ATOMIC ENERGY (FACTORIES) RULES, 1984

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ATOMIC ENERGY (FACTORIES) RULES, 1984

G.S.R. 782, dated 30th June, 1984 1.- In exercise of the powers conferred by Sec. 23 of the Atomic Energy Act, 1962 (Act 33 of 1962). the Central Government hereby makes the following rules :

CHAPTER 1
Introduction

1. Short title, application and commencement :-

(i) These rules may be called the Atomic Energy (Factories) Rules, 1984.

(ii) They shall extend to all the factories owned by the Central Government and engaged in carrying out the purposes of the Atomic Energy Act, 1962.

(iii) They shall come into force on the date of their publication in the Official Gazette.

2. Definitions :-
In these rules, unless the context otherwise requires :

(a) "Act" means the Factories Act, 1948;

(b) "Competent Authority" means any officer or authority appointed by the Central Government by notification for the purposes of these rules;

(c) "Competent Person" means an officer described in Schedule "A";

(d) "Inspector" means an Inspector appointed by the Competent Authority under these rules;

(e) "Schedule" means a Schedule annexed to these rules.

3. Approval of plans :-
(1) An application for obtaining previous permission for the site on which the factory is to be situated and for the construction or extension of a factory shall be made to the Competent Authority. Application for such permission shall be accompanied by the following documents:

(a) a flow chart of the manufacturing process supplemented by a brief description of the process in its various stages ;

(b) plans in duplicate drawn to scale showing -

(1) the site of the factory and immediate surroundings including adjacent buildings and other structures, roads, drains, etc ;

(2) the plan elevation and necessary cross-section of the various buildings, indicating all relevant details relating to natural lighting, ventilation, means of escape in case of fire. The plans shall also clearly indicate the position of the plant and machinery, aisles and passage ways;

(c) details of exhaust ventilation and control of gaseous releases ;

(d) details of effluent treatment and liquid effluent charges; and

(c) such other particulars as the Competent Authority may require.

4. Prohibition of use of premises as factory without approval :-
No occupier of a factory shall use any premises as a factory except with the approval of the Competent Authority.

CHAPTER 2
The Inspecting Staff

5. Appointment of Inspectors :-
No person shall be appointed as Inspector for the purposes of these rules, unless he possesses the qualification prescribed for such Inspectors at the time of his appointment.

6. Qualification for appointment as Inspectors :-
The Competent Authority may prescribe necessary qualifications for appointment of Inspectors for the purposes of these rules.

7. Powers of the Inspectors :-
An Inspector shall for the purpose of the execution of these rules, have powers to or any of the following things:

(a) To photograph any worker to inspect, examine, search, copy, photograph, sketch or test, as may be, any building or room, any plant, machine, appliances, or apparatus, any register or document or anything provided for the purpose of securing the health, safety or welfare of the worker employed in the factory.

(b) To carry out such medical examination as may be necessary for the purpose of the Act.

(c) To enquire into safety related unusual occurrences.

(d) To advise the Head or Manager of the factory against unsafe acts and practices and to point out unsafe conditions, if any, in the factory.

(e) To report any unsafe conditions or practices existing in a factory to the Competent Authority.

8. Medical examination :-

Every worker of a factory shall be examined by certifying surgeons once in a year, and if any worker is found to be no longer medically fit to work in the factory, report thereof, shall be made by them to the Head or the Manager of the factory and the Competent Authority, who may ask such Head or the Manager of the factory not to employ such person in the factory for such time or period as the Competent Authority might deem necessary. After such time or period the Competent Authority may require the Head or the Manager of the factory to get such worker re-examined by certifying surgeons. If he is found medically fit to be employed in the factory, a certificate to this effect shall be forwarded by the certifying surgeons to the Competent Authority, who may permit the Head or Manager of the factory to re-employ him in the factory.

CHAPTER 3
Safety

9. Planning of process and work places :-

(1) General- Safety and fire protection provisions shall be incorporated in all plans, designs and layouts of buildings. The National Buildings Code (I.S.I.) shall be followed forall class designs and layouts of buildings. Possible dangers to properties and to health and safety of employees shall be participated in the handling and storage of raw materials and finished products and during different operational stages appropriate corrective measures shall be incorporated in all the operational stages to ensure safety.

(2) Structural safety.-

(a) All buildings, permanent or temporary shall be structurally safe and sound so as to prevent risk of collapse

(b) Foundations and ail floor areas shall be so constructed that they are able to withstand the anticipated loads.

(3) Location and spacing.- Building for storing hazardous materials shall be located away from other buildings and main roads or shall be suitably barricaded. Suitable sign boards indicating the hazards shall be displayed in the vicinity.

(4) Layout of roads and side-walks.-

(a) Roads and side-walks shall be so arranged in the premises that the anticipated traffic will not congest the roads and pedestrians will have enough space on the side-walks. As far as possible, the roads shall be straight and wide enough to allow free passage of moving vehicles/equipment.

(b) Speed breakers shall be provided at strategic locations to control the speed of vehicles. Pedestrain crossing shall be marked.

(c) Sign boards shall be displayed to give information on the maximum permitted speed and traffic hazards.

(5) Effluent control.- Liquid and gaseous effluents originating from manufacturing process shall be taken away from their places of origin and disposed of safely and, if necessary, after treatment.

(6) Space requirements.-

(a) Floor space in building shall not be crowded with materials/machinery. Adequate space shall be provided so that each operator can perform his duties without interfering with other workmen/machines.

(b) Adequate aisle space shall be provided and clearly demarcated in shop floors and plants to facilitate internal tansportation and personnel movement. Appropriate corridor space shall be provided in other areas.

(7) Guarding of openings/elevated places.-

(a) All openings such as shafts, hatch- way, cut-out and manholes into which persons may fall accidentally shall be guarded suitably.

(b) Removable permanent railings shall be used for guarding. Standard railings shall have a height of at least 105 cm. from floor level to upper surface of the top rail and shall have posts not more than 2 m. apart and an intermediate rail halfway between the floor and top rail.

(c) The boards atleast 15 cm. in height shall be provided to prevent objects from falling down to a lower level and causing accidents.

(d) Elevated places such as terraces, balconies and staircase landings from where persons may fall accidentally shall be effectively guarded by providing a parapet wall of height atleast 105 cm. or standard railing with toe board protection.

(8) Safe access to elevated areas.-

(a) Safe access shall be provided to all elevated parts of buildings such as roofs and terraces, overhead crane cabins, crane ways and bridges, tops of tanks and boilers, elevator machine rooms, mezzanine floors and other similar locations. This shall be achieved by means of stairs or fixed laddrs.

(b) All stairs and landings shall be of sufficient strength so as to sustain a live load of not less than 300 kg/m2 with a factor of safety of four.

(c) The slope of stairway shall be between 30Z-35Z from the horizontal. Treads and risers on each stairway shall be of uniform width and height.

(d) The treads shall be no less than 24 cm. in width exclusive of nosings or projections. A nosing of non-slip type (2.5 cm. wide) shall be provided. The risers shall be not more than 20 cm. nor less than 13 cm. in height

(e) A flight of stairs having four or more risers shall have a railing of vertical height 90 cm. from the level of the tread to upper surface of the top rail. A landing shall be provided after every ten to twelve treads.

(f) Fixed ladders shall be of sound material and designed for a concentrated live load of about 90 kg. wt. with a safety factor of five. The integrity of the ladders shall be ensured at least once in six months.

(g) A fixed ladder shall, be installed making an angle between 75Z to 90Z with the horizontal. The rungs shall be provided at uniform spacing of 30 cm. They shall be of appropriate diameter.

(h) There shall be clearance of not less than 18 cm. of the back of the ladder. Distance from front of rungs to nearest permanent objects on the climbing side of the ladder shall not be less than 75 cm.

(I) The ladder shall be provided with a safety climb device or with a cage 65 cm. wide and 65 cm. deep, starting 2.2 m. from the floor/ground level.

(9) Ramps.- Ramps shall be built with least practicable slope but not more than 15Z. The amps shall be given a non-slip surface finish.

(10) Markings.- Where there is a difference in floor levels, oblique yellow and black stripes shall be painted conspicuously at the interface as warning to prevent tripping of persons. Big glazings used as partitions/doors shall be conspicuously marked with indicators to prevent persons from breaking through.

(11) False ceiling.-Wherever persons can gain access over false ceilings, the design for the false ceiling shall include a passage way of adequate strength for use of maintenance personnel. It

shall be clearly distinguishable from the fragile ceiling material.

(12) Colour codes for pipelines.- Service and plant pipelines shall be painted as per colour codes laid down in Schedule "B".

(13) Ventilation.- Adequate ventilation shall be provided for all occupied areas and work spaces, as well as for the areas where hazardous materials are stored. Competent Authority shall, from time to time, authorise the number of air changes that are required to be provided for different areas/operations.

(14) Illumination.- Adequate illumination shall be provided so that work may be carried on safely and without undue strain to the eyes. Specific care shall be taken to avoid glare. The type and intensify of lamps shall be based upon nature of operation to be performed. Competent Authority shall, from time to time fix the standard levels of illumination that are required for different occupancies/operations.

(15) Lightning protection.- Potection against lightening shall be provided for all the buildings of strategic importance and tall structures. It shall also be provided for buildings in which dangerous operations are carried out; flammable materials are manufactured, stored, handled or used; for storage tanks containing oils, paints or other flammable liquids.

10. Building construction and maintenance :-

(1) Excavations.-

(a) Underground utilities such as water mains and cables shall be located and protected during excavaton.

(b) Adequate provisions shall be made for workers to get in and out of an excavation.

(c) Adequate slopes shall be given to the excavated sides by way of provision of steps or gradual slopes. Where this is not possible, adequate shorings and bracings shall be provided.

(d) Under-cutting of banks of trenches and other excavations shall be avoided. This shall apply to earth work above surface also.

(e) Excavated materials shall be dumped away from the edge of the trench to avoid slipping of the material into the trench.

(f) Excavations shall be properly fenced to protect persons and animals from falling into them. Warning red lights shall be provided on the fence during night time.

(g) Trenches under excavation shall be kept free of water.

(2) Scaffolds and platforms.-

(a) Scaffolds and their parts such as supports and platforms, shall be of good construction, sound material and of adequate strength for the purpose for which they are meant. They shall be properly maintained to ensure their continued integrity.

(b) No plank shall be kept loose so that levering up of one end of the plank while walking is avoided. Nails used in the construction of scaffolds, staging and supports shall be of ample size and in sufficient numbers at each connection. Nails shall penetrate to the holding piece to a depth of at least 12 times the diameter of nail.

(c) A safe and convenient means of access shall be provided to the scaffold. Means of access shall be portable ladder, ramp or a stairway.

(d) All platforms, gangways, etc. shall be free from any unnecessary obstruction, material, rubbish and projecting nails. These shall be maintained always in a non-slippery condition.

(e) Guard rails shall be always provided at the edges of scaffolds which are more than 3.6m. in height, measured from the ground of supporting area.

(f) On platforms, the planks used shall not project beyond the end supports to a distance exceeding four times the thickness of the planks used.

(3) Portable ladders.-

(a) Ladder shall be of good construction and of strength adequate for the intended use of the ladder. Rungs shall be parallel, level and uniformity spaced at 30 cm.

(b) Ladders shall be inspected regularly, and repaired immediately when so indicated. Wooden ladder shall not be painted. For preserving the material from deterioration linseed oil or clear varnish shall be used.

(c) All ladders with spreading bases, such as steps and frestile ladders shall be equipped with right spreaders or other means to prevent their premature opening or closing.

(d) Portable ladders shall be used as a pitch so that the horizontal distance from the wall to the foot of the ladder shall approximate, but not exceed one fourth of the length of the ladder between supports.

(e) Single portable ladders over 9 m. in length shall not be used.

(f) The use of metal ladders around electrical lines or in places where they may come in contact with such wires shall be prohibited.

(4) Cranes.-

(a) Cranes shall be operated only by authorised persons who are well trained and experienced. Operators shall ensuie that all safety devices are functioning properly before crane is put into operation.

(b) A mobile crane shall be operated so that none of its parts can approach live electric lines closer than 3 m. While lifting loads such a crane shall be located on level ground.

(c) Standard signals shall be used and operators shall recognise signals from only one person during crane operation. Signal men shall direct equipment, movement at fills, quarries, pits, intersections or any other place where necessary to prevent possible accidents.

(d) Sling hitches on loads shall be made under the supervision of experienced persons.

(e) No person shall be permitted to work or walk under a load.

(f) Thorough inspection and load testing of a crane shall be done by a competent person atleast once every 12 months. The load to be used for the purpose of testing shall be as follows: Safe working load Test load Upto 20 tons. 25% in excess 20-50 tons. 5 tons. in excess Over 50 tons. 10% in excess

(5) Concreting and cementing.-

(a) All form raising de-shuttering shall be conducted under proper supervision. While working at a height, the workers shall use appropriate safety belts.

(b) Shuttering and supporting structures shall be of adequate strength. This shall be ensured before concrete is poured.

(c) Workers handling cement or concrete shall protect their legs and hands from the exposure to cement.

(d) Proper guards and covers shall be provided on mixer gears, chains and rollers.

(e) All pipes and hoses used to convey grout shall be of sufficient strength to withstand the maximum pressure that is likely to be reached during the operations.

(6) Welding and cutting.-

(a) Welding or gas cutting shall not be carried out where there is danger of burning combustible materials or causing explosion.

(b) Welding and gas cutting shall be done only by authorised and qualified persons.

(c) Adequate ventilation shall be provided while welding in confined spaces, or while brazing, cutting or welding zinc, brass, bronze, galvanized or lead coated material.

(d) Defective torch or hose shall not be used for welding or cutting. Any leakage shall be checked for before lighting the flame.

(e) Torch shall not be put down until the gases have been completely shut off. It shall not be suspended from a regulator or other equipment where it can come in contact with the sides of gas cylinders.

(f) Suitable protective shields shall be worn by welders while welding. Barriers shall be erected to protect other persons, from harmful rays. The persons who assist the welders shall use suitable goggles.

(g) Gauntlet gloves shall be worn while welding or cutting. Outer clothes shall be free from oil and grease.

(h) In oxyacetylene welding, oil or grease shall not be allowed to come in contact with gas cylinder regulators or connections of gas welding equipment Acetylene cylinders shall be kept vertical. The cylinders shall be protected from direct sunlight.

(i) The gas supply shall be turned on only when the person is ready to light it.

(j) When welding or cutting in elevated positions, precautions shall be taken to prevent sparks or hot metal falling on to persons or flammable material.

(k) When electrical welding is undertaken near pipe lines carrying flammables, such pipe lines shall not be used as part of earth conductor, but a separate earth conductor shall be connected to the machine directly from the job.

(L) Personal contact with the electrode or other live parts of electric welding equipment shall be avoided.

(m) Extreme caution shall be exercised to prevent accident contact of electrode with ground.

(n) Suitable goggles shall be worn while chipping slag.

(7) Cleaning of upper reaches.- For carrying out cleaning operations at upper reaches of buildings, both inside and outside, procedure shall be worked out in advance to ensure complete safety of persons.

(8) Maintenance at higher elevations.- For persons attending to maintenance job at elevated places with limited access, safe procedures for work shall be laid down in advance.

(9) Painting.-

(a) Persons working at height shall make use of safety belts unless they are safely hung in cages.

(b) Goggles shall be worn for eye protection where scales and rust are to be chipped.

(c) Sufficient warning and danger signs shall be placed when men are working overhead. Proper precautions shall be taken from dropping materials when overhead work is carried out.

(d) Painters engaged in spray painting of large objects, such as tanks shall make use of diretional winds to take paint spray away. In case natural ventilation is insufficient, air blowers shall be used; otherwise respiratory protection of the appropriate type shall be worn by the painters.

(e) Smoking shall be prohibited during painting. Thinners and paints shall be kept in sealed containers.

11. Material storage :-

(1) General.-

(a) Each item of the hazardous material shall be stored in an environment well suited to its properties. The materials shall be grouped based on the mutual compatibility in such a way that a judicious use is made of the available space keeping in mind the requirement of safety. Other statutory provisions, such as Indian Explosives Act, 1884, the Petroleum Act, 1934 and Inflammable Substances Act, 1952 wherever applicable, shall also be complied with.

(b) Adequate natural ventilation shall be available for storage of hazardous materials in the storage area. R.C.C. louvres with covers of brass/G.I, mesh shall. be provided for the purpose so that the louvres will prevent entry of rain water, and the mesh will prevent the entry of rodents.

(c) Flame/explosion proof electrical fittings of the appropriate type shall be provided in areas where large quantities of flammable materials are stored. In areas where corrosive chemicals are stored, the electrical fittings shall be corrosion proof.

(d) Smoking shall be strictly prohibited in the storage area. Naked flames or any spark producing agents shall not be allowed in the storage area.

(2) Flammable liquids.-

(a) Storage area for large quantities of flammable liquids shall be isolated by distance so that fire that may originate there does not expose important buildings.

(b) Bulk storage of highly inflammable liquids shall be made only in tanks of approved construction. Enough outage space shall be given while filling the tanks. Suitable vents shall be provided for the vapours to escape.

(c) Suitable devices shall be provided to indicate the level of liquids in bulk storage tanks.

(d) Storage of flammable liquids in open containers shall be prohibited. Barrels and containers for flammable liquids shall be sealed after each use and when empty.

(e) Flammable liquids shall be stored in original containers on steel racks not more than 19 m. high. A clearance of atleast 30 cm. between the bottom tier and the floor shall be maintained. Cupboards shall be used to store not more than a total of 190 litres of flammable liquid, with no container exceeding 20 litres in capacity.

(f) In approved storage areas for small containers suitable sumps should be provided so that the liquid when spilled does not spread under storage racks. Dispensing of flammable liquids shall not be allowed inside stores.

(g) Adequate arrangements shall be made for natural ventilation in storage area. Louvres shall be provided both at floor and ceiling level in order to bring about quick clearance of solvent vapours which are normally heavier than air.

(h) Before accepting any consignment it shall be checked whether the containers are in good condition for storage and the defective ones are rejected.

(i) Smoking and carrying of matches, lighters and sparks producing devices shall be prohibited inside the storage area.

(3) Alkali metals.-

(a) Storage area for large quantities of alkali metals shall be isolated by distance so that an explosion that may result there does not affect important buildings.

(b) Storage areas shall be of good construction. Chances of flooding shall be eliminated by proper location and by providing raised floors.

(c) Particular care shall be taken during the construction of the buildings meant for storage of these materials against possible ingress of rain water so that the building is always kept dry. Slopped roof shall be provided so that water leakage is avoided.

(d) An explosion venting shall be provided in the ratio I m @2 /15 m @3 of the storage volume in the room.

(e) Alkali metal containers shall be stored on cement blocks or elevated platforms. Containers of alkali metals shall not be stored in corrosive atmosphere.

(f) Water connection shall not be available in the building.

(g) Apart from a "No Smoking" board a suitable warning prohibiting the use of water shall be displayed.

(h) Fire extinguishers of the dry chemical powder type shall be available in the storage area.

(i) Adjacent to bulk storage area a dispensing area shall be provided with all the design requirement as applicable to bulk storage areas. The dispensing area should be separated from the storage area by a firm wall.

(j) Original containers of alkali metals shall be checked periodically for any defect/corrosion and the damaged containers shall be immediately replaced.

(4) Corrosive and oxidising chemicals.-

(a) Flooring in the acid storage area shall be acid proof.

(b) Arrangements shall be made for exhaust ventilation in order to remove the corrosive vapours.

(c) Acid carboys shall be kept on a layer of sand atleast 7.5 cm. thick provided on floor as far as possible or on cement shelves. Separate areas/ shelves be provided for each type of acid.

(d) In case of alkalis, each item shall be stored separately. Drums shall not be stored more than 2 metre high. Bags shall not be stored more than a metre high.

(e) Before accepting any container it shall be checked whether it is in good condition for storage and defective ones rejected.

(f) Oxidising agents shall be stored in original containers on steel racks not more than 1.9 m. high. No combustible materials shall be brought or left near the oxidising agents.

(g) Emergency showers shall be provided wherever corrosive materials are stored/handled. They shall consist of large volume, low velocity discharge from directly overhead so that a person could be drenched completely and continuously. Only quick acting value shall be used in this line.

(h) Containers of corrosive and oxidising chemicals shall be checked periodically for any defect/corrosion and the damaged containers shall be immediately replaced.

(5) Toxic materials.-

(a) All toxic substances shall be stored only in the original containers on standard racks of 1.9m. height. It shall be ensured that the labels are intact and contain all the relevant information.

(b) Toxic materials shall be stored in isolation and away from other storage area to prevent them from involving in fires which originate elsewhere. There shall be good administrative control over the stock of these materials.

(6) Explosives.-

(a) Explosives and detonators shall be stored separately in fireproof and weather-proof magazines of a type approved under the Indian Explosives Act, 1884.

(b) Locations of magazines shall be away from the main roads and other buildings.

12. Fire protection :-

(1) General.-

(a) Any building shall be so designed and the type of materials used in its construction so chosen that the building is fire resistant and spread of fire, smoke or fumes will not occur. Provisions of relevant fire safety rules and regulations shall be applied.

(b) The amount of combustibles used in construction of buildings shall be as low as possible. The use of flammable surface finishes on wall and ceilings could contribute to rapid spread of fire. Their use therefore shall be carefully controlled.

(c) Structural components of buildings shall be as far as possible, fire resistant; their fire rating shall depend on the use to which the structure will be put.

(d) Airconditioning and ventilating systems shall be installed as to minimise the danger or spread of fire, smoke or fumes from one floor of fire area to another.

(e) In operational areas, the amount of combustible shall be kept to the minimum consistent with operational requirements, the bulk quantities being kept in separate storage areas.

(f) Carrying of matches, cigarette lighters, or other flame producing articles, shall be prohibited in all places where explosive, flammable or highly combustible materials are stored or handled. Smoking shall also be prohibited and "No Smoking" sign shall be displayed.

(g) Viewing windows shall be provided on all doors of laboratories, plants, etc. in order to aid in early detection of fire or any other untoward incident.

(2) Fire detection and extinguishment.-

(a) In all working areas. fire alarms shall be provided at convenient locations so that prompt action can be taken in extinguishing fires.

(b) All areas associated with high and moderate Fire hazard shall be equipped with early fire detection and alarm systems of sufficient capacity and capability. The signals shall be clearly audible to all persons in the buildings whenever the alarm is sounded in any portion thereof.

(c) The number and type of fire extinguishing equipment required by each work unit shall be finalised in consultation with fire services personnel apart from a judicious use of portable (or first-aid) fire extinguishers, water sprinkler system shall be installed wherever indicated.

(d) An adequate water supply with predetermined pressure shall be maintained at all times for extinguishing fires.

(e) Fire hydrants shall be available and so located or protected that they shall not be liable to damage from moving vehicles.

(f) Hydrants and supply pipes shall be flushed at frequent intervals in order to remove sediments that may otherwise accumulate. They shall be checked atleast once in three months.

(g) Fire detection/fire fighting equipment shall be tested before installing and periodically so that they are ready for action all the time.

(h) All portable extinguisher and other appliances shall be conveniently and conspicuously located taking the nature of the combustible materials in the working area into account.

(3) Fire control.-

(a) In relation to the size and number of persons employed in each workroom or areas, it shall be provided with adequate number of fire exits. For high risk areas such as workrooms in higher floors where more than twenty persons are working or where flammable materials are stored, atleast two exits shall be provided.

(b) The doors of the fire exits shall open outwards.

(c) No fire exit shall be less than 90 cm. in width nor less than 200 cm. in height.

(d) The fire escape stair shall be within 22 m. along the line of travel from any part of the floor from which it is meant to provide escape. Escape stair shall be made of sound construction and fire resistant materials.

(e) No fire escape stair shall be constructed at an angle greater than 45Z from the horizontal. Every stairway which affords a means of escape in case of fire shall be provided with a substantial handrail which if the stairway has an open side shall be on that side and if the stairway has two open sides, such handrails shall be provided on both sides.

(f) The fire escape staircase shall be provided with emergency illumination. It shall be so constructed that it will not be smoke logged during a fire incident.

(g) Smoke venting facilities, wherever required for safe use of exits in window-less buildings, underground structures and large working areas, shall be automatic in action.

13. Machine guarding and operation :-

(1) General.-

(a) All moving parts of machinery shall be guarded whenever such motion presents a hazard to personnel. All belts, pulleys, gears, shafts, clutches, drums, flywheels, spindles and all other rotating or reciprocating parts within 2.1 m. of floor or operating platform shall be construed to present a hazard to personnel.

(b) Guards made of wood or other suitable material shall be used where the presence of a metal guard would introduce a hazard.

(c) An efficient stopping and starting device shall be provided on every machine. The control of this device shall be in such a position as to be readily and conveniently operated by the person in charge of the machine.

(d) Use of close-fitting garments by machine operators and service personnel shall be enforced. Wearing loose clothing, dangling cuffs, ornaments, etc. shall be prohibited. Suitable caps shall be provided for women employees working with revolving machinery.

(e) Machine shall not be permitted to run unattended unless it is specifically designed for automatic operation. Strokes of any machine shall not extend into aisle spaces.

(f) Only the minimum stock of materials shall be stored in a workshop. The space surrounding every machine in motion shall be kept free from obstruction.

(g) The floor surrounding every machine shall be maintained in good and level condition and shall not be allowed to become slippery. The floor in a machine shop shall be kept free from chips or other loose material.

(h) There shall be adequate illumination throughout the workshop. According to the nature of the job and requirements of each machine the illumination shall be improved upon by providing local illumination.

(i) Scrap materials shall be deposited in designated containers and shall be promptly removed before they overflow.

(j') No person shall be allowed to work on a machine unless he has been sufficiently trained in the working of that class of machine, or he works under adequate supervision of a person who has a thorough knowledge of its working.

(k) Unauthorisd persons shall not be allowed to work on machines.

(2) Prime movers and transmission machinery.-

(a) The operation of prime movers and transmission machinery shall be such that they do not present any hazard to personnel.

(b) Fly wheels shall not be operated at speeds exceeding those designated for any reason.

(c) Belts shall be inspected on a periodic schedule and a proper record kept.

(d) The inspection shall include checks for cuts, accumulation of dirt or grease, excessive looseness or tension, misalignment of slipping. Belt facing and fasteners shall also be inspected and necessary observation shall be made to determine that undue stress is not applied on them,

(e) All gears regardless of size, type or location shall be guarded by a complete enclosure.

(f) All shaft couplings shall be so constructed that there are no projections or else they shall be covered with safety sleeves.

(3) Lathes.-

(a) Chuck wrenches shall be spring loaded or otherwise designed to assure their disengagement prior to use.

(b) Circular shields shall be installed around chuck or the lathe dog if it has projections which can hurt.

(c) Proper chip breaker, shall be used to eliminate injuries when steel and such other materials are turned on lathes.

(d) Lathes shall not be cleaned while on motion. Proper brush shall be used to remove the turnings.

(4) Milling machines.-

(a) Milling machines shall be provided with a metal or transparent guard over the cutter designed to prevent accidental contact with it and to serve also as a chip guard.

(b) The lubricant shall be directed on the part of the tool turning away from the work.

(5) Circular saws.-

(a) Circular saws for cutting cold metal shall have a good guard which automatically adjusts according to the thickness of the stock being cut.

(b) The portion of the saw under the table shall be guarded with a complete enclosure having a provision for the collection of scrap meal.

(c) Bandsaws shall have the upper and lower wheels completely enclosed with sheet metal or sturdy mesh screens.

(d) The portion of the saw blade between the upper wheel and the saw table shall be completely enclosed with a sliding fixture attached to the guide. The length of the blade exposed at any time shall not be more than 9 mm. greater than the thickness of the stock being cut.

(6) Grinding machines.-

(a) Abrasive discs and wheels shall be stored in a dry area not subject to extreme temperatures. Abrasive discs and wheels require careful handling to prevent dropping or dumping.

(b) Every grinding wheel shall be carefully fitted to the machine shaft. A safety washer shall be placed on each side between the wheel and the flange which shall be of correct size.

(c) Operating speed of the machine shall be checked to make sure that it does not exceed the maximum design speed of the wheel. To ensure this, there shall be a notice, conspicuously displayed on the machine, indicating the maximum safe working peripheral speed of every grind stone or abrasive wheel, the speed of the shaft or spindle upon which the wheel is mounted and the diameter of the pulley upon such shaft or spindle necessary to secure such safe working.peripheral speed.

(d) Grinding machine shall not be operated unless it is provided with a guard.

(e) The work-rest shall be suitably constructed and securely clamped at not more than 3 mm. from the face of the wheel.

(f) When operating any grinder, proper eye protective equipment shall be worn.

(7) Wood working machinery.-

(a) Every circular table saw shall be provided with a spreader, a self adjusting hood and a non-kick back device hinged on to the hood (crown guard). The part of the same blade beneath the saw table shall be completely enclosed.

(b) A push stick or other suitable appliance shall be provided for use to enable the work to be done without exposure to unnecessary risk.

(c) All portions of the band saw shall be enclosed except the working side of the blade.

(d) Band saw wheels shall be completely enclosed.

(8) Shearing machine.-

(a) Fixed or self-adjusting shall be installed at the front and rear of the blade. The distance of the lower edge of each barrier from the table and blade shall not exceed 11 mm.

(b) Rails shall be installed on the exposed sides and at the rear of the machine.

(9) Power presses.-

(a) Power presses not equipped with fully automatic feed shall be equipped with a non-repeat device.

(b) Where a fully automatic or semi-automatic feed is used the ram shall be completely enclosed or its stroke limited to 11 mm. or a gate guard installed.

(c) A manually feed press shall be protected by one or more of the following arrangements:

(i) a complete enclosure of the ram allowing not more than 11 mm. between the bottom of the enclosure and the job;

(ii) limitation of the ram stroke is not more than 11mm;

(iii) gate guards interlocked with control mechanism;

(iv) a two-hand tripping device;

(v) a sweep guard;

(vi) specially designed hand tools and manual feeding guard.

(d) Where automatic or complete gravity ejection is not provided, strippers, knock- outs, kick-outs, compressed air jets or special hand tools shall be provided to permit the safe removal of the materials from the press.

14. Electrical equipment :-

(1) General.-

(a) Only trained and authorised persons shall be permitted to work on electrical installations.

(b) Operation of electrical equipment shall be avoided when standing on wet flow of when hands are wet.

(c) Whenever possible, only one hand shall be used when working on circuits or control devices.

(d) Wearing rings, metallic watch bands, etc. shall be avoided when working with electrical equipment or in the vicinity of strong induced fields.

(e) When a person is working with energised equipment a second person capable of helping him in an emergency must be present.

(f) Electricity shall not be tagged by inserting bare wires into sockets. Suitable plugs shall be used for the purpose.

(g) Insulation resistance test (megger test) shall be made periodically on electrical installations and the result recorded. Exceptionally low readings or sudden changes shall be carefully investigated. When tests are made, the electrical equipment shall be disconnected from all sources of power and the terminals shall be short-circuited and grounded before and after each test to drain off all residual charges.

(h) All statutory requirements under Indian Electricity Act, 1910 and rules thereunder shall be followed in respect of installation, operation and maintenance of electrical equipment.

(2) Installations.-

(a) All electrical equipment and installations shall be of such construction and so installed and maintained as to prevent danger both from contact with live conductors and from fire.

(b) Material for all electrical equipment shall be selected with due regard to the working tension, load and to any special condition of use.

(c) After installation of new electrical systems or after extensive alterations to existing installations an inspection shall be made by a person with a supervisor's licence, other than the person or persons engaged in the work, before the new system or new extension is placed in service.

(d) When it is impossible or impracticable to enclose electrical circuits or current carrying parts of

electrical equipment operating with A.C. voltage of 50 volts or more to ground, accidental contact by persons or objects shall be prevented by installing the circuits or equipment:

I. in rooms or enclosures which are effectively grounded and accessible to authorised persons, only, or

II. on balconies, galleries or platforms so elevated and arranged as to exclude access to unauthorised persons.

(e) Electrical equipment which requires adjustment for examination during operation shall be so installed that readily accessible and adequate working space, sure footing can be provided and maintained at all necessary points.

(f) Where electric transformers, capacitors of other equipment contain oil in excess of 50001 per tank compartment or chamber, the oil containing equipment shall be :

I. situated outside the industrial buildings, and

II. so erected over pits, drains or sumps that the whole of the contents of anyone of the containers will be collected in it.

(3) Grounding.-

(a) Armouring and sheathing of electric cables, metal conduits and their fittings, metallic safeguards and other non-current carrying parts of utilisation equipment shall be effectively grounded.

(b) Grounding conductors shall be of low resistance and of sufficient capacity to carry safely the heaviest flow of current which may result from a break down of the insulation of the equipment to be protected.

(c) Where portable electrical equipment with exposed metal parts are used, exposed metal frames equipment operated on A.C. and D.C. systems supply shall be effectively grounded.

(d) Isolating switches shall be provided for disconnecting electrical equipment or conductors from source of supply when repair or maintenance work has to be done on the equipment or conductors. When equipment or conductors are so isolated, they shall be effectively grounded and where necessary, short-circuited.

(e) All portable electric tools and equipment shall be provided with three core cables, one of which is a ground wire. Electric supply for the tools/equipment shall be tapped using only three-pin plugs of good quality.

(4) Guarding of live parts.-

(a) Pliers, screw drivers, fuse pullers and similar hand tools used in connection with electric work shall be adequately insulated.

(b) Handles of oil cans and wipers, brushes and other cleaning devices used around electrical equipment shall be made of non-conducting materials.

(c) Motor generators, rectifiers or transformers in arc welding or cutting machines and all current carrying parts shall be protected against accidental contact with uninsulated live parts.

(5) Fire extinguishment.-

(a) Water shall not be used for extinguishing fires involving electrical equipment except where emulsions are formed for purposes of fire extinguishing and where fire is otherwise uncontrollable in the latter case, precautions against electrical contact shall be taken before the use.

(b) C02 gas type extinguishers shall be provided for use on electrical installations. In addition, dry sand or other non-conducting materials may be used as extinguishants.

(6) Personal protective clothing.-

(a) While working on or close to live electrical circuits or equipment, workers shall-

I. wear tight fitting clothing. They shall be free from metallic buttons or cuffs,

II. not wear unnecessary metal objects such as rings, key or watch chains.

(7) Static electricity.-

(a) Where dangerous accumulation of static charges may be caused by belt and pulley drives, both shaft and bearings shall be grounded.

(b) Where sparking may occur between the belt and pulley in such a way as to cause risks to the workers, the accumulation of static charges shall be reduced by means of metallic combs connected to ground and placed, if necessary, on both sides as close as possible, to the belts at the point where they run off the pulleys.

(8) Hazardous locations.- All electrical equipment such as motors, switches and lighting fixtures installed in places where there is danger of explosion from flammable gas or vapour mixtures shall be of an approved explosion-proof type.

15. Hand tools and portable power tools :-

(1) Hand tools.-

(a) Hand tools shall be of good quality material and appropriate for the work for which they will be used.

(b) Hand tools shall be used only for the specific purposes for which they are meant. Their handles shall be free from grease, oil, etc.

(c) Wooden handles of hand tools shall be of good quality, straight-grained material. They shall be smooth and free from splinters or sharp edges.

(d) Where there is any risk of an explosive atmosphere being ignited by sparks, the hand tools used therein shall be of non-sparking type.

(e) Heads of shock tools shall be dressed or ground to a suitable curvature on the edges as soon as they begin to mushroom or crack.

(f) Hand tools shall be tempered, dressed and repaired only by qualified persons.

(g) Handtools shall not be left on floors, passage ways, etc.; while working at elevations, hand tlools shall be properly secured to belts or other equipment/structures so that they may not fall on persons below.

(h) Workers shall be properly instructed and trained in the safe use of hand tools.

(i) Workers using cold chisels or chisel cutters in operation involving risk of eye injuries shall be provided with suitable eye protection.

(j) Files shall be used with substantial ferruled handles.

(k) Handles of hammers and sledges shall be fitted securely.

(1) Pliers shall not be used as substitutes for wrenches to tighten or loosen nuts.

(m) Edges of screw drivers shall be properly rounded so as to fit the slot of the screws.

(n) Screw drivers shall not be used for prising or as chisels.

(o) Pipes or other extensions shall not be permitted on wrenches or spanners unless the tools are designed for use in this manner.

(p) Wrenches and spanners shall not be used as hammers.

(q) Hackshaw blades shall be stretched tight in their frames and moved in a straight line with steady strokes, so as to avoid the blades from breaking and possibly injuring the hands.

(2) Portable power tools.-

(a) Portable electrical tools shall not be used in the presence of flammable vapours, gases and

dusts unless the tool is specially designed for such uses.

(b) In all electrically operated tools, a three core cable shall be used and the ground wire properly connected to the body of the tool [see also rule 12(3) (e)].

(c) Switches shall be provided on powered tools in such a manner that the possibility of accidental starting is minimised.

(d) Portable power tools and their accessories shall be frequently and thoroughly inspected on a period schedule and record of all such inspections maintained.

(e) Electrically actuated tools shall be operated only by persons who have been trained and instructed in the use of such tools.

(f) In portable grinders, the wheel shall be properly mounted with safety washers and flanges large-enough for the type of wheel installed.

(g) Goggles/face shield shall be worn when performing grinding work.

(h) While using a portable power drill the material to be drilled shall be kept suitably secured.

(d) When power tools are used in elevated places, the operator shall wear a safety belt to minimise the danger of falling, should the tools break suddenly or he receives an electric shock.

(j) Effective local exhaust ventilation shall be provided for dry operations such as buffling, grinding and sanding which produce harmful dusts in appreciable concentrations.

(k) In case of pneumatic- impact tool, a short chain shall be securely attached to airhose to prevent it from whipping.

16. Pressure vessels and plants :-

(1) General.-

(a) Every pressure vessel/plant other than any vessel which comes in the scope of Indian Boilers Act, 1923 and metal bottles of cylinders used for the storage or transport of compressed gases of liquified or dissolved gases under pressure and operated at a pressure greater than atmospheric pressure shall be-

(I) of good construction, sound material, adequate strength and free from any patent defect; and

(ii) properly maintained in a safe condition.

(b) No new pressure vessel shall be taken into use in a factory unless it has been hydrostatically tested by a competent person at a pressure atleast 1.3 times the design pressure, and no pressure vessel or plant which has been previously used or has remained isolated or idle for a period exceeding 2 months or which has undergone alterations or repairs shall be taken into use in a factory unless it has been thoroughly examined by a competent person externally and internally if practicable, and has been hydrostatically tested by competent person at a pressure which shall be 1.5 times the maximum permissible working pressure.

(c) No pressure vessel/plant shall be used in a factory unless a certificate specifying the design pressure or maximum permissible working pressure thereof and slating the nature of tests to which the pressure vessel/plant and its fittings (if any) have been subjected, has been obtained from the manufacturer of the pressure vessel/plant or from the competent person and every pressure vessel/plant so used shall be marked so as to enable it to be identified as to the pressure vessel/plant to which the certificate relates and the certificate shall be kept available for perusal by the Inspector.

(d) Competent Authority shall stipulate specific requirements for the reactor vessels as well as associated high pressure piping and competents.

(2) Safety fittings.- Every pressure vessel/plant shall be fitted with,

(i) a suitable safety valve or other effective pressure relieving device of adequate capacity to ensure that the maximum permissible working pressure of the pressure vessel/plant shall not be

exceeded. It shall be set to operate at a pressure not exceeding the maximum permissible working pressure:

(ii) a suitable pressure gauge with a dial range not less than 1.5 times the maximum permissible working pressure. It shall be clearly visible and designed to show at all times the correct internal pressure and marked with a prominent red mark at the maximum permissible working pressure of the pressure vessel;

(iii) a suitable stop valve or valves by which the pressure vessel may be isolated from other pressure vessel/plant or source of supply of pressure. Such a stop valve or valves shall be located as close to the pressure vessel as possible and shall be easily accessible: and

(iv) a suitable drain cock or valve at the lowest part of the pressure vessel for the discharge of the liquid or other subtances that may collect in pressure vessel.

(3) Pressure reducing devices.-

(a) Every pressure vessel which is designed for a working pressure less than the pressure at the source of supply or less than the pressure which can be obtained in the pipe connecting the pressure vessel with any other source of supply shall be fitted with a suitable pressure reducing valve or other suitable automatic device which prevent the maximum permissible pressure being exceeded.

(b) To further protect the pressure vessel in the event of failure of the reducing valve or device at least one safety valve having a capacity sufficient to release all the steam, vapour or gas without undue pressure rise as determined by the pressure at the source of supply and the size of the pipe connecting the source of supply shall be fitted on the, low pressure side of the reducing valve.

(4) In service test and examinations.-

(a) No new pressure vessel shall be taken into use in a factory unless it has been hydrostatically tested by a competent person at a pressure of atleast 1.3 tmes the design pressure and no pressure vessel/plant which has been previously used or has remained isolated or idle for a period exceeding 2 months or which has undergone alterations or repairs shall be taken into use in a factory unless it has been thoroughly examined by a competent person externally and internally if practicable, and has been hydrostatically tested by the competent person at a pressure which shall be 1.5 times the maximum permissible working pressure.

(b) No pressure vessel/plant shall be used in a factory unless there has been obtained from the manufacturer of the pressure vessel/plant or from the competent person a certificate specifying the design pressure or maximum permissible working pressure thereof and staling the nature of tests to which the pressure vessel/plant and its fittings (if any) have been subjected and every pressure vessel/plant so used shall be marked so as to enable it to be indentified as to the pressure vessel/plant to which the certificate relates and the certificate shall be kept available for perusal by the Inspector.

(c) Every pressure vessel/plant in service shall be thoroughly examined by a competent person:

(i) externally, once in every period of six months;

(ii) internally, once in every period of twelve months: Provided that if by reason of the construction of a pressure vessel a thorough internal examination may be replaced by a hydrostatic test which shall be carried out once in every period of two years;

(iii) hydrostatically tested once in every period of four years;

(iv) Provided that if owing to its construction and use a pressure vessel/plant cannot be hydrostatically tested as required in sub-clauses (ii) and (in) above at least once in every period of four years a systematic non- destructive test like ultrasonic test for metal thickness or other defects of all parts the failure of which might lead to eventual rupture of the pressure vessel/plant shall be carried out.

(d) The pressure of the hydrostatic test to be carried out for the purpose of this sub- rule shall be

1.25 times the design pressure or 1.5 times the maximum permissible working pressure, whichever is less.

(5) Report of test.-

(a) If during any examination any doubt arises as to the ability of the pressure vessel/plant to work safely until the next prescribed examination, the competent person shall record his observations, findings and conclusions with other relevant remarks with reasons and may authorise the pressure vessel to be used and kept in operation/subject to a lowering of maximum permissible working pressure or to more frequent special examination or test or subject to both these conditions.

(b) The competent person making report of any examination under this rule, shall within seven days of the completion of the examination send to the inspector a copy of the report in every case where the maximum permissible working pressure is reduced or the examination shows that the pressure vessel/plant or any part thereof cannot continue to be used with safety unless certain repairs are carried out or unless any other safety measure is taken.

17. Compressed gas cylinders :-

-(1) Storage.-

(a) To avoid mix-up of compressed gas cylinders and to prevent a potentially hazardous situation cylinders containing different gases shall be stored separately.

(b) If a large number of gas cylinders are to be stored, separate storage facility shall be provided under the following groups :

(i) inert gases (e.g. argon, helium etc.) and oxygen,

(ii) toxic but non-flammable gases (e.g. chlorine, sulphur dioxide, etc.),

(iii) flammable gases - both toxic and non-toxic (e.g. acetylene carbon- monoxide, hydrogen sulphide, etc.).

(c) If the number of cylinders to be stored centrally is small, a small store only may be provided but arrangements shall be made to segregate cylinders into the three groups.

(d) Cylinders shall be stored in a cool, dry and well ventilated place. Cylinders kept in the open for temporary use shall be protected from rain and sun. Cylinders shall be stored with their protective caps on.

(e) A notice indicating names of the gases stored and maximum quantity permitted to be stored shall be put up at the entrance of the stores.

(f) Round bottomed cylinders shall be laid on the floor and stacked pyramid style not more than 4-high, with substantial wooden wedges retaining the bottom layer at each side. Outlet valves shall all face the same way.

(g) Flat or concave bottom cylinders may be stored upright but then they shall be in such a place that they cannot be accidentally knocked down or they shall be firmly secured with proper chain arrangement

(h) Cylinders of acetylene and of liquefied gases shall be stored upright to avoid possibility of leakage of the liquid.

(i) Smoking shall be prohibited particularly where flammable gases are stored: "No Smoking" signs shall be displayed at prominent place in and outside the stores.

(j) Use of open flames, spark producing agents or hot work such as welding shall be prohibited in the stores where flammable gases are kept.

(k) Combustible materials (e.g. oil, rags, paper, wood, paints, etc.) shall not be kept in the stores.

(1) Full and empty cylinders shall be kept apart and "full" and "empty" notices shall be displayed

inappropriate positions.

(m) Gases shall not be tapped from compressed gas cylinders kept in the stores.

(n) Statutory requirements laid down under Gas Cylinder Rules, 1981 shall be observed in addition to the above sub-rules.

(2) Handling and use.-

(a) While transporting cylinders, whether full or empty, then- protective caps shall be in place.

(b) Cylinders shall be stacked when they are transported in trucks so as not to project beyond the sides of the trucks.

(c) Adequate precautions shall be taken to prevent cylinders from falling off the truck and being subjected to rough usage, excessive shocks or stresses.

(d) Drivers of trucks transporting compressed gas cylinders shall exercise necessary care in loading, transporting and unloading.

(e) In the case of transport of toxic and flammable gas cylinders on trucks, drivers of trucks shall have their attention drawn to contents of the cylinders by the persons directing the operations and shall be asked to exercise the necessary care in loading, transporting and unloading.

(f) Trucks that are laden with full cylinders shall not be left unattended in public places.

(g) Lifting magnets shall not be used in loading or unloading cylinders.

(h) When loading or unloading cylinders is to be carried out with a crane a properly designed cradle shall be used.

(i) For transporting cylinders inside a plant/laboratory, suitable hand trolley shall be used. Such a hand trolley shall be provided with a chain for securing the cylinder so that it cannot fall if the hand trolley passes over a bump.

(j) Rolling, dragging and sliding of cylinders shall be avoided.

(k) When the cylinder is brought to its place of use in the plant/laboratory, it shall be preferably secured to a wall, bench or some other firm support.

(l) Cylinders shall not be kept in the vicinity of sources of heat such as furnaces radiators, steam pipes ovens, etc. This is particularly important in the case of cylinders of liquefied gases.

(m) Cylinder's valves shall be closed at all times except when the gas is actually being drawn.

(n) Only the standard key shall be used to operate the valve spindle. Leverage must not be increased by any means nor must excessive force, e.g. hammering, be used.

(o) Cylinders valves, shall be kept clean. Before fitting regulator, any loose dirt lying within the valve socket shall be removed by cracking the valve.

(p) Cylinder valve and fittings shall not be lubricated except under specific advice from the gas supplier. On no account shall oil or grease be used on oxygen cylinders because of the risk of fire or explosion.

(q) Empty cylinders shall be handled with as much care as full ones.

18. Handling of hazardous materials :-

(1) General.-

(a) All hazardous materials shall be handled in such a way that personal injuries do not result. The planning for this shall include the proper design and maintenance of equipment/systems.

(b) Proper personal protective equipment shall be provided at the time when hazardous materials are handled.

(c) Personnel who are required to handle hazardous materials shall be knowledgeable about their dangerous properties, precautions that are to be taken while handling First aid and fire fighting

methods that may be required in cases of emergencies that may arise.

(d) All spillages shall be disposed of promptly and safely. Proper procedures for the same shall be laid down and conspicuously displayed in the handling areas.

(e) Appropriate Fire extinguishers in sufficient numbers shall be provided in the handling areas. Suitable instructions shall be displayed. Fire service personnel shall be aware of the type of material burning and the relative hazards of fumes encountered before attempting to extinguish the fire.

(f) Eating, drinking and smoking shall be strictly prohibited in the areas handling hazardous materials.

(2) Flammable liquids.-

(a) Where flammable liquids are handled there shall be no open flames or other sources of ignition including sparking sources.

(b) Transferring of flammable liquids by means of pneumatic pressure applied or the container or tanks shall be prohibited unless the container or tank is designed for the purpose and periodically tested and found sound enough. These shall be drawn from or transferred into vessels, containers or portable tanks within a building only through a closed piping system preferably using gravity and by employing an approved self-closing valve.

(c) Where volatile fluids are transferred from tankers or road vehicles the metal work of the storage system shall be bonded to the metal work of the tanker or road vehicle and also to earth.

(d) Approved safety cans shall be used for transfer and handling flammable liquids up to 20 litres. The safety cans shall have the following essential features:

(i) be leak tight,

(ii) automatically vent vapour at approximately 0.3 kg./cm. gauge internal pressure to prevent rupture (or explosion in the event of Fire),

(iii) have a flame arrester to prevent flame from reaching the flammable contents.

(iv) automatically close after filling or pouring.

(e) To avoid static electricity formation the rate of flow of flammable liquids shall be restricted to a maximum of I metre/sec.

(f) Waste flammable liquids shall be collected, transferred and stored in containers with tight fitting lids. When waste or rags are used in connection with dipping operations, metal waste, cans with tight filing lids shall be provided and all impregnated rags or waste deposited therein immediately after use. The contents of the waste can shall be properly disposed of as and when it gets filled.

(g) Under any circumstances, common drain shall not be made use of to dispose of spilled flammable liquids.

(3) Alkali metals.-

(a) Handling area for alkali metals shall be completely devoid of water taps and pipes.

(b) The equipment and systems used in handling alkali metals shall be properly designed for ensuring safety. Any system containing molten alkali metals shall have drip trays under all equipment and valves to confine molten metal spills.

(c) All tools used in alkali metal handling areas shall be dry. Non-speaking tools shall always be used in opening metal drums containing alkali metals.

(d) The degree of protective clothing required in handling the alkali metals shall depend on the quantity of metal to which a worker is exposed and on the temperature of the metal. Aprons, leggings, head coverings, gloves and face protection shall be used depending on the situations.

(e) Molten alkali metals shall be transferred under the cover of an inert gas or under vacuum at

the lowest possible temperature and pressure to minimise the possibility of fire.

(f) Operations such as welding, gas cutting, heat treatment, etc. shall be avoided where alkali metals are handled.

(g) A fast-acting drainage system shall be incorporated in the liquid metal handling system to allow the liquid metal to drain into a secondary containment system.

(h) The system shall be tested for pressure or vacuum periodically to ensure that safety is not endangered and a record of the tests shall be maintained.

(I) Air and water-lines shall never be connected, directly or indirectly, to piping that handles liquid metals.

(j) All machinery and pipe lines on which static electricity is likely to accumulate shall be effectively grounded.

(k) Suitable notices indicating the dangers involved and safety measures to be taken shall be displayed on the barrels or tankers used for transport.

(1) Small quantities of alkali metals spilled in the laboratory shall be covered with a layer of soda ash and then scrapped up for immediate disposal at a designated place. Suitable methods of disposal shall be planned for larger quantities of alkali metals.

(4) Corrosives.-

(a) Containers of corrosive materials shall be of the appropriate type and sound material.

(b) Personal protective equipment such as chemical goggles, aprons and gumboots shall be worn by the workers when they handle corrosive materials.

(c) Transferring of corrosive liquids by means of pneumatic pressure applied on the container or tank shall be prohibited unless the container or tank is designed for the purpose and periodically tested and found sound enough.

(d) Wherever large quantities of corrosive materials are handled water in plenty shall be available nearby. In addition there shall be a safety shower and eye wash fountain.

(e) Flooring in the corrosive material handling area shall be corrosion resis tant

(f) The drainage line from the areas corrosive materials are handled shall be corrosion resistant.

(5) Toxic materials.-

(a) There shall be a close administrative control over the storage and use of toxic materials. They shall be in the charge of responsible persons and shall be issued only when required for specific experiments/operations.

(b) Persons who are engaged in toxic materials handling shall be provided with necessary personal protective equipment.

(c) Persons working in the areas where toxic material are handled shall maintain strict personal hygiene.

(d) All wastes containing toxic materials shall be disposed of safely.

19. Handling methods :-

(1) Manual handling.-

(a) Manual handling of heavy articles shall be avoided as far as possible instead mechanical appliances shall be provided and used for lifting and carrying them.

(b) Workers assigned to handle materials shall be instructed as to how to lift and carry materials safly.

(c) Where heavy objects are lifted or carried by two or more workers, the raising and lowering of loads shall be governed by well-understood signals in order to ensure unity of action.

(d) Where heavy objects such as loaded drums or tanks are handled on inclines in either direction:

I. ropes and tackle shall be used to control their motion in addition to the use of checks or wedges; and

II. workers shall be prohibited from standing on the downward side.

(e) Where heavy objects are moved by means of rollers, bars or sledges shall be used instead of hands or feet for changing the direction of the rollers while in motion.

(f) Workers handling objects with sharp edges, fins, slivers, splinters or similar dangerous projecting parts or handling hot, caustic or corrosive materials shall use suitable personal protective equipment,

(g) Materials shall be so piled up that the piles will not interfere with :

I. the adequate distribution of natural or artificial light;

II. the proper operation of machines or other equipment :

III. the unobstructed use of passage ways or traffic lanes; and

IV. the efficient functioning of sprinkler systems or the use of other fire extinguishment equipment.

(h) Materials shall not be piled up against partitions or walls of buildings unless it is known that the partition or wall is of sufficient strength to withstand the force.

(i) The maximum weights that can be permitted to be lifted, carried or moved by hand or on head by a single adult male or female shall be 50 kg and 30 kg, respectively.

(j) The passage over which an article is carried or moved shall be cleared of all obstructions or other hazardous situations before hand.

(k) Hand trucks and wheel barrows shall be equipped with knuckle guards. Nails, piece of wire and other substitutes shall not be used in place of cotter pins.

(1) When loading a truck, consideration shall be given to the method of unloading. Blocks shall be placed underneath the loads so that slings can be easily fastened if mechanical equipment are to be used at the unloading station.

(m) Material handling equipment shall be periodically inspected and kept in good repair. The record of maintenance should be kept in a register.

(n) When they arc in use, the trucks shall be parked only in the designated places.

(2) Mechanically handling.-

(a) Industrial power trucks:

I. equipment shall be operated only by authorised persons who have been given specific training in their safe operation ;

II. loads shall be transported in such a manner as to provide maximum clear vision for the operator;

III. safe load capacity and operating speeds shall be indicated on each piece of equipment;

IV. persons riding on loads or equipment shall be prohibited;

V. industrial trucks shall be painted with yellow and black stripes so that they are clearly seen by persons.

(b) Lifting machines :

I. persons shall not be allowed to ride on the load or on crane hooks :

II. loads shall not be carried on a crane while persons are working underneath. the gong or horn

shall always be in service when the crane is in motion;

III. slings, chains, etc. shall not be dragged. After the load is taken off the crane shall not be moved until the hook is lowered and the sling or chain is detached from the hook;

IV. a load on the crane shall not be moved unless the signals from the floor are clearly understood;

V. the load shall not be allowed to swing;

VI. when raising or lowering a load it shall be checked that it will safely clear adjacent stockpiles or machinery ;

VII. the safe load capacity of the crane shall not be crossed at any time.

(c) Conveyors:

(i) all power driven conveyors shall be of sound construction and shall be guarded with enclosures or railing to prevent workers from being caught on moving parts on getting injured by falling materials, all moving belts, gears, sprockets, pulleys, shafts and chains shall be effectively guarded;

(ii) power driven conveyors shall be provided with emergency control device conveniently located. Wherever cross over walks are to be provided they shall be of appropriate design;

(iii) portable gravity chutes, rollers and belts, when used in the handling of materials, shall be of sound construction and provided with positive locking devices in each section;

(iv) sideboards shall be installed along the edges and at corners and turns of all overhead conveyors and screen guards shall be placed beneath to protect workers from falling materials;

(v) persons shall be prohibited from riding on conveyors.

20. Hoisting apparatus :-

(1) General.-

(a) All slings, chains and other gear used in connection with cranes, hoists, derricks and similar equipment shall be under the supervision of and maintained by authorised persons.

(b) Records of maintenance and inspection shall be kept.

(c) All hoisting apparatus shall be stored on hooks or racks so that they will not be damaged during the storage.

(2) Pulley blocks.-

(a) The lifting capacity of blocks shall be plainly marked on each block.

(b) The lashing of the upper block shall be of sufficient strength. It shall be able to support five times the maximum load which may be hoisted by the block.

(c) Frayed fibre ropes or rusty wire ropes shall not be used.

(d) Blocks shall be periodically examined and maintained in operating conditions.

(3) Hooks.-

(a) The type of hooks shall be selected in accordance with the size and type of materials to be handled. Overstraining of any part of the hook shall not be permitted.

(b) Hooks shall be constructed from forged or laminated steel.

(c) Hooks which have become deformed due to overloading shall not be repaired or put back into service.

(d) Hooks shall not be heated or otherwise treated in a manner as to affect its rated capacity.

(e) Hooks shall be equipped as far as possible with safety latches.

(4) Ropes.-

(a) Fibre rope :

(i) only manila Or synthetic fibre rope of good quality shall be chosen for use. Leads to be applied on such ropes shall not exceed 20% of the minimum breaking strength;

(ii) all ropes shall be examined periodically. Visual inspection shall be made for abrasions, broken fibres, cuts, frays or other defects. Fibre ropes found to have defects under such inspection and examination shall be removed from service;

(iii) ropes shall be stored on hooks or racks provided in well ventilated rooms. They shall not be exposed to moist and corrosive atmospheres and extremes of temperatures.

(b) Wire ropes:

(i) every wire rope shall be used and maintained in strict accordance with recommendations of the manufacturer. Load applied on wire ropes shall not exceed 20% of the minimum breaking strength;

(ii) ropes shall be inspected at the time of installation and once every week thereafter, when in use;

(iii) a wire rope which has not been in use for three months or more and subjected to water, moisture, dampness, etc. shall be inspected for corrosion, prior to its subsequent use. If marked corrosion is found, it shall be removed from hoisting or load carrying service. Wire ropes shall be removed from load carrying service when 4% of the total number of wires comprising of such ropes are found to be broken;

(iv) wire ropes shall be lubricated with a lubricant as recommended by the manufacturers. Kinking and untwisting of the wire rope shall be avoided. Loads shall not be applied to a kinked rope;

(v) in attaching U-type rope clamps, the closed or curved end of the 'U' shall be placed in contact with the short or dead end of the rope and thimbles shall be used in eyes of the loops. The nuts on U-clamps shall be inspected and tightened frequently during operations.

(5) Chains.-

(a) Every chain shall be used and maintained in strict accordance with recommendations of the manufacturer. Load applied on chain shall not exceed 20 per cent of the minimum breaking strength.

(b) When in constant use, hoisting chains shall be thoroughly inspected at least once each month by an authorised person.

(c) Chains shall not be shortened or spliced by placing nails or bolts between two links nor shall a chain be knotted. Defective links or portions of the chain shall be replaced only by links or sections furnished by the manufacturer of the chains.

(6) Slings.-

(a) The ends of the slings shall be properly tied to form loops.

(b) Fibre (manila or synthetic) ropes showing evidence of cuts, excessive wear or other damage shall be discarded. After being placed in service, ropes shall be inspected every 30 days under normal conditions and every 7 days if they are used to support scaffolding on which men work. If exposed to acids or caustics they shall be inspected daily. Fibre rope slings shall not be used to lift molten metals or hot articles.

(c) Wire rope and chain slings shall be frequently inspected and lubricated.

(d) Blocks or heavy padding shall be used at edges of load to protect the sling from sharp bending. When single or multiple slings are used, the load shall be so arranged that the stress will be equal between ropes.

(e) Spreader shall be used in connection with slings handling long materials.

21. Industrial hygiene :-

(1) General.-

(a) The agents such as physical, chemical and biological present in the working environment shall be recognised, evaluated and controlled so that the health of workers is not adversely affected.

(b) When workers are allowed to expose themselves to levels above the permissible values during planned operation, a physician shall be in attendence.

(2) Physical agents.-

(a) Heat stress:

(i) vessels, pipes or flues storing or containing fluids at high temperatures shall be covered with sufficient insulated material;

(ii) every effort" shall be made to reduce the heat stress in the working area, by providing insulating materials, thermal shields, supply of cool air and/or means for air circulation. Where the heat stress cannot be reduced to below permissible values by these methods, the exposure shall be controlled by providing rest breaks (in cool areas) between spells of work in hot environment and/or by personal control measures like protective suits.

(b) Non-lonising radiations:

(i) all electric arc operations shall be adequately screened to prevent eye injury to workers in the vicinity. Welders shall wear suitable hoods which protect the eyes and skin of neck and lace and are equipped with suitable filter glass;

(ii) Welder's helpers or others working in the vicinity of operations giving rise to high intensities of radiation and are not screened, shall wear suitable goggles with side shields;

(iii) exposure of persons to infra-red/ultra-violent radiations shall be maintained within limits by using suitable shields or working at safe distances. Similarly, exposures to microwave radiation shall be controlled to within permissible levels;

(iv) exposures to coherent energy (lasers) shall be kept to the minimum chiefly by engineering control measures and supplemented by personal and medical control methods. In particular direct viewing of laser beams shall be prohibited.

(c) Noise.- Exposure to noise in working environment shall be kept below the permissible values by suitable engineering control measures. Where enough reduction in the levels is not achievable, these duration of exposures shall be restricted and suitable ear muffs shall be provided for the workers,

(3) Chemical agents.-

(a) In any work place where the air is likely to be contaminated by dusts, mists, fumes, vapours or gases generated processes or operations their concentrations shall be kept well within the appropriate Threshold Limit Values (TLVs).

(b) Sampling and analysis of air shall be done and results interpreted only by authorised persons.

(c) Respiratory protection is to be considered only as a temporary protection against exposure to toxic materials. Adequate ventilation or other environmental engineering control measures shall be provided to control health hazards associated with any permanent operation.

(d) Some toxic gases and vapours can enter the body through the skin as well as by inhalation. Sufficient precautions shall be taken to prevent the ingress of the materials through skin in such cases.

(e) Every precaution shall be taken to avoid direct contact with any corrosive chemicals such as acids, alkalies etc., and defatting agents such as organic solvents.

(f) Laboratories/plants shall have only the minimum quantities of hazardous chemicals consistent

with operational requirements.

(g) It shall be possible to identify a hazardous material inside a pipeline, vessel or container by means of label /symbol placed conspicuously.

(h) Chemicals shall be stored and handled in containers which are not incompatible.

(i) Special care shall be taken when working with chemicals such as unstable compounds, corrosives, solvents and highly toxic materials

(4) Biological agents.--

(a) All micro-organisms shall be handled as if they were pathogenic. The principle of asepsis shall be understood and applied during the handling of all cultures and equipment containing microorganisms.

(b) Animal caretakers and research personnel shall be continuously alert to and make use of techniques and environmental control measures which will limit the spread of infection in animal quarters, from animal to animal or from animal to men.

(c) In maintaining hygienic environmental candidates, such aspects as vermin control, removal of animal wastes, maintaining clean cages and facilities and satisfactory air quality shall be taken into consideration.

22. Personal protective equipment :-

(1) General.--

(a) When selecting work clothes, consideration shall be given to the hazards to which the wearer may be exposed and those types shall be selected which will reduce the potential hazards to the minimum.

(b) Work clothes shall fit well; there shall be no loose flaps or strings. Pockets shall not be provided unnecessarily. They shall not be larger than what is required.

(c) Loose, torn or ragged garments, full sleeved shirts, neckties and key or watch chains shall not be wom while working on machines.

(d) Personal protective equipment shall be of quality material and conform to specifications of Indian Standards Institution where available.

(e) The factory shall provide personal protective equipment, wherever necessary, and employees shall use them, as and when required.

(2) Respiratory protection.-

(a) In selecting respiratory protective equipment consideration shall be given to the following points :

(i) the process and conditions that create the exposure;

(ii) the chemicals and physical properties and toxicity of the substance from which protection is required;

(iii) the nature of the duties to be performed by the persons who wear the equipment and the encumbrance or restriction of movement in the working area that it may create, and

(iv) the facilities for maintenance, upkeep and supervision of use.

(b) Respiratory protective equipment shall be suitable for fitting various types of facial contours without allowing for leaks.

(c) Mechanical filter respirators shall not be used for protection against solvent vapours, toxic gases or in atmospheres deficient in oxygen, under any circumstances whatever.

(d) Filters shall be changed when breathing resistance exceeds a present value.

(e) Cartridge type respirators and canister masks shall not be worn in any confined space or in

any other place that is poorly ventilated or in atmospheres deficient in oxygen. Instead, a self-contained breathing apparatus shall be wom.

(f) Canister masks shall be replaced as per manufacturer's recommendations.

(g) Supplied air respirators or hose masks :

(i) shall be used for work in dangerous atmosphere in all cases where the work is of such a nature and carried out in such places that the fresh air supply can be safely maintained, and

(ii) shall be used for non-emergency operations in atmospheres in which the concentration of the dangerous gas of vapour is too high for the safe use of canister masks or cartridge respirators.

(h) The supply of air to a mask or respirator shall not be at a pressure exceeding 1.75 kg/cm2 (25 psi).

(i) Self-contained breathing apparatus shall be wom only by persons specially trained for this in advance.

(j) At intervals not exceeding one month, every breathing apparatus shall be:

(i) carefully examined by authorised person with respect to its general condition and with particular attention to any delicate parts, and

(ii) tested for leakage.

(k) Gauges on self-contained breathing apparatus shall be tested at least once in every six months. Record of such examiantion and test shall be kept.

(3) Head protection.-

(a) Workers exposed to failing or flying objects and potential hits on the head shall wear well-fitted hard hats.

(b) Hard hats shall be made of non-combustible materials which are non-conductors of electricity.

(c) Hard hats shall have a brim all round to provide protection for the head, face and back of the neck. For working in confined spaces, hard hats without brims may, however, beused.

{4) Ear protection.- Persons who are working in areas of high levels of noise shall wear suitable ear muffs (Ear plugs are not preferred as they present problems of poor fitting).

(5) Eye protection.-

(a) Suitable eye protection shall be used by all workers performing any operation which may endanger their eyes.

(b) Goggles for workers engaged in chipping, rivetting, scaling dry grinding and similar operations shall conform to standards of strength accepted by the competent authority.

(c) Goggles for working exposed to fumes which would cause injury or discomfort to the eyes of the wearer shall have eye cups which fit the face closely and have no ventilation openings.

(d) Wherever there is a chance of splashing chemicals, chemical goggles shall be used to protect eyes from their injurious effects.

(e) When not in use, goggles and face masks shall be kept in special closed containers protecting them from mechanical damage and contamination by oil, grease and other materials.

(f) Goggles shall be provided for workers exposed to infra-red and ultra-violet radiations (furnace workers, glass blowers, in laboratories where ultra-violet lamps are used, etc).

(6) Body protection.-

(a) Persons working with large quantities of corrosive chemicals shall wear suitable protective aprons.

(b) Persons engaged in shot-blasting operations shall wear suitable protective hoods. aprons, etc.

(c) Aprons shall not be worn near revolving or reciprocating machine parts.

(7) Hand protection--

(a) Gloves shall be wom for protection of hands and forearms.

(b) The type of gloves selected shall afford effective protection and be suitable for the job. The material of the gloves shall be compatible with the chemicals/materials handled.

(8) Foot protection.-

(a) Safety shoes shall be worn in operations where heavy materials are being handled.

(b) Footwear for workers handling corrosive liquids such as acids and caustic shall be made of rubber, neoprene or other suitable corrosion resisting materials.

(c) Footwear for electrical workers shall be free from metal fittings.

(d) On jobs which require persons to work near flames and furnaces asbetos footwear shall be used.

(9) Safety belts.-

(a) Safety belts shall be provided for and used by all workers exposed to the risk of falling from height such as by window cleaners, stack climbers and riggers, painters working at heights more than 4.5 m. above ground or above a temporary or permanent floor or platform.

(b) Safety belts and hamesses shall be made of substantial chrome tanned leather, nylon or cotton webbing or other suitable material.

(c) All belts and their fittings shall be examined at frequent intervals and defective parts replaced.

(d) All fittings and fastenings of a safety belt shall be enable of supporting a load at least equal to the ultimate breaking strength specified for the belt

(10) Protective equipment for electrical work.-

(a) Gloves and gumboots for electrical workers shall be made of rubber or other suitable materials and shall conform to standards of dielectric strength accepted by competent authority.

(b) Footwear for electrical workers shall be free from metal fittings.

(11) Care and maintenance.-

(a) Personal protective equipment shall be maintained in clean condition; particularly parts coming in direct contact with the body shall be kept in a perfect sanitary condition.

(b) Those protective equipment such as respirators, helmets and ear muffs which are not issued individually to workers, shall not be interchanged among employees until they have been cleaned and sterilised.

(c) Respiratory protective equipment shall be periodically checked for proper functioning of its parts such as valves and diaphragm and inspected for serviceability.

(d) All respirators and masks shall be inspected to ensure that they are in working order. Any broken, badly worn or damaged parts shall be replaced promptly. Goggles and face shields which have become scratched, opaque or otherwise cannot be used effectively shall be discarded. Gloves shall be tested periodically and the defective ones discarded. Proper records shall be mantained of all inspections carried out on personal protective equipment and repairs made.

23. Medical control :-

(1) General.-

(a) Emergency first-aid treatment shall be available for all persons in a factory or installation. To achieve this, there shall be training in First-aid imparted to a large number of employees.

(b) In the event of accidental exposure to toxic or corrosive materials, poisonous substance or in

case of traumatic injuries, the services of a physician shall be available without delay. He shall be fully informed regarding the nature of the accident, the hazardous condition or substance involved and the extent of exposure.

(c) Size and location of the medical unit shall be determined by the number of employees to be served, distance from the location of hazardous operations and anticipated load due to accidents.

(2) Preventive medical services.-

(a) Preplacement medical examinations shall be made of all entrants for employment to evaluate their physical and physiological capability in relation to the job requirements to ensure his continued good health at work and to provide maximum safety to himself and his fellow employees.

(b) Periodical examination of employees exposed to health hazards shall be made at such periodicity and in such manner as may be presented by one competent authority and/or as by exigencies.

(c) Complete medical examination shall be made of persons before they are relieved of work in hazardous areas/operations.

24. Training :-

(1) Safety education.-

(a) An educational programme covering all aspects of health and safety shall be established and conducted on a regular basis. The overall objective of the training programme shall be the elimination of unsafe acts and conditions by providing well informed and trained employees.

(b) Education and training shall include such items as the following:

(i) safe practices in different operations;

(ii) location and use of first-aid fire extinguishers;

(iii) rendering first-aid treatment in different situation;

(iv) initiating alarms and reporting emergencies;

(v) emergency evacuation procedures;

(vi) investigation of accidents and reporting unsafe conditions:

(vii) use of personal protective equipment;

(viii) conspicuous display of safety posters and signs.

(2) Rescue and first-aid.-

(a) When persons are involved in situations dangerous to life such as overcome by poisonous gases/vapours, in contact with electrical circuits and trapped in locations under fire, steps shall be taken in to rescue them, without the rescuer himself getting endangered.

(b) An emergency cupboard shall be provided in a safe location near to a hazardous area for use during a possible emergency to faciliate prompt rescue work. It shall be clearly marked and contain equipment that are required to tackle an expected emergency. Lifebuoys/water jackets shall be provided near large water bodies. These equipment shall be familiar with procedures of artificial respiration.

(c) Enough persons shall be trained in first-aid in each plant or laboratory. In factories in which the conditions of work involve a risk of suffocation, asphyxiation or electrocution, there shall be rescue equipment which shall include resuscitation apparatus. Personnel shall be trained in its operation and shall be familiar with procedures of artificial respiration.

(d) Persons shall be designated as in-charge of first-aid and their locations shall be made known.

(3) Fire squad.- In each work area, there shall be persons designated to form fire squads, who shall be given training in fire extinguishment and emergency requirements. The fire squad shall

thus be equipped to render first-aid fire fighting and help in emergency evacuation of persons affected.

25. Special work permits :-

In every factory in order to regulate the performance of hazardous jobs and to ensure that special considerations are given to the safety of personnel doing them, special work permits shall be issued by the Head or Manager of the factory or by an officer authorised by him in this respect.

26. Entry into confined spaces :-

(a) Before entering any confined space such as a vessel, tank, tunnel, etc., it shall be ensured that the atmosphere inside will not be dangerous to personnel.

(b) The space concerned shall be isolated from the rest of the system. The flanges shall be blanketed and the isolating valves shall be closed and suitably tagged.

(c) The-equipment/spaces which are originally charged with toxic, corrosive and flammable materials or asphyxiants, shall be purged to remove their contents from inside. The purging shall be done with water, steam or air, as found suitable provided that if sludge is present inside the vessel, tank, etc. purging with air shall not be considered sufficient.

(d) All man-holes and inspection doors shall be kept open and care shall be taken that toxic gases or vapours cannot leak from adjacent equipment. Advantage of prevailing wind direction shall be taken in diluting the gases that may leak, if the location is outdoors.

(e) After the purging has been completed and equipment/space has been well ventilated, the atmosphere inside the space shall be tested to ensure that the concentration of toxic gas or the asphyxiant is less than the respective TLV. Oxygen concentration shall be tested to be above 16 per cent (by volume) before personnel entry is permitted. Purging with fresh air shall be continued during the course of the work.

(f) In case a person has to enter the space for testing, he shall be provided with a self-contained breathing apparatus and a safety belt or harness attached to a rope, the free end of which is held by a person standing outside the confined space.

27. Work at height :-

(a) Persons who are required to work at height shall be medically fit for the job.

(b) All persons who climb up a stack shall be provided with safety belts.

(c) Persons shall be adequately instructed in the proper use of safety belts. Safety/belts shall be kept clean, frequently inspected and maintained in good condition.

(d) Persons engaged in cleaning the windows from outside where there is no proper arrangement for their standing and working shall be provided with safety belts. In places where the use of safety belts is impractical, suitable net of adequate strength fastened to substantial supports shall be employed.

(e) Shoes worn by person engaged in work at height shall be of the non-slippery type.

(f) At least one person shall be stationed on the ground to be of assistance to those who climb up.

(g) Maintenance work at height shall be performed in good day light preferably at a time when strong winds and rains are not prevailing.

28. Electrical isolation :-

(a) When it is necessary to cut out the source of electricity to a machine or a circuitry, such isolations shall be done in a positive manner.

(b) Whereas in low-voltage circuits the fuses shall be removed, in high-voltage systems the circuit breakers shall be drawn out.

(c) As far as possible, the switches shall be locked in the open position and the workers shall take the keys with them. Otherwise, the switches shall be tagged with caution notices.

(d) Only authorised persons shall turn on the switches, on completion of the maintenance work, and then only remove the caution notices.

29. Special operations :-

(1) General.- -

(a) As specific hazards are involved in some special operations, these shall be attended to with appropriate precautions. In typical operations, listed below, precautions shall be taken as indicated.

(b) The Competent Authority may specify any other jobs and indicate the special precautions that arc required to be taken.

(2) Foundry.--

(a) The foundry floor shall be arranged for efficient operating economy and to prevent accidents, especially those caused by spills and runouts of molten metal.

(b) Floors shall be cleaned frequently and kept in good condition, firm and level. Worn out spots, holes, and other defects shall be reported and got repaired immediately.

(c) Local and general exhaust ventilation shall be carefully planned taking into consideration the different operations that are to be carried out.

(d) A comfortable ambient temperature shall be maintained in all part of the foundry where workers are required to work.

(e) Careful planning and safe practices shall be adopted while handling large objects in foundries.

(f) Compressed air shall not be used for any type of cleaning except as a last resort and then only when the pressure is reduced to less than 2 kg/cm @2 (30 psi) and proper personal protective equipment are used.

(g) A fire prevention programme shall be organised. Periodic fire inspections shall be earned out.

(3) Electroplating operations.-

(a) All the plating facilities shall be carefully planned and designed as health hazards are generally associated with these.

(b) Electroplating tanks shall be provided with a local exhaust system preferably of the slot type along the length of the tanks. The exhaust system shall be made of corrosion resistant materials.

(c) ' The floor areas of all electroplating facility shall be made acid proof. The floor shall be cleaned frequently arid kept in good condition.

(d) As plating operations involve risk of contact with strong chemicals which could give rise to serious burns, the use of personnel protective equipment such as rubber boots, gloves and aprons shall be made compulsory.

(e) In view of the high possibility of dermatitis due to electrolytes especially with chromium and nickel salts, skin contact with the electrolytes shall be avoided.

(f) Cyanide salts shall be kept away from contact with all acids. A close control shall be kept on the stock of cyanide salts and electrolytes. It shall be in the charge of a responsible person and shall be issued only when required for specific operations and then only in quantities immediately required.

(g) Cyanide wastes shall not be allowed to run into drainage lines which might receive acidic solutions. Waste quantities of cyanide shall be disposed of in a safe manner.

(h) Workers shall be made to understand the need for a high degree of personal hygiene. Food articles shall never be stored, prepared or eaten where these operations are conducted.

(i) Workers attending to plating work, especially with chromium and nickel, shall be under regular medical supervision.

(j) An emergency shower and eye wash fountain shall be provided in the area.

(5) Beryllium operations.-

(a) Work on beryllium and its compounds involving risk of any air contamination shall be carried out in a specially designed facility. Use of the beryllium rooms shall be restricted solely for beryllium work. A suitable notice shall be displayed at the entrance prohibiting the entry of unauthorised personnel.

(b) All stocks of beryllium and toxic compounds shall be kept in a fire proof store.

(c) Physical contact with beryllium and its compounds shall be avoided. Gloves shall be worn while working on these. A laboratory coat and overshoes shall be worn while working in the beryllium area.

(d) Air sampling shall be carried out at frequent intervals both inside and outside the plant/ laboratory. Surface/equipment contamination shall be determined by way of taking swipe samples and if found necessary the area or equipment shall be properly decontaminated under competent supervision.

(e) A thorough housekeeping routine shall be maintained in the working area. Walls, floors and other surfaces shall be decontaminated using "teepol" and water.

(f) Smoking and eating in the area shall be prohibited. A change room facility with showers shall be provided near the beryllium area.

(g) Strict medical supervision shall be kept on all beryllium workers. A pre- employment examination and periodical medical examinations, preferably every six months, shall be performed on all the workers.

(6) Zirconium operations.-

(a) Work on zirconium and its compounds involving risk of fire shall be carried out in a specially designed facility. Use of such facilities shall be restricted only for zirconium work. A suitable notice shall be displayed at the entrance prohibiting the entry of unauthorised personnel.

(b) Surface of plant/laboratories and store shall be designed to prevent accumulation of zirconium powder.

(c) Source of ignition shall be excluded from zirconium handling areas. The design for these areas shall include lightning protection and means to prevent accumulation of static electric charge.

(d) Electrical equipment installed in these areas shall be of approved explosion proof type.

(e) Wherever zirconium powder may be formed, a local exhaust system shall be provided. The duct shall be as short as possible, shall be free from sharp bends and dead space and shall have proper means of access for inspection and cleaning.

(f) A high standard of, cleanliness shall be maintained throughout the zirconium handling areas. Wet mopping shall be adopted for cleaning. Mops used for cleaning shall be stored always under water.

(g) The design of plant/laboratories shall make adequate provision for the safe storage of zirconium powder, sludges sponges or scrap.

(h) Containers for product or waste shall be metallic and labelled. They shall not be exposed to extremes of temperature.

(I) Zirconium wastes containing sludges, sponge or scrap shall be stored separately from any other waste material. They shall be stored under water (minimum IS cm). Safe procedures shall be formulated for the collection, transportation, storage and disposal taking into account the pyrophoricity of the material.

(j) Disposal of powder waste shall be done by incineration under controlled conditions by trained personnel at a suitable place designated for the purpose.

(k) Before discharge, waste liquid containing zirconium in suspension shall be treated by a process which removes the suspended zirconium.

(1) Fire fighting appliances shall be provided in all the areas. Operations involving zirconium shall never remain unattended.

CHAPTER 4
Welfare

30. Change room and wash room :-

(1) Adequate facilities for washing shall be provided for employees. When these are engaged in operation process involving toxic. dirty or wet materials, adequate change room and shower facilities also shall be provided.

(2) When women are employed, separate washing and shower facilities shall be provided for them. These shall be duly indicated.

(3) Soap and other cleansing agents shall be provided at the washing rooms.

(4) Locker rooms shall be provided at convenient locations for all employees whose work requires change of clothing.

(5) Suitable arrangements shall be made in change rooms to enable workers to take nest during a designated period/time.

(6) Change room and wash room shall be well ventilated and lighted.

31. First-aid appliance :-

(1) First-aid boxes shall be provided at convenient locations in the work area and these shall be distinctly marked.

(2) Fire-aid boxes shall contain such equipment and medicines as may be determined by the factory Medical Officer.

(3) Persons who shall be designated as in-charge of first-aid shall arrange to replenish the contents of these boxes as and when they are depleted.

32. Notice regarding first-aid :-
A notice containing the names of the persons within the precincts of the factory who are trained in first-aid treatment and who are in charge of first-aid boxes shall be posted in every factory at a conspicuous place near each such box. The notice shall also indicate the work room where the said person shall be available. The name of the nearest hospital and its telephone number shall also be mentioned prominently in the said notice.

33. Ambulance room/dispensary :-

(1) The ambulance room or dispensary shall be in charge of a qualified medical officer assisted by adeast one qualified nurse and suitable subordinate staff.

(2) There shall be displayed in the ambulance room or dispensary a notice giving the name, address and telephone number of the Medical Officer-in-charge. The name of the nearest hospital and its telephone number shall also be mentioned prominently in the said notice.

(3) The ambulance room or dispensary shall be separate from the rest of the factory and shall be used only for the purpose of first-aid treatment and rest. The size of the ambulance room or dispensary and the minimum facilities that are required in it shall be as decided by the Medical Officer.

34. Canteens :-

(1) Adequate canteen facility shall be provided in the factory premises.

(2) The precincts of the canteen shall be maintained in a clean and sanitary condition. Suitable

arrangements shall be made for the collection and disposal of garbage.

(3) The canteen shall be managed preferably by a Cooperative Society formed by the employees, such that wholesome food is made available to the workers at a reasonable rate.

(4) Every member of the canteen staff who handles food stuff shall be medically examined at the time of appointment and periodically thereafter by the factory Medical Officer.

35. Creche :-

(1) The creche shall be adequately furnished and equipped with toys, cot or cradle, bedding for the children and seating accommodation for the mother while she is feeding or attending to her child.

(2) Suitably fenced and shady open air playground shall be provided for the older children.

(3) A wash room shall be provided adjacent to the creche for washing of the children themselves and their clothing.

(4) An adequate supply of clean clothes, towels and soap shall be made available for each child while it is in the creche.

(5) Atleast 300 ml. pure milk shall be available for each of the older children for every day it is accommodated in the creche. In addition, an adequate supply of wholesome refreshments shall be provided.

(6) The mother of young child shall be allowed in the course of her daily work intervals of 15 mts. to feed the child.

(7) Creche staff shall be provided with suitable clean clothes for use while on duty in the creche.

SCHEDULE 1
SCHEDULE

(See rule 2(C)] Competent person : (1) For the purpose of sub-rule 8 (4)(/) shall be graduate in mechanical engineering or equivalent, with 5 years in responsible position, designated by the Head/Manager of the Factory. (2) For the purposes of rule 14, shall be a graduate in chemical engineering/mechanical engineering or equivalent, with 5 years in responsible position, designated by the Head/Manager of the Factory.

SCHEDULE 2
SCHEDULE

"B" {See rule 9(12)]
Water \: Grass green (218) Ice Water \: Grass green (218) with occasional single white bands. Sea Water \: Oriental blue (174) Demineralised Water \: French blue (174) Single distilled Water \: French blue (166) with occasional single white bands. Double distilled Water \: French blue (166) with occasional double while bands. Condensate \ \: Sky blue Steam \ \: Aluminium with occasional single red (538) bands. Compressed Air \ \: White Drainage \: Black Electrical conduits and cables - Single phase \: Terra cotta (444) with occasional single white bands. Electrical conduits and cables- 3-phase \: Terra cotta (444) only. Electrical panels, electrical switches and transformers \: Aircraft grey (693) H2 \ \: White with red (537) bands N2 \ \: White with lemon yellow (355) bands H2 and N2 \ \: White with red (537) and yellow (355) bands CO2 \ \: White with golden brown (414) bands. HF \ \: White with light orange (557) bands Argon \ \: White with oriental blue (174) bands Helium \ \: White with Apple green (281) bands Vacuum \ \: White with black bands. High speed diesel oil \: Light brown (410) Furnace Oil \: Middle brown (411) Crude Oil \: Daric brown (412) Vent lines \: Salmon pink (443) Heavy Water \ \: Violet (796) Fire lines \: Signal red (537) Steel structures \: Eaude nil (216) Railings \: Top black rest-Eaude nil (216)
A - Stainless steel and aluminium pipes shall be painted with bands of colour only. B - A breakable pipe shall also have a band painted lengthwise along it in one of the prominent colours prescribed for it in the code. C - All pipes shall be marked inwhite or black (to give maximum contrast with the code numbers shown on the corresponding flow sheets). D - The direction of flow shall be shown by arrows in white or black. E - All equipment (tanks, heal exchangers, etc.) shall be painted with aircraft grey (693). Colour coding of piping shall start from the flanges or connection to equipment. P - Primary cooling water, sea water, compressed air, drains, vents and the main supply of service water shall follow the colour codes of the respective systems. All other water piping shall be painted in the colour of vice water-grass green (218) with the following additions : Bands to be painted at convenient intervals on the pipes in the same colour as those on the air condition graphic panels, code numbers and direction of flow shall be shown as in all other systems. All outgoing air lines in air conditioning shall have the same colour as vent lines- viz, salmon pink (443), all incoming airlines or filtered air supply lines, the colour shall be determined by the Architect depending upon colour scheme adopted in the room in question. G - When coding a system with bands of different colour the bands shall be painted on the pipe where it enters or leaves a wall, floor or ceiling, connects to equipment, valves or other branches of pipes. The bands shall be 5 cm. wide of even appearance and will be spaced where practicable approximately 15 cm. from the floor, or ceiling and equipment or

valves, etc. H - Valve bodies shall be painted with the same colour as the coded line to which they are connected, but spindle wheel shall be painted with the same colour as the identifying band for that line. I - Prior to the final colour being painted, identification labels shall be checked against the relevant flow sheet and this colour code.