suitable seat, a foot rest and protection from vibration;
- 13.12.3 Afford the operator an adequate view of the area of operation;
- 13.12.4** Afford the necessary access to working parts in the cab;
- 13.12.5 Afford the operator adequate protection against the weather;
- 13.12.6 Be adequately ventilated; and
- 13.12.7 Be provided with a suitable fire extinguisher.

### **13.13 Operation of lifting appliances:** Operator of every crane or lifting appliance shall possess adequate skill and training in the operation of the particular lifting appliances, provided further that

- 13.13.1 No person under eighteen years of age shall be in control of any lifting machine, scaffold winch, or give signals to the operator;
- 13.13.2 Precaution shall be taken by the trained operator to prevent lifting appliance from being set in motion inadvertently;
- 13.13.3 The operation of lifting appliances shall be governed by signals in conformity with the approved standards;
- 13.13.4 The operator's attention shall not be distracted while he is working;



- 13.13.5 No crane, hoist, winch or other lifting appliance or any part of such crane, hoist, winch or other lifting appliance shall, except for testing purposes, be loaded beyond the safe working load;
- 13.13.6 During the hoisting operation, effective precaution shall be taken to prevent any person from standing or passing under the load in such operation;
- 13.13.7 Operator shall not leave lifting appliance unattended while power is on or the load is suspended to such appliance;
- 13.13.8 No person shall ride on a suspended load of any lifting appliance;
- 13.13.9 Every part of a load in course of being hoisted or lowered shall be adequately suspended and supported to prevent danger;
- 13.13.10 Every receptacle used for hoisting bricks, tiles, slates or other material shall be suitably enclosed as to prevent the fall of any such material;
- 13.13.11 The hoisting platform shall be enclosed when loose material or loaded wheel barrows are placed directly on such platform or lowering such materials or wheel barrows;
- 13.13.12 No material shall be raised, lowered or slewed with any lifting appliance in such a way as to cause sudden jerks to such appliance;
- 13.13.13 In hoisting a barrow, any wheel of such barrow shall not be used as a means of support unless adequate steps have been taken to prevent the axle of such wheel from slipping out of its bearing;
- 13.13.14 Long objects like planks or girders shall be provided with tag line to prevent any possibility of danger while raising or lowering such objects;
- 13.13.15 During the process of landing or material, a building worker shall not be permitted to lean out into empty space for finding out the loading and unloading of such material;
- 13.13.16 When hoisting of load is done in an enclosed space, neither the lifting material nor the boom shall project outside the enclosed space;
- 13.13.17 Adequate steps shall be taken to prevent a load, in the course of being hoisted or lowered from coming into contact with any object to avoid any displacement of such load and appropriate appliances provided and used for guiding heavy loads when raising or lowering heavy loads to avoid crushing of hands of building workers during such raising or lowering of loads.

#### **13.14 Hoists**

- 13.14.1 Hoist towers shall be designed according to the relevant national standards;
- 13.14.2 Hoist shafts shall be provided with rigid panels or other adequate fencing at the ground level on all sides of such shafts and at all other levels on all sides of the access to such shafts while the walls of hoist shafts, except at approaches, extend at least two meters above the floor or platform of access to such shafts;
- 13.14.3 Approaches to hoist shall be adequately lit and provided with gates that shall be guarded to maintain visibility at least of two meters height; and equipped with a device, which requires such gate to be closed before the platform of such hoist can leave the landing, and prevents the gate from being opened unless such platform is at the landing;

- 13.14.4 The guides of hoist platforms shall offer sufficient resistance to bending and to bucking in the case of jamming, by providing a safety catch;
- 13.14.5 Overhead beams and their supports are capable of holding the total maximum live and dead loads that such beams and supports will be required to carry, with a safety factor of at least five;
- 13.14.6 A clear space shall be provided –
- a. Above the highest stopping place of a cage or platform to allow sufficient unobstructed travel of such cage or platform in case of overwinding and
  - b. Below the lowest stopping place of such cage or platform;
- 13.14.7 Adequate covering shall be provided above the top of hoist shafts to prevent materials from falling into such shafts;
- 13.14.8 Outdoor hoist towers shall be erected on adequately firm foundations and securely braced, guyed and anchored;
- 13.14.9 A ladder way shall extend from the bottom to the top of every outdoor hoist tower in case no other ladder way exists within easy reach and such ladder way shall comply with the relevant national standards;
- 13.14.10 The rated capacity of a hoisting engine shall at least be one and a half times the maximum load that such engine will be required to move;
- 13.14.11 All gearing on a hoisting engine shall be securely enclosed;
- 13.14.12 Steam piping of hoisting engine shall be adequately protected against accidental contact of such piping with a building worker;
- 13.14.13 Electrical equipment of a hoisting engine shall be effectively earthed;
- 13.14.14 A hoist shall be provided with suitable devices to stop a hoisting engine as soon as the platform of such hoist reaches its highest stopping place;
- 13.14.15 A hoisting engine shall be protected by suitable cover against weather and falling objects;
- 13.14.16 A hoisting engine set up in a public thoroughfare shall be completely enclosed;
- 13.14.17 All exhaust steam pipes shall discharge steam in such a manner that the steam so discharged does not scald any person or obstruct the operator's view;
- 13.14.18 The motion of a hoist shall not be reversed without first bringing it to rest to avoid any harm from such reverse motion;
- 13.14.19 A hoist not designed for the conveyance of persons shall not be set in motion from the platform of such hoist;
- 13.14.20 Pawls and ratchet wheels of a hoist, requiring disengagement of such pawls from such ratchet wheels, before the platform of such hoist is lowered, shall not be used;
- 13.14.21 A platform of a hoist shall be capable of supporting such maximum load that such platform may carry with a safety factor of at least three;
- 13.14.22 A platform of a hoist shall be equipped with suitable safety gear which can hold such platform with its maximum load in case its hoisting rope breaks;

- 13.14.23 On platform of a hoist, the wheel barrows or truck shall be efficiently blocked in safe positions;
- 13.14.24 A cage of a hoist or platform where the building workers are required to enter into such cage or to go on such platform at landing levels, shall be provided with a locking arrangement to prevent such cage or platform from moving during the time a worker enters or leaves such cage or platform;
- 13.14.25 The sides of platform of a hoist which are not used for loading or unloading, shall be provided with toe-board and enclosures of a wire mesh or any other suitable means to prevent the fall of any part of a load from such platform, further provided that
- i) The platform of a hoist, which has any probability of falling of any part of a load from it, shall be provided with an adequate covering to prevent such fall;
  - ii) The counter weights of a hoist consisting of an assemblage of several parts shall be so constructed that such parts shall be rigidly connected together;
  - iii) The counter weights of a hoist shall run between guides;
  - iv) At every level of work the building workers shall be provided with adequate platforms for performing such work;
  - v) A legible notice in Hindi as well as in a local language shall be displayed in a conspicuous place of the platform of a hoist and that such notice shall state the maximum carrying capacity of such hoist in kilograms on the hoisting engine;
  - vi) On a hoist authorized and certified for the conveyance of the persons on the platform or in the cage and such notice shall state the maximum number of persons to be carried on such hoist at one time;
  - vii) On a hoist carrying goods and other materials such notice shall state that such hoist is not meant for carriage of persons.

### **13.15 Fencing and means of access to lifting appliances**

- 13.15.1 Safe means of access shall be provided to every part of lifting appliances;
- 13.15.2 The operator's platform on every crane or tip driven by mechanical power shall be securely fenced and provided with safe means of access and where access to such platform is by a ladder, the sides of such ladder shall extend to a height reasonable beyond such platform or some other suitable handhold shall be provided in the platform;
- 13.15.3 The handling place on such platform shall be maintained free from obstruction and slipping; and
- 13.15.4 In case the height of such ladder exceeds six meters, the resting platforms shall be provided on such ladder at every six meters of its height and where the distance between last platform so provided and the top end of such ladder is more than two meters then on such top end.

**13.16 Rigging of derricks:** Every derrick shall have current and relevant rigging plans and any other information necessary for the safe rigging of such derrick and its gear.

**13.17 Securing of derrick foot:** Appropriate measures shall be taken to prevent the foot of a derrick from being lifted out of its socket or supports.

### **13.18 Construction and maintenance of lifting gear**

13.18.1 Every lifting gear shall be –

- i) Of good design and construction, sound material and adequate strength to perform the work for which it is used;
- ii) Free from patent defects; and
- iii) Properly maintained in good repair and working order;

13.18.2 Components of the loose gear, at the time of its use, shall be renewed if one of its dimensions at any point has decreased by ten per cent or more;

13.18.3 A chain shall be withdrawn from use when it is stretched and increased in length which exceeds five per cent of its length or when a link of such chain is deformed or is otherwise damaged or defects in the welds have appeared on it;

13.18.4 Rings, hooks, swivels and end links attached to a chain shall be of the same materials as that of such chain;

13.18.5 The voltage of electric supply to any magnetic lifting device shall not fluctuate by more than **plus** or **minus** 10%.

### **13.19 Test and periodical examination of lifting gears**

13.19.1 A lifting gear shall be initially tested for the manufacturer by a competent person in a manner specified as per schedule annexed before taking into use or after undergoing any substantive alterations which renders its any part liable to affect its safety and such gear after such test shall subsequently be retested for the use of its owner at least once in every five years;

13.19.2 A lifting gear in use shall thoroughly examined once at least in every twelve months by a competent person;

13.19.3 A chain in use shall be thoroughly examined at least once every month by a responsible person for its use;

13.19.4 Certificates of initial and periodical test and examinations of loose gears shall be obtained in the form annexed.

### **13.20 Ropes**

13.20.1 No rope shall be used for building or other construction work unless -

- i) It is of good quality and free from patent defects; and
- ii) In the case of wire rope, it shall be tested and examined by a competent person in the manner annexed;

- iii) Every wire rope of lifting appliance or lifting gear used for building or other construction work shall be inspected by a responsible person for such use, once at least in every three month;
- 13.20.2 Provided that after if any such wire is broken in such rope, the responsible person shall thereafter inspect it once at least in every month and ensure that;
- 13.20.3 No wire rope shall be used for building or other constructing work if in any length of eight diameters of such wires, the total number of visible broken wires exceed ten per cent of the total number of wires in such rope, or such rope shows signs of excessive wear, corrosion or other defects which in the opinion of the person who inspects it, is unfit for use;
- 13.20.4 Eye splices and loops of ropes for the attachment of hooks, rings and other such parts to wire rope shall be made with suitable thimble;
- 13.20.5 A thimble or loop splice made in any wire rope sling shall conform to the following standards, namely:
- i) Wire rope sling shall have at least three tucks with full strand of rope and two tucks with one-half of the wires cut out of each of such strand in all cases, such strands shall be tucked against the lay of the rope;
  - ii) Protruding ends of such strands in any splice of wire rope slings shall be covered or treated so as to leave no sharp points;
  - iii) A fiber rope or a rope sling shall have at least four tucks, tail of such tuck being whipped in a suitable manner; and
  - iv) A synthetic fiber rope or rope sling shall have at least four tucks with full strands followed by further tuck with one-half filaments cut out of each of such strand and final tuck with one-half of the remaining filaments cut out from such strands. Any portion of the splices containing such tucks, with reduced number of filaments, shall be securely covered with suitable tape or other materials;
  - v) Provided further that nothing contained above shall apply where any other form of splice, which may be shown to be as efficient as the splice with above standards, shall be used.

### **13.21 Heat treatment of lifting gears**

- 13.21.1 All chains other than bridle chains attached to derricks and all rings, hooks, shackles and swivels used in hoisting or lowering of such derricks shall be effectively annealed under supervision of a competent person and at the following intervals, namely:
- i) Such chains, rings, hoods, shackles and swivels which are not more than twelve and a half millimeter of length annealed at least once in every six months; and
  - ii) All other such chains rings hooks shackles and swivels shall be so annealed at least once in every twelve months;
- 13.21.2 Provided that the clause (a) above shall not apply to -
- iii) Pitched chins, working on sprocket or sprocket wheels;

- iv) Rings, hooks and swivels permanently attached to pitched chains, pulley blocks or weighing machines, and
- v) Hooks and swivels having ball bearings or other case hardened parts;

13.21.3 A chain or a loose gear made of high tensile steel or alloy steel shall be plainly marked with a mark indicating that it is so made;

13.21.4 No chain or loose gear made of high tensile steel or alloy steel shall be subjected to any form of heat treatment except where such treatment is necessary for the purpose of repair of such chain or loose gear and that such repair shall be made under the direction of the competent person;

13.21.5 That the wrought iron gear, the past history of which is not traceable, shall be suspected of being heat treated at incorrect temperature shall be normalized before using it on any building or other construction work.

**13.22 Certificate to be issued after actual testing and examination etc:** A competent person shall issue a certificate after actual testing or examination of the apparatus specified and record of such test or examination shall be maintained for inspection.

### **13.23 Register of periodical test, examination and certification thereof**

13.23.1 A register in the form annexed shall be maintained and particulars of such test and examination of lifting appliances, lifting gears and heat treatment as required shall be entered in such register;

13.23.2 Certificate in respect of each of the following shall be obtained from a competent person:

- i) In cases of initial and periodical test and examination of the lifting appliances such as Winches, Derricks and their accessory gears, Cranes or Hoists and their accessory gears;
- (ii) In case of test, examination and re-examination of loose gears;
- (iii) In case of test and examination of wire ropes;
- (iv) In case of heat treatment and examination of loose gears;
- (v) In case of annual thorough examination of the loose gears, except where required particulars of such exemption have been enclosed in the register referred to in Form annexed and such certificates are attached to the register referred to as above and certificates kept at such construction site in case such register and certificate relate to lifting appliances, loose gear and wire ropes and

13.23.3 Produced on demand and retained for at least five years after the date of the last entry made in such register;

13.23.4 No lifting appliance or lifting gear in respect of which an entry is required to be made in register referred to above and certificate of test and examination are required to be attached in such register in the manner as specified, shall be used for building or other construction work unless the required entries have been made in such register and certificates.

### **13.24 Vacuum and magnetic lifting gear**

13.24.1 No vacuum lifting gear, magnetic lifting gear or any other lifting gear where the load on it is held by adhesive power, shall be used while workers are performing operations beneath such gear;

13.24.2 A magnetic lifting gear used in connection with building or other construction work shall be provided with an alternative supply of power, such as batteries, which may come into operation immediately in the event of failure of the main power supply;

13.24.3 No building worker shall work within the swinging zone of the lifting gear or load or building or other construction material suspended to such lifting gear.

**13.25 Knotting of chains and wire ropes:** No chain or wire rope with a knot in it shall be used in building or other construction work.

### **13.26 Carrying of persons by means of lifting appliances etc.**

13.26.1 No building worker shall be raised, lowered or carried by a power driven lifting appliance, except

- i. On the drive's platform in the cage of a crane; or
- ii. On as hoist; or
- iii. On an approved suspended scaffold;

13.26.2 Provided that a building worker may be raised, lowered or carried by a power driven lifting appliance:

- i. In circumstances where the use of a hoist or of a suspended scaffold shall not reasonably be practicable, or
- ii. On an aerial cableway or aerial ropeway, provided further that the following requirements are met:
  - iii. That the appliance referred to above can be operated from one position only and that
  - iv. Any winch used in connection with the appliance shall also comply with the requirements as laid down vide clause **10.1.8.6** above.

13.26.3 The appliance referred to above shall not carry any person except:

- (i) In a chair or cage,
- (ii) In a skip or other receptacle at least three feet deep which shall be suitable for safe carriage of a person and any such chair, cage, skip or other receptacle shall be made of good construction, sound material, and adequate strength and properly maintained with suitable means to prevent any occupant therein from



falling out of it and shall be free from any material or tools which may interfere with the handhold or foothold of such occupant or otherwise endanger him; and

- (iii) Those suitable measures shall be taken to prevent the chair, cage skip or other receptacle from spinning or tipping in a manner dangerous to any occupant therein.

### **13.27 Hoists carrying persons**

13.27.1 No building worker shall be carried with the help of a hoist unless it is provided with a cage which:

- i) Is so constructed as to prevent, when its gates are shut, any building worker carried by such hoist from falling out of it or from being trapped between any part of such cage and any fixed structure or other moving part of such hoist or from being struck by articles or materials falling down the hoist way on which such hoist is moving; and
- ii) Is fitted on each of its side from which access is provided to a landing place with a gate which has efficient interlocking or other devices to secure so that such gate cannot be opened except when such cage is at a landing place and that such cage cannot be moved away from any such place until such gate is closed;

13.27.2 Every gate in the hoist way enclosure of such hoist used for carrying persons shall be fitted with efficient interlocking or other devices to secure so that such gate cannot be opened except when the cage of such gate is at the landing place and that such cage cannot be moved away from the landing place until such gate is closed;

13.27.3 In every hoist used for carrying building workers there are provided with suitable and efficient automatic devices to ensure that the cage of such hoist comes to rest at a point above the lowest point to which such cage may travel.

### **13.28 Attachment of loads**

13.28.1 When a sling is used to hoist long materials, a lifting beam shall be used to space the sling legs for proper balance and when a load is suspended at two or more points with slings, the eyes of the lifting legs of such slings shall be shackled together and such shackled eyes of the shackled slings shall be placed on the hook or the eyes of such lifting legs shall be shackled directly to the hoisting block, ball or balance beam, as the case may be;

13.28.2 Every container or receptacle used for raising or lowering stone, bricks tiles, slates or other similar objects shall be so enclosed with the hoist as to prevent the fall of such objects;

13.28.3 A loaded wheel barrows placed directly on a platform of a hoist for raising or lowering of such wheel barrows shall be so secured that such wheel barrows cannot move and such platform shall be enclosed to prevent the fall of the contents kept in such wheel barrows;

13.28.4 Landings of hoists shall be so designed and arranged that building workers on such hoist be not required to lean out into empty space for loading and unloading on any material from such hoist.

### **13.29 Tower Cranes**

13.29.1 No person other than the operator trained and capable to work at heights shall be employed to operate tower cranes;

13.29.2 The ground on which a tower crane stands shall have adequate bearing capacity;

13.29.3 Bases for tower cranes and trucks for rail mounted tower cranes shall be firm and leveled and such cranes erected at a reasonably safe distance from excavations and operated within gradient limits as specified by the manufacturer of such cranes;

13.29.4 Tower cranes shall be sited where there is a clear space available for erection, operation and dismantling of such cranes;

13.29.5 Tower cranes shall be sited in such a way that the loads on such cranes shall not be handled over any occupied premises, public thoroughfares, railways or near power cables, other than construction works for which such cranes are used;

13.29.6 Where two or more tower cranes are sited and operated, every care shall be taken to ensure positive and proper communication between operators of such cranes to avoid any danger or dangerous occurrences;

13.29.7 Tower cranes shall not be used for loading magnet, or demolition ball service, piling operation or other similar operations which could impose excessive load stresses on the crane structure of such cranes;

13.29.8 The instruction of the manufacturer of a tower crane and standard safe practices regarding such cranes shall be followed while operating or using such cranes.

### **13.30 Qualification of operator of lifting winches and of signaler etc.**

13.30.1 No person shall be employed to drive or operate a lifting appliance whether driven by mechanical power or otherwise or to give signals to driver of operator of such lifting appliance or to work as an operator of a rigger or derricks unless he is

- i) Sufficiently competent and reliable;
- ii) Possesses the knowledge of the inherent risks involved in the operation of lifting appliance;
- iii) Medically examined periodically as specified and
- iv) Is above eighteen years of age.

## **14.0 Safety in the use of transport, earthmoving equipment etc.**

### **14.1 Earthmoving equipment and vehicles**

- 14.1.1 All vehicles and earthmoving equipment shall be made of good material, proper design and sound construction and be sufficiently strong for the purpose for which such equipment are properly used in accordance with standard safe operating practices;
- 14.1.2 Provided that the truck or trailer employed for transporting freight containers shall be of the size sufficient to carry the containers, without over hanging and provided with twist locks conforming to approved standards, at all the four corners of each of such use by an authority under the relevant law for the time being in force and is inspected by a responsible person, at least once in a month and record of such inspection shall be maintained:
- 14.1.3 All transport or earth moving equipment and vehicles shall be inspected at least once a week by a responsible person and in case any defect is noticed in such equipment or vehicle it shall be immediately taken out of use;
- 14.1.4 Power trucks and tractors shall be equipped with effective brakes, headlights and tail lamps and maintained in good repair and working order;
- 14.1.5 Side stanchions on power trucks and trailers for carrying heavy and long objects shall be
- i) Of sound construction and free from defects;
  - ii) Provided with tie chains attached to the top across the loads for preventing such stanchions from spreading out; and
  - iii) Kept in position while loading and unloading;
  - iv) Safe gangways provided for to and fro movement of building workers engaged in loading and unloading of lorries, trucks, trailers and wagons;
  - v) Trucks and other equipment shall not be loaded beyond their safe capacity and carry workers engaged in loading and unloading of lorries, trucks trailers and wagons in an unsafe condition;
  - vi) Handles of trucks shall be so designed as to protect the hands of the building workers working on such trucks, or such handles provided with knuckle guards;
  - vii) No unauthorized person shall ride the transport equipment employed in such work;
  - viii) A driver of a transport equipment shall maneuver such equipment under the direction of a signaler;
  - ix) Adequate precaution such as isolating the electric supply or erecting overhead barriers of a safe height shall be taken when earth moving equipment or vehicles are required to operate in dangerous proximity to any live electric conductor;
  - x) Vehicles and earth moving equipment shall not be left on a slope with the engine of such vehicles or equipment running;

- xi) All earth moving equipment, vehicles or other transport equipment shall be operated only by such person who are adequately trained and possess such skills as required for safe operation of such equipment, vehicle or other transport equipment.

## **14.2 Power shovels and excavator**

- 14.2.1 A shovel or an excavator whether operated by steam or electric or by internal combustion, shall be constructed, installed, operated, tested and examined as per approved standards;
- 14.2.2 Excavator equipped for use as a mobile crane shall be examined and tested in accordance with the requirements for such mobile cranes as laid down by the manufacturer; and
- 14.2.3 Fitted with an automatic safe working load indicator;
- 14.2.4 Buckets or grabs of power shovels shall be propped to restrict the movement of such buckets or grabs while being repaired or while the teeth of such buckets or grabs are being changed.

## **14.3 Bulldozer**

- 14.3.1 Operator of every such bulldozer before leaving the dozer shall take the following steps:
  - i) Apply the brakes;
  - ii) Lower the blade and sipper and
  - iii) Put the shift lever into neutral;
  - iv) Dozer left on level ground at the close of the work for which such bulldozer is used;
  - v) The blade of a bulldozer kept low when such bulldozer is moving uphill;
  - vi) The bulldozer blades not used as brakes except in an emergency.

## **14.4 Scrapers**

- 14.4.1 A tractor and scraper shall be joined by safety line at the time of its operation;
- 14.4.2 The scraper bowls shall be propped while blades of such scraper are being replaced;
- 14.4.3 A scraper moving downhill shall not be left in gear.

## **14.5 Mobile asphalt layers & finishers**

- 14.5.1 A mixture elevator shall be located within a wooden or sheet metal enclosure with a window for observation, lubrication and maintenance;
- 14.5.2 Bitumen scoops shall have adequate covers;

- 14.5.3 When asphalt plants are working on public road, adequate traffic control shall be established on such road and the building workers working with such plant provided with reflective jackets;
- 14.5.4 A sufficient number of fire extinguishers shall be kept in readiness at such workplace where fire hazards may exist;
- 14.5.5 The materials shall be loaded on the elevator after the drying drain has warmed up of such elevator;
- 14.5.6 No open light shall be used for ascertaining the level of asphalt;
- 14.5.7 Inspection opening shall not be opened till there is a pressure in the boiler, which may cause injury to building workers.

**14.6 Pavers:** Pavers shall be equipped with guards suitable to prevent building workers from walking under the skip of such pavers.

**14.7 Road rollers:** Before a road roller is used on the ground, such ground shall be examined for its bearing capacity and general safety, especially at the edges of slopes such as embankment on such grounds and shall not be moved downhill with the engine out of gear.

#### **14.8 General safety in respect of powered construction machinery**

14.8.1 Every vehicle or earthmoving equipment shall be equipped with -

- i) Silencers;
- ii) Tail lights
- iii) Power and hand brakes;
- iv) Reversing alarm; and
- v) Search light for forward and backward movement, which are required for safe operation of such vehicle or earthmoving equipment;

14.8.2 The cab of vehicle or earthmoving equipment shall be kept at least one meter from the adjacent face of a ground being excavated;

14.8.3 When cranes or shovel are traveling, the boom of such crane or shovel shall be in the direction of such travel and the bucket or scoop attached to such crane or shovel raised and without load except when such traveling is downhill.

### **15.0 Safety in the use Runways and Ramps**

#### **15.1 Use of runways and ramps:**

15.1.1 Runway or ramps shall not be less than 430 mm in width and constructed of not less than 25 mm thick planking or any other material of adequate strength to withstand the required load, supported substantially in relation to the span and braced with

such runway or ramp, and design and construction of such runway or ramp shall be in accordance with the approved standards;

15.1.2 Every runway or ramp located more than 3 m above the floor or ground shall be on open sides and provided with a guardrail of adequate strength and height of not less than 1 m.

15.1.3 Use of runways and ramps by vehicles:

i) All runways and ramps shall be of sound construction, strength and securely braced and supported;

15.1.4 Every runway or ramp for the use of transport equipment like trailers, trucks or heavier vehicles shall have a width of not less than 3.7 m and provide with timber curbs or any other material of adequate strength with not less than 200 mm by 200 mm in width placed parallel to, and secured to, the side of such runway or ramp and such runways or ramps shall be designed in accordance with the approved standards.

**15.2 Slope of Ramps:** Every ramp shall have a slope not exceeding one in four and the total rise of a continuous ramp used by building workers carrying material or using wheelbarrows shall not exceed 3.7 m, unless broken by horizontal landing of at least 1.2 m in length.

**15.3 Use of runways or ramps by wheelbarrows, etc.**

15.3.1 Every runway or ramp used for wheelbarrows and carts or hand trucks shall not be less than 1 m width and constructed of not less than 50 mm thick planking, and supported and braced suitably for such use;

15.3.2 Every runway or ramp located more than 3 m above the floor or ground shall be provided on the open sides with suitable guardrails of adequate strength.

## 16. **Safety in handling and use of explosives**

### **16.1 General Provisions:**

16.1.1 The use of explosives shall be carried out in a safe manner to avoid injury to any person and under the direct supervision of a responsible person;

16.1.2 No person other than authorized and competent one shall be allowed to handle and use explosives;

16.1.3 Before using any explosive, necessary warning and danger signals shall be erected, at conspicuous places of such use to warn the building workers and the general public of the danger involved in such use.

16.1.4 No person other than authorized and competent one shall be allowed to handle and use explosives.

- 16.1.5 Smoke, open lamps, other type of hot or heat producing items and sparks shall be prohibited in or near explosives magazines or while explosives are being handled, transported or used.
- 16.1.6 No person shall be allowed to handle or use explosives while under the influence of intoxicating liquors or dangerous drugs.
- 16.1.7 The explosives shall be accounted for at all times. No explosives or blasting agents shall be abandoned.
- 16.1.8 No fire shall be fought where the fire is in the imminent danger of contact with explosives. All employees shall be removed to a safe area and the fire area shall be guarded against intruders.
- 16.1.9 Employees authorized to prepare explosive charges or conduct blasting operations shall use every reasonable precaution including but not limited to visual and audible warning signals, flags, or barricades to ensure employee safety.
- 16.1.10 Due precautions shall be taken to prevent accidental discharge of electric blasting caps from current induced by induced voltage, lightning, adjacent power lines, dust storms, or other sources of extraneous electricity or otherwise. These precautions shall include:
- 16.1.11 Short-circuiting of detonators in holes, which have been primed and shunted until wired into the blasting circuit.
- 16.1.12 The suspension of all blasting operations and removal of persons from the blasting area during the approach and progress of an electric storm.
- 16.1.13 The prominent display of adequate signs, warning against the use of radio transmitters, on all roads within 1000 ft of blasting operations. Whenever adherence to the 1000 ft distance would create an operational handicap, a competent and expert person shall be consulted to evaluate the particular situation, and an alternative provided, which are adequately designed to prevent any premature firing of electric blasting caps. A description of any such blasting shall be reduced to writing and shall be certified as meeting the purposes of this subdivision by the competent person consulted. The description shall be maintained at the construction site during the duration of the work, and shall be available for inspection.
- 16.1.14 Empty boxes and paper and fiber packing materials, which have previously contained high explosives, shall not be used again for any purpose, but shall be destroyed by burning at an approved location.
- 16.1.15 Explosives, blasting agents and blasting supplies that are obviously deteriorated or damaged shall not be used.
- 16.1.16 Delivery and issue of explosives shall only be made authorized persons into authorized magazines or approved temporary storage or handling areas.



16.1.17 Blasting operations in the proximity of overhead power lines, communication lines, utility services, or other services and structures shall not be carried on until the operators and/or owners have been notified and measures for safe control have been taken. In such situations controlled blasting shall be restored to.

16.1.18 All loading and firing shall be directed and supervised by competent persons thoroughly experienced in this field.

16.1.19 Loaded boreholes shall not be left unattended after the end of the shift.

16.1.20 Suitable and sufficient means of egress to ground level shall be provided in all cases of excavations, trenches, all other places where explosives are handled above or below ground level.

16.1.21 At an appropriate time before the final blasting warnings, workers in the area shall be removed to a designated safe place.

16.1.22 An unmistakable, audible, final warning shall be sounded one minute prior to the detonation of explosives; after completion, when the person in charge has established that safe conditions prevail, an "all clear" shall be sounded. To prevent persons entering any danger zone during blasting operations notices shall be given to all concerned.

16.1.23 Notices referred to in paragraph 16.1.22 shall indicate:

- (a) that explosives are in use;
- (b) the audible warning sound and the "all clear" and state when they will be sounded; and
- (c) the warning flags in use, including an "all clear" flag.

16.1.24 Precautions against lightning shall be provided in accordance with the Indian Electricity Act and Indian Explosives Act and Rules and regulations framed there under.

16.1.25 Package containing explosives shall not be dragged, dropped or handled roughly.

16.1.26 Non-sparking tools shall be used to open keys.

16.1.27 The explosives shall not be carried in the box or otherwise on any individual.

16.1.28 Nothing shall be inserted in the open end of the blasting cap except fuses.

16.1.29 Deteriorated or damaged explosives shall not be used but shall be disposed or destroyed strictly in accordance with the approved methods and in the doing so the manufacturers or the appropriate authority's instructions shall be followed.

19.1.30 Lightning shall be in accordance with Indian Electricity Act/Rules

## **16.2 Transportation of explosives**

16.2.1 Keep safe distance and to use non-sparking tools while opening packages containing explosives;

16.2.2 Stop the use of explosives and handling thereof while the weather conditions are not suitable for such use or handling;

16.2.3 Due precautions shall be taken to prevent accidental discharge of electric blasting caps from current induced by induced voltage, lightning, adjacent power-lines, dust storms or other sources of extraneous electricity or otherwise. These precautions shall include –

- vi) Suspension of all blasting operations and evacuation of persons;
- vii) All warning signs shall be displayed within 200 m of blasting operations and in case putting up a sign at 200 m is impractical, the contractor shall consult the Engineer-in-charge for alternatives;
- viii) All loading and firing shall be directed and supervised by competent persons thoroughly experienced in the field;
- ix) To prevent persons entering any danger zone during blasting operations, notices shall be given to all concerned;

16.2.4 In addition to these provisions, all measures and precautions that are required to be observed for use, handling, storing or transportation of explosives under the Rules framed under the Explosives Act, 1884 (4 of 1884) shall be observed;

16.2.5 All the relevant statutory provisions, local laws and rules and regulations shall be complied with.

16.2.6 Where the magazine is located near the construction site and blasting operation continues daily, actual requirement of explosives shall be drawn from the magazine and transported to the site. Any leftovers shall be returned to the magazine each time after the blast. In case of work at scattered places and for a small duration, portable magazines shall be used and kept within a fence in safe place and properly guarded.

16.2.7 For carrying higher quantity (more than 5 kg of explosives) specially designed insulated containers shall be used. These containers shall be constructed of finished wood not less than 5cm thick or plastic not less than 6mm thick or pressed fibre not less than 10mm thick. There shall be no metal parts (not even nails, bolts, screws etc.) and the containers shall be provided with suitable non-conductive carrying device, such as rubber, leather or canvas handle or strap.

16.2.8 Vehicles to be used for transportation explosives shall be in good working condition and shall have a tight wooded or non-sparking metal (copper, brass and the like) floor with sides and ends high enough to prevent the explosives from falling off the vehicle. In open bodied vehicles, the explosives shall be covered with a waterproof and fibre tarpaulin.

16.2.9 Electrical wiring in vehicle shall be fully insulated so as to prevent the danger of short-circuiting and at least two fire extinguishers of carbon dioxide type shall be carried. The vehicle shall be properly marked indicating adequate warning to the public in regard to the nature of cargo.

16.2.10 No metals except approved metal truck shall be allowed to come in contact with cases of explosives, metal, flammable, or corrosive substance shall not be transported with explosives. As far as possible, transportation of any material along with explosives shall be prohibited.

16.2.11 Smoking shall be prohibited in the vehicle carrying explosives.

16.2.12 No unauthorized person shall be allowed in the vehicle, carrying explosives.

16.2.13 Loading and unloading of explosives shall be done carefully.

16.2.14 Explosives and detonators or blasting caps shall not be permitted to be transported in the same vehicle.

16.2.15 Detonators and other explosives for blasting shall be transported to the site of work in the original containers or in securely locked separate non-metallic containers and shall not be carried loose or mixed with other materials.

### **16.3 STORAGE OF EXPLOSIVES AND BLASTING AGENTS**

16.3.1 Explosives and related materials shall be stored in approved facilities.

16.3.2 Blasting caps, electric blasting caps, detonating primers, and primed cartridges shall not be stored in the same magazine with other explosives or blasting agents.

16.3.3 Smoking and open flames shall not be permitted within 50 feet of explosives and detonators storage magazine.

16.3.4 No Explosives or blasting agents shall be permanently stored in any underground area until the area has been developed to the point where at least two modes of exit have been provided.

16.3.5 Permanent underground storage magazine shall be at least 300 feet from any shaft or other active under ground working area.

16.3.6 Permanent underground magazines containing detonators shall not be located closer than 50 feet to any magazine containing other explosives or blasting agents.

### **16.4 DRILLING AND LOADING**

16.4.1 Before planning out the drilling operations for blasting purposes, nature of stratum and the over burden shall necessarily be examined to avoid possibilities of landslides after blasting.

**16.4.2** The face or rock shall be carefully examined before drilling to determine the presence of unfired explosives. No attempt shall be made to drill at a site if undetonated explosives are suspected. In such case the boreholes shall be thoroughly cleaned before a cartridge is inserted. Wooden tamping rods (not pointed, but cylindrical throughout) shall be used in the charging the holes. The cartridge will be on the top.

**16.4.3** The borehole shall be carefully checked for length, presence of water dust, etc. with a wooden temping pole or a measuring tape before loading.

16.4.4 Surplus explosives shall not be stacked near working areas during loading/unloading.

16.4.5 The line of detonating fuse extending into a borehole shall be cut from the spool before loading the remainder of the charge.

- 16.4.6 A bore shall not be loaded with explosives after springing (enlarging the hole with explosives) or upon completion of drilling without making sure it is cool and it does not contain any hot smoldering material. Temperatures in excess of 65° C are dangerous.
- 16.4.7 A bore near another hole loaded with explosives shall not be sprung.
- 16.4.8 No force shall be used for inserting cartridges or any explosives into a bore hold or pass any obstruction in a borehole.
- 16.4.9 No force shall be used for inserting a blasting cap or an electric blasting cap into explosive. The cap shall be inserted into a hole made with a pickers designed for the purpose. A hitch of the electric blasting cap leading wire shall be made on the primer cartridge so as to prevent pulling out the electric blasting cap from the explosive charge. In case of fuse, the fuse shall be tied to the explosive cartridge so that the blasting cap is not pulled out. Care shall be taken so that the blasting cap is not pulled out. Care shall be taken so that the electric blasting cap, leading wire or the length of the fuse does not get damaged during loading of the charge.
- 16.4.10 To attempt shall be made to slit, drop, deform or abuse the primer.
- 16.4.11 Blasting caps or electric blasting caps shall not be connected to detonating fuse except by methods recommended by the manufacturers of caps.
- 16.4.12 Explosive cartridge shall not be cut, nor explosive removed from the cartridge for use.
- 16.4.13 Metallic devices of any kind shall not be used in tamping. Wooden tamping tools with not exposed metal parts except non-sparking metal connectors for jointed poled shall be used. Violent tamping shall be avoided. Primer shall not be tamped.
- 16.4.14 Care shall be taken to confine the explosives in the bore hold with sand, earth clay or other suitable combustible stemming material.
- 16.4.15 Kinking or injuring of fuse or electric blasting cap wires shall be avoided when tamping.

## **16.5 ELECTRICAL SHOT-FIRING CIRCUIT**

- 16.5.1 In deciding the sizes of wires, fuses, circuits, blasting switches, etc., instructions issued by the manufacturers of these articles shall be followed, if they do not contradict with Indian Explosives Act or framed under it.
- 16.5.2 No person shall attempt to uncoil the wires and open out the short-circuited bare leading wires of the electric blasting cap during approach of dust storm or near any source of large charge of static electricity or near a radio transmitter. The manufacturer of the cap or the Inspectorate of Explosives shall be consulted regarding the distance from the transmitter beyond which electric short firing shall be conducted.
- 16.5.3 Firing circuit shall be kept completely insulated from the ground of the other conductors, such as wires, rails, pipes or other paths or stray current.
- 16.5.4 There shall not be any electric live wires or cables of any kind near electric blasting caps or other explosives except at the time and for the purpose of firing the blast.

- 16.5.5 All electric blasting caps shall be tested singly and also when connected in a circuit in series using only an approved type of circuit continuity tester or ohmmeter.
- 16.5.6 No attempt shall be made to use in the same circuit either electrical blasting caps made by more than one manufacturer or electric blasting caps of different design or function even if made by the same manufacturers unless such use is approved by the manufacturers.
- 16.5.7 No attempt shall be made to fire a circuit of electric blasting caps with less than the minimum current specified by the manufacturer of that electric blasting cap.
- 16.5.8 Care shall be taken to ensure that all wire ends to be connected are bright and clean.
- 16.5.9 The electric cap wires or leading wires shall be kept short circuited until ready to fire.
- 16.5.10 Then energy for blasting is taken from power circuits the voltage shall not exceed 220v. The wiring controlling arrangements shall conform to the following:
- 16.5.11 The blasting switch shall be strictly according to the specifications, externally operated double-throw switch, which when locked in the open position will short circuit and ground the leading wires. The switch shall be installed at the location where the firing is to be controlled.
- 16.5.12 A 'safety' switch of the same type as the blasting switch shall be installed between the blasting switch and the firing circuit and lead lines, at a distance not to exceed 180cm from the blasting switch.
- 16.5.13 Both the safety switch and the blasting switch shall be locked in the open position immediately after the shot and before any person is permitted to return to the blasting area. Key to the switches shall remain in the possession of the blaster at all times.
- 16.5.14 Rubber covered or other adequately insulated copper wires in good condition shall be used for firing lines and shall have solid cores of appropriate gauge. Sufficient firing line shall be provided to permit the blaster to be located at a safe distance from the blast. Single conductor lead lines shall be used.
- 16.5.15 Blasting operations in the proximity of overhead power lines, communication lines, utility lines, or other structures shall not be carried on until the operator or the owner, or both of such lines as been notified and precautionary measures deemed necessary, have been taken.
- 16.5.16 All holes loaded on a shift shall be fired on the same shift.
- 16.5.17 As far as possible, blasting shall be carried out using suitable exploder with 25 per cent excess capacity. Electric power from the mains shall be used only when it is absolutely necessary.

## **16.6 SHOT-FIRING WITH SAFETY FUSE**

- 16.6.1 The fuse shall be carefully handled to avoid damaging the covering. In very cold weather the fuse shall be slightly warmed before using so as to avoid cracking the waterproofing.
- 16.6.2 Short fuse shall not be used. The length of a fuse shall not be less than 120cm. The rate of burning of the fuse shall be known and it would be necessary to make sure that it will

take sufficient time in burning so as to enable all persons to reach a place of safety. The burning rate of the fuse shall not be more than 60 cm/min.

- 16.6.3 The fuse shall not be cut until the operation to insert the fuse into a blasting cap is ready. The fuse shall be cut off about 2.5 to 5 cm to ensure a dry end. It shall be cut squarely across with a clean and sharp blade. The fuse shall be seated lightly against the cap charge and care shall be taken to avoid twisting after it has been placed in position.
- 16.6.4 Blasting caps shall not be crimped by any means except by a cap crimper designed for the purpose. It shall be necessary to make sure that the cap is squarely crimped to the face.
- 16.6.5 The fuse shall be lighted with a fuse lighter designed for the purpose. If a match is used, the fuse shall be slit at the end and the match head held in then slit against the power core and then the match head rubbed against an abrasive surface to light the fuse.
- 16.6.6 The fuse shall not be lighted until sufficient stemming has been placed over the explosives to prevent sparks of live match heads from coming into contact with the explosives.
- 16.6.7 The explosives shall not be held in hands when lighting the fuse.

## **16.7 UNDERGROUND WORK**

- 16.7.1 Only permissible explosives and in the manner as specified by the appropriate authority shall be used.
- 16.7.2 Excessive quantities of explosives shall not be taken underground at any time. Black blasting powder or pellet powder shall not be used with any other explosive in the same borehole.

## **16.8 BEFORE AND AFTER FIRING**

- 16.8.1 Before firing, sufficient warning shall be given to enable the people working in the area to get off the danger zone. The danger zone shall be suitable cordoned off and flag men posted at important points.
- 16.8.2 No loose materials, such as tools, drilling implements etc. Shall be left on the rock surfaces to be blasted.
- 16.8.3 Blasting in the open shall be carried out during the fixed hours every day or on fixed days in the week. This information shall be amply publicized and the following precautions observed:
  - b) On the project sites, where blasting operations are carried out, daily blasting hours shall be clearly printed on the sign-boards on all the roads approaching that area.
  - c) Road closing barriers should be provided to close the traffic on these roads, at least 400 meters away when the firing is to take place.
  - d) The beginning of the firing shall follow loud sirens and similarly loud sirens shall succeed the completion of the firing.
- 16.8.4 The shot-firer shall not be allowed to return to the blasting site after firing, until at least 5 min have elapsed. In case of electric shot firing, the shot holes shall be examined after



firing and in case of misfire no person shall be allowed to approach the blasting site for at least 5 min. In case of shot firing with safety fuse, utmost care shall be taken to count the number to ensure that all the shots have fired and in the event of misfire, no person shall be allowed to approach the blasting site for at least 30 min. In any case, a careful inspection for the remaining un-detonated explosive shall be made after firing the shots. All misfired shot holes shall be cross-marked. No other person than those duly authorized shall approach the holes until one of the following operations has been performed in respect of each of the misfired holes:

- 16.8.5 If the misfire is due to a faulty cable or faulty electrical connection the defect shall be remedied and the shot fired.
- 16.8.6 The stemming shall be floated out by use of water or air jet from hose until the hole has been opened to within 60 cm of the charge, whereupon water will be siphoned or pumped out, then a fresh new charge placed and duly detonated. Or
- 16.8.7 A careful search shall be made of unexploded material in the debris of the charge.
- 16.8.8 If a shift charge is unavoidable, the person in-charge of one shift before leaving the work shall inform the person relieving him for the next shift of any cases misfired and shall point out their position duly cross marked and also state clearly what action has to be taken in the matter.
- 16.8.9 The rules are made considering statutory provisions and other National/International standards. However, if any statutory provision overruling these laws is made, the statutory provisions shall overrule the NTPC Rules.

## **17. Safety in excavation & tunneling work**

### **17.1 Safety in excavation**

#### **General provisions**

- 17.1.1 Before undertaking any activity, the soil shall be tested and in case of availability of any explosive gas, necessary arrangements must be made to remove/dilute such gases and in case they are found to be toxic or poisonous, the workplace must be purged and continuous ventilation maintaining the contamination below the permissible level ensured;
- 17.1.2 The position of underground installations such as sewers, water pipes and electrical cables shall be verified and in case of their existence, they must be isolated;
- 17.1.3 If they cannot be isolated or removed or shutdown, they shall be fenced, hung up or otherwise protected. On every part likely to be visited by persons or where transport vehicles ply, the area shall be suitably fenced, guarded or barricaded to prevent fall of persons, vehicles or livestock into the excavated area;
- 17.1.4 Warning signs shall be erected and the in the night hours the area shall be illuminated to warn pedestrians and vehicular traffic;
- 17.1.5 Arrangements shall be made to prevent external vibrations due to rail/road traffic;
- 17.1.6 Blasting shall be carried out in accordance with the norms applicable in this regard. Special care shall be taken to control the impact of vibrations/tremor caused by blasting to protect excavations from cave-ins;



17.1.7 Arrangements shall be made to save other buildings/structures in the affected zone or in the vicinity of the area of excavation, from collapse;

## **17.2 Shoring and timbering**

- 17.2.1 Site of excavations, where workers are exposed to danger from moving ground, shall be made safe by maintaining due slope not exceeding the angle of repose of different types of soil or otherwise by shoring, portable shields or other effective means;
- 17.2.2 All trenches in the soil, other than rock or hard compact soil more than 1.5 m deep into which men enter, shall be securely shored and timbered under the supervision of a competent person and only the trained workers shall be allowed to substantially alter or dismantle the shoring or timbering;
- 17.2.3 All struts, braces and walls in excavation shall be adequately secured so as to prevent their accidental displacement;
- 17.2.4 In all excavations in soft or fissured rock or hard soil exceeding 2 m in depth, except those which are sloped to within 1.5 m of the bottom into which men enter, shall be securely shored and timbered;
- 17.2.5 Where the sides of the excavations are sloped as outlined above, but not within the 1.5 m of the bottom, vertical sides shall be shored and the shoring shall extend at least 30 cm above the vertical sides. When open spaced sheathing is used, a toe-board shall be provided to prevent material rolling down the slope and falling into the excavated.

## **17.3 Sheathing**

- 17.3.1 The sheathing should be placed against the side of the trench so that length of each piece of sheathing is vertical. It should be held securely in place against the wales by ensuring that sheathing is kept firmly pressed against the wall of the trench. Where the trench excavated is loose, sandy or soft soil or soil which has been previously excavated or soil which is under hydrostatic pressure, each piece of sheathing shall be driven into the bottom of the trench so as to firmly hold it in place;
- 17.3.2 Where two or more pieces of sheathing are used one above another, the sheathing shall be so arranged that the lower pieces of sheathing shall overlap the lowest wales supporting the piece of sheathing next above it. These pieces of sheathing shall be firmly driven into the soil and securely supported by wales and struts, as the trench is made deeper.

## **17.4 Wales**

- 17.4.1 The wales shall be parallel to the bottom or the proposed bottom of the trench. Each wale shall be supported on cleats spiked to the sheathing or by posts set on the wales next below it and in the case of the lowest wale on the bottom of the trench itself. Where necessary, wedges may be provided between a wale and the sheathing it supports so that roughly uniformity is given to all individual pieces of sheathing.

## **17.5 Struts**

- 17.5.1 Struts shall be horizontal and at right angles to the wales or sheathing supported thereby. Struts shall be cut to the proper length required to fit in tightly between the wales. Where necessary, the struts shall be held securely in place by wedges, driven between the struts and the wales;
- 17.5.2 Struts shall be placed on cleats spiked or bolted to the posts supporting the Wales.

17.5.3 **Loose site materials:** No loose material shall be kept very close to the excavation creating possibility of its fall into the excavated area. A safe distance of at least 1 m shall be maintained.

17.5.4 **Plant & Machinery:** Movement of vehicles and heavy equipment shall be kept at a distance least equal to the depth of the excavation or at least 6 m for excavation deeper than 6 m and the workers shall be provided with proper tools.

## **17.6 Means of access**

17.6.1 For trenches deeper than 1.5 m, safe means of access and egress shall be provided at intervals of every 15 m. Where it is not possible to provide safe means of access and egress as above, ladders shall extend from the bottom of the trench to at least 90 cm above the ground;

17.6.2 Walkways, runways and sidewalks shall be kept clear of excavated materials or other obstructions and no side walls shall be undermined-undercut unless it is capable of carrying a minimum live load of 125 lbs per square feet;

17.6.3 If planks are used for raising walkways, runways or sidewalks, they should be parallel to the length of the walk and fastened together against displacement;

17.6.4 Lone worker shall not be allowed to work in the excavated area.

17.6.5 **Inspections:** A competent person shall make inspections every day and necessary measures shall be taken to safeguard against possible cave-ins or slide or collapse of the excavations.

## **17.7 Notification of intention to carry out excavation and tunneling work**

17.7.1 Within thirty days, prior to the commencement of such excavation or tunneling work, the contractor shall inform in writing the detailed layout plans, method of construction and schedule of such excavation or tunneling work to the Engineer in-charge of NTPC;

17.7.2 In case compressed air is used in such excavation or tunneling work or any work incidental to or required for such excavation or tunneling work, the technical details and drawings of all man-locks and medical-locks together with names and addresses of all construction medical officers duly qualified and so appointed by such contractor for the purpose of such excavation or tunneling work shall be sent to the Engineer in-charge.

## **17.8 Project Engineer**

17.8.1 The contractor undertaking any excavation or tunneling work shall appoint a Project Engineer for safe operation of such projects;

17.8.2 Such Project Engineer shall exercise overall control of the operations and the activities at such project and be responsible for carrying out the activities safely.

## **17.9 Responsible Person**

17.9.1 The contractor undertaking excavation or tunneling work at construction site of a building or other construction work shall appoint a responsible person for safe operation of such excavation or tunneling work;

17.9.2 The name and addresses of such responsible persons shall be forwarded to the Engineer in-charge;

17.9.3 Duties and responsibilities of the responsible person referred to above person shall include

- i. To carry out smoothly such excavation or tunneling work;
  - B) To inspect and rectify any hazardous situation relating to such excavation or tunneling work;
  - C) To take remedial measures to avoid any unsafe practice or conditions relating to such excavation or tunneling work.

### **17.10 Warning signs and notices**

17.10.1 Suitable warning signs or notices, required for the safety of building workers carrying out the work of an excavation or tunneling, shall be displayed or erected at conspicuous places in Hindi and in language understood by the majority of such building workers at such excavation or tunneling work;

17.10.2 Such warning signs and notices with regard to compressed air working shall include:

- i) The danger involved in such compressed air work;
- ii) Fire and explosion hazards;
- iii) The emergency procedures for rescue from such danger or hazards.

### **17.11 Register of employment**

17.11.1 The contractor shall ensure that at a construction site of a building or other construction work where an excavation or tunneling work is being carried on, a register of employment of building workers carrying out such excavation or tunneling work is maintained and produced on demand;

17.11.2 Periods of work of such excavation or tunneling work shall be maintained in a register on day-to-day basis and such register shall be produced on demand

### **17.12 Illumination**

17.12.1 All contractors carrying out excavation or tunneling work at a construction site of a building or other construction work shall provide for emergency generators on such construction site to ensure illumination of intensity as mentioned in IS, at all work places where such excavation or tunneling work is being carried out;

17.12.2 In case of power failure, all workplaces where excavation or tunneling works are carried out shall be adequately illuminated

**17.13 Pneumatic tools:** Supply lines to pneumatic tools used within a tunnel are fitted with water trap or safety chain or safety wire, as the case may be.

**17.14 Stability of structure during general excavation & tunneling:** The contractor shall ensure that where there is any doubt as to the stability of any structure adjoining the workplace or other areas to be excavated or where tunneling work is to be carried out –

**17.14.1** The Project Engineer shall arrange for measures like underpinning, sheet piling, shoring, bracing or other similar means to support such structure and to prevent injury to any building worker working adjacent to such structure or damage to property or equipment adjacent to such structure;

**17.14.2** Where any building worker engaged in excavation is exposed to hazard of falling or sliding material or article from any bank or side of such excavation which is more than 1.5 m above his footing, such worker shall be protected by adequate piling and bracing against such bank or side;

**17.14.3** The excavation and its vicinity shall be checked by a responsible person after every rain, storm or other occurrences carrying hazards and in case a hazard is noticed at such checking, adequate protection against slides and cave-in to prevent such hazard shall be provided;

**17.14.4** Temporary sheet piling installed for the construction of a retaining wall after excavation shall not be removed, except on the advice of the responsible person after an inspection carried out by such responsible person;

**17.14.5** Where banks of an excavation are undercut, adequate shoring shall be provided to support the material or article overhanging such bank;

**17.14.6** Excavated material shall not be stored at least 0.5 m from the edge of an open excavation or trench and the banks of such excavation or trench shall be stripped of loose rocks and other materials which may slide, roll or fall upon a building worker working below such bank;

**17.14.7** Adequate and suitable warning signs shall be put-up at conspicuous places at the excavation work to avoid any person falling into the excavations or trenches;

**17.14.8** The responsible person shall ensure at the excavation that no building worker is permitted to work where such building worker may be struck or endangered by the excavation machinery or material or article used in such excavation.

**17.15 Safe access and egress:** Ladders, staircases or ramps are provided, as the case may be, for safe access to and egress from excavation where the depth of such excavation exceeds one point 1.5 m and such ladders, staircases or ramps comply with the relevant national standards.

## **17.16 Trenches**

**17.16.1** A trench or excavation shall be protected against falling of a person by suitable measures if the depth of such trench or excavation exceeds 1.5 m and such protection shall be an improved protection in accordance with the design and drawing of a Professional Engineer, where such depth exceeds 4 m;

**17.16.2** Where the depth of a trench requires two lengths of sheet piling, one above the other, the lower piling shall be set inside the bottom strings or wales of the upper piling and such sheet piling shall be driven down and braced as the excavation continues;

**17.16.3** All metal sheet piles used in excavation or a trench shall be welded end-to-end and secured by other similar means.

**17.17 Positioning and use of machinery:** Any machinery used in excavation and tunneling work shall be positioned and operated in such a way that such machinery will not endanger the operator of such machinery or any other person in the vicinity.

**17.18 Breathing apparatus:** Suitable breathing apparatus shall be provided to a building worker while working in compressed air environment for his use at excavation or tunneling work and such breathing apparatus shall be maintained in good working condition at all times.

### **17.19 Safety measures for tunneling operations**

17.19.1 Where there is a danger of falling or sliding of material from the roof face or wall of a tunnel, adequate measures such as shoring, supporting by means of rock bolts, segments or steel sets shall be taken for the safety of building workers;

17.19.2 The excavated areas shall be made safe by use of suitably designed and installed steel sets, rock bolts or similar other safe means;

17.19.3 The responsible person shall examine and inspect the workplaces in a tunnel before the commencement of work in such tunnel and at regular intervals thereafter to ensure safety of the building workers in such tunnel;

17.19.4 The portal areas of a tunnel with loose soil or rock, likely to cause injury to a person shall be adequately protected with supports.

### **17.20 Surroundings of a shaft**

17.20.1 Surroundings of a shaft used in excavation or tunnel work shall be protected from being washed away by construction of sufficient height;

17.20.2 Where a building worker is required to enter a shaft at an excavation or tunneling work, safe means of access shall be provided for such entry;

17.20.3 Every shaft at excavation or tunneling work shall be provided with a steel casing, concrete piping, timber shoring or other materials of adequate strength for the safety of building workers working in such shaft;

17.20.4 Such casing and bracing shall be provided to shafts at an excavation or tunneling work according to the appropriate design for such casing and bracing;

17.20.5 A reinforced concrete raft and beam shall be provided around the opening of a shaft at an excavation or tunneling work if the ground surrounding such opening is unstable or unsafe.

**17.20.6 Lift for shaft:** Lift shall be provided for transport of building workers and materials or articles at an excavation or tunneling work required to descend more than 50 m in a shaft.

### **17.21 Means of communication**

17.21.1 Reliable and effective means of communication such as telephone or walkie-talkie shall be provided and maintained in working order for arranging better and effective communication at an excavation or tunneling work at the following locations, namely:

- i. Working chamber of an excavation;

- ii. Intervals of hundred meters along the tunnel;
- iii. Working chamber side of a man lock near the door of such man lock;
- iv. Interior or each chamber of a man lock;
- v. Location conspicuous lock attendant's situation;
- vi. A compressor plant;
- vii. A first-aid station, and
- viii. Outside the portal or the top of a shaft;
- ix. Such number of bells and whistles shall be made available at all times at the locations as are necessary for the safety of persons at such locations.

**17.21.2 Signals:** The standard audio or video signals shall be used in excavation or tunneling work and conspicuously located or displayed near entrance to the workplace and in such other locations as may be necessary to bring such signals to notice of all building workers employed in such excavation or tunneling work.

## **17.22 Clearances**

17.22.1 The minimum lateral clearances of 0.5 m shall be maintained between any part of a vehicle and any fixture or any equipment used in an excavation or tunneling work after allowing the throw or swing of such fixture or equipment;

- (a) The overhead clearance for a locomotive drive at excavation or tunneling work shall not be less than 1.20 m above the seat of such driver and not less than 2 m above the platform where such driver stands or of any other dimension in accordance with the approved standard.

**17.23 Shelters:** The adequate number of shelters for the safeguard of the building workers are provided where, in the course of working, they are liable to be struck by a moving vehicle or other material handling equipment in a tunnel.

**17.24 Use of internal combustion engine:** No internal combustion engine shall be used underground in excavation or tunneling work unless such engine is so constructed that the air entering the engine gets cleared before entry and the engine emits no fumes or sparks.

**17.25 Inflammable oils:** Inflammable oils with the flash point below the working temperature that is likely to be encountered in a tunnel shall not be used in excavation or tunneling work.

**17.26 Coupling and hoses:** All high-pressure hydraulic hoses and couplings shall be adequately protected against any possible damage in excavation or tunneling work.

**17.27 Hose installation:** All hydraulic lines and plants working at a temperature exceeding 75<sup>0</sup> c shall be protected by adequate insulation or otherwise against accidental human contact in excavation or tunneling work.



**17.28 Fire resistant hoses:** No fire hydraulic hoses other than fire resistant hydraulic hoses are used when hydraulically activated machinery and equipment are employed in tunnels.

**17.29 Flameproof equipment:** Only flameproof equipment of appropriate type as per approved standards shall be used where there is a danger of flammable or explosive atmosphere being prevalent inside the tunnel.

**17.30 Storing of oil and fuel underground:** All oils, greases or fuels stored underground in excavation or tunneling work shall be kept in tightly sealed containers and in fire resistant areas at safe distances away from explosive and other flammable chemical and appropriate flameproof installation shall be used in such storage areas.

### **17.31 Use of gases underground**

17.31.1 Petrol or liquefied petroleum gas or any other flammable substances shall not be used or stored inside the tunnel except with the prior approval of the Project Engineer;

17.31.2 After the use of the petroleum or liquefied petroleum gas, or highly inflammable substances, all remaining petroleum or liquefied petroleum gas or highly inflammable substances shall be removed immediately from such tunnel;

17.31.3 No oxy-acetylene gas shall be used in a compressed air environment in excavation or tunneling work.

### **17.32 Water for fire fighting**

17.32.1 Adequate number of water outlets shall be provided on excavation or tunneling work and readily made accessible throughout the tunnel for fire fighting purposes and such water outlets shall be maintained for effective fire lighting;

17.32.2 All air locks shall be equipped with fire fighting facilities at excavation or tunneling work;

17.32.3 An audible fire alarm shall be provided to warn the building workers whenever a fire breaks out on an excavation or tunneling work;

17.33.4 Adequate number and types of fire extinguishers, in accordance with relevant national standards, shall be provided and made readily available to fight any outbreak of fire at an excavation or tunneling work;

17.33.5 Fire extinguishers with vaporizing liquids and high pressure carbon dioxide shall not be used in tunnels or other confined spaces;

17.33.6 The instructions regarding steps to be followed to fight outbreak of fire, at an excavation or tunneling work, written in Hindi or local language understood by the majority of the building workers employed on such excavation or tunneling work, shall be displayed at conspicuous and vulnerable places of such excavation or tunneling work.

### **17.34 Flooding**

17.34.1 Water tight bulkhead doors shall be installed at the entrance of a tunnel to prevent flooding during a tunneling work where more than one tunnel is driven from a shaft;



- 17.34.2 All necessary measures shall be taken to ensure that no building worker is trapped in any isolated section of a tunnel when any bulkhead door of such tunnel is closed;
- 17.34.3 Where there is likelihood of flooding or water rushing into a tunnel during a tunneling work, arrangements shall be made for immediate starting of water pumps to take out water of such flooding or water rushing and for giving alert signals to the building workers and other persons to keep them away from danger.
- 17.34.4 Airtight steel curtains shall be provided in areas liable to flooding at tunneling work and in case of descending tunnels, such curtains shall be provided in the top half of such tunnels to ensure the retention of pockets of air for rescue purpose.

### **17.35 Rest shelters**

- 17.35.1 Where building workers employed in a compressed air environment in a tunneling work are required to remain at the work site for one hour or more after de-compression from pressure exceeding one bar, adequate and suitable facilities shall be provided for such building workers to rest;
- 17.35.2 Every man-lock, medical-lock and any other facility inside these locks in a tunneling work shall be maintained in a clean state and in good repairs;
- 17.35.3 A first-aid room shall be provided and readily available at a construction site of a tunneling work;
- 17.35.4 Each man-lock attendant at the station shall be provided with a first-aid box.

### **17.36 Permissible limit of exposure of chemicals**

- 17.36.1 The working environment in a tunnel or a shaft in which building workers are employed shall not contain any of the hazardous substances in concentrations beyond the permissible limits;
- 17.36.2 The responsible person referred to shall conduct necessary test before the commencement of a tunneling work for the day and at suitable intervals as fixed by the Engineer in-charge, to ensure that the permissible limits of exposure are not exceeded and a record of such test shall be maintained and made available for inspection.

**17.37 Ventilation:** All working areas in a free air tunnel shall be provided with the approved ventilation system and the fresh air supplied in such tunnel shall not be less than 6 m<sup>3</sup> per minute for each building worker employed underground in such tunnel and the free air-flow movement inside such tunnel not less than 9 m<sup>3</sup> per minute.

**17.37 Air supply intake point:** The air intake points for all air compression shall be located at places where such intake air does not get contaminated with dust, fumes, vapor and exhaust gases or other contaminants.

### **17.38 Emergency generators**

- 17.38.1 Every compressed air system in a tunnel shall be provided with emergency power supply system for maintaining continued supply of compressed air in such compressed

air system, which shall be capable of operating air compressor and ancillary systems of such compressed air system;

17.38.2 The emergency power supply system shall be maintained and made readily available at all times.

**17.39 Air mains:** Every air-main supplying air to the working chamber, man-lock or medical-lock used at an excavation or tunneling work shall be protected against accidental damage and where it is not practicable to provide such protection, a stand-by air-main shall be provided.

#### **17.40 Bulkhead and air locks**

17.40.1 A bulk head or air tight diaphragms retaining compressed air, when used within a tunnel or a shaft, shall be constructed to withstand the maximum pressure at 1.25 the maximum working pressure of such bulk head or diaphragm and such bulk head or diaphragm shall be tested before its each use by a responsible person to ensure that such bulk head or diaphragm is in proper working order;

17.40.2 Such responsible person shall keep the record of each test and such record shall be produced for inspection.

17.40.3 The bulk head or diaphragm shall be made of sound material of adequate strength, which shall be able to withstand the maximum pressure on which they are subjected to at any time of their use;

**17.40.4** A bulkhead anchorage and air lock shall be tested at its work place at an excavation or tunneling work immediately after their installation at such place.

**17.41 Diaphragm:** All diaphragms, which are in the form of horizontal decks across a shaft used at excavation or tunneling work, shall be securely anchored

**17.42 Portable electrical hand tools:** All portable electrical hand tools and inspection lamps used underground or in a confined space shall be operated at a voltage not exceeding 24 V.

#### **17.43 Circuit breaker**

17.43.1 Adequate numbers of differential ground fault circuit breakers shall be installed for every electrical distribution system and its sub-systems used at an excavation or tunneling;

17.43.2 Work and the sensitivity of each of circuit breaker shall be adjusted in accordance with the requirement set out in accordance with the approved standards;

17.43.3 No semi-enclosed fuse unit shall be used in underground place.

**17.44 Transformer:** The contractor shall ensure no transformer is used in any section of a tunnel under compressed air unless such transformer is of the dry type and conforms to the approved standards.

**17.45 Live wires:** There shall be no exposed live wire in working areas at an excavation or tunneling work which are accessible to building workers other than those authorized to work on such live lines.

**17.46 Welding sets:** All welding sets used in a tunnel shall be of adequate capacity and of suitable type, duly approved.

#### **17.47 Quality and quantity**

17.47.1 Every working chamber at an excavation or tunneling work where compressed air is used, the supply of such air shall be maintained at not less than 0.3 m<sup>3</sup> per minute per person working therein;

17.47.2 A reserve supply of compressed air shall be made available at all times for man-locks and medical locks used at a tunneling work;

17.47.3 The air supplied in a compressed air environment at a tunneling work shall be, as far as practicable, free from contaminants, namely, dust, fumes and other toxic substances.

**17.48 Working temperature:** The temperature in any working chamber at an excavation or tunneling work where building workers are employed shall not exceed 29<sup>0</sup> c and the arrangement shall be maintained for kipping records in which the temperatures measured by dry bulb and wet bulb inside such working chamber once in every hour and for producing such records for inspection on demand.

#### **17.49 Man-locks and working in compressed air environment**

**17.49.1** Man-locks used at a tunneling work shall be of adequate strength, made of sound material and designed to withstand any pressure, internal or external, to which it may be subjected in the normal use or in an emergency;

**17.49.2** Doors of man-locks at an excavation or tunneling work shall be made of steel and used at a tunneling work for keeping the work airtight and devices shall be provided for sealing the doors when such locks are under pressure. The anchorage of a man-lock used at tunneling work shall have adequate strength to withstand the pressure exerted by air on the man-lock. There shall be adequate room available for the workers for working in the man-locks;

**17.49.3** Where work is carried out in any compressed air tunnel, a Man-lock in accordance with the approved standards shall be used;

**17.49.4** Where a man-lock is used, safety Instructions in Hindi and in local language understood by majority of building workers employed there, shall be displaced at conspicuous places;

**17.49.5** Except in an emergency, compression and de-compression operations shall be carried out in a man-lock and in an emergency any material-lock may be used;

**17.49.6** A record of compression and de-compression shall be kept in writing and produced for inspection on demand;

**17.49.7** Material lock shall be used with the permission of the Engineer in-charge where it is impracticable to install both the man-lock and the material-lock at;

A)The man-lock at tunneling work shall not be used for any purpose other than compression or de-compression of building workers;

B)No de-canting of building workers at tunneling work shall be carried out without prior approval of the Engineer in-charge except in an emergency;

**17.49.8** In case a building worker collapses or is taken ill during his de-compression in a man-lock, the lock attendant of such man-lock shall raise the pressure to a level equal to the maximum pressure which that building worker was exposed to in the working chamber prior to such de-compression and such lock attendant shall immediately report the

matter relating to such collapse to the medical lock attendant and medical officer on duty;

**17.49.9** A building worker who had previously received training with a trained building worker to work in a compressed air environment at tunneling work shall be employed to work independently in such a compressed air environment;

**17.49.10** building worker who had undergone three de-compressions from a pressure exceeding one bar in a period of eight hours at tunneling work shall not be allowed to enter a compressed air environment except for the purpose of carrying out rescue work;

**17.49.11** building worker employed in a compressed air environment for a period of eight hours in a day at tunneling work shall not be employed again in such environment unless he has spent not less than twelve consecutive hours of rest at atmospheric pressure;

**17.49.12** No building worker shall be engaged in a compressed air environment at a pressure, which exceeds three bars at a tunneling work unless prior permission, in writing, has been obtained from the Engineer in-charge;

**17.49.13** No building worker shall be employed in a compressed air environment for more than fourteen consecutive days in a month;

**17.49.14** A register of employment of all building workers in compressed air environment shall be maintained;

**17.49.15** An identification badge shall be supplied to a building worker employed in compressed air environment;

**17.49.16** The badge of a building worker shall contain particulars of his name, location of the medical-lock allotted to him for work, the telephone number of the Construction Medical Officer concerned for his treatment and the instructions in case of his illness of unknown and doubtful causes;

**17.49.17** Record of all identification badges supplied to building shall be kept in a register;

**17.49.18** Every building worker whose name appears in the register shall wear the badge supplied to him at all times during his duty hours;

**17.49.19** Suitable warning signs shall be displayed in the compressed air for the prohibition of the following, namely:

- i) Use of alcoholic drinks;
- ii) Use and carrying of lighters, matches or other sources of ignition;
- iii) Smoking; and
- iv) No entry to person who has consumed alcoholic drink

**17.49.20 safety instruction:** All building workers employed in compressed air environment at tunneling work shall follow the instructions issued for their safety in the course of such employment.

### **17.50 Medical-lock**

**17.50.1** A suitably constructed medical lock shall be maintained at tunneling work where building workers are employed in a working chamber at a pressure exceeding one bar;

**17.50.2** Where more than one hundred building workers are employed in a compressed air working environment exceeding one bar at tunneling work, one medical-lock is provided for every one hundred building workers or part thereof and such medical lock shall be situated as near as possible to the main-lock used at such tunneling work.

## **18.Safety in Piling Work**

### **18.1General provisions**

- 18.1.1 All pile driving equipment shall be of good design and sound construction, taking into account the ergonomic principles and properly maintained;
- 18.1.2 A pile driver shall be firmly supported on a heavy timber sill, concrete bed or other secured foundation;
- 18.1.3 In case a pile driver is required to be erected in dangerous proximity to an electrical conductor, all necessary precautions shall be taken to ensure safety;
- 18.1.4 The hoses of steam and air hammer shall be securely lashed to such hammer so as to prevent them from whipping in case of connection or break;
- 18.1.5 Adequate precaution shall be taken to prevent the pile driver from over turning and hammer from missing the pile;
- 18.1.6 A responsible person for inspecting pile-driving equipment shall inspect such equipment before taking it into use and takes all appropriate measures as required for the safety of building workers before commencing piling work by such equipment;
- 18.1.7 Where there is any question of stability of a structure for its adjoining areas to be piled, such structure shall be supported, where necessary, by underpinning, sheet piling, shoring, and bracing or by other means to ensure safety and stability of such structure and to prevent injury to any person.

**18.1.8 Protection of operator:** The operator of every pile driving equipment shall be protected from falling objects, steam, cinders or water by substantially covering or otherwise or by other means.

**18.1.9 Instruction to and supervision of building workers working on pile-driving equipment:** Every building worker working on a pile driving equipment shall be given instructions regarding safe work procedure to be followed in piling operation and shall be supervised by a responsible person throughout such work.

**18.1.10 Entry of unauthorized person:** The contractor shall ensure at a construction site of a buildings or other construction work that all piling areas where pile-driving equipment is in use are effectively cordoned off to prevent entry of unauthorized persons.

### **18.2 Inspection and maintenance of pile driving equipment**

- 18.2.1 Pile-driving equipment shall not be taken into use until it has been inspected by a responsible person and found to be safe for such use;
- 18.2.2 A responsible person for such inspection at suitable intervals to ensure safety to the building worker working on such equipment shall inspect pile driving equipment in use;
- 18.2.3 All pile lines and pulley blocks shall be inspected by a responsible person before the beginning of each shift of piling operations.

### **18.3Operation of pile-driving equipment**

- 18.3.1 Only experienced and trained building worker shall operate pile driving so as to avoid any probable danger from such operation;
- 18.3.2 Pile-driving operations shall be governed generally prevalent and accepted signals so as to prevent any probable danger from such operations;
- 18.3.3 Every building worker employed in pile driving operation or in the vicinity of such pile driving operation shall wear ear protection and safety helmet or hardhat and safety shoes;
- 18.3.4 Piles shall be prepared at a distance, at least equal to twice the length of the longest pile, from the place of pile-driving operations;
- 18.3.5 When a pile driver is not in use, the hammer of such pile driver shall be blocked at the bottom of the heads of such pile driver.

**18.4 Working platform on piling frames:** Where a structural tower supports the lead of a pile driver, leads at which it is necessary for the building workers to work and such platforms except on the hammer of such pile driver or lead sides of such platform and where such platforms cannot be provided with such railing and toe boards, a safety belt shall be provided to each such building worker.

#### **18.5 Pile testing**

- (a) The testing of pile shall be conducted under the supervision of a responsible person for such testing;
- (b) All practicable measures like displaying of warning notices, barricading the area and other similar measures shall be taken to protect the area where the pile testing is carried out;
- (c) Entry to a pile testing area shall be prohibited to general public to ensure safety.

#### **18.2 Piling, shoring and bracing**

- 18.2.1 Planks used for sheet piling in excavation or tunneling work shall be of sound material with adequate strength;
- 18.2.2 Shores and braces used in excavation or tunneling work shall be of adequate dimensions and so placed as to be effective for their intended purposes;
- 18.2.3 Earth supported shores or braces used in excavation or tunneling work shall bear against a footing of sufficient area and stability to prevent the shifting of such shores or braces.



## **19.Safety in the erection, use and dismantling of Scaffolds**

### **19.1 Scaffold construction**

- 19.1.1 Every scaffold and every component thereof shall be of adequate construction, made of sound material and free from defects and safe for the purposes for which it is intended for use;
- 19.1.2 In case bamboo is used for scaffolding, such bamboo shall be of suitable quality, good condition, free from protruding knots and stripped off to avoid any injury to building workers during handling such bamboo;
- 19.1.3 All metal scaffolds used in building or other construction work shall conform to the approved standards;
- 19.1.4 **Supervision by a responsible person:** No scaffold shall be erected, added, altered or dismantled except under the supervision of a responsible person.

### **19.2 Maintenance**

- 19.2.1 The scaffold used in building or other construction work shall be maintained in good repairs and the measures taken against its accidental displacement or any other hazard;
- 19.2.2 No scaffold or part thereof shall be partly dismantled and allowed to remain in such a condition unless –
- i) The stability or safety of the remaining portion of such scaffold has been ensured by a responsible person for the safety of such scaffolds;
  - ii) In case the remaining part of such scaffold cannot be used by the building workers, necessary warning notice written in Hindi and in a language understood by the majority of the building workers that such scaffold is unfit for use, shall be displayed at the place where such scaffold is erected.

### **19.3 Standards, ledgers, putlogs**

- 19.3.1 Standards of a scaffold shall be plumb, where practicable, fixed sufficiently close together to secure the stability of such scaffold having regard to all the possible working situations and conditions for the intended use of such scaffold, spaced, as close as practicable, to ensure safety and stability of such scaffold;
- 19.3.2 Adequate measures are taken to, prevent displacement of a standard of a scaffold either by providing sole plate or a base plate, as necessary;
- 19.3.3 Ledgers of metal scaffold are placed at vertical intervals with due regard to safety and stability of such scaffold;
- 19.3.4 Bamboo ledgers are kept as nearly as possible and are placed and fastened to the standards of a scaffold with due regard to the stability of such scaffold.

### **19.4 Working platform**



- 19.4.1 Working platform shall be provided around the face or edge of a building adjoining at every upper most permanent floor of such building under construction and at any level where construction work of such building is carried out;
- 19.4.2 A platform shall be designed to suit the number of building workers to be employed on each bay of a scaffold work on such platform and the materials or articles and tools to be carried with them in such bay;
- 19.4.3 The safe working load and the number of building workers to be employed in each bay of a scaffold shall be displayed for the information of all the building workers employed at such construction site.

#### **19.5 Board, plank and decking**

- 19.5.1 Board, plank and decking used in the construction of a working platform shall be of uniform size and strength and shall be capable of supporting the load and number of building workers keeping in view the safety of such building workers;
- 19.5.2 Metal decking, which forms part of a working platform, shall be provided with non-skid surface;
- 19.5.3 No board or plank which forms the working platform shall be projected beyond its end support unless it is effectively prevented from tripping or lifting and board, plank or decking shall be fastened and secured;
- 19.5.4 At any one time, not more than two working platforms per bay, shall be used to support building workers or materials or articles at such bay;
- 19.5.5 Adequate measures shall be taken to prevent injury which may be caused by falling material and objects by using safety nets or other suitable means;
- 19.5.6 Concrete, other debris or materials shall not be allowed to accumulate at any platform on a scaffold;
- 19.5.7 Where a work is to be done at the end of a wall, working platform at such workplace shall be faced or, wherever practicable, at least 0.6 m beyond the end of such wall.

#### **19.6 Repair of damaged scaffold**

- 19.6.1 No building worker shall be permitted to work on a scaffold that has been damaged or weakened unless adequate safety measures have been taken to ensure the safety of such building worker;
- 19.6.2 Necessary warning signs shall be displayed at such places where repairs of scaffold are undertaken.

#### **19.7 Opening**

- 19.7.1 There shall be no opening in any working platform except for allowing access to such working platform;
- 19.7.2 Wherever opening on a platform is unavoidable, necessary measures for protection against falling of objects or building workers from such platform shall be taken by providing suitable safety nets, belts or any other similar means;

- 19.7.3 Access from one working platform to another platform on a scaffold, if required, shall be provided with suitable and safe ladder for the use of building workers working on such platforms;
- 19.7.4 Every opening or shaft in the floor shall be provided with suitable means to protect the fall of a person or material by providing suitable fencing or railing of height not less than 900 mm.
- 19.7.5 **Guardrails:** Every side of a working platform from which a person is liable to fall shall be provided with suitable and safe guardrails and toe board of adequate strength to prevent fall of any building worker, material or tools from such platform.

## **19.8 Scaffold used by building workers of different employers**

19.8.1 Where a scaffold or a part of a scaffold is used, which has previously been used by another employer for his building workers, such scaffold or part thereof shall be used only after its inspection and examination by a responsible person for ensuring that such scaffold or part thereof is safe and fit for such use;

19.8.2 If any rectification, alteration or modification in a scaffold or part thereof, needed to suit its use, shall be made in consultation with the responsible person.

**19.8.3 Protection against electric power line:** The contractor shall ensure that all necessary and practical measures for protection are taken to prevent any building worker, working on a scaffold, from coming into contact with the electric wires or dangerous equipment.

**19.8.4 Screening net and wire nets:** Where a scaffold is erected in an area where the construction activities may pose hazards to pedestrians or vehicular traffic nearby from the falling of objects, wire nets or screening nets shall be used to envelope such scaffold.

## **19.9 Tower scaffold**

19.9.1 The height of every tower scaffold used in building or other construction work shall not be more than eight times the lesser to the base dimension of such scaffold;

19.9.2 A tower scaffold shall be lashed to a building or a fixed structure before being used by the building workers;

19.9.3 Any tower scaffold which can be moved or castered shall be –

- i) Constructed with due regard to the stability and, if necessary, adequately weighted at the base;
- ii) Used only on plain and even surface; and
- iii) Has casters provided with positive locking devices to hold such scaffold in position;

19.9.4 No building worker shall remain on board scaffold or leave behind tools and material when it is being shifted from one position to another position.

## **19.10 Gear for suspension of scaffold**

19.10.1 Chains, ropes or lifting gears used for suspension of a scaffold shall be of adequate strength, made of sound material and suitable for the purpose of their use and maintained in good repairs;

19.10.2 Chains, wires, ropes or metal tubes used for the suspension of a scaffold shall be:

- i) Properly and securely fastened to every anchorage point and to the scaffold ledgers of other main supporting members used for the support of such scaffold; and
- ii) So positioned as to ensure stability of the scaffold.

### **19.11 Trestle scaffold and cantilever scaffold**

19.11.1 No trestle scaffold shall be constructed with more than three tiers or if its working platform is more than 4.5 m above the ground or floor or other surface upon which such scaffold is erected;

19.11.2 Trestle scaffold shall be designed by professional engineer and shall have the approval of the Engineer in-charge before being taken into use.

19.11.3 No trestle scaffold shall be erected on a suspended scaffold;

19.11.4 No cantilever or jib scaffold shall be used unless it is adequately supported, fixed and anchored on opposite side of its support and have out triggers of adequate length and, where necessary sufficiently, supported and braced to ensure safety and stability of such scaffold;

19.11.5 No working platform resting on bearers let into a wall at one end and without other support shall be used unless such bearers are of adequate strength, braced through the wall and securely fastened on the other side.

### **19.12 Scaffold supported by building**

19.12.1 No part of a building shall be used as support or part of a scaffold unless such part of the building is made of sufficient strength and made of sound material to afford safe support;

19.12.2 Overhanging eaves gutters shall not be used for supporting scaffold;

19.12.3 Suspended scaffold shall be made of in accordance with the approved standards before being used by the building workers.

### **19.13 Use of winches and climbers for suspended scaffold**

19.13.1 No scaffold shall be raised or lowered by winches or climbers unless such scaffold is made of sound material, adequate strength and has been tested and certified safe for use of winches or climber by a competent person before being taken into use;

19.13.2 All suspended scaffolds counter-balanced by counter weights shall be of approved types before being taken into use for building or other construction work;

19.13.3 The working platform of a suspended scaffold shall be securely fastened to the building or structure as to be safe and to prevent such platform from swing;

19.13.4 The safe working load that a suspended scaffold can carry, shall be displayed where such scaffold is being used

#### **19.14 Safety devices for suspended scaffold**

19.14.1 Every suspended scaffold, raised or lowered by the winches or climbers, shall be provided at each of its suspension point with a safety rope with automatic safety device mounted on each of such rope so that such safety rope with such automatic safety device support the platform of such scaffold in the event of failure of the primary suspension wire ropes, winches, climbers or any part of the mechanism used for raising or lowering such suspended scaffold;

19.14.2 Provided that the clause 19.14.1 shall not apply -

- i) Where the platform of such scaffold is supported at two independent suspension wire rope at or near each end of such platform so that in the event of failure of one of such suspension wire rope, the other wire rope is capable of sustaining the weights of such platform and its load and prevent it from tilting; or
- ii) Where a system is incorporated which operates automatically to support the platform of such scaffold and its load in the event of failure of the primary suspension wire rope of such scaffold.

### **20.Safety in the construction of structural frame & formwork**

#### **20.1General provision**

20.1.1 The trained building worker under the direct supervision of a person, responsible for structural frame and formwork, shall be employed for erection of such structural frame or formwork, dismantling of building and structure and performance of and engineering work formwork, false work and shoring work;

20.1.2 Adequate measures shall be taken to guard against hazards arising from any temporary state of weakness or unsuitability of a structure.

#### **Formwork, false work and shoring**

20.1.3 Formwork and false work shall be so designed, constructed and maintained that such formwork and false work are able to support the load that may be imposed on them;

20.1.4 Such formwork shall be so erected that working platform, means of access, bracings, means of handling and stabilizing could easily be fixed with such formwork.

#### **20.2Erection or dismantling of steel and prefabricated**

20.2.1 Erection or dismantling of any pre-fabricated structure shall be made safe against danger by using appropriate means such as ladders, gangways or fixed platforms, buckets, boatswains chair or other appropriate means suspended from lifting appliances, safety harness, life lines, catch nets or catch platforms, power-operated mobile working platforms etc.;

- 20.2.2 The work of erection or dismantling of buildings or structures or formwork or false work or shoring or any other civil engineering work shall be carried out by trained building workers under the supervision of a person responsible for such work;
- 20.2.3 Steel or prefabricated structures shall be so designed and made that such structures can be safely transported or erected; and weight of each unit of such structures shall be clearly marked on such unit;
- 20.2.4 The design of each such part shall maintain stability of each part of the structures referred to in clauses above when erected, and to prevent danger, the design shall explicitly take into account –
- i) The relevant conditions and methods of attachment in the operations of stripping, transport, storing and temporary support during erection of such parts;
  - ii) Safeguards, such as provision of railings with working platforms, and for mounting such railings and platforms easily on the structural steel or prefabricated parts;
- 20.2.5 The hooks and softer devices built in or provided on the structural steel or prefabricate parts that are required for lifting and transporting such parts shall be so shaped, dimensioned and positioned to withstand the stresses to which such hooks or other devices are subjected;
- 20.2.6 Prefabricated parts made of concrete shall not be stripped or erected before such concrete has set and hardened sufficiently to the extent provided for in the plans, and such parts are examined by the responsible person for any sign of damage before their use;
- 20.2.7 Store-places shall be so constructed that –
- i) There shall be no risk of structural steel or prefabricated parts falling or overturning;
  - ii) Storage conditions shall generally ensure stability and avoid damage having regard to the method of storage and atmospheric conditions; and
  - iii) Racks shall be set on firm ground and designed so that units cannot move accidentally in such store-places;
- 20.2.8 Structural steel or pre-fabricated parts shall not be subjected to stresses prejudicial to their stability while they are stored or transported or raised or set down;
- 20.2.9 Tongs, clamps and other appliances for lifting structural steel and prefabricated part shall be:
- i) In such shape and dimensions as to ensure a secure grip without damaging and marked with the maximum permissible load in the most unfavourable lifting conditions; and
  - ii) Structural steel or pre-fabricated parts shall be lifted by such methods and appliances that prevent them from spinning accidentally;
- 20.2.10 Structural steel or pre-fabricated parts shall be provided with railings and working platforms before raising such parts to prevent any danger of falling of building workers, materials or articles at the time of any work with such parts;
- 20.2.11 All reasonably practical measures shall be taken to avoid injury to building workers, building structure or equipment while structural steel or pre-fabricated parts are handled or stored or transported or raised or lowered;
- 20.2.12 Structures shall not be worked on during violent storms or high winds or any other such hazardous situation;

20.2.13 The risk of falling to which building workers, moving on high or sloping girders, may be exposed is limited by all means of adequate collective protection or by the use of a safety harness which shall be well secured to a sufficiently strong supports;

20.2.14 Structural steel parts, which are to be erected at a great height, shall, as far as practicable, be assembled on the ground;

20.2.15 When structural steel or pre-fabricated parts are being erected, a sufficiently extended area underneath the workplace shall be barricaded or guarded;

20.2.16 Steel trusses, which are being erected, shall be adequately shored, braced or guyed until they are permanently secured in position;

20.2.17 Structural members shall not be forced into place

20.2.18

20.2.19 by the hoisting machine while any building worker is in such a position that he is likely to be injured by such operation.

### **Formwork**

20.2.20 All formwork shall be properly designed keeping in view the safety of building workers, buildings or structures;

20.2.21 A responsible person for structural frame and formwork shall –

- i. Inspect and examine the material, timber, structural steel and scaffolding for its strength and suitability before being taken into use;
- ii. Lay-down procedures to cover all stages of such structural frame and formwork;
- iii. Supervise such structural frame and formwork;
- iv. Take all necessary steps or measure to correct any situation with a view to prevent accident or dangerous occurrence during performances of such structural frame and formwork.

### **De-shoring**

20.2.20 When shoring is removed, sufficient props shall be left in place of such shoring to prevent any possible hazard; and

20.2.21 Deshoring shall be adequately braced and tied together with support to prevent any hazard.

## **21.Safety in Concrete Work**

### **21.1 General provisions regarding use of concrete**

21.1.1 All construction with the use of concrete or reinforced concrete shall be based on plans including specification of steel and concrete and other material to be used in such construction –

- i. Giving technical details regarding methods for safe placing and handing of such materials and indicating the type, quality and arrangement of each part of a structure of such construction; and
- ii. Explaining the sequence of steps to be taken for completion of such construction;

21.1.2 Formwork and shores used for concrete work shall be structurally safe and properly braced or tied together so as to maintain position and shape of formwork or shores;

21.2.3 Formwork structure used shall have sufficient catwalks and other secure access for inspection of such structure if such structure is in two or more tiers;

21.2.4 No machinery or any object should fall below by using wire nets, screen nets etc.

## **21.2 Preparation and pouring of concrete and erection of concrete structure**

21.2.1 A building worker handling cement or concrete shall –

- i) Wear close-fitting clothing, gloves, helmet or hardhat, safety goggles, proper footwear and respirator or mask to protect himself from danger in such handling;
- ii) Keep as much of his body covered as is required to protect himself from danger in such handling;
- iii) Take all necessary precautions to keep cement and concrete away from his skin in such handling;

21.2.2 Lime pits shall be fenced or enclosed and filled and emptied by such devices, which do not require workers to go into the pit;

21.2.3 Moving parts of the elevators, hoists screens bunkers, chutes, grouting equipment used for concrete work and of other equipment used for storing, transport and other handling ingredients of concrete shall be securely fenced to avoid contact of building workers with such moving parts;

21.2.4 Screw conveyors used for cement, lime and other dusty materials shall be completely enclosed.

### **Buckets**

21.2.5 Concrete buckets used with cranes or aerial cableways shall be free from projections from which accumulations of concrete could fall;

21.2.6 Movements of concrete buckets shall be governed by signals necessary to avoid any danger by such movements.

### **Pipes and pumps**

21.2.7 A scaffolding carrying a pipe for pumped concrete shall be strong enough to support such pipe at a time when such pipe is filled with concrete or water or any other liquid and carry the combined load of the all the building workers who may be on such scaffold at such time, safely;



21.2.8 Every pipe for carrying pumped concrete shall be –

- i) Securely anchored at its end point and at each curve on it;
- ii) Provided near the top of such pipe with an air release valve;
- iii) Securely attached to a pump nozzle by a bolted collar or other adequate means;

21.2.9 The operation of concrete pumps shall be governed by standard signals;

21.2.10 Building workers employed around a concrete pump shall wear safety goggles;

### **21.3 Mixing and pouring of concrete**

21.3.1 The concrete mixture shall not contain any material, which may unduly affect the setting of such concrete, weaken such concrete or corrode steel used with such concrete;

21.3.2 When dry ingredients of concrete are being mixed in confined spaces such as silos –

- i) The dust shall be exhausted at the time of such mixing and
- ii) In case the dust cannot be exhausted, as specified, the workers shall wear respirators at the time of such mixing;

21.3.3 When concrete is being tipped from buckets, building workers shall be kept out of the range of any kickbacks of such buckets;

21.3.3 Loads shall not be dumped or placed on settling concrete.

### **21.4 Concrete panels and slabs**

21.4.1 All parts of a concrete panel or concrete slab shall be hoisted uniformly;

21.4.2 Concrete panels shall be adequately braced in their final positions and such bracings shall remain in such positions until such panels are adequately supported by other parts of the construction for which such panels are used;

21.4.3 Temporary bracings of concrete panels shall be securely fastened to prevent any part of such panels from falling when such panels are being moved.

### **21.5 Stressed and tensioned elements**

21.5.1 Building workers shall not stand directly over jacking equipment while stressing of concrete girders and beams is being done;

21.5.2 A pre – stressed concrete unit shall not be handled except at points on such unit and by the devices specified for such work by the manufacture of such devices;

21.5.3 During transport, pre-stressed concrete girders or concrete beams shall be kept upright by bracing or other effective means;

21.5.4 Anchor fittings for pre-tensioned strands of pre-stressed concrete girders or concrete beams are kept in a safe condition in accordance with the instruction of manufacturer of such anchor fittings;

21.5.5 Building workers shall not stand behind jacks or in line with tensioning elements and jacking equipment during tensioning operations of pre-stressed concrete girders of concrete beams;

21.5.6 Building workers do not cut wires of pre – stressed concrete girders or concrete beams under tension before such concrete used of such girder or beams is sufficiently hardened.

## **21.6 Vibrators**

21.6.1 A building worker, who is in good physical condition, shall operate vibrators used in concreting work;

21.6.2 All practical measures shall be taken to reduce the amount of vibration transmitted to the operators working in concreting work and

21.6.3 When electric vibrators are used in concreting work

- i) Such vibrators shall be earthed;
- ii) The leads of such vibrators shall be heavily insulated; and
- iii) The current shall be switched off when such vibrators are not in use.

## **21.7 Inspection and supervision**

21.7.1 A person responsible for a concreting work shall supervise the erection of the formwork, shores, braces and other supports used for such concreting work, make a through inspection of every formwork to ensure that such formwork is safe, regularly inspect the formwork, shores, braces, reshores and other supports during the placing of concrete, keep all records of inspections referred to above at the workplace relating to such inspection and produce them for inspection upon the demand.

21.7.2 Any unsafe condition, which is discovered during the inspections, shall be remedied immediately.

## **21.8 Beams, floors and roofs**

21.8.1 Horizontal and diagonal bracings shall be provided in both longitudinal and transverse direction as may be necessary to provide structural stability to formwork used in concreting work and shores used in such concreting work shall be properly seated on top and bottom and secured in their places;

21.8.2 Where shores used in concreting work rest upon the ground, base plates shall be provided for keeping such shores firm and in level;

21.8.3 Where the floor to ceiling height of a concreting work exceeds 9 m or where the formwork deck used in such concreting work is supported by shores constructed in two or more tiers, or where the dead, live and impact loads on the formwork used in such concreting work exceed 700 kilogram per m<sup>2</sup>, the structure of such formwork shall be designed by a professional engineer in the relevant field and the specifications and drawings of such formwork kept at such construction site and produced on demand.

21.8.4 Where a professional engineer designs the structure of the formwork used in concreting work, such engineer shall be responsible for the supervision of construction and the stability of such structure.

## **21.9 Stripping**

21.9.1 Stripping of formwork used in concreting work shall not commence until the concrete on such formwork is fully set, examined and certified to this effect by the responsible person and record of such examination and certification is maintained;

21.9.2 Stripped forms in concreting work shall be removed or stock piled promptly after stripping from all areas in which building workers are required to work or pass;

21.9.3 Protruding nail, wire ties and other formwork accessories not required for subsequent concreting work shall be pulled, cut or otherwise made safe.

## **21.10 Re-shoring**

21.10.1 Re-shoring used in concreting work shall be provided to a slab or beam for its safe support after its stripping or where such slab or beam is subjected to superimposed loads due to construction above such slab or beam;

21.10.2 The provisions applicable to shoring in a concreting work shall also be applicable to reshoring in such work or pass.

21.11 Safety in construction, repair and maintenance of steep roofs

**21.11.1** Work on steep roofs: All practicable measures shall be provided to protect the building workers against sliding when carrying outwork on steep roofs.

**21.11.2** Construction and installation of roofing brackets

**21.11.3** Roofing brackets shall be constructed to fit the pitch of steep roof and such brackets shall be used to provide level working platform;

**21.11.4** Roofing bracket shall be secured in its place by nailing pointed metal projections attached to the underside of such bracket and securely driven into a steep roof on which it is used or secured by a rope passed over the ridgepole and tie of such roof.

**21.12** Crawling boards

**21.12.1** All crawling boards used for work on steep roofs shall be of adequate strength, made of sound material and of the type approved for the purpose of their use;

**21.12.2** Crawling boards shall be kept in good repairs and inspected by a responsible person before being taken into use;

**21.12.3** Crawling boards shall be secured to a steep roof on which it is used by ridge hooks or other effective means;

**21.12.4** A firmly fastened lifeline of adequate strength shall be strung beside each crawling board throughout its length while using such crawling boards.

## **22. Safety in construction of catch platforms and hoardings**

### **22.1 Catch platform**

22.1.1 Catch platform shall not be used for storage of material or as a working platform;

22.1.1 Catch platform shall at least be of 2 m wide and inclined so that the position of outer edge of such platform is 1500 mm higher than the inner edge;

22.1.2 The open end of catch platform shall be properly fenced to the height not less than 1 m.

**22.1.3 Hoardings:** Hoardings shall be constructed when the Registering Authority / Assistant Labour Commissioner considers it necessary for protection of building workers and directs such employer to construct such hoardings.

## **23. Safety in use of chutes**

### **23.1 Chutes, its construction and use**

23.1.1 Wooden or metal chutes which are at an angle of more than 45° to the horizontal and used for the removal of materials shall be closed on all sides except at their openings used for receiving or discharging of materials or articles;

23.1.2 All openings of chutes except their top openings shall be closed when not in use;

23.1.3 Every chute –

- i. Shall be constructed of sound material, adequate strength and suitable for the purpose it is intended for use;
- ii. Exceeding 12 m in height shall be constructed in accordance with the design and drawings of professional engineer for such;
- iii. A suitable warning notice shall be displayed at conspicuous locations, written in Hindi and in a local language, at the discharge end of every chute;
- iv. Shall be cleared when debris has accumulated to a height, which can pose danger to building worker, but such clearance shall be done in no case less frequently than once a day.

## **24. Safety in work on or adjacent to water**

### **24.1 Transport of workers by water**

24.1.1 When any building worker has to proceed to or from any workplace by water for purposes of carrying on a building or other construction work, proper measures shall be taken to provide for his safe transportation and vessels used for such purpose shall be in charge of a responsible person, properly equipped for safe navigation and maintained in good condition;

24.1.2 Maximum number of persons which can be safely carried in a vessel shall be marked plainly and conspicuously on such vessel and such number shall not be exceeded during use of such vessel for carrying persons;

24.1.3 Adequate protecting shall be provided to the building workers in such vessel from inclement weather;

- 24.1.4 Such vessel shall be manned by adequate and experienced crew;
- 24.1.5 In case the bulwarks of such vessel are lower than 60 cm from the level of the deck of such vessel, the open edge of such bulwarks shall be fitted with suitable fencing to a height of at least 1 m above such deck and the post and stanchions and similar parts used in such fencing shall not be spaced more than 2 m;
- 24.1.6 The number of life buoys on deck of such vessel shall at least be equal to the number of crew members of such vessel and shall not be less than two;
- 24.1.7 All life buoys on deck of such vessel shall be kept in good state of maintenance and so placed that if such vessel sinks then they will remain afloat and one of such buoys shall be within the immediate reach of the Steersman of such vessel and another is situated after part of such vessel; and
- 24.1.8** The position of the steersman of the vessel shall be such that he has a reasonably free view of all sides.

## **24.2 Prevention from drowning**

- 24.2.1 Where, on or adjacent to the workplace of any contraction site, there is water into which a building worker employed for work on such site, in the course of his employment, may fall and has the risk of drowning, suitable rescue equipment shall be provided and kept in an efficient state of ready use and measures shall be taken to arrange for the prompt rescue of such building worker from the danger of drowning and where there is a special risk of such fall from the edge of adjacent land or from a structure adjacent to or above the water, or from floating stage on such water, secure fencing shall be provided near the edge of such land, structure or floating stage, as the case may be, to prevent such fall, and such fencing may be removed for the time and to the extent necessary for the access of building workers to such work or the movement of material for such work;
- 24.2.2 For handling rescue equipment, at least two persons knowing diving should be available at such sites.

## **25. Safety in cofferdams & caissons**

### **25.1 Every cofferdam and caisson shall be**

- 25.1.1 Of good construction, sound material and of adequate strength, provided with adequate means for workers to reach safely at the top of such cofferdam or caisson in the event of an in rush of water and safe means of access to every place where workers shall be employed;
- 25.1.2 Work relating to construction, positioning, modification, dismantling of cofferdams or caissons shall be carried out under the supervision of a responsible person and inspected by the responsible person at the specified intervals;
- 25.1.3 A worker shall be allowed to work in a cofferdam or caisson after such cofferdam or caisson has been inspected and found safe by responsible person within such preceding period as approved and a record of such inspection maintained.

### **25.2 Work in compressed air in a cofferdam or caisson shall be**

- 25.2.1 Carried out in accordance with the procedure laid down;
- 25.2.2 Carried out by such building workers who have completed eighteen years of age and are medically examined and found fit for the work;

- 25.2.3 Carried out under the supervision of a responsible person;
- 25.2.4 If the work in cofferdam or caisson is carried out in shifts, a record of the time spent by each worker in each such shift for carrying out the work shall be maintained in a register with particulars or time taken for the compression of such building worker, if any;
- 25.2.5 At every work site or project in a cofferdam or caisson, where workers are employed to work in compressed air environment, a construction medical officer assisted by a nurse or trained first-aid attendant, shall be available at all times and there shall be one standby reserve compressor to meet the emergency.

### **25.3 Pressure plant and equipment**

- 25.3.1 Pressure plant and equipment for which it is used shall be –
- 25.3.2 Properly maintained in good repairs and working condition and fitted with a suitable safety valve or other effective device to provide maximum safe discharge pressure from being exceeded at any time; a suitable pressure gauge with a dial range not less than 1.5 times and not exceeding twice the maximum working pressure, easily visible and designed to show at all times, the internal pressure in kilogram per square centimeter and marked with the maximum safe working pressure, a suitable stop valve or valves by which the pressure plant or the system of the pressure plant may be isolated from the source supply of pressure or otherwise;
- 25.3.3 Every pressure plant or equipment shall be thoroughly examined by the competent person, externally, once in every period of six months; internally, once in every period of twelve months; and by hydraulic test, once in a period of four years.

## **26. Safety in demolition work**

### **5.1 Preparation**

5.1.1 All glass or similar material or article in exterior openings shall be removed before commencing any demolition work and all water, steam, electric, gas and other similar supply lines put off and suitably capped and the concerned department of the appropriate authority informed and permission obtained wherever required before commencing;

5.1.2 Wherever it is necessary to maintain water, gas or electric line or power during such demolition, such line shall be so located or protected with substantial coverings so as to protect it from damage and to afford safety to the building workers and the general public.

### **Protection of adjacent structures**

5.1.3 Examination of walls etc. of adjacent structures –

- i) During demolition process, the contractor shall examine the walls of all structures adjacent to the structure to be demolished to determine the thickness, method of support to such adjacent structures and;
- ii) In case, such employer has reason to believe that any of such adjacent structure is unsafe or may become unsafe during such demolition process, he shall not perform

demolition activity unless stability to such unsafe adjacent structure from collapsing has been taken. All roads and open spaces adjacent to the site of demolition work shall be closed or suitably protected by bracketing.

## **5.2 Demolition of walls, partitions, etc.**

- 5.2.1 Any demolition of walls or partitions shall be proceeded in a systematic manner as per the standard safe operating practices approved and all work above each tier of any floor beams shall be completed before the safety of the supports of such beam is impaired;
- 5.2.2 Masonry shall be neither loosened nor permitted to fall in such masses or volume or weight as to endanger the structural stability of any floor or structural supports;
- 5.2.3 No wall chimney or other structure or part of a structure shall be left unguarded in such a condition that it may fall, collapse or weaken due to wind pressure or vibration;
- 5.2.4 In the case of demolition of exterior walls by hand, safe footing shall be provided for the workers employed in, such walls or partitions, which are to be demolished by hand shall be not left standing more than one storey high above the uppermost floor on which persons are working.
- 5.2.5 **Method of operation:** The contractor shall ensure that debris, bricks and other materials or articles are removed by means of chutes, buckets or hoists and through openings in the floors.

## **5.3 Access to floor**

- 5.3.1 Safe access to and egress from every building shall be provided at all times in the course of demolition by means of entrances hallways, stairways or ladder runs which shall be so protected as to safeguard the workers using such means from falling material or articles;
- 5.3.2 Demolition of structural steel etc. shall be demolished column by column and tier by tier and every structural member, which is being demolished, shall not be under any stress, and such structural member shall be suitably lashed to prevent it from any uncontrolled swinging, dropping or falling or falling;
- 5.3.3 Large structural members shall not be thrown or dropped from the building, but carefully lowered by adopting suitable safe method;
- 5.3.4 Where a lifting appliance like a derrick is used for demolition, the floor on which such lifting appliance rests shall be completely planked over or supported and such floor shall be of adequate strength to sustain bearing load for such lifting appliance and its operation.

## **5.4 Storage of material or article**

- 5.4.1 No materials or articles shall be not stored or kept on platform, floor or stairways of a building being demolished, provided that this clause shall not apply to the floor of a building when such floor is of such strength as to support safely the load to be superimposed by storing such material or articles;



- 5.4.2 No access to any stairway or passageway shall be affected or blocked by storing any material or article;
- 5.4.3 Suitable barricades shall be provided so as to prevent materials or articles from sliding or rebounding into any space used by the workers.

**26.5 Floor openings:** Every opening used for the removal of debris from every floor which is not closed to access, except the top or working floor, shall be provided with an enclosure from such floor to its ceiling, or such opening is so barricaded that no building worker shall access to within a horizontal distance of 6.0 m from such opening through which debris is being dropped.

**26.6 Inspection:** A person responsible for demolition work shall make continuous inspections during demolition process so as to detect any hazard resulting from weakened or deteriorated floors or walls or loosened materials or articles, and that no building worker shall be permitted to work where such hazard exist unless remedial measured like shoring or bracing shall be taken to prevent such hazards.

#### **26.7 Warning signs, barricades, etc.**

**26.7.1** Barricades and warning sign shall be erected along every side throughout the length and breadth of a building or other construction work to be demolished to prevent unauthorized persons from entering into the during demolition operations;

**26.7.2** During the demolition of an exterior masonry wall or a roof from a point more than 12 m above the adjoining ground level of such wall or roof, if persons below such wall or roof are exposed to falling objects, suitable and safe catch platform shall be provided and maintained at a level not more than 6 m below the working level except where an exterior built-up scaffold is provided for safe and adequate protection of such persons;

**26.7.3** Suitable and standard warning signs shall be displayed or erected at conspicuous places or position at the workplace;

#### **26.8 Mechanical method of demolition**

**26.8.1** The following requirements shall be fulfilled in case the mechanical method of demolition like use of swinging weight, clamshell bucket, power shovel, bulldozer or other similar mechanical methods are used for the purpose of demolition namely –

- i) The building or structure or structure or remaining portion thereof shall be not more than 12 m in height;
- ii) Where a swinging weight is used for demolition, a zone of such demolition having a radius of at least 1.5 times the height of the structure of portion thereof being demolished shall be maintained around the points of impact of such swinging weight;
- iii) Where a clamshell bucket is being used for demolition, a zone of demolition shall be maintained within eight metres of the liner of travel of such bucket;
- iv) Where other mechanical methods are being used to affect total or partial collapse of a building or other construction work, there shall be maintained, in the area into which the affected portion of such building or other construction work may fall, a zone of demolition at least 1.5 times the height of such affected portion thereof; and

- v) No person other than building workers or other persons essential to the operation of demolition work shall be permitted to enter a zone of demolition, which shall be provided with substantial barricades.

## 27. **Fire Safety Provisions**

### 27.1 **Fire Extinguishers & other means of prevention and protection**

27.1.1 Every contractor shall have a fire protection and prevention plan developed and implemented with the following details:

- i) The specific work practices requiring fire control measures;
- ii) Response measures to be taken in case of fire;
- iii) Equipment required;
- iv) Personnel requirements and responsibilities;
- v) Schedules of daily and weekly inspection;
- vi) Open flames and fires are prohibited in all underground construction;
- vii) Readily visible signs to be posted in the fire prone/inflammable/explosive areas prohibiting smoking use of open flames and other hot work.
- viii) A system of Permit-to-Work.

27.1.2 For the protection of the workers from the outbreak of fire, the contractor shall

27.1.3 Provide, maintain and regularly inspect the Fire extinguishing equipment, which shall be sufficiently provided to extinguish any probable fire;

27.1.4 Ensure availability of an adequate supply of water at ample pressure;

27.1.5 Make available

- i. Adequate number of trained persons required to operate the fire extinguishing equipment;
- ii. Properly maintain Fire extinguishing equipment and inspect them at regular intervals of not less than once in a year by the responsible person and a record of such inspections maintained;

27.1.6 Portable fire extinguishers provided in the operator's cabin of earthmoving machinery, material handling systems, construction equipment etc. shall be regularly inspected, maintained and replenished/refilled;

27.1.7 The operators and the helpers of such equipment shall be trained in the methods operating the equipment and fighting the fire effectively;

27.1.8 All combustion engine power equipment shall be so located that the exhausts are well away from combustible material;

27.1.9 No smoking shall be allowed at or in the vicinity of operations, which constitute fire hazards and shall be conspicuously posted with No smoking or open flame signs;

27.1.10 In the flammable environment as described in IS: 9570, the electrical fittings and equipment shall be of flame proof type conforming to IS: 2206 & IS; 2148;

- 27.1.11 Arrangements shall be made to contain sparks generated during welding, cutting or other operations and spark shall not be allowed to fall down on combustible material kept below; All means of exit shall be kept free of obstruction at all times;
- 27.1.12 Appropriate type of fire extinguishers according to IS: 5698 shall be kept in fully charged condition at the places which have potential risk of fire;
- 27.1.13 The contractor shall educate his or his sub-contractors' men working in the vicinity of fire risk, on how to operate these equipment and know in particular circumstances which type of extinguishers is to be used;
- 27.1.14 The contractor shall take full responsibility for the upkeep and replenishment/refilling of the fixed and portable fire extinguishers.

# APPENDIX

## Annexure I

### Important Indian Standards related to Safety

#### **Personal Protection**

IS: 1179-1967 Equipment for eye and face protection during welding

IS: 4770-1991 Rubber gloves for electrical purposes

IS: 8519-1977 Guide for selection of industrial safety equipment for body protection

IS: 8520-1977 Guide for selection of industrial safety equipment for eye, face & ear protection

IS: 8807-1978 Guide for selection of safety equipment for protection of arms and hands

IS: 1224-1985 Safety shoes

IS: 2925-1984 Safety helmets

IS: 8940-1978 Code of practice for maintenance and care of industrial safety equipment eye and face protection

IS: 8990-1978 Code of practice for maintenance and care of industrial safety clothing

IS: 10667-1983 Guide for selection of industrial safety for protection of foot and leg

IS: 816-1969 Code of practice for safety and health requirements in electric and gas welding and cutting operations

IS: 818-1968 Code of practice for safety and health requirements in electric and gas welding and cutting operations

IS: 7194-1994 Assessment of noise exposure during work for hearing conservation purposes

#### **Civil Engineering Construction**

IS: 2750- 1967(Part II) Steel scaffolds

IS: 875-1987 Structural safety of building: loading standards

IS: 4014-1967 Code of practice for steel tubular scaffolding

IS: 3696 Safety code of scaffolds and ladders

IS: 4138-1977 Safety code for working in compressed air

- IS: 4912-1978 Safety requirements for floor and wall openings, railings and toe boards
- IS: 7293-1974 Safety code for working with construction machinery
- IS: 9944-1992 Recommendations on safe working load for natural and man-made rope slings
- BS: 1129 Portable timber ladders, steps, Trestles & lightweight staging
- BS: 1139 Metal scaffolds
- BS: 5973 Code of practice for access & working scaffolds
- BS: 5974 Code of practice for temporary installed scaffolds and access equipment
- BS: 5975 Code of practice for falsework

### **Fire Protection**

- IS: 2190-1992 Code of practice for selection, installation and maintenance of portable first-aid fire extinguishers
- IS: 5896 Code of practice for selection, operation and maintenance of fire-fighting appliances
- IS: 8433-1984 Code of practice for dissolved acetylene cylinders

### **Electrical**

- IS: 3043-1987 Code of practice for earthing
- IS: 5424-1969 Rubber mats for electrical purposes
- IS: 3646 (Part II) Artificial lightings
- IS: 2148 & IS: 2206 Flame proof electrical fittings

### **Machinery**

- IS: 1860-1980 Code of practice for installation, operation and maintenance of electric passenger and goods lifts
- IS: 1991-1987 Safety requirements for the use, care and protection of abrasive grinding wheels
- IS: 5903-1970 Safety devices for gas cylinders
- IS: 8216-1976 Guide for inspection of lift wire ropes
- IS: 8964-978 Recommendations for safety conditions for woodworking machines
- IS: 9474-1980 Principles of mechanical guarding of machinery

IS: 11461-1985 Code of practice for compressors safety

IS: 13367-1992 Code of practice for safe use of cranes

## **Annexure - II**

### **Basic Structure of Safety Plan**

- 01- Safety Policy
- 02- When was the Safety Policy last reviewed
- 03- Details of implementation procedure / methods to implement Safety Policy / Safety Rules
- 04- Qualification & Experience of Safety Officers
- 05- Review of Accidents analysis - Methods to ensure safety & health and steps identified for prevention of accidents
- 06- Unit/site Executive responsible for ensuring safety at various levels in the workplace
- 07- List of Employees trained in safety at the commencement of execution of the job; details of training – its module and contents
- 08- Safety Training Targets, Schedules, Methods to be adopted for providing safety training to all employees
- 09- Details of checklists for different jobs/ work & responsible persons to ensure Compliance
- 10- Regular Safety Inspection Methods and Periodicity and the list of members authorized
- 11- Risk Assessment, Safety Audit by professional agencies, their Periodicity
- 12- Implementation of recommendations of Audit / Inspections. - Procedures for implementation & follow-up
- 13- Provision for treatment of Injured persons at work site
- 14- Review of overall safety by top Management and Periodicity
- 15- System for implementation of statutory provisions.
- 16- Issue of PPE to employees, Periodicity / stock on hand, etc.

**Signature**  
**Head of Organization**  
**With Date & Stamp**

**REPORT OF ACCIDENTS AND DANGEROUS OCCURANCES**

1. Name of the project / work:
2. Location of the Project/ work:
3. Stage of Construction work:
4. Particulars of Employer:
  - a) Main Contractor firm/ Co.:
    - Name
    - Address
    - Phone Nos.
  - b) Nature of Business
  - c) Sub contractor's Particulars:
    - Name
    - Address
    - Phone No.
    - Nature of Business
5. Particulars of the injured person:
  - a) Name: (First) (Middle) (Surname)
  - b) Home address:
  - c) Occupation:
  - d) Status of worker: (Casual) (Permanent)
  - e) Sex: Male Female
  - f) Age:
  - g) Experience:
  - h) Marital Status: Married/ Unmarried / Divorced
6. Particulars of Accident:
  - a) Exact Place where the Accident Occurred:
  - b) Date:
  - c) Time:
  - d) What the Injured Person was doing at the time of Accident?
  - e) Weather Condition
  - f) How long employed by you for this particular job?
  - g) Particulars of Equipment/Machine/Tool Involved & condition of the same after the Accident occurred:
  - h) Brief description of the Accident:
7. Nature of Injuries:
  - a) Fatal
  - b) Non Fatal
  - c) If non fatal, state precisely the nature of Injuries  
(Describe in detail the nature of injury, for instance Fracture of right arm, sprain etc.)
  - d) First Aid: Given: Not Given:
  - e) If not, Give reasons:
  - f) Name and Designation of the person by whom first-aid was given



- g) If admitted to a hospital,
  - i. Name of the Hospital:
  - ii. Address of the Hospital:
  - iii. Phone Nos.
  - iv Name of the Doctor
- 8. Mode of Transport used:  
 Ambulance    Truck    Tempo    Taxi    Private Car
- 9. How much time was taken to shift the injured person?
  - a) If very late, State the reasons:
  - b) How reporting was made: Telephone / Telegram / Special Messenger / Letter
  - c) Who visited the Accident site first and what action did he propose?
  - d) What are the actions taken for the investigation of the accident by the employer?  
 (Describe with Photographs / Video film / measurements taken, etc.)
- 10. Particulars of the persons as witnesses:
 

a) Name	Address	Occupation
b) Whether Temporary or Permanent		
- 11. Particulars in case of Fatality:
 

Date:	Time:
Whether registered with Building and other Construction Workers' Welfare Board?	
If Yes -- Registration No.	
- 12. Dangerous Occurrences as covered under the regulation
  - a) Collapse or failure of lifting appliances, hoist conveyers, etc.
  - b) Collapse or subsidence of soil, any wall, floor, gallery, etc.
  - c) Collapse of transmission towers, pipeline, bridges, etc.
  - d) Explosion of receiver, vessels, etc.
  - e) Fire and explosion
  - f) Spillage or leakage of hazardous substances
  - g) Collapse, capsizing, toppling or collision of transport equipment
  - h) Leakage or release of harmful toxic gases at the construction site
  - i) Failure of lifting appliance, loose gear, hoist or building and other work machinery, transport equipment etc.

# Schedules:

## Schedule I

### MANNER OF TEST AND EXAMINATION BEFORE TAKING LIFTING APPIANCE, LOOSE GEAR AND WIRE ROPE INTO USE FOR THE FRIST TIME

#### Test Loads

##### (1) Lifting appliance

27.2 Every lifting appliance with the accessory gear shall be subjected to a test load, which shall exceed the safe working load (SWL) as specified in the following table

Safe working load	Test load
Up to 20 tones	25 per cent. in excess of safe working load
20 to 50 tones	5 tones in excess of safe working load
Over 50 tones	10 per cent. in excess of safe working load

##### (2) Lift Gear:

27.3 Every ring hook, chain shackle, swivel, eye-bolt, plate champ, triangular plate or

27.4 Pulley block (except single sheave block) shall be subjected to a test load which shall not be less than the load as specified in the following table:

SWL (in tonnes)	Test load (in tonnes)
Up to 25	2 x safe working load
Above 160	(1.22 x safe working load) + 20

(a) In the case of a single sheave block, the safe working load shall be the maximum load which can safely be lifted be the block when suspended by it head fitting and the load is attached to a rope which passes around the sheave of the block and a test load not less than fore time the proposed safe working load shall be applied to the head of the block.

(b) In the case of a multi sheave block, the test load shall not be less than the load as specified in the following table:

SWL (in tonnes)	Test load (in tonnes)
Up to 25	2 x safe working load
25 to 160	(0.9933 x safe working load) + 27
Above 160	1.1 x safe working load

(d) In the case of hand-operated pulley blocks used with pitched chains and rings, hooks, shackles or swivels, permanently attached thereto, a test load not less than 50 per cent in excess of the safe working load shall be applied.

(e) In the case of a pulley block fitting with a bucket, the bucket shall be tested and the load applied to the bucket when testing block will be accepted as test load of the bucket.

(f) In the case of a sling having two legs, the safe working load shall be calculated when the angle between the legs is 90 degree. In case of multi-legged sling the safe working load shall be calculated as per national standard.

(a) Every lifting beam, lifting, frame, container spreader, bucket, tub, or other similar devices shall be subjected to a test load which shall not less than the load as specified in the following table:

Proposed safe working load (in tonnes)	Test load (in tonnes)
Up to 10	2 x safe working load
10 to 160	(1.04 x safe working load) + 9.6
Above	1.1 x safe working load

(b) Wire ropes – In the case of wire ropes a sample shall be tested to destruction. The test procedure shall be in accordance with recognized national standards. The safe working load of the rope is to be determined by dividing the load at which the sample broke by a coefficient of utilization, determined as specified in the following table.

(c) Before any test is carried out, a visual inspection of the lifting appliance, or lifting gear involved shall be conducted and any visible defective gear shall be replaced or renewed;

(d) After being tested, all the lifting gears shall be examined to see whether any parts have been injured or permanently deformed by the test.

Item	Co-efficient of utilization
(a) Wire Rope forming part of sling. Safe working load of the Sling: Safe working load up to and equal to 10 tonnes, SWL above 10 tonnes and up and equal to 160 tonnes. Safe working load above 160 tonnes	5 10 (8.85 x SWL) + 1910
(b) Wire Rope as Integral part a Lifting Appliance: SWL of the lifting appliance: SWL up to and equal to 160 tonnes.	3 10 (8.85 x SWL) + 1910
SWL above 160 tonnes	3

## Procedure for testing

### (3) Derricks –

27.4.11A derrick shall be tested with its boom at the minimum angle to the horizontal for which the derrick is designed (generally 15 degrees) or at such greater angle as may be agreed.

The angle at which the test has been carried out shall be mentioned in the test certificate.

27.4.12The load shall be applied by hoisting moveable weights. During the test, boom shall be swung with the test load, as far as practicable, in both directions.

27.4.13A derrick boom, designed to be raised with power, with the load suspended, shall, in addition to the tests at (a), be raised (with the load suspended) to its maximum working angle to the horizontal and the two outermost positions.

27.4.14While test loading of a heavy lift derrick, the competent person responsible for test using moveable weights shall ascertain from the Mater that the ship's stability will be adequate for the test.

27.4.15The derrick tested under clause (3) shall not be used in union purchase rig unless:

27.4.16The derrick rigged in union purchase are tested with the test load appropriate to the SWL in union purchase (at the designed headroom and with the derrick booms in their approved working positions);

27.4.17The safe working load of that derrick in union purchase rig has also been specified by a competent person in a specified report Form;

27.4.18Any limitation or conditions specified in the sad report are complied with; and

27.4.19The two hoist ropes are coupled together by a suitable swivel assembly.

**Note** - The safe working loads of derrick (for each method of rig including union purchase) shall be shown on the Certificate of Test and marked on the derrick booms.

### (4) Lifting appliance (other than ship's derrick and winches) –

(a) The test load shall be lifted and swung, as far as possible, in both directions. If the jib or boom of the crane has a variable radius, it shall be tested with test loads at the maximum and minimum radii. In case of hydraulic cranes when owing to the limitation of pressure, it is impossible to lift a test load in accordance with table under item (1), it will be sufficient to lift the greatest possible load which shall be more than safe working load.

(b) The test shall be performed at maximum minimum and intermediate radius points as well as such point in the arc of rotation, as the competent person may decide. The test shall consist of hoisting, lowering breaking and swinging through all positions and operations normally performed. Operating the machinery at maximum working speed with the safe working load suspended shall make an additional test.

### (5) Use of spring or hydraulic balances, etc for test loading –

28 All tests shall normally be carried on with the help of dead weights. In case of periodical test, replacements or renewals test load may be applied by means of suitable springs or hydraulic balance

29 In such case, test load shall be applied with the boom, as far out as practicable, in both directions. The test shall not be taken as satisfactory unless the balance has been certified for accuracy by the competent authority within 2.0 per cent

and the pointer of the machine has remained constant at the load for a period of at least five minutes.

**(6) Testing machine and dead weights –**

- (a) A suitable testing machine shall be used for testing of chains, wire ropes and other lifting gears.
- (b) Testing machines and balance to be used in test loading, testing and checking shall not be used unless they have been certified for accuracy at least once in the preceding twelve months by the competent authority.
- (c) Movable weights used for the test loading of the lifting appliance having a safe working load not exceeding twenty tonnes shall be checked for accuracy by means of suitable weighing machine of certified accuracy.

**(7) Thorough examination after testing or test loading –**

- (a) After being tested or test loaded, every lifting appliance and associated gear shall be thoroughly examined to see that no part has been damaged or permanently deformed during the test. For this purpose, the lifting appliance or gear shall be dismantled to the extent considered necessary by the competent person.

**Schedule II**

**Register of periodic test & examination of lifting appliances and gears**

<b>Part I – A: Initial and periodic load tests of lifting appliances</b>						
1	2	3	4			
Situation and description of lifting appliances tested with distinguishing number/marks, if any	Number of certificate of test and examination of competent person	I certify that on the date I have appended my signature, the lifting appliances shown in column 1 was tested and no defects affecting its safe working condition were found other than those shown in column 4	Remarks, to be signed and dated with seal			
1 2 3						
<b>Part I – B: Annual thorough examination</b>						
I certify that on the date on which I have appended my signature, the lifting appliance shown in column 1 was thoroughly examined and no defects affecting its safe working conditions were found other than those shown in column 11						
5	6	7	8	9	10	11
Date & signature with seal	Date and signature with seal	Date and signature with seal	Date and signature with seal	Date and signature with seal	Date and Signature with seal	Date and signature with seal
1 2						

## **Part II**

### **Initial and periodical load test of loose gear and annual thorough examination**

#### **List of loose gears:**

The following classes of loose gear, namely –

Chains made of malleable cast iron;

Plate link chains;

Chains, rings, hooks, shackles and swivels made of steel;

Pitched chains;

Rings, hooks, shackle and swivels permanently attached to pitched chains;

Pulley blocks, containers, spreaders, trays, slings, baskets, etc. and any other similar gears;

Hooks and swivels having screw threaded parts or ball bearings or other casehardened parts;

Bordeaux connections.

<b>Initial test and periodical load test of loose gears</b>				
1 Distinguishing number or marks	2 Description of loose gear tested and examined	3 Number of certificate of test and examination of competent person	I certify that on the date to which I have appended my signature, the loose gears shown in column 1 and 2 were tested and no defects affecting the safe working condition were found other than those shown in the remark column 6	
			4 Date and signature with seal	5 Date and signature with seal
1				
2				
3				
<b>Annual thorough examination of loose gears</b>				
6 Remarks, to signed & dated	I certify that on the date to which I have appended my signature the loose gear shown in column 1 and 2 were thorough examined by me and no defects affecting their safe working condition were found other those shown column 10			
	7 Date and signature with seal	8 Date and signature with seal	9 Date and signature with seal	10 Date and signature with seal
<b>Part III</b>				
<b>Annealing of chains, rings, hooks, shackles and swivels (other than those exempted)</b>				
1 Disting uishing number or marks	2 Descripti on of gear annealed	3 No, of certificate of test & examination	I certify that on the date on which I have appended my signature, the gear described in column 1 & 2, was effectively annealed under my supervision; that after being so annealed, every article was carefully inspected and that no defects affecting its safe work condition were found other those shown in column 7	7 Remarks, signed and sealed



## Schedule III

### NOTIFIABLE OCCUPATIONAL DISEASES IN BUILDING AND OTHER CONSTRUCTION WORK

1. Occupational dermatitis.
2. Occupational cancer.
3. Asbestosis.
4. Silicosis.
5. Lead poisoning including poisoning by preparation or compound of lead or their squeal.
6. Benzene poisoning, including poisoning by any of its homologues, their nitro or amino derivatives or its sequelae.
7. Occupational asthma.
8. Pesticide poisoning.
9. Carbon monoxide poisoning.
10. Toxic jaundice.
11. Toxic anemia.
12. Compressed air illness (Cessions disease).
13. Noise induced hearing loss.
14. Isocyanides poisoning.
15. Toxic nephritis.

## Schedule IV

### CONTENTS OF A FIRST-AID BOX

- (i) A sufficient number of eye wash bottles filled with distilled water or suitable liquid clearly indicated by a distinctive sign which shall be visible at all times.
- (ii) 4 percent. Xylocaine eye drops, and boric acid eye drops and soda bicarbonate eye drops.
- (iii) Twenty- four small sterilized dressings.
- (iv) Twelve-medium size sterilized dressings.
- (v) Twelve large size sterilized dressing.
- (vi) Twelve large size sterilized burn dressing.
- (vii) Twelve (fifteen cm) packets of sterilized cotton wool.
- (viii) (Two hundred ml) bottle of cetrimide solution (1 per cent.) or suitable antiseptic solution.
- (ix) One (two hundred ml) bottle of mercurochrome (2 per cent.) solution in water.
- (x) One (one hundred twenty ml) bottle of Sal volatile having the doses and mode of administration indicated on the label.
- (xi) One pair of scissors.
- (xii) One roll of adhesive plaster (six cm x one meter).
- (xiii) Two rolls of adhesive plaster (two cams x one meter).
- (xiv) Twelve pieces of sterilized eye pads in separate sealed packets.

- (xv) A bottle containing hundred tablets (each of three hundred twenty-five mg) of aspirin or any other analgesic.
- (xvi) Twelve roller bandages ten cms wide.
- (xvii) Twelve roller bandages five cms wide.
- (xviii) One tourniquet.
- (xix) A supply of suitable splints.
- (xx) Three packets of safety pins.
- (xxi) Kidney tray.
- (xxii) A snakebite lancet.
- (xxiii) One (thirty ml) bottle containing potassium permanganate crystals.
- (xxiv) One copy of first-aid leaflet issued by the Directorate General.
- (xxv) Six triangular bandages.
- (xxvi) Two pairs of suitable, sterilized, latex hand gloves.

## Schedule V

### ARTICLES FOR AMBULANCE ROOM

- A glazed sink with hot and cold water always available.
- A table with a smooth top at least 180 cm x 105 cm.
- Means for sterilizing instruments.
- A couch.
- Two stretchers.
- Two buckets or containers with close fitting lids.
- Two rubbers hot water bags.
- A kettle and spirit stove or other suitable means of boiling water.
- Twelve plain wooden splints 900 cm x 100 cm x 6 cm.
- Twelve plain wooden splints 350 cm x 75 cm x 6 cm.
- Six plain wooden splints 250 cm x 50 cm x 12 cm.
- Six woolen blankets.
- Three pairs of artery forceps.
- One bottle of spirits anemia arematations (120 ml).
- Smelling salt (60 gm).
- Two medium size sponges.
- Six hand towels.
- Four kidney trays.
- Four cakes of toilet, preferably antiseptic soap.
- Two glass tumblers and two wine glasses.
- Two clinical thermometers.
- Two teaspoons.
- Two graduated (120 ml.) measuring glasses.
- Two minimum measuring glasses.
- One wash bottle (1000 cc) for washing eyes.
- One bottle (one liter) carbolic lotion 1 in 20.
- Three chairs.
- Onscreen.
- One electric hand torch.

- Four first-aid boxes or cupboards stocked to the standards prescribed in the Schedule VII.
- An adequate supply of tetanus toxoid.
- Injections --- morphia, pethidine, atrophine, adrenaline, coramine, novocaine (6 each).
- Cramine liquid (60 ml.).
- Tablets --- antihistaminic antispasmodic (25 each).
- Syringes with needles --- 2 cc, 5 cc, 10 cc and 500 cc.
- Three surgical scissors.
- Two needle holders, big and small.
- Suturing needles and materials.
- Three dissecting forceps.
- Three dressing forceps.
- Three scalpels.
- One stethoscope and a B.P. apparatus.
- Rubber bandage --- pressure bandage.
- Oxygen cylinder with necessary attachments.
- Atropine eye ointments.
- I.V. Fluids and sets 10 nos.
- Suitable, foot operated, covered, refuse containers.
- Adequate number of sterilized, paired, latex hand gloves.

## Schedule VI

### CONTENTS OF AMBULANCE VAN OR CARRIAGE

The ambulance van shall have equipments prescribed as under:

- (a) *General* -- A portable stretcher with folding and adjusting devices with the Head of the stretcher capable of being tilted upward. Fixed suction unit with equipment. Fixed oxygen supply with equipment. Pillow with case, sheets, blankets, towels, emergency bag, bedpan, urinal glass.
- (b) *Safety Equipment* -- Flares with life of three thousand minutes, floor lights, flashlights, fire extinguishers (dry powder type), insulated gantlets.
- (c) *Emergency Care Equipment* -- (i) Resuscitation --- Portable suction unit, portable oxygen unit, bag valve mask, hand operated artificial ventilation unit, airways, mouth gag tracheotomy adapters short spine board, I.V. FLUIDS with administration unit, B.P. manometer cuff stethoscope.
  - (ii) Immobilization ---- Long and short padded boards, wire ladder splints, Triangular bandage--- long and short spine boards
  - (iii) Dressing ---- Gauze pads--- 100 m x 100 mm universal dressing 250 x 1000 mm, roll of aluminum foils --- soft roller bandages 150 mm x 5 mm yards adhesive tape in 75 mm roll safety pins, bandage sheets, and burn sheets.

- (iv) Poisoning ---- Syrup of ipecac, activated charcoal prepackaged dose, snakebite kit, drinking water.
- (v) Emergency Medicines ---- As per requirement (under the advice of construction Medical Officer).

## **Schedule VII**

### **Qualification & conditions of service of Safety Officers**

#### **Qualification:**

- A. A person shall not be eligible for appointment as a Safety Officer unless he,
  - (a) Possesses a recognized degree in any branch of Engineering, or Technology, or Architecture and has had a practical experience of working in a building or other construction work in a supervisory capacity for a period of not less than two years or possesses a recognized Diploma in any branch of Engineering or Technology and has had a practical experience of building or other construction work in a supervisory capacity for period of not less than five years;
  - (b) Possesses a recognized Degree or Diploma in Industrial Safety with at least one paper in construction safety (as an elective subject);
  - (c) As adequate knowledge of the language spoken by majority of building workers from the construction site in which he is to be appointed.
- B. Notwithstanding the provision contained in clause (a), any person who
  - (a) Possesses a recognized Degree or Diploma in Engineering or Technology or Architecture and has had experience of five years in the field, dealing with the Factories Act, 1948 or the Dock workers (safety, health and welfare) Act, 1986 or the Building and other construction (regulation of employment and conditions of service) Act, 1006;
  - (b) Possesses a recognized Degree or Diploma in Technology and has had experience of not less than five years or has under gone training in education, consultancy or research in the field of accident prevention in industry, port, or in any institution or an establishment dealing with building or other construction work; shall also be eligible for appointment as a Safety Officer.

#### **Conditions of service:**

- (a) Where number of Safety Officers appointed exceeds one, one of them shall be designated as Chief Safety Officer and shall have higher than the others. The Chief Safety Officer shall be in overall charge of the

safety functions and also other Safety Officers working under his control.

- (b) The Chief Safety Officer or the Safety Officer where only one Safety Officer is appointed shall be given the status of a Senior Executive and he shall work directly under the control of his Chief Executive. All other safety Officers shall be given appropriate status to enable them to dispatch their functions effectively.
- (c) The scale of pay and allowances to be granted to the safety Officers including the Chief Safety Officer and the other conditions of their service be the same as those of the officers of the corresponding status of the establishment in which they are employed.

## **Schedule VIII**

### **PERIODICITY OF MEDICAL EXAMINATION OF BUILDING WORKERS**

1. The employer shall arrange a medical examination of all the building workers employed as drivers, operators of lifting appliances and transport equipment before employing, after illness or injury, if it appears that the illness or injury might have affected his fitness and, thereafter, once in every two years up to the age of forty and once in a year, thereafter.
2. Complete the employer shall maintain the confidential records of medical examination or the physician authorized by the employer.
3. The medical examination shall include: -
  - (a) Full medical and occupational history.
  - (b) Clinical examination with particular reference to
    - General Physique;
    - Vision: - Total visual performance using standard orthorator like Titmus Vision Tester should be estimated and suitability for placement ascertained in accordance with the prescribed job standards.
    - Hearing: - Persons with normal must be able to hear a forced whisper at twenty-four feet. Persons using hearing aids must be able to hear a warning shout under noisy working conditions.
    - Breathing: - Peak flow rate using standard peak flow meter and the average peak flow rate determined out of these readings of the test performed. The results recorded at pre-placement medical examination could be used as a standard for the same individual at the same altitude for reference during subsequent examination.
    - Upper Limbs: - Adequate arm function and grip
    - Spine: - Adequately flexible for the job concerned.
    - Lower Limbs: - Adequate leg and foot concerned.
    - General: - Mental alertness and stability with good eye, hand and foot coordination.
- (c) Any other tests which the examining doctor considers necessary

